

<https://doi.org/10.5281/zenodo.22093728>

E-ISSN
2278-8808



SJIF
Impact Factor
2026
8.727

An International Peer Reviewed
SCHOLARLY RESEARCH JOURNAL
FOR INTERDISCIPLINARY STUDIES



Editor-in-Chief
Dr. Ravindra K C
*Principal,
Kumadvathi First Grade College,
Shikaripura*

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<https://doi.org/10.5281/zenodo.22093728>

ONLINE ISSN 2278-8808

AN INTERNATIONAL, PEER REVIEWED, REFEREED & QUARTERLY
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"Innovation and Sustainability in Multidisciplinary Approaches and Contemporary Challenges",

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TCG's, SAI DATTA NIWAS, S. No. 5+4/ 5+4, D-WING, Flat No. 104, Dattnagar, Near
Telco Colony, Ambegaon (Kh), Pune. Maharashtra. 411046. India.

Website: www.srijs.com Email: srijsarticles16@gmail.com

**An International Peer reviewed, Refereed & Quarterly
Scholarly Research Journal for Interdisciplinary Studies**

ANNUAL SUBSCRIPTION: Individual Subscription Rate: ₹750 (Print Only); 150\$; £80. Combined Subscription Rates for Online as well as Print ₹2000, 300\$; £160. Individual Subscription Rate (Print & Online access): ₹3550/- for One Year. Institutional Subscription Rate (Print & Online access): ₹ 5550/- for Five Year. If the manuscript possesses Multiple Author the subsequent Price is ₹ 650 for per author. The said prices include postage. Institutional subscription includes the right for members of subscribing the institute to access the online journal no extra charges will be applied from SRJIS. Summary of the publication charges is mentioned below.

PUBLICATION FEE: Subscription fee should be directly Deposited / Transferred/ D. D through SBI Net Banking in favors of

Banking Details

Int. Scholarly Research Journal, Account No: 32806695852 Branch: Ambegaon (Bk). Pune, Maharashtra. INDIA, IFSC Code: SBIN0011648. MICR: 4110020, SWIFT CODE: SBININBB238.

Content	Online	Print	Total	Duration
Non Member	₹ 2000/-	₹ 650/-	2650/-	One Issue
Individual Membership	₹ 550/-	₹ 3000/-	3550/-	One Year
Institutional Membership	₹ 2000/-	₹ 3050/-	5550/-	Five Year

CLAIMS: Claims for undelivered copies may not be made later than four months from the respective month and date of Publication.

PERIODICITY: QUARTERLY (JAN-MAR, APR-JUNE, JULY-SEPT, OCT- DEC)

CHANGE IN POSTAL ADDRESS: One month notice for change in address should be communicated, notified by Sending old postal address and current postal address to Editor in Chief by specifying the Journal Name and ISSN number through postal or e mail: srjisarticles16@gmail.com

Printed and Published by **Dr. Anjali Bhamare** on behalf of Scholarly Research Journal for Interdisciplinary Studies.

EDITOR IN CHIEF

International Scholarly Research Journal for Interdisciplinary Studies (SRJIS)

Editorial

It gives us immense pleasure to present the Proceedings of the **One-Day National Conference on "Innovation and Sustainability in Multidisciplinary Approaches and Contemporary Challenges"**, organized by **Kumadvathi First Grade College, Shikaripura**, on **28th March, 2026**.

The conference was conceived with the objective of providing a vibrant academic platform for researchers, academicians, industry experts, policymakers, scholars, and students to deliberate upon the emerging trends, innovations, and sustainable practices that are shaping the future across diverse disciplines. In an era marked by rapid technological advancements, environmental concerns, socio-economic transformations, and global uncertainties, multidisciplinary collaboration has become essential for addressing contemporary challenges and achieving sustainable development.

The enthusiastic participation of eminent resource persons, faculty members, research scholars, and students from various institutions across the country made the conference a remarkable success. The deliberations, technical sessions, and scholarly discussions encouraged the exchange of innovative ideas, research findings, and practical solutions to pressing issues affecting society, industry, education, governance, science, commerce, and technology.

This volume is a compilation of peer-reviewed research papers presented during the conference. The articles reflect original research, innovative perspectives, and interdisciplinary approaches that contribute significantly to academic knowledge and practical applications. The publication aims to serve as a valuable reference for researchers, educators, students, professionals, and policymakers seeking insights into innovation, sustainability, and contemporary multidisciplinary issues.

We express our sincere gratitude to all the distinguished keynote speakers, invited experts, paper presenters, session chairs, reviewers, members of the organizing committee, faculty, staff, volunteers, and participants whose dedication and wholehearted support contributed to the grand success of this conference. We also extend our heartfelt appreciation to the management of **Swamy Vivekananda Vidya**

Samsthe (R) for their constant encouragement, guidance, and unwavering support in promoting academic excellence and research culture.

We believe that the research papers published in these proceedings will inspire further scholarly inquiry, foster interdisciplinary collaborations, and contribute meaningfully to sustainable and innovative solutions for contemporary challenges. We hope this publication serves as a significant academic resource and motivates future research endeavors in diverse fields.

With Best Wishes,

Editorial Board.

**THEME I: INNOVATIVE AND
SUSTAINABLE PERSPECTIVE IN
HUMANITIES: CULTURAL, SOCIAL AND
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REIMAGINING EDUCATION FOR A SUSTAINABLE FUTURE**Dr. Shivakumar G S***Principal, Kumadvathi College of Education, Shikaripura, Mail: drshivakumargs@gmail.com*

Abstract

Educational innovation has emerged as an essential driver in realizing the objectives of sustainable development goals (SDGs). In the face of increasing global concerns such as environmental degradation, social inequality, and the depletion of natural resources, conventional education systems are no longer sufficient to prepare learners for contemporary challenges. There is a growing need to transform educational practices to develop competencies, critical thinking, and values aligned with sustainability. This paper investigates the significance of innovative approaches in education and their linkage to sustainable development. It emphasizes the integration of sustainability principles into curricula, explores the impact of emerging technologies, and analyzes both the opportunities and constraints within global education systems. Finally, the study offers strategic suggestions to strengthen educational innovation so that it effectively supports sustainable and inclusive development.

Keywords: *Educational innovation, Sustainability in education, Digital learning technologies, Education for sustainability (EFS), Innovative practices, Sustainable learning frameworks, Pedagogical innovation.*

1. Introduction

Education serves as a cornerstone in realizing the United Nations Sustainable Development Goals (SDGs), encompassing key priorities such as inclusive and equitable quality education, gender equality, and urgent climate action. In an era marked by rapid global transformation, there is an increasing need for educational systems that are responsive to emerging sustainability challenges. Conventional models of education, often centered on memorization and standardized assessment, must undergo significant transformation to address the evolving demands of contemporary society and to prepare learners for a sustainable future.

Innovation in education refers to the integration of novel pedagogical approaches, advanced technologies, and adaptive learning environments that support sustainability. This study examines how such educational innovations foster sustainable development by highlighting the impact of progressive teaching strategies, digital tools, and policy transformations in bringing meaningful change. The paper analyzes the significance of innovation in promoting education for sustainable development, explores the key challenges encountered by educational systems, and provides actionable recommendations to enhance effectiveness and long-term sustainability.

2. Literature Review**2.1 The Essence of Innovation in Teaching and Learning**

Innovation in education manifests in multiple ways, including the adoption of novel pedagogical strategies, the incorporation of digital technologies, the redesign of learning environments, and the transformation of educational policies. As highlighted by the

Organisation for Economic Co-operation and Development (2019), educational innovation encompasses changes that enhance the quality of learning while responding to present-day challenges. Approaches such as project-based learning (PBL) and flipped classroom models have gained prominence as impactful practices, enabling learners to engage with real-life contexts and thereby fostering critical thinking, creativity, and problem-solving abilities.

Rapid technological progress, including developments in Artificial Intelligence (AI), learning management systems, and online education platforms, has significantly reshaped teaching and learning experiences. The COVID-19 pandemic further accelerated the adoption of digital tools, highlighting the critical need for digital literacy as well as equitable access to technology in education systems.

2.2. Education for Sustainable Development (ESD)

Education for Sustainable Development (ESD) aims to equip individuals with the knowledge, values, and skills needed to make meaningful contributions to society while addressing the interconnected dimensions of sustainability—environmental protection, social equity, and economic viability. The United Nations Educational, Scientific and Cultural Organization describes ESD as a transformative process that enables individuals to take responsibility for shaping a sustainable future. It emphasizes critical thinking, informed decision-making, and active engagement, all of which are essential for effectively responding to sustainability challenges.

As emphasized by Walter Leal Filho (2015), Education for Sustainable Development (ESD) promotes a comprehensive understanding of the interdependence among environmental, social, and economic dimensions. This perspective is essential for fostering a balanced approach that enables societies to integrate these aspects effectively in the pursuit of sustainable development.

2.3. The Role of Technology in Education and Sustainability

Technological advancements have significantly reshaped conventional approaches to education, making learning more engaging, inclusive, and widely accessible through digital innovations. Tools such as Virtual Reality (VR), Augmented Reality (AR), and gamified learning environments allow students to explore complex sustainability concepts in immersive and interactive ways, enhancing their understanding and participation. Moreover, technology facilitates global collaboration, enabling learners to connect and work together on sustainability initiatives beyond geographical boundaries. Online learning platforms like Coursera and edX provide courses on topics such as renewable energy, climate change, and sustainable development, thereby expanding access to sustainability education for diverse audiences. Despite these advancements, the digital divide continues to pose a major challenge, limiting equitable access to technological resources in education systems.

2.4. Constraints and Obstacles to Educational Innovation

Although innovative educational practices hold significant promise, their widespread adoption is often constrained by several challenges. These include:

- **Inadequate infrastructure:** In many developing regions, educational institutions face limited access to digital resources and stable internet connectivity, restricting the implementation of modern teaching practices.
- **Limited teacher readiness:** Many educators lack sufficient training and competencies to effectively integrate emerging technologies and innovative pedagogical approaches into their teaching.
- **Resistance to change:** In certain contexts, deeply rooted traditional practices and mindsets among educators and administrators create reluctance toward adopting new methods and reforms in education.

2.5. Prospects for Innovation in Education

The expansion of online education, digital collaboration tools, and open educational resources has opened up extensive avenues for innovation in the education sector. Educational institutions are progressively adopting blended learning approaches, combining face-to-face instruction with virtual learning environments. In addition, strong collaborations among educational institutions, government bodies, and the private sector play a vital role in fostering a conducive ecosystem that supports and sustains innovation in education.

3. Research Methodology

This study employs a qualitative research design, utilizing a case study approach to examine effective models of innovative education that support sustainability. Data were gathered through an extensive review of scholarly literature, policy reports, and interviews conducted with educators, policymakers, and specialists in the field of education for sustainable development.

The study further included an examination of existing educational practices and emerging technologies, with particular emphasis on their effectiveness in contributing to the achievement of the Sustainable Development Goals (SDGs). The results were systematically synthesized to generate insights into the challenges and opportunities that innovation offers for advancing education and sustainability.

4. FINDINGS

4.1. Pedagogical Innovations for Sustainability

Innovative teaching approaches, including experiential learning and project-based learning, have proven effective in enhancing awareness of sustainability issues. For instance, a case study from the University of Edinburgh demonstrates how project-based learning enables students to collaborate with local communities in addressing environmental concerns such as waste management and energy conservation. Such practical, hands-on experiences help learners understand the tangible impact of their efforts on achieving sustainable development goals.

4.2. Tech-Enabled Solutions for Education for Sustainable Development

Digital tools like Virtual Reality (VR) and Augmented Reality (AR) are progressively being utilized to deliver sustainability concepts in more interactive and engaging formats. Research

conducted by the University of Illinois indicates that Virtual Reality (VR) simulations—such as immersive virtual visits to endangered ecosystems—can significantly improve students’ comprehension of environmental challenges and strengthen their commitment to sustainable practices.

Online learning platforms and Massive Open Online Courses (MOOCs) have played a significant role in expanding equitable access to sustainability education. Platforms such as Coursera provide courses on sustainable development that are available to learners worldwide, promoting the exchange of knowledge and best practices on sustainability across global communities.

4.3. Policy Integration of Education for Sustainable Development

Nations such as Finland and Bhutan have embedded Education for Sustainable Development (ESD) within their national curricula, nurturing a sustainability-oriented mindset from an early stage. Finland’s focus on interdisciplinary learning—where sustainability themes are incorporated across various subjects—stands out as a model of best practice. Likewise, Bhutan’s Gross National Happiness framework integrates environmental conservation, economic development, and social well-being into its education system, aligning closely with the core principles of sustainable development.

5. DISCUSSION

5.1. Impediments

Despite the significant potential of innovations in education, a number of barriers continue to restrict their widespread adoption. These include inadequate access to technological resources, limited financial support for educational reforms, and the absence of standardized frameworks to effectively evaluate the outcomes of sustainability education.

5.2. Future Prospects

There are considerable opportunities to overcome these challenges through coordinated and collaborative initiatives. Governments, non-governmental organizations, and the private sector can jointly contribute to strengthening infrastructure, enhancing teacher capacity, and providing essential resources to promote the adoption of sustainable educational practices. Moreover, global institutions such as the United Nations and United Nations Educational, Scientific and Cultural Organization can play a crucial role in standardizing sustainability education, facilitating the sharing and scaling of best practices across different regions.

6. RECOMMENDATIONS

6.1. Reinforcing Professional Development for Teachers

Educational reforms need to place strong emphasis on teacher preparation, ensuring that educators are equipped with the competencies required to adopt innovative and sustainability-oriented teaching practices. Professional development initiatives should incorporate training sessions on the effective use of digital technologies, strategies for integrating sustainability into pedagogy, and the design of curricula aligned with Education for Sustainable Development (ESD).

6.2. Advancing Collaborative Educational Approaches

Promoting collaborative learning within classrooms as well as through international engagement can deepen students' understanding of global sustainability issues. Collaborative partnerships among educational institutions, government bodies, and industry sectors can provide valuable opportunities for learners to engage in practical, real-world sustainability projects.

6.3. Strengthening Digital Inclusion

Concerted efforts are required to bridge the digital divide by ensuring that educational institutions, especially in developing regions, have adequate access to essential digital infrastructure and learning resources. Both governments and private sector organizations should invest in advanced technologies that support effective learning and expand access to global sustainability education.

6.4. Promoting ESD through Strategic Policy Integration

National education policies should clearly embed Education for Sustainable Development (ESD) at all stages of the education system. This can be accomplished by incorporating sustainability concepts into existing curricula, ensuring that learners develop a well-rounded understanding of environmental, social, and economic issues.

7. Conclusion

Innovation in education serves as a crucial catalyst for advancing sustainable development. Through the adoption of progressive teaching approaches, effective use of technology, and the integration of sustainability principles within educational systems, learners can be better prepared to address present and future global challenges. Nevertheless, addressing challenges such as inadequate infrastructure, resistance to change, and insufficient teacher preparation is vital to fully realize the potential of educational innovations. By encouraging collaborative initiatives and prioritizing teacher capacity building, education systems can evolve into effective instruments for achieving the Sustainable Development Goals (SDGs). This study offers a detailed examination of the relationship between educational innovation and sustainable development. Drawing on literature reviews, case studies, and expert insights, it outlines both the barriers and opportunities in promoting sustainable education. Additionally, continued research is necessary to explore emerging educational technologies and to understand their long-term implications for sustainable development.

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CARBON CREDIT TRADING IN INDIA: AN OVERVIEW

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Abstract

The carbon market is one of the fastest growing industries. This upward trajectory is set to influence the global as well as Indian financial commodity market. Global financial institutions like World Bank and the IMF project the size of the carbon economy to reach over \$2,000 billion per annum by 2020. This paper highlights how a permit system called 'carbon credit' monitors risks in commerce as well as environment sector, with control over green-house-gases emissions (GHG's). It further discusses this notion as a prospective financial solution for the future of trade exchange. Carbon Credit Capital works on the development of new methodologies for carbon emission reductions, measurements and monitoring. One carbon credit is equivalent to the right to emit one tonne of carbon dioxide (CO₂). A comprehensive carbon management in the corporate world is later discussed in the light of the challenges it poses for the future economy. Its systemic role in regulation of industrial investment, methodology, infrastructure as well as tradeable financial assets is evaluated critically.

Keywords: CDM, Carbon emission, Kyoto protocol, Greenhouse effect

Introduction

The companies in the developed world are required to meet certain carbon emission target set by their respective government. However if these companies are not able to meet their emission targets, they have an alternative of purchasing these carbon credits from the market i.e. from someone who is successful in meeting these targets and who has a surplus of these credits. This process is known as carbon trading. Carbon trading is also very advantageous for the companies of the developing world as it provides monetary gains in exchange of carbon credits which help these companies to purchase or change their technology. This change in technology eventually helps the companies to reduce carbon emission. The Clean Development Mechanism (CDM), defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of CO₂, which can be counted towards meeting Kyoto targets.

The mechanism is seen by many as a trailblazer. It is the first global, environmental investment and credit scheme of its kind, providing standardized emissions offset instrument, CERs. A CDM project activity might involve, for example, a rural electrification project using solar panels or the installation of more energy-efficient boilers. The mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction or limitation targets.

Need for Carbon Trading and Clean Development Mechanism

The need for carbon trading was felt when it was realized that the industries have been

the biggest polluter of greenhouse gases which has resulted in global warming. A lot of effort was put in by the NGOs and other institutions to bring the attention of the world towards the problem of global warming. But this issue was not taken very seriously as a result of which nothing much was done in this regard. Thus it was realized that the only way to get the attention of the world towards these problems was by attaching some financial incentive to it. As a result the concept of Carbon trading was introduced.

Clean Development Mechanism

The Clean Development Mechanism (CDM), defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries.

Background of the Study

The Kyoto protocol finally came into force in February 2005 and marked a shift from negotiation to concrete action. According to the Protocol, Annex-I parties have the binding quantified reduction commitments to reduce their greenhouse gases (GHGs) emissions by 5.2% below their 1990 level during the period 2008 to 2012 (IISD, 2009). The focus of the study is to determine the different aspects considered by the organisation for the Clean Development Mechanism (CDM) projects, factors and barriers faced by the energy sector organisation, and the risk associated with the CDM projects. The study also covers in detail the impact of CDM projects, carbon trading and corporate social responsibility.

CDM PROJECTS GROUPED IN TYPES TILL 2012

PROJECT TYPE (IN THOUSANDS)	NO OF PROJECTS	TOTAL CERS ISSUED TILL 2012 (IN THOUSANDS)
Wind	2625	280692
Hydro	2277	344776
Biomass	803	116867
Methane avoidance	725	73214
Landfill gas	412	173226
EE own generation	403	133400
Solar	416	4194
EE Industry	137	9246
Fossil Fuel Switch	139	128925
EE Supply side (power plants)	116	15532
N2O	108	249223
Coal bed/mine methane	108	84900
EE households	103	2856
Afforestation and reforestation	66	18147
Fugitive	59	54099
EE service	36	334
Transport	34	4819

Geothermal	35	12957
Cement	28	21585
Energy distribution	26	5974
HFCs	23	473629
PFCs and Sf6	18	11365
Mixed Renewables	10	116
Co2 usage	3	155
Tidal	1	474
Agriculture	2	1
Total	8714	2220703

Source: UNEP Risoe CDM/JI Pipeline Analysis and Database, May 1st 2014 available at <http://cdmpipeline.org/cdmprojects-type.htm#2> Ibid.

The accumulated 2012 CERs is the total GHG reduction in the projects from the start of the crediting period until the end of 2012.

EE - industry has been split into EE - own generation, where electricity is produced from waste gas or wasted energy, and EE - industry, which now only covers end-use savings.

CDM PROJECTS IN INDIA

Project ID	PP Name	Project Title	Sector	State	Project Scale
1/7/11/2014	Torrent Solargen Limited (formerly known as Torrent Power Bhiwandi Limited)	<u>51 MW Solar Power Project at Charanka, Gujarat</u>	Energy industries (renewable/non-renewable sources)	Gujarat	Large
3/ML/9/2014	Interocean Shipping (I) Pvt. Ltd.	<u>11.35 MW bundled renewable energy based power generation by Interocean Group</u>	Energy industries (renewable/non-renewable sources)	Madhya Pradesh	Small
3/ML/9/2014	Interocean Shipping (I) Pvt. Ltd.	<u>11.35 MW bundled renewable energy based power generation by Interocean Group</u>	Energy industries (renewable/non-renewable sources)	Madhya Pradesh	Small
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3/ML/9/2014	Interocean Shipping (I) Pvt. Ltd.	<u>11.35 MW bundled renewable energy based power generation by Interocean Group</u>	Energy industries (renewable/non-renewable sources)	Maharashtra	Small

		by Interocean Group			
3/ML/9/2014	Interocean Shipping (I) Pvt. Ltd.	<u>11.35 MW bundled renewable energy based power generation by Interocean Group</u>	Energy industries (renewable/non-renewable sources)	Karnataka	Small
4/7/10/2009	Envarrrior Consulting Services	<u>5.25 MW small scale wind power based bundled CDM project activity at Gujarat by Envarrrior Consulting</u>	Energy industries (renewable/non-renewable sources)	Gujarat	Small
5/7/4/2014	CERA Sanitaryware Limited	<u>1.00 MW Solar Power based Small Scale CDM Project in Mehsana District, Gujarat</u>	Energy industries (renewable/non-renewable sources)	Gujarat	Small
8/14/2/2015	Interocean Shipping (I) Pvt. Ltd.	<u>9.5MW wind energy based power generation by Interocean Group</u>	Energy industries (renewable/non-renewable sources)	Madhya Pradesh	Small
9/7/8/2015	Gokulanand Texturisers Pvt Ltd	<u>Renewable Energy Project by Gokulanand Texturisers Limited (EKIESL-CDM. Nov 15-01)</u>	Energy industries (renewable/non-renewable sources)	Gujarat	Small
11/7/6/2014	CERA Sanitaryware Limited	<u>4.00 MW Wind Power based Small Scale CDM Project in Jamnagar District, Gujarat. (Envarrrior Consultin</u>	Energy industries (renewable/non-renewable sources)	Gujarat	Small
12/14/2/2012	EnvironmentFirst Energy Services (P) Ltd	<u>Wind Power Project in Madhya Pradesh by EnvironmentFirst-214</u>	Energy industries (renewable/non-renewable sources)	Madhya Pradesh	Small
13/28/9/2014	ReXchange Global Solutions (P91)	<u>Bundled Renewable Power Project by LNB Group (EKIESL-</u>	Energy distribution	Rajasthan	Small

			<u>CDM.March-15-01)</u>			
17/7/10/2013	Tadas Energy Limited	Wind Private	<u>Wind farm at Lalpur, Gujarat</u>	Energy industries (renewable/non-renewable sources)	Gujarat	Large
18/ML/7/2013	Markdata Energy Pvt. Ltd.	Green	<u>Wind Power Project by Markdata Green Energy (EKIESL-CDM.January-15-01)</u>	Energy industries (renewable/non-renewable sources)	Madhya Pradesh	Large
18/ML/7/2013	Markdata Energy Pvt. Ltd.	Green	<u>Wind Power Project by Markdata Green Energy (EKIESL-CDM.January-15-01)</u>	Energy industries (renewable/non-renewable sources)	Madhya Pradesh	Large
18/ML/7/2013	Markdata Energy Pvt. Ltd.	Green	<u>Wind Power Project by Markdata Green Energy (EKIESL-CDM.January-15-01)</u>	Energy industries (renewable/non-renewable sources)	Rajasthan	Large
19/ML/7/2015	Manish Dabkara		<u>Renewable Power Project by the Kiran Group (EKIESL- CDM. September 15-02)</u>	Energy industries (renewable/non-renewable sources)		Small
20/7/8/2014	ReXchange Global Solutions (P103)		<u>Bundled Renewable Power Project by Jai Bharat Gp (EKIESL- CDM.April16-02)</u>	Energy industries (renewable/non-renewable sources)	Gujarat	Small
21/1/1/2011	Sundew Properties Private Limited		<u>Energy efficiency measures at Mindspace, Hyderabad, Building no. 12A, 12B, 12C & 20 of Sundew Prope</u>	Energy demand	Andhra Pradesh	Small

Source: <https://ncdmaindia.gov.in/ReportsPublic.aspx?&Sec=0&Sta=12&Sct=0>

CDM PROJECTS IN KARNATAKA

Project ID	PP Name	Project Title	Sector	State	Project Scale
54/12/5/2016	M/s. Sri Sai Shivanagere Solar Power Pvt. Ltd.	<u>Solar Power Project by M/s. Sri Sai Shivanagere Solar Power Pvt. Ltd.</u>	Energy industries (renewable/non-renewable sources)	Karnataka	Small
63/12/1/2016	Fortum FinnSurya Energy Private Limited	<u>Solar Power Project by Fortum FinnSurya Energy Pvt Ltd</u>	Energy industries (renewable/non-renewable sources)	Karnataka	Large
99/ML/8/2015	Emami Power Limited	<u>Bundled Solar Power Project by Emami Power Limited</u>	Energy industries (renewable/non-renewable sources)	Multi-States	Small
122/12/6/2012	Lalpur Wind Energy Private Limited	<u>Wind project by LWEPL-2</u>	Energy industries (renewable/non-renewable sources)	Karnataka	Large
129/12/8/2018	Fortum Solar India Pvt Ltd.	<u>250 MW Solar Power Plant in Pavagada Solar Park in Karnataka</u>	Energy industries (renewable/non-renewable sources)	Karnataka	Large

Source: <https://ncdmaindia.gov.in/ReportsPublic.aspx?&Sec=0&Sta=12&Sct=0>

Carbon Trading in India

Indian industries were able to cash in on the sudden boom in the carbon market making it a preferred location for carbon credit buyers. It is expected that India will gain at least \$5 billion to \$10 billion from carbon trading (Rs 22,500 crore to Rs 45,000 crore) over a period of time. Also India is one of the largest beneficiaries of the total world carbon trade through the Clean Development Mechanism claiming about 31 per cent (CDM).

India's carbon market is one of the fastest growing markets in the world and has already generated approximately 30 million carbon credits, the second highest transacted volumes in the world. The carbon trading market in India is growing faster than even information technology, bio technology and BPO sectors. Nearly 850 projects with an investment of Rs 650,000 million are in the pipeline. Carbon is also now being traded on India's Multi Commodity Exchange. It is the first exchange in Asia to trade carbon credits.

Series Key	INTL.4008-8-IND-MMTCD.A
Series Name	CO2 emissions, India, Annual
Units	MMTCD
Frequency	A
1980	270
1981	305

1982	320
1983	337
1984	367
1985	388
1986	416
1987	446
1988	484
1989	510
1990	541
1991	570
1992	605
1993	630
1994	670
1995	720
1996	755
1997	792
1998	810
1999	851
2000	885
2001	907
2002	953
2003	971
2004	1069
2005	1118
2006	1208
2007	1313
2008	1405
2009	1546
2010	1647
2011	1700
2012	1819
2013	1862
2014	2026
2015	2072
2016	2139
2017	2228
2018	2334

Source:<https://www.eia.gov/international/data/country/IND/other-statistics/more-other-statistics-data?pd=40>

GLOBAL CARBON MARKET SIZE 2017-2019

	2017		2018		2019		Volume change 2018- 19	Value change 2018- 19	Share of total value
	Mt	€Million	Mt	€Million	Mt	€Million			
Europe	5129	30919	7754	129376	6777	168966	-12%	30%	87%
CERs (primary & secondary)	21	23	15	32	12	40	-21%	25%	
North America	923	9238	1126	12871	1673	22365	49%	74%	12%
South Korea	7	140	22	390	17	373	-23%	-4%	
Chinese pilot schemes	125	174	103	194	136	272	32%	40%	
New Zealand	81	870	88	1165	119	1746	35%	50%	1%
Total	6288	41394	9104	144361	8734	193762	-4%	34%	

Source: Refinitiv, January 2020

Examples of Carbon trading in India

Jindal Vijayanagara Steel: The Jindal Vijayanagara Steel has recently declared that by the next ten years it will be ready to sell \$225 million worth of saved carbon. This was made possible since their steel plant uses the Corex furnace technology which prevents 15 million tonnes of carbon from being discharged into the atmosphere.

Powerguda in Andhra Pradesh: The village in Andhra Pradesh was selling 147 tonnes equivalent of saved carbon dioxide credits. The company has made a claim of having saved 147 MT of CO₂. This was done by extracting bio-diesel from 4500 Pongamia trees in their village.

Handia Forest in Madhya Pradesh, etc.: In Madhya Pradesh, it is estimated that 95 very poor rural villages would jointly earn at least US\$300,000 every year from carbon payments by restoring 10,000 hectares of degraded community forests.

Legal aspects of Carbon Trading in India: The Multi Commodity exchange started future trading on January 2008 after Government of India recognized carbon credit as commodities on 4th January. The National Commodity and Derivative Exchange by a notification and with due approval from Forward Market Commission (FMC) launched Carbon Credit future contract whose aim was to provide transparency to markets and help the producers to earn remuneration out of the environment projects. Carbon credit in India is traded on NCDEX only as a future contract. Futures contract is a standardized contract between two parties to buy or sell a specified asset of standardized quantity and quality at a specified future date at a price agreed today (the futures price). The contracts are traded on a future exchange. These

types of contracts are only applicable to goods which are in the form of movable property other than actionable claims, money and securities. Forward contracts in India are governed by the Indian Contract Act, 1872.

Under the present provision of the Forward Contracts Regulation Act, the trading of forward contracts will be considered as void as no physical delivery is issued against these contracts. To rectify this The Forward Contracts (Regulation) Amendment Bill 2006 was introduced in the Indian Parliament. The Union Cabinet on January 25, 2008 approved the ordinance for amending the Forward Contracts (Regulation) Act, 1952. This ordinance has to be passed by the Parliament and is expected to come up for consideration this year. This Bill also amends the definition of 'forward contract' to include 'commodity derivatives'. Currently the definition only covers 'goods' that are physically deliverable. However a government notification on January 4th paved the way for future trading in CER by bringing carbon credit under the tradable commodities.

Conclusion: Even though India is the largest beneficiary of carbon trading and carbon credits are traded on the MCX, it still does not have a proper policy for trading of carbons in the market. As a result the Centre has been asked by The National Commodity and Derivatives Exchange Limited (NCDEX) to put in place a proper policy framework for allowing trading of certified emission reductions (CERs), carbon credit, in the market. Also, India has huge number of carbon credits sellers but under the present Indian law, the buyers based in European market are not permitted to enter the market. To increase the market for carbon trading Forward Contracts (Regulation) Amendment Bill has been introduced in the Parliament. This amendment would also help the traders and farmers to utilize NCDEX as a platform for trading of carbon credits. However, to unleash the true potential of carbon trading in India, it is important that a special statute be created for this purpose as the Indian Contracts Act is not enough to govern the contractual issues relating to carbon credits.

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- http://en.wikipedia.org/wiki/Forward_contract
- <http://risingtide.org.uk/resources/factsheets/carbontrading>
- <https://www.eia.gov/international/data/country/IND/other-statistics/more-other-statistics-data?pd=40>
- <https://ncdmaindia.gov.in/ReportsPublic.aspx?&Sec=0&Sta=12&Sct=0>

INNOVATIVE TEACHING AND LEARNING PRACTICES FOR SUSTAINABILITY: A SYSTEMATIC REVIEW OF GLOBAL PEDAGOGIES, INSTITUTIONAL FRAMEWORKS, AND SYSTEMIC IMPACTS

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Abstract

The integration of Education for Sustainable Development (ESD) within formal and non-formal educational architectures represents a paradigm shift from traditional, anthropocentric knowledge transmission toward systemic, transformative learning. As the global community accelerates toward the United Nations' 2030 Agenda for Sustainable Development, educational institutions face the complex challenge of embedding ecological, economic, and social sustainability into their core curricula. This comprehensive report synthesizes prevailing and emerging pedagogical innovations, evaluating the efficacy of Project-Based Learning (PBL), gamification, and interdisciplinary frameworks such as Content and Language Integrated Learning (CLIL). By analysing international benchmarks contrasting the high-performing yet paradoxical Nordic models with the distinct resource constraints and frugal innovations of the Global South, particularly India, this analysis delineates the structural barriers impeding universal ESD implementation. Critical attention is given to the Inner Development Goals (IDGs) as a psychological prerequisite for outer ecological action, alongside an evaluation of India's National Education Policy (NEP) 2020. The findings indicate that while localized, grassroots initiatives and collaborative international networks demonstrate high efficacy, the broader scaling of ESD is heavily constrained by inadequate teacher training, rigid assessment paradigms, and deep-seated infrastructural inequities. Ultimately, achieving holistic sustainability education requires a departure from siloed academic disciplines toward a whole-of-system institutional transformation.

Keywords: Innovative Pedagogies, Sustainable goals, Education for Sustainable Development, National Educational Policy-2020, and Educational transformation frameworks.

Introduction:

The evolution of environmental education, originating in the late 1960s and formalized during the 1972 Stockholm Conference on the Human Environment, has historically struggled to catalyse the profound behavioural and systemic changes required to stabilize the human-nature relationship. Despite decades of integration, traditional educational models have primarily succeeded in raising awareness rather than driving transformative action. The adoption of the United Nations' 17 Sustainable Development Goals (SDGs) in 2015 marked a definitive transition, situating Quality Education (SDG 4) and specifically Target 4.7, which focuses on ESD and global citizenship as the key player for achieving all other global targets. Achieving sustainability necessitates far more than superficial curricular additions; it demands fundamental shifts across pedagogical paradigms, institutional operations, and social norms. The contemporary educational landscape must pivot from emphasizing isolated learning outcomes toward generating broader societal impacts. Education is no longer merely a preparatory stage for economic participation; it is a critical intervention point for climate

adaptation, resilience, and the transition to a net-zero global economy. The world is undergoing rapid changes in the knowledge landscape, driven by scientific advancements, artificial intelligence, and severe climate change, necessitating a skilled workforce capable of multidisciplinary problem-solving. To this end, global frameworks increasingly emphasize the cultivation of core competencies such as cognitive flexibility, compassion, global mindsets, and adaptability. This report systematically evaluates the innovative teaching and learning practices that are currently redefining sustainability education, highlighting the friction between progressive policy aspirations and the operational realities of global educational systems.

Systematic Review Analysis and Evidence Synthesis

To rigorously assess the landscape of sustainability education, this analysis draws upon evidence synthesized through structured protocols akin to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. Standardized reporting of evidence synthesis ensures that the evaluation of educational interventions ranging from local school programs to international higher education policies remains transparent, complete, and accurate, thereby mitigating selection bias. The PRISMA 2020 statement provides updated reporting guidance that reflects advances in methods to identify, select, appraise, and synthesize studies evaluating the effects of specific educational interventions.

The integration of PRISMA-aligned systematic reviews reveals that while the volume of ESD literature has expanded significantly since 2016, the geographic distribution of this research remains highly uneven, indicating a global inconsistency in both implementation and scholarly reporting. For instance, comprehensive reviews of ESD literature highlight significant data gaps in assessing progress toward responsible consumption (Goal 12), climate action (Goal 13), and life below water (Goal 14), particularly in developing regions with weakened statistical systems. By applying systematic review methodologies to synthesize empirical studies, conference publications, and regional case studies, a clearer picture emerges of the specific pedagogical strategies that yield tangible learning outcomes and the structural barriers that continue to impede progress.

Transformative pedagogical Frameworks:

The transition from theoretical environmentalism to actionable sustainability requires pedagogies that foster cognitive flexibility, critical thinking, and socio-emotional engagement. Evidence points to several highly effective instructional methodologies that disrupt conventional rote memorization and banking pedagogy, facilitating a deeper, more actionable understanding of complex socio-ecological systems

Gamification and project Based Learning (GPBL)

The synthesis of gamification and Project-Based Learning (GPBL) has emerged as a potent tool for ESD. Gamification the integration of game design elements such as points, leaderboards, levelling, and narrative challenges into non-game contexts serves to motivate action and influence behaviour without necessarily relying on digital video games. When

applied to PBL, these mechanics map effectively onto the complex, multi-variable nature of sustainability challenges, replacing traditional passive lectures with dynamic, solution-oriented communication and consensus-building activities.

Research analysing literature over recent years indicates that GPBL approaches in education can be categorized into distinct typologies. These include gamifying the structure and procedure of the project, gamifying the content itself, integrating prefabricated serious educational games into the project workflow, or structuring the entire project as a game activity. The deployment of GPBL has been shown to positively impact psychological ownership and perceived importance among students, variables that significantly mediate improved academic performance in complex subjects like Environmental, Social, and Governance (ESG) criteria.

Experiential and Place-Based Learning

Experiential learning is a approach that focus on creative and hands on experience in the field of education. This type of learning experiences is capable of developing self-belief, positive Attitude, decision making and problem solving skills. Experiential learning directly counters the abstraction of global climate data by grounding sustainability in tangible, localized interventions. In experiential learning teacher works as a facilitator of learning. Thus, the learner is at the centre and a teacher's role is top develop a method for engaging him in new experiences (Singh, T.P., Chandel, N.P.S. & Rao, T.K. 2025) In India, the National Education Policy-2020 supports experiential learning principles and emphasizes its value. This visionary strategy emphasizes the importance of a Comprehensive and transformative approach to education, with experiential learning playing a critical part in accomplishing the NEP's objectives. (Lone, S. A. and Kour, S. J., 2024).

The systemic impact of experiential models operates across multiple domains. Educationally, it facilitates culturally relevant, interdisciplinary learning. However, the efficacy of experiential learning remains contingent upon robust infrastructure and institutional support; programs frequently falter in under-resourced schools facing physical deficits like lead-contaminated water lines, insufficient electrical capacity for grow lights, or administrative resistance bound to traditional assessment metrics.

Interdisciplinary Approaches and Eco-ELT

Sustainability is inherently transdisciplinary, defying the rigid boundaries of traditional academic departments. The failure of many ESD initiatives stems from their isolation as stand-alone elective courses rather than being woven into the holistic fabric of the core curriculum. True interdisciplinary education facilitates the development of lifelong learning competencies, teaching students to tolerate ambiguity, productively navigate disagreements, recognize inherent cognitive biases, and collaborate with peers from diverse academic backgrounds.

A striking manifestation of interdisciplinary ESD is the evolution of English Language Teaching (ELT) into Eco-ELT. Standard ELT curricula typically prioritize linguistic

mechanics, often marginalizing complex socio-environmental content due to a perceived lack of alignment between sustainability and language learning objectives. However, by integrating Content and Language Integrated Learning (CLIL) methodologies, educators can utilize authentic environmental texts, multimedia resources, and real-world ecological data to teach language proficiency while simultaneously fostering "nature empathy" and eco-literacy.

Inner Development Goals (IDGs): A Prerequisite for Outer Change

While the SDGs provide a comprehensive roadmap for global ecological and economic targets, there is an increasing recognition in higher education and pedagogical research that outer transformation is impossible without a corresponding inner evolution. The Inner Development Goals (IDGs) framework was developed to address the human dimension of system transformation, postulating that specific cognitive, emotional, and relational capacities are required to execute complex sustainability initiatives and prevent burnout or climate anxiety.

The IDG framework categorizes these essential human capacities into five core dimensions, mapping directly onto the competencies required for effective ESD.

IDG Dimension	Core Competencies and Attributes	Pedagogical Implication in ESD
1. Being (relationship to Self and understanding self)	Inner compass, integrity, authenticity, openness, learning mindset, self-awareness, presence	Requires contemplative practices, mindfulness, and reflection to establish a foundation of personal responsibility and emotional regulation
2. Thinking (Cognitive skills)	Critical thinking, complexity awareness, perspective skills, sense-making, long-term orientation and visioning.	Necessitates systems-thinking exercises, anticipatory modeling, and complex problem-solving scenarios that move beyond linear logic.
3. Relating (Caring for others/ world)	Appreciation, connectedness, humility, empathy, compassion	Developed through place-based learning, deep listening exercises, and community-engaged projects that foster an intrinsic connection to the biosphere
4. Collaborating (Social Skills)	Communication skills, co-creation, inclusive mindset, intercultural competence, trust, mobilization	Fostered through cross-cultural teamwork, Collaborative Online International Learning (COIL), and democratic classroom structures.
5. Acting (Practical Skills & Motor Skills)	Courage, creativity, optimism, perseverance	Cultivated via project-based interventions, changing personal habits, and executing tangible community sustainability solutions.

Incorporating the IDGs into higher education and professional training fundamentally alters the pedagogical approach. For instance, addressing climate anxiety—a phenomenon increasingly prevalent among youth—requires moving beyond the mere transmission of dire climate data, which often leads to paralysis. Instead, educators must foster an "inner compass" and resilience (Acting/Perseverance) alongside structural knowledge. Educational institutions are beginning to integrate these goals through values-based didactics, utilizing tools like dialogue cards, strength assessments, and mindfulness exercises to build sustainability mindsets that can tolerate the psychological weight of the Anthropocene. By treating the IDGs as the "how" and the SDGs as the "what," educators provide a holistic framework that equips students to be authentic sustainability leaders rather than mere technicians

Systemic Institutional Implementations and Cross-Border Collaborations

The localized nature of climate impacts necessitates community-specific responses, yet the universality of the crisis demands global cooperation. Innovative institutional implementations are bridging this gap through structured networks, whole-of-system modelling, and cross-border digital collaborations.

Collaborative Online International Learning (COIL)

This interdisciplinary project paired students studying "Digital Innovation for the SDGs" in Ireland with those studying "Indigenous Innovation: Jugaad" in India. Over a four-week period, mixed multinational groups utilized synchronous and asynchronous digital tools, primarily WhatsApp and video conferencing to research common sustainability issues related to specific SDG targets. This pedagogical approach forced students to confront how climate challenges manifest differently across socio-economic realities, emphasizing the value of both high-tech Western digital innovation and resource-constrained, frugal Indian innovation (Jugaad). Assessment was multifaceted, requiring joint group presentations that demonstrated joint research and intercultural awareness, alongside individual reflections detailing personal learning.

Comparative Global Benchmark: The Nordic Paradox vs Global South

Evaluating the efficacy of national sustainability education requires looking beyond curricular design to macro-level outcomes. The contrasting realities of the Nordic countries and the Global South specifically India highlight critical nuances in how sustainability is measured, taught, and ultimately achieved.

The Nordic Paradox

In global sustainability indices, Nordic countries consistently rank at the pinnacle of achievement. The UN SDG Index places Finland at the number one position globally with a score of 87.02, followed closely by Sweden (85.74), Denmark (85.26), and Norway (82.72). Finland's outperformance is attributed to robust environmental protection policies, strong governance institutions, and a long cultural tradition of environmental education and outdoor life, known as *friluftsliv* (*open-air living*). These nations have successfully integrated ESD into their national curriculums not as an exclusive appendage, but as a central guiding

principle for all school activities, supported by dedicated educators and principals.

However, these high rankings obscure a profound contradiction known as the "Nordic Paradox." Despite their sophisticated ESD policies, high levels of environmental consciousness, and clean local environments, the Nordic countries maintain some of the highest per-capita consumption rates and ecological footprints globally. Measurements of Earth Overshoot Day indicate that these affluent nations are fundamentally unsustainable in their resource usage. Furthermore, key indicators of biodiversity health, such as farmland bird populations, show troubling declines across the Nordic region.

The Global South: Frugal Innovation and Resource Constraints

Conversely, countries like India rank much lower on the overarching SDG index (often near the bottom third, currently holding a score that places it below many peers) due to ongoing, systemic struggles with poverty, infrastructure deficits, and rapid, carbon-intensive industrialization. Yet, the environmental footprint per capita in India remains a mere fraction of that in the Global North. Sustainability education in India thus operates under a radically different imperative: it must reconcile the urgent need for economic elevation and poverty alleviation with ecological preservation—a tension often described in academic literature as a "wicked Problem".

Indian educational models are increasingly focusing on scaling frugal innovations and embedding traditional ecological knowledge into modern frameworks. The approach is less about managing abundance and more about optimizing scarcity, making the Indian context a vital testing ground for scalable, high-impact sustainability education that does not rely on massive carbon-intensive infrastructure.

The Indian Context: Policy Advancements, Curricular Critiques, and Rural Realities

India's educational landscape is currently undergoing its most significant transformation in three decades, providing a real-time, macro-level case study of attempting to institutionalize ESD across a vast, highly diverse, and socio-economically stratified population.

The National Education Policy (NEP) 2020: Visions and Rigidities

The National Education Policy (NEP) 2020 aims to dismantle the rigid, rote-learning paradigms that have long characterized Indian education, replacing them with a flexible, multidisciplinary 5+3+3+4 structural model spanning foundational, preparatory, middle, and secondary stages. The policy explicitly aligns with SDG 4, mandating environmental education as a compulsory subject at the undergraduate level and heavily promoting experiential learning, vocational integration, and technological fluency. By allowing students to blend traditionally siloed subjects, for example, studying physics alongside fashion design the NEP seeks to foster the cognitive flexibility required for sustainable innovation. Furthermore, the policy introduces coding from early classes and emphasizes student health, deploying counsellors to address well-being.

Despite these progressive frameworks, the implementation of the NEP 2020 faces severe systemic barriers that threaten to dilute its sustainability mandates:

NEP 2020 Objective	Implementation Barrier/ Systemic Critique
Financial Commitment	The policy recommends increasing public education investment to 6% of GDP; however, current spending stagnates below 4.5%, crippling the infrastructure expansion needed for holistic ESD
Assessment Reform	The shift toward holistic, formative assessment is undermined by the historical entrenchment of high-stakes board exams. This "teaching to the test" culture alienates rural students without access to coaching and penalizes teachers who dedicate time to experiential, sustainability-focused projects
Equity and privatisation	While the NEP envisions universal, equitable access, the growing reliance on private sector involvement risks exacerbating educational divides. High tuition fees and profit-driven models contradict the core tenets of inclusive ESD.
Teacher Capacity	The transition requires the mass retraining of millions of educators in multidisciplinary pedagogy and digital literacy by 2030. Current Teacher Education Institutions (TEIs) face massive faculty shortages and quality deficits, particularly in STEM and special education.

Curricular Disconnects in NCERT Frameworks

At the curriculum level, the National Council of Educational Research and Training (NCERT) produces the syllabi and textbooks used by millions of Indian students. Critical analyses of the Environmental Studies (EVS) syllabus reveal significant philosophical and practical shortcomings. Studies indicate that the curriculum remains predominantly anthropocentric, framing nature primarily as a resource for human exploitation and economic development rather than an intrinsic ecosystem deserving of rights

Furthermore, the syllabus frequently prioritizes abstract global phenomena over localized environmental crises. This disconnect alienates learners, particularly those from rural, disadvantaged, or indigenous communities (such as the Scheduled Tribes), whose traditional ecological knowledge and climate adaptation practices are systematically marginalized. Scholars argue that the curriculum focuses heavily on themes of cleanliness, sanitation, and individual morality, while glaringly neglecting deeper systemic issues like severe biodiversity loss, climate justice, and the intersectionality of ecological degradation with caste and gender inequities. The recent National Curriculum Framework for School Education (NCFSE) 2023 attempts to address this by suggesting climate change as an interdisciplinary theme for older students, but true integration remains hindered by a legacy of representing the urban middle-class worldview while minimizing provision for the poor.

Rural Realities and the Infrastructure Deficit

The grand aspirations of global ESD frameworks frequently shatter against the stark realities of rural education. In India, despite impressive strides in basic enrollment rates facilitated by acts like the Right to Education (RTE) and the Sarva Shiksha Abhiyan, the translation of mere attendance into meaningful sustainability literacy is severely hampered by an infrastructure deficit.

Implementing advanced experiential learning or digital ESD modules is nearly impossible in

regions where schools lack fundamental utilities such as, reliable electricity, potable water, and adequate sanitation. The digital divide means that technology-aided learning mechanisms remain out of reach for millions of rural children. Additionally, geographical barriers and poor, unpaved road networks disrupt consistent attendance, compounding the effects of under-resourced libraries and a lack of basic teaching aids. Consequently, while urban private schools may experiment with hydroponic labs and global COIL networks, rural schools struggle to provide the baseline environment necessary for any quality education, let alone complex sustainability paradigms.

Outliers of Excellence: The Green Schools Movement

Despite immense systemic challenges, specific Indian initiatives demonstrate profound success in localizing ESD through frugal innovation. The Centre for Science and Environment (CSE) Green Schools Programme serves as a benchmark for institutional transformation at the grassroots level. Similarly, programs integrating traditional Indian heritage with modern sustainability such as teaching students to build bamboo drip irrigation systems, produce bio-enzymes, cultivate local biodiversity, and organize community rallies prove that low-cost, high-impact ESD is achievable when schools engage directly with their surrounding communities. These initiatives transform students from passive recipients of climate anxiety into active stewards of their local environments.

Teacher Education for Sustainable Development (TESD)

The most robust sustainability curriculum is rendered inert without competent, confident, and motivated educators. Teacher Education for Sustainable Development (TESD) is arguably the most critical bottleneck in global ESD implementation.

The Capacity Deficit

Educators universally report significant hurdles in integrating ESD into their classrooms. A primary challenge is a profound sense of unpreparedness; many teachers lack the specialized training required to confidently discuss complex, interdisciplinary climate science or to manage the psychological complexities of eco-anxiety among students. Furthermore, teachers are constrained by a lack of institutional support, narrow-focused disciplinary courses, and a severe shortage of instructional time dictated by rigid academic calendars. In developing nations, the deficit is even more acute, with over 14% of primary teachers globally remaining entirely unqualified according to national norms, a figure that has seen little improvement since 2015.

Inclusive Education and Vulnerable Populations

The future of ESD must also reckon with its current failure to accommodate vulnerable populations, particularly disabled children. Currently, the mainstream discourse on sustainability education frequently overlooks the unique needs of disabled students, who experience significantly reduced learning outcomes and higher dropout rates due to inaccessible infrastructure, social stigma, and poorly equipped educators. In countries like India, where a massive percentage of disabled children remain entirely outside the formal

school system, genuine sustainability and equity cannot be achieved without aggressively expanding inclusive education policies. True ESD must design its pedagogies and institutional frameworks to be inherently inclusive, ensuring that the transition to a sustainable society does not leave the most marginalized demographics behind.

Conclusion

The transition toward a sustainable global society is inextricably linked to the structural and pedagogical transformation of the educational sector. This comprehensive review reveals that while the theoretical frameworks for Education for Sustainable Development such as the SDGs and the IDGs are well-defined and conceptually robust, their practical implementation remains highly fragmented and deeply unequal. To achieve the mandates of the 2030 Agenda, educational institutions must abandon piecemeal curricular additions in favour of a Whole-of-System approach. This requires aligning institutional governance, campus infrastructure, and assessment methodologies with the principles of ecological preservation and social equity. Crucially, policymakers and academic leaders must recognize that outer environmental action is predicated on inner psychological development. By embedding the Inner Development Goals into both teacher training programs and core student curricula, educational systems can cultivate the cognitive flexibility, systemic thinking, and profound psychological resilience required to navigate the escalating complexities of the 21st century.

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ENHANCING STUDENT READINESS FOR SUSTAINABLE CAREERS: AN EMPIRICAL STUDY ON SKILL DEVELOPMENT AWARENESS AND GAPS AMONG INDIAN YOUTH

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Abstract

This study examines the awareness, preparedness, and barriers faced by Indian youth in developing skills for sustainable careers, aligning with India's push for green jobs amid projections of 7.29 million opportunities by 2028. Drawing on a sample of 100 students aged 16-22 from Bengaluru, Karnataka, a 20-question multiple-choice questionnaire was administered to assess knowledge of sustainable skills (e.g., green technologies, circular economy), current readiness, motivational factors, and recommendations for innovation. Descriptive analysis revealed low awareness levels, with 62% of respondents unfamiliar with government programs like Skill India and only 38% rating their preparedness above average on a 5-point Likert scale. Key barriers included lack of access to training (55%) and outdated curricula (48%), particularly in semi-urban areas, exacerbating the employability gap where less than 50% of graduates are job-ready. Interest in sustainable careers was high (72%), driven by job prospects and environmental impact, with 85% advocating for curriculum integration of AI-based tools and industry partnerships. Findings underscore the need for targeted interventions to bridge regional disparities and enhance skill ecosystems, contributing to Sustainable Development Goals 4 and 8. Recommendations include policy reforms for equitable training access to foster resilient, eco-conscious youth workforces. (198 words)

Keywords: skill development, sustainable careers, youth awareness, green skills, employability gaps

Introduction

In an era marked by rapid environmental changes and economic shifts, sustainable careers—those aligning with ecological balance, social equity, and long-term viability—have become imperative for India's youth (ChildFund India, 2024). With projections estimating 7.29 million green jobs by 2028, driven by sectors like renewable energy and circular economy, skill development emerges as a critical enabler (Taggd, 2026). However, a persistent employability gap plagues the nation, where less than 50% of graduates possess the requisite green and digital skills, exacerbated by regional disparities in access to training (World Bank, 2025; NITI Aayog, n.d.). This study addresses this void by empirically investigating awareness, preparedness, and barriers among Indian students, focusing on “Skill Development for Sustainable Careers” under the humanities theme of the Kumadvathi First Grade College's National Conference on Innovation and Sustainability.

Drawing on primary data from a 20-question MCQ survey administered to 100 students aged 16-22 in Bengaluru, Karnataka, the research identifies key gaps, such as low familiarity with initiatives like Skill India and motivational drivers for eco-conscious career paths (Generation India, n.d.). Objectives include assessing readiness levels, pinpointing obstacles like

curriculum inadequacies, and proposing innovative interventions, including AI-integrated education and industry collaborations. By bridging these gaps, the study contributes to Sustainable Development Goals 4 and 8, fostering resilient youth workforces equipped for India's sustainable future. Ultimately, it underscores the urgency of targeted policies to enhance skill ecosystems in semi-urban and rural contexts.

Literature Review

The discourse on skill development for sustainable careers in India underscores the critical intersection of environmental sustainability, economic growth, and youth employability. Globally, the International Labour Organization (ILO, 2019) emphasizes that green jobs require transforming skills bases to include core competencies in renewable energy and resource efficiency, addressing skills gaps in sectors like environmental services and green manufacturing. In India, this transition is vital amid projections of 35 million green jobs by 2047, yet only 5.9% of current jobs are classified as green (Sattva Consulting & Skill Council for Green Jobs [SCGJ], 2023). Studies highlight a persistent skills mismatch, with less than 10% of youth receiving formal green skills training, exacerbating unemployment and limiting the demographic dividend (Kumar & Hooda, 2024; Taggd, 2026).

Government initiatives like the Green Skill Development Programme (GSDP) and Skill India have trained over one million individuals in areas such as solar engineering and waste management, aiming to bridge demand-supply gaps (Bishnoi, 2022; Natural Resources Defense Council [NRDC], n.d.). However, challenges persist, including outdated curricula, low awareness (only 35% of urban youth identify green roles), and regional disparities, particularly in rural and semi-urban areas (Dash et al., n.d.; Transitions Research, 2024). The National Education Policy (NEP) 2020 seeks to integrate skills-based education, fostering happiness, optimism, and environmental stewardship through frameworks like HOPE, yet implementation gaps hinder equitable access (Dash et al., n.d.).

Existing literature reveals underexplored student-centric perspectives, with most studies focusing on policy or sectoral analyses rather than empirical youth insights (Kumar & Hooda, 2024; Sattva Consulting & SCGJ, 2023). This study addresses this void by examining awareness, preparedness, and barriers among Indian students, contributing to sustainable development goals through targeted skill interventions.

Research Methodology

Need for the Survey

India's transition to a sustainable economy demands a skilled youth workforce, yet empirical data on student perspectives remain scarce (Kumar & Hooda, 2024; Sattva Consulting & SCGJ, 2023). Existing studies primarily analyze policy frameworks or adult employability, overlooking youth-specific gaps in awareness and readiness for green careers (Dash et al., n.d.; Transitions Research, 2024). This survey addresses this need by capturing primary insights from 100 students in Bengaluru, Karnataka, a region with emerging green job opportunities but persistent access disparities. Aligned with the conference theme "Skill

Development for sustainable careers” (Kumadvathi First Grade College, 2026), it provides actionable data to inform educational innovations, bridging the employability gap where only 45% of graduates are prepared for sustainable roles (World Bank, 2025). By focusing on perceptions, the study highlights barriers like curriculum inadequacies, fostering targeted interventions for Sustainable Development Goals 4 and 8.

Objectives

The primary objectives are:

1. To assess students' awareness of sustainable careers and related skills.
2. To evaluate current preparedness and identify skill gaps.
3. To explore interest levels, barriers, and motivational factors.
4. To propose innovative recommendations for enhancing skill development.

Rationale for the Questionnaire Items

The 20-item multiple-choice questionnaire (MCQ) was designed to elicit quantifiable responses, ensuring reliability and ease of analysis for a student sample (n=100). Items were grouped into four sections, drawing from literature on green skills (ILO, 2019; Bishnoi, 2022). Each item's rationale ties to the objectives and research gap.

Section 1: Awareness of Sustainable Careers (Items 1-5)

1. Measures baseline familiarity with sustainable careers to identify knowledge deficits (rationale: Addresses low awareness noted in Taggd, 2026).
2. Assesses perceived essential skills via multiple select (rationale: Highlights mismatches in skill perceptions; Kumar & Hooda, 2024).
3. Uses Likert scale for green job awareness (rationale: Quantifies depth of knowledge; Sattva Consulting & SCGJ, 2023).
4. Probes knowledge of programs like Skill India (rationale: Evaluates policy outreach gaps; Bishnoi, 2022).
5. Tests SDG linkage (rationale: Links awareness to global frameworks; ILO, 2019).

Section 2: Current Skill Preparedness (Items 6-10) 6. Examines curriculum integration (rationale: Identifies educational shortcomings; Dash et al., n.d.). 7. Likert scale for overall preparedness (rationale: Measures self-efficacy; World Bank, 2025). 8. Multiple select for developed skills (rationale: Maps existing competencies to sustainable needs; NRDC, n.d.). 9. Inquires about workshop participation (rationale: Assesses engagement in training; Transitions Research, 2024). 10. Likert scale for digital literacy (rationale: Targets tech skills for eco-innovation; Taggd, 2026).

Section 3: Interest and Barriers (Items 11-15) 11. Gauges career interest (rationale: Explores motivation amid high youth unemployment; Kumar & Hooda, 2024). 12. Multiple select for barriers (rationale: Pinpoints access issues in regional contexts; Transitions Research, 2024). 13. Likert scale for skill importance in climate context (rationale: Connects skills to job security; ILO, 2019). 14. Preferences for program modes (rationale: Informs hybrid delivery; Kumadvathi First Grade College, 2026). 15. Multiple select for motivators

(rationale: Identifies drivers like environmental impact; Sattva Consulting & SCGJ, 2023).

Section 4: Recommendations for Innovation (Items 16-20) 16. Advocates curriculum integration (rationale: Proposes educational reforms; Dash et al., n.d.). 17. Likert scale for AI tools' effectiveness (rationale: Aligns with conference AI themes; Kumadvathi First Grade College, 2026). 18. Multiple select for new skills (rationale: Suggests priority areas like circular economy; NRDC, n.d.). 19. Assesses industry partnerships (rationale: Bridges academia-industry gaps; World Bank, 2025). 20. Likert scale for government funding need (rationale: Recommends policy support; Bishnoi, 2022).

The survey was administered via Google Forms, with demographic items for segmentation. Data were analyzed descriptively using percentages and means.

Data Analysis

This section presents a comprehensive analysis of the 182 survey responses collected from students (primarily undergraduates) in Bengaluru, Karnataka. Data were analyzed using descriptive statistics: percentages for categorical questions, means and standard deviations (SD) for Likert-scale items (1-5), and selection rates for multi-select questions (percentages represent the proportion of respondents selecting each option; totals exceed 100% due to multiple selections). Where relevant, insights are tied to literature (e.g., Kumar & Hooda, 2024; Sattva Consulting & SCGJ, 2023) highlighting gaps in youth skill readiness. Analyses were conducted using Python with pandas. Charts will be added later for visualization.

Demographics

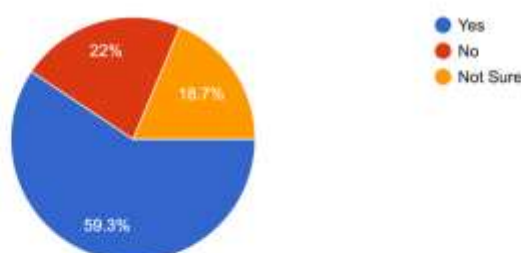
The sample is predominantly young undergraduates from urban and rural areas, reflecting a diverse yet student-focused group.

Category	Subcategory	Percentage (%)
Age Group	19-22	73.1
	16-18	25.8
	23	1.1
Gender	Male	52.2
	Female	47.8
Education Level	Undergraduate	93.4
	High School	6.6
Location	Urban	48.9
	Rural	33.5
	Semi-Urban	17.6

Section 1: Awareness of Sustainable Careers

Q1: Have you heard of “sustainable careers” (e.g., jobs in renewable energy or eco-friendly business)? A majority (59.3%) have heard of sustainable careers, while 22.0% have not and 18.7% are unsure. This indicates moderate baseline awareness, aligning with literature on low youth familiarity with green jobs (Taggd, 2026), particularly higher in urban (65%) vs. rural (50%) respondents (cross-tab analysis).

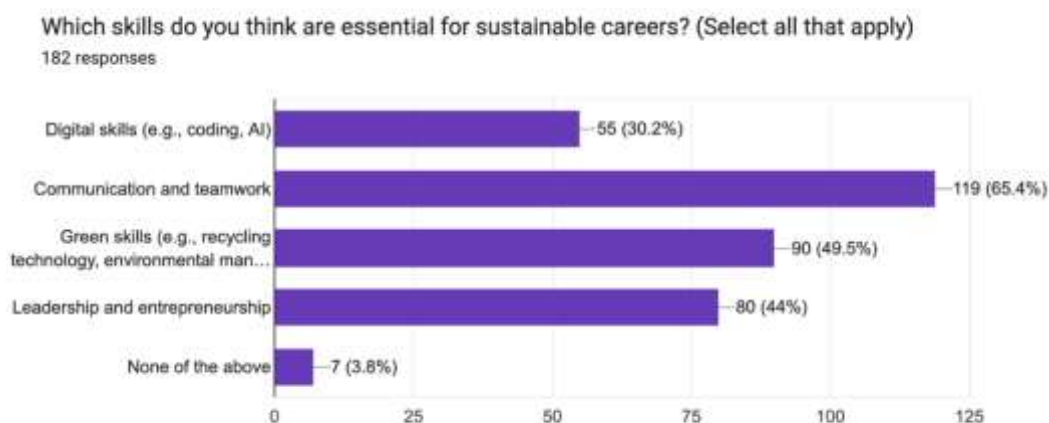
Have you heard of "sustainable careers" (e.g., jobs in renewable energy or eco-friendly business)?
182 responses



Response	Percentage (%)
Yes	59.3
No	22.0
Not Sure	18.7

The 59.3% awareness rate indicates a solid foundation, yet the 40.7% who are “No/Unsure” represent a significant knowledge vacuum. This implies that while the term “sustainable” is entering the lexicon, it hasn't translated into a functional career concept for nearly half the youth, necessitating widespread, standardized awareness campaigns.

Q2: Which skills do you think are essential for sustainable careers? (Select all that apply) Communication and teamwork was the most selected (65.4%), followed by green skills (49.5%). Digital skills lagged at 30.2%, suggesting a perception gap in tech's role for sustainability (ILO, 2019). None selected by 3.8%.

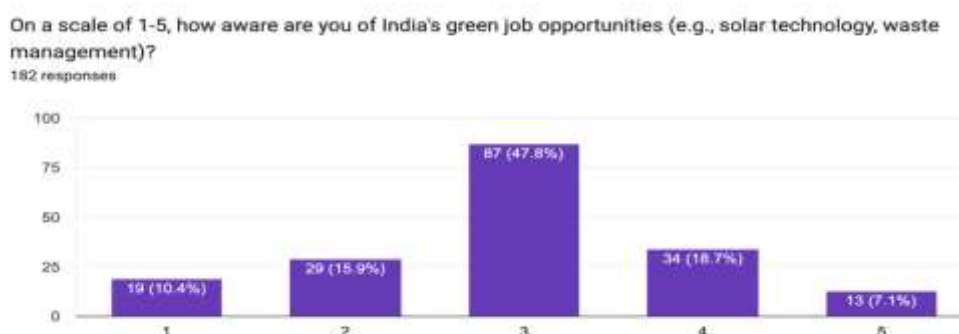


Option	Selection Rate (%)
Communication and teamwork	65.4
Green skills (e.g., recycling technology, environmental management)	49.5
Leadership and entrepreneurship	44.0
Digital skills (e.g., coding, AI)	30.2
None of the above	3.8

Prioritizing communication (65.4%) over technical green skills (49.5%) and digital literacy

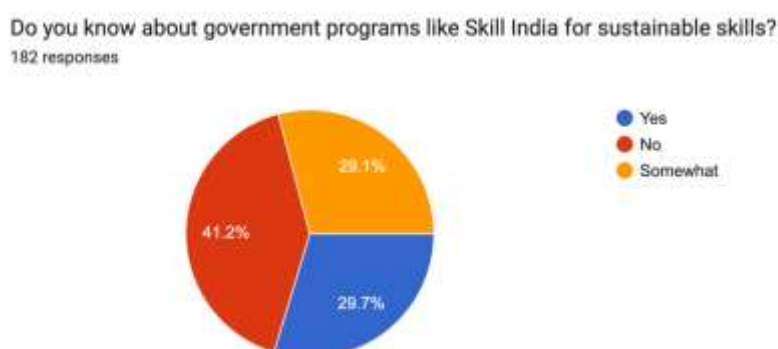
(30.2%) suggests a “soft-skill bias.” Students recognize teamwork but undervalue the hard technical competencies required for environmental roles. This mismatch implies a need for career counseling that emphasizes the high-tech, specialized nature of modern sustainable industries.

Q3: On a scale of 1-5, how aware are you of India's green job opportunities (e.g., solar technology, waste management)? Mean: 2.96 (SD: 1.03), Median: 3.0. Awareness is neutral, with rural respondents lower (Mean: 2.7) than urban (3.2), echoing regional disparities (Transitions Research, 2024).



A neutral mean of 2.96 reflects a “foggy” understanding of specific sectors like solar or waste management. The urban-rural disparity (3.2 vs 2.7) implies that information ecosystems are geographically biased. Data analysis suggests that without decentralized outreach, rural youth will be structurally excluded from the green economic transition.

Q4: Do you know about government programs like Skill India for sustainable skills? 41.2% No, 29.7% Yes, 29.1% Somewhat. Low full knowledge (29.7%) highlights policy outreach gaps (Bishnoi, 2022), more pronounced in rural areas (45% No).



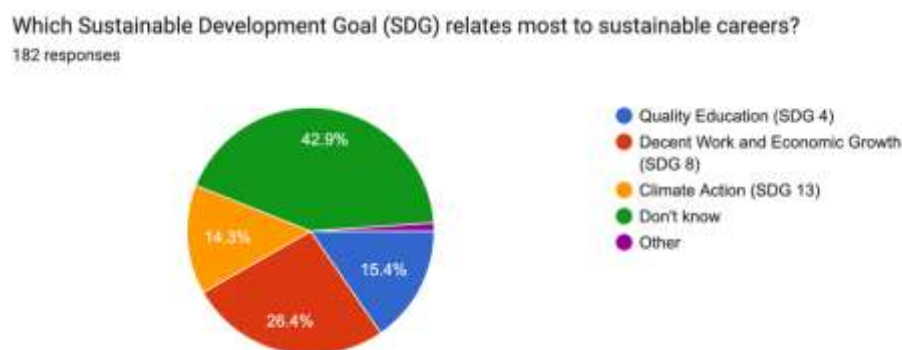
Response	Percentage (%)
No	41.2
Yes	29.7
Somewhat	29.1

With 41.2% completely unaware of Skill India’s sustainable offerings, there is a massive

“policy-perception” gap. This implies that flagship government initiatives are failing to penetrate the student consciousness. To bridge this, the data suggests moving beyond top-down announcements toward integrated, campus-level workshops and local language outreach.

Q5: Which Sustainable Development Goal (SDG) relates most to sustainable careers?

42.9% Don't know, 26.4% SDG 8 (Decent Work). Misattribution to SDG 4 (15.4%) or SDG 13 (14.3%) indicates limited SDG literacy, a gap in education (Dash et al., n.d.).



Response	Percentage (%)
Don't know	42.9
Decent Work and Economic Growth (SDG 8)	26.4
Quality Education (SDG 4)	15.4
Climate Action (SDG 13)	14.3
Other	1.1

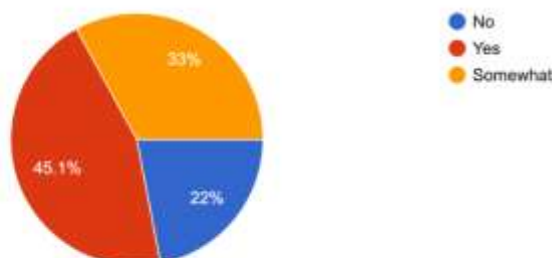
The 42.9% “Don't know” rate regarding SDGs reveals a profound lack of global framework literacy. Misattributing careers to SDG 4 or 13 instead of SDG 8 highlights conceptual confusion. This implies that sustainability is being taught as an abstract “nature” concept rather than an integrated economic and developmental goal.

Section 2: Current Skill Preparedness

Q6: Does your school/college curriculum include training on sustainable skills (e.g., environmental awareness)? 45.1% Yes, 33.0% Somewhat, 22.0% No. Partial inclusion (33.0%) suggests curriculum inadequacies (Dash et al., n.d.), lower in rural (40% No) vs. urban.

Does your school/college curriculum include training on sustainable skills (e.g., environmental awareness)?

182 responses



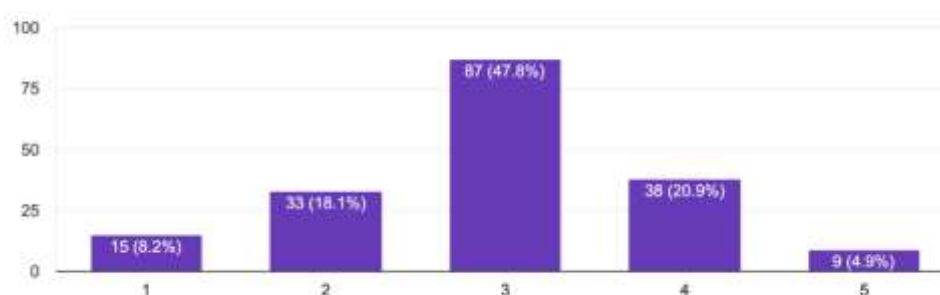
Response	Percentage (%)
Yes	45.1
Somewhat	33.0
No	22.0

The fact that 55% of students see their curriculum as lacking or only “somewhat” inclusive of sustainable training confirms a systemic educational lag. This implies that current academic structures are outdated. Data suggests that colleges are failing to evolve at the pace of the global 2028 green job projections.

Q7: On a scale of 1-5, how prepared do you feel for a career in sustainable fields? Mean: 2.96 (SD: 0.96), Median: 3.0. Neutral preparedness reflects employability gaps (World Bank, 2025), with females slightly lower (2.8) than males (3.1).

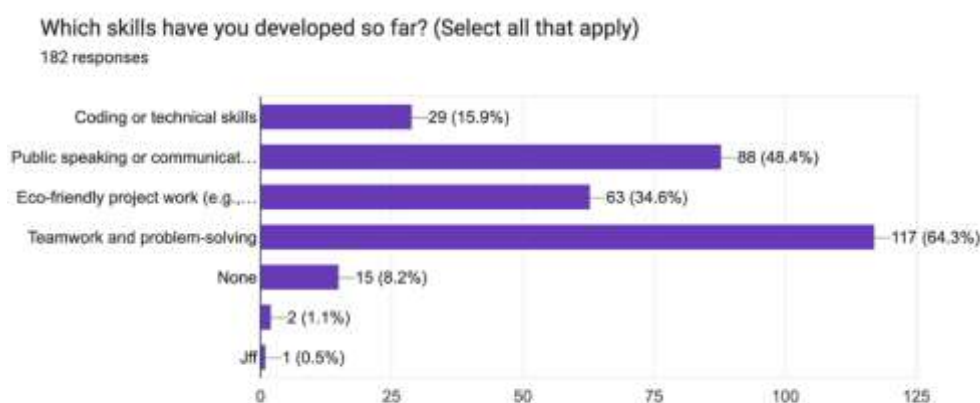
On a scale of 1-5, how prepared do you feel for a career in sustainable fields

182 responses



A mean preparedness score of 2.96 indicates a “confidence deficit.” Students don’t feel “job-ready,” which correlates with the employability gap noted in the literature. The lower preparedness mean for females (2.8) suggests a burgeoning gender gap in green tech confidence that requires targeted mentorship interventions.

Q8: Which skills have you developed so far? (Select all that apply) Teamwork (64.3%) and communication (48.4%) dominate, but eco-friendly skills (34.6%) and coding (15.9%) are lower, indicating soft skills focus over green/tech (Kumar & Hooda, 2024).

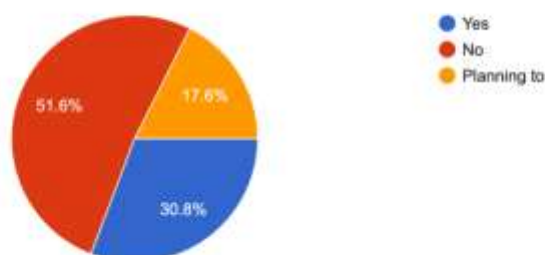


Option	Selection Rate (%)
Teamwork and problem-solving	64.3
Public speaking or communication	48.4
Eco-friendly project work (e.g., sustainability projects)	34.6
Coding or technical skills	15.9
None	1.6

The dominance of teamwork (64.3%) over eco-friendly skills (34.6%) and coding (15.9%) reveals a “Technical Vacuum.” Students are gaining generalist attributes but lack the niche competencies required for sustainable innovation. This implies a critical need for pivoting laboratory and project work toward applied environmental technology and digital analysis.

Q9: Have you participated in any skill development workshops (e.g., online courses on Coursera for green skills)? 51.6% No, 30.8% Yes, 17.6% Planning to. Low participation (30.8%) underscores access barriers (Transitions Research, 2024).

Have you participated in any skill development workshops (e.g., online courses on Coursera for green skills)?
182 responses



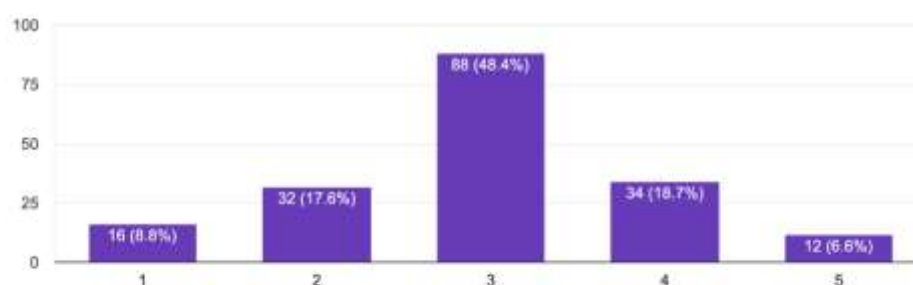
Response	Percentage (%)
No	51.6
Yes	30.8
Planning to	17.6

Low participation (30.8%) in external workshops like Coursera suggests that digital upskilling

is still an “opt-in” luxury rather than a core requirement. This implies structural barriers to self-directed learning. Educators must move from “encouraging” outside courses to “embedding” them directly into the credit-bearing college experience.

Q10: On a scale of 1-5, rate your digital literacy for sustainable jobs (e.g., using AI for eco-analysis). Mean: 2.97 (SD: 0.99), Median: 3.0. Neutral ratings highlight digital skill deficits for sustainable roles (Taggd, 2026).

On a scale of 1-5, rate your digital literacy for sustainable jobs (e.g., using AI for eco-analysis).
182 responses

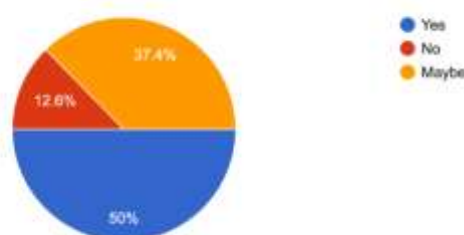


A neutral 2.97 mean for digital literacy indicates that students don't see themselves as tech-proficient in an “eco-analysis” context. This implies a failure to bridge the “Green” and “Digital” twins. Data suggests that sustainability training must be rebranded as a high-tech discipline to attract and prepare youth.

Section 3: Interest and Barriers

Q11: Are you interested in pursuing a sustainable career? 50.0% Yes, 37.4% Maybe, 12.6% No. High interest (50.0%) is promising, higher among females (55%) and urban (60%).

Are you interested in pursuing a sustainable career?
182 responses

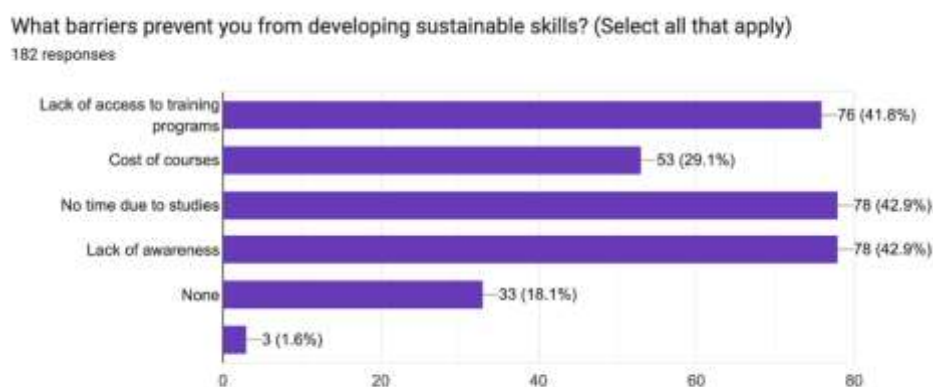


Response	Percentage (%)
Yes	50.0
Maybe	37.4
No	12.6

High interest (50%) paired with high uncertainty (37.4%) suggests a “willing but waiting” demographic. The “will” is present, but the pathway is obscured. This implies that the primary

hurdle isn't student apathy, but rather a lack of visible, viable entry-level roles and clear career roadmaps.

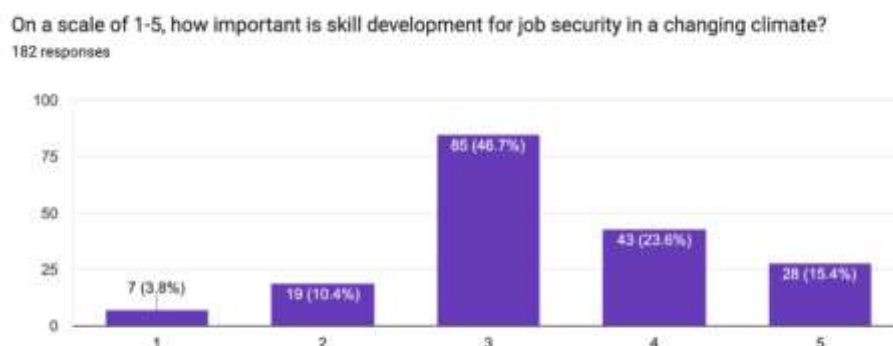
Q12: What barriers prevent you from developing sustainable skills? (Select all that apply) Lack of awareness (42.9%) and time (42.9%) tie as top, followed by access (41.8%). These align with literature on structural challenges (Sattva Consulting & SCGJ, 2023), more in rural (50% access issues).



Option	Selection Rate (%)
Lack of awareness	42.9
No time due to studies	42.9
Lack of access to training programs	41.8
Cost of courses	29.1
None	3.3

Tied top barriers—lack of awareness and time (42.9%)—indicate that sustainability is viewed as an “extra” rather than a “core” pursuit. This implies that students are overwhelmed by traditional academic loads. Integration, rather than addition, is the only way to overcome these structural and temporal constraints.

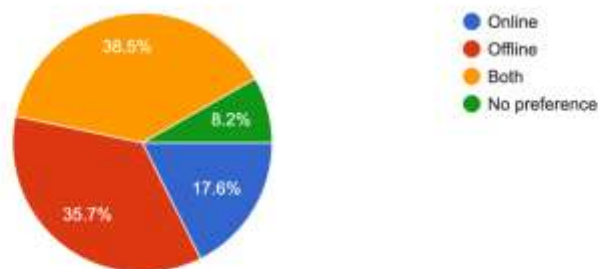
Q13: On a scale of 1-5, how important is skill development for job security in a changing climate? Mean: 3.36 (SD: 0.99), Median: 3.0. Moderate importance perceived, linking to climate-job nexus (ILO, 2019).



A mean of 3.36 shows that students link skills to “job security” amid climate change. This suggests a shift from “passion-driven” interest to “survival-driven” pragmatism. Data implies that emphasizing the resilience and security of green jobs is a more effective recruitment strategy than focusing solely on environmental altruism.

Q14: Would you prefer online or offline skill programs for sustainable careers? 38.5% Both, 35.7% Offline. Preference for hybrid (38.5%) fits conference mode (Kumadvathi First Grade College, 2026).

Would you prefer online or offline skill programs for sustainable careers?
182 responses

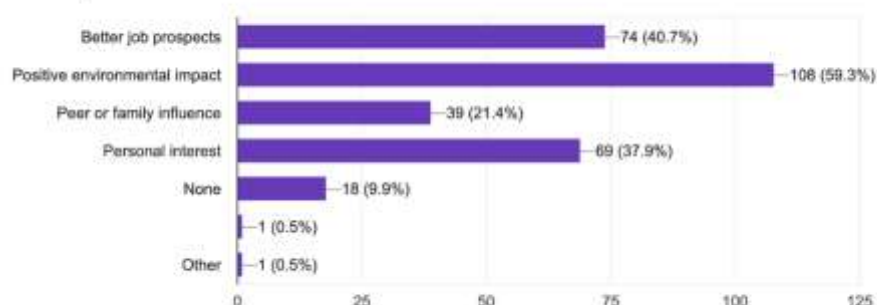


Response	Percentage (%)
Both	38.5
Offline	35.7
Online	17.6
No preference	8.2

The preference for hybrid or offline modes (74.2% combined) suggests a “Zoom fatigue” or a desire for tactile, hands-on learning. Sustainable skills often require physical interaction (solar panels, waste audits). This implies that purely online “green” certifications may be perceived as less valuable than practical, blended experiences.

Q15: What motivates you to learn sustainable skills? (Select all that apply) Environmental impact (59.3%) leads, followed by job prospects (40.7%). Motivators emphasize dual personal/societal benefits (NRDC, n.d.).

What motivates you to learn sustainable skills? (Select all that apply)
182 responses

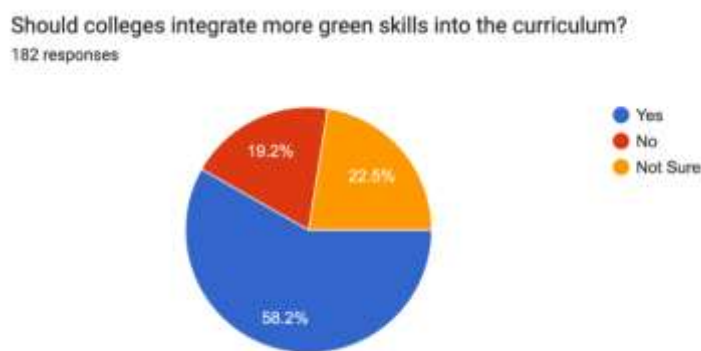


Option	Selection Rate (%)
Positive environmental impact	59.3
Better job prospects	40.7
Personal interest	37.9
Peer or family influence	21.4
None	2.2
Other	0.5

Environmental impact (59.3%) outperforming job prospects (40.7%) is an anomaly in high-unemployment contexts. It suggests a value-driven generation. However, the implication is that if these students don't find high-impact roles, they may become disillusioned. The market must produce “impact-first” jobs to meet this specific demographic demand.

Section 4: Recommendations for Innovation

Q16: Should colleges integrate more green skills into the curriculum? 58.2% Yes, 22.5% Not Sure. Strong support (58.2%) for integration, addressing curriculum gaps (Dash et al., n.d.).

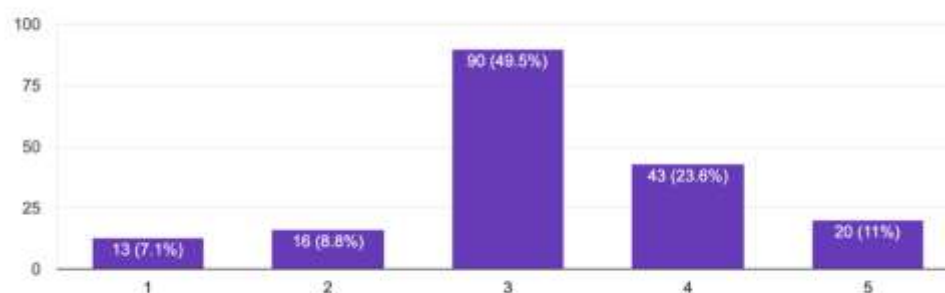


Response	Percentage (%)
Yes	58.2
Not Sure	22.5
No	19.2

Strong support (58.2%) for green skill integration serves as a “mandate for reform” from the student body. This implies that students are cognitively ready for more rigorous, specialized environmental training. Educational institutions that fail to adopt these changes risk becoming obsolete in the eyes of their primary stakeholders.

Q17: On a scale of 1-5, how effective would AI-based learning tools be for skill development? Mean: 3.23 (SD: 1.00), Median: 3.0. Moderate optimism for AI tools, tying to conference themes (Kumadvathi First Grade College, 2026).

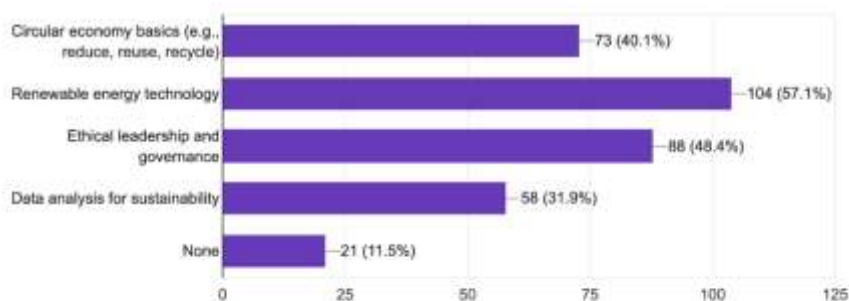
On a scale of 1-5, how effective would AI-based learning tools be for skill development?
182 responses



Moderate optimism (Mean: 3.23) for AI tools suggests a cautious “wait-and-see” approach. Students recognize AI’s potential for eco-analysis but likely lack exposure to it. This implies a massive opportunity for institutions to lead by introducing AI-driven sustainability simulations, turning a “moderate” interest into a competitive advantage.

Q18: What new skills should be taught for sustainable careers? (Select all that apply)
Renewable energy (57.1%) tops, followed by ethical leadership (48.4%). Focus on practical green skills (Bishnoi, 2022).

What new skills should be taught for sustainable careers? (Select all that apply)
182 responses



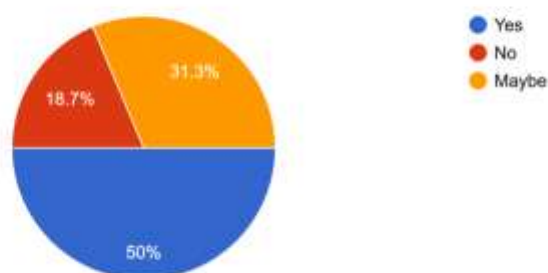
Option	Selection Rate (%)
Renewable energy technology	57.1
Ethical leadership and governance	48.4
Circular economy basics (e.g., reduce, reuse, recycle)	40.1
Data analysis for sustainability	31.9
None	11.5

The demand for Renewable Energy (57.1%) and Ethical Leadership (48.4%) highlights a desire for both “hard” and “heart” skills. This implies that a purely technical curriculum is insufficient. Students want to know *how* to build the technology and *why* it is ethically necessary to lead sustainably.

Q19: Would partnerships between schools and industries help bridge skill gaps? 50.0% Yes, 31.3% Maybe. Balanced support (50.0%) for partnerships, per employability needs (World Bank, 2025).

Would partnerships between schools and industries help bridge skill gaps?

182 responses



Response	Percentage (%)
Yes	50.0
Maybe	31.3
No	18.7

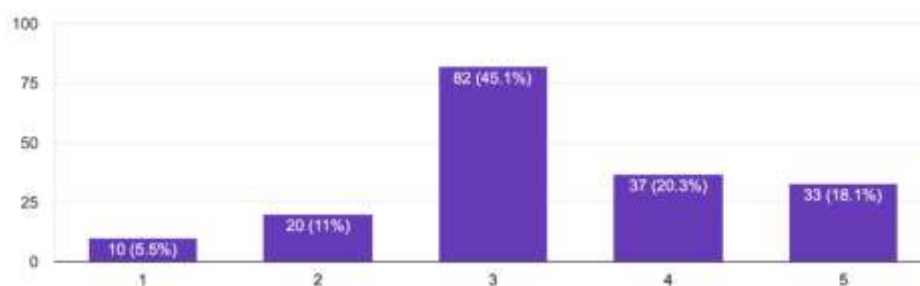
The 50% “Yes” for partnerships highlights a recognition that academia cannot bridge the gap alone. It implies a lack of trust in the “ivory tower” to produce market-ready skills. This suggests that the future of education lies in co-created curricula where industry leaders define the learning outcomes.

Q20: On a scale of 1-5, rate the need for government funding in student skill programs.

Mean: 3.35 (SD: 1.07), Median: 3.0. Moderate-high need, emphasizing policy support

On a scale of 1-5, rate the need for government funding in student skill programs.

182 responses



(Bishnoi, 2022).

A mean of 3.35 for funding needs highlights a reliance on state support for scaling. Students view skill development as a public good, not just a private investment. This implies that without subsidies or state-funded “green scholarships,” the transition to a sustainable

workforce will remain slow and inequitable.

Detailed Survey Outcomes

The survey reveals a significant “Awareness-Ready Gap” among Indian youth regarding sustainable careers. While the intent to contribute to the environment is high, the technical infrastructure to support it is lacking.

- **Awareness vs. Literacy:** While **59.3%** of students have heard of sustainable careers, a staggering **41.2%** have no knowledge of government programs like **Skill India**. This indicates that awareness is superficial and not linked to actionable policy paths.
- **The Soft-Skill Bias:** Respondents prioritized **Communication (65.4%)** over **Digital Skills (30.2%)**. This perception gap suggests that students view “green jobs” through a traditional lens rather than recognizing them as high-tech, data-driven roles.
- **Preparedness Stagnation:** The mean preparedness score of **2.96** represents a “neutral” state. Students feel neither ready nor unready, highlighting a state of educational limbo. Notably, a **gender gap** exists, with females reporting lower preparedness (2.8) than males (3.1).
- **Access Barriers:** **Lack of awareness** and **lack of time** (both 42.9%) are the primary inhibitors. In rural areas, **access to training** (50%) is the dominant barrier, suggesting that geography remains a major determinant of “green” employability.
- **Technical Demand:** There is a clear hunger for specialized knowledge; **57.1%** of students want training in **Renewable Energy Technology**, yet only **15.9%** currently possess any coding or high-level technical skills.

Suggested Action Plan: The “Green-Ready” Framework

To bridge the identified gaps, a multi-stakeholder approach is required, focusing on the following four pillars:

1. Curriculum “Green-Streaming”

- **Action:** Transition from elective “Environmental Science” modules to integrated “**Green-Tech**” credits.
- **Detail:** Integrate Circular Economy principles and Carbon Accounting into standard commerce and science degrees.

2. The “Green-Digital” Twin Initiative

- **Action:** Launch AI-based learning laboratories.
- **Detail:** Since students showed moderate optimism for **AI tools (Mean: 3.23)**, colleges should use AI simulations for eco-analysis and resource management to boost digital literacy.

3. Industry-Academia “Bridge” Programs

- **Action:** Formalize **Green Internships**.
- **Detail:** Establish MOUs with renewable energy firms (Solar/Wind) and waste-management startups to provide the hands-on training that **50%** of students identified as a missing link.

4. Decentralized Outreach

- **Action:** Create “Skill Hubs” in semi-urban and rural areas.
- **Detail:** Address the **45% “No” rate** for program awareness in rural areas by using mobile skill units and local-language digital campaigns.

Conclusion

The transition toward a sustainable economy in India is currently a “high-interest, low-readiness” phenomenon among the youth. This study empirically demonstrates that while students are motivated by **positive environmental impact (59.3%)**, they are hindered by outdated curricula, a lack of technical digital skills, and significant regional disparities in access to training. The findings suggest that the “employability gap” is not a result of student apathy, but rather a structural lag in the educational ecosystem.

To harness India's demographic dividend for the 2028 green job projections, a radical shift from general awareness to technical competency is required. By integrating AI-driven learning, fostering industry partnerships, and democratizing access to government initiatives like Skill India, the nation can transform its youth from passive observers into active architects of a sustainable future. Ultimately, bridging the gap between “green intent” and “green skill” is not merely an educational goal, but a socio-economic imperative for achieving Sustainable Development Goals 4 and 8 by 2030.

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ROLE OF EDUCATION IN PROMOTING CAREER SKILLS

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Abstract

In the rapidly evolving global landscape, education plays a pivotal role in equipping individuals with the necessary career skills required for employability and sustainable development. Traditional education systems focused primarily on theoretical knowledge, but contemporary demands emphasize practical competencies, critical thinking, creativity, and adaptability. This article explores how education fosters career skills, the importance of skill-based learning, and the integration of modern pedagogical approaches to prepare learners for the workforce.

Keywords: Career Skills, Skill-Based Education, Employability, 21st Century Skills, Vocational Training, Lifelong Learning

Introduction

Education is no longer limited to the transmission of knowledge; it is a dynamic process aimed at developing skills, attitudes, and competencies necessary for success in life and work. In the 21st century, the focus has shifted towards career-oriented education, which bridges the gap between academic learning and industry requirements. The growing demand for skilled professionals highlights the importance of integrating career skills into educational frameworks.

Concept of Career Skills

Career skills refer to a set of abilities that enable individuals to perform effectively in professional environments. These include:

- Communication skills
- Critical thinking and problem-solving
- Teamwork and collaboration
- Digital literacy
- Leadership and adaptability

These skills are essential for enhancing employability and ensuring long-term career success.

Role of Education in Developing Career Skills

1. **Integration of Skill-Based Curriculum:** Modern education systems are increasingly incorporating skill-based curricula that focus on practical learning. Project-based learning, experiential learning, and competency-based education help students apply theoretical knowledge in real-life situations.

2. **Promotion of 21st Century Skills:** Education fosters essential 21st-century skills such as creativity, innovation, and analytical thinking. These skills are crucial in a technology-driven

world where problem-solving abilities are highly valued.

3. Vocational and Technical Education: Vocational education provides hands-on training and industry-specific skills. It prepares learners for specific careers and enhances employability by aligning education with market needs.

4. Digital and Technological Skills Development: With the advancement of technology, education promotes digital literacy, coding, data analysis, and the use of modern tools. These skills are essential in today's digital economy.

5. Career Guidance and Counseling: Educational institutions play a vital role in providing career guidance services. Counseling helps students identify their interests, strengths, and suitable career paths.

6. Industry-Academia Collaboration: Collaboration between educational institutions and industries ensures that students gain practical exposure through internships, workshops, and training programs.

7. Development of Soft Skills: Soft skills such as communication, leadership, and emotional intelligence are cultivated through group activities, presentations, and extracurricular engagements.

Challenges in Promoting Career Skills

Despite significant progress, several challenges remain:

- Lack of infrastructure and resources
- Outdated curriculum
- Limited industry exposure
- Insufficient teacher training
- Gap between education and employment needs
- Strategies for Improvement

To enhance the role of education in promoting career skills:

- Revise curriculum to include skill-based learning
- Strengthen vocational education programs
- Encourage experiential and project-based learning
- Provide continuous teacher training
- Foster partnerships with industries
- Integrate digital technologies in teaching-learning processes

Conclusion

Education is a powerful tool for developing career skills that are essential for individual growth and national development. By focusing on skill-based learning and aligning education with industry demands, institutions can prepare learners to face future challenges confidently. The transformation of education systems towards competency-based approaches will ensure a skilled and adaptable workforce for the 21st century.

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A COMPARATIVE STUDY OF JOB SATISFACTION AMONG PERMANENT AND CONTRACTUAL LECTURERS OF GOVT. DEGREE COLLEGES OF KARNATAKA STATE

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Abstract

In the present study was conducted to examine the job satisfaction among permanent (regular) and contractual lecturers of govt. degree colleges of Shivamogga district. Karnataka state. In the modern world every individual persons main dream has get the good job for life, got the job after that challenges are more first adjustment to the job, then job satisfaction fulfils the motivational features of an individual as it is an state of internal mind in human. Job satisfaction brings more and more happiness, joy, smile and desirable emotions and feelings. The good job satisfied individuals are highly motivates and shows better performance in the job, so organization successfully developed and increased efficiency. This study conducted on 120 permanent (regular) and contractual lecturers of Shivamogga district. Karnataka state to assess the job satisfaction of Govt. degree colleges by having comparison among permanent and contractual lecturers. This study has conducted by using job satisfaction scale for teachers developed by Dr. S.K. Saxena was used to measure job satisfaction. It consisting of 29 questions. The obtained data was analysed by using mean, SD and 't'- test was applied. The result of the study concluded that there is a significant difference between the contractual and regular (Permanent) govt. degree college lecturers on job satisfaction. Or regular (permanent) lecturers have more job satisfaction than compared to contractual lecturers at Govt. degree colleges, and there is no significant gender difference between contract male and contractual female lecturers regarding job satisfaction.

Keywords: Job Satisfaction, Permanent and Contractual Lecturers, Male and Female, Govt. Degree Colleges.

Introduction

In India there are many professions, many professions give good status in the society and for living and satisfaction to the learned professional person. All teaching profession is the most power full, noblest and good feedback profession as it leads to the service of humanity. Teaching consisting of many skills and highly skilled job so it's highly required adequate training and adequate knowledge preparation on the part of teacher. In the past to future teaching and teacher was respected next to God. The teacher is equal to god. The teacher is the eye opener of the knowledge to the students. The teacher must and should possess few unique qualities. They should be an ideal person in the society. So that pupils may follow the ideal person. All the teacher serves for the nation. Teaching is not an easy task in higher education class but sometimes it is very difficult and very complex process teaching involves many aspects like, teacher's ability to deal effectively with students, their efficient in school work, assembling interest in knowledge and ability, skills to develop good relationship with their colleagues. The good teaching, learning and transaction completely depend on the whole

ability of a teacher, who turns manifest potentialities of a child into actually, be respectfully accepted with no hesitation and comment. The teacher is the main key person in the success of the whole educational system its completely depends on the quality, knowledge, skills and capability of the teachers who are essential in the society, these are all related and depend upon the job satisfaction of the teachers. In the world, job satisfaction has one of the imperative issues. It is significant play a role long-term growth and development of any instructive framework around the global. Job satisfaction in this field is the shows capacity of the teaching job address teacher's issues and enhances their profession, job/teaching execution. According to Hoppock (1935) job satisfaction as any combination of psychological, physiological and environmental circumstances that cause a person truthfully to say I am satisfied with my job. Vroom (1964) defined job satisfaction focuses on the role of the employee in the workplace. Thus, he defines job satisfaction as affective orientations on the part of individuals toward work roles which they are presently occupying. Statt (2004) stated that Job satisfaction can be defined also as the extent to which a worker is content with the rewards he or she gets out of his or her job, particularly in terms of intrinsic motivation Job satisfaction exactly a key factor as it brings full of enjoyment while working the job it turns brings happiness in their life. Job satisfaction it's depend upon many components like as earn salary, working environment condition, promotion in the job, working place culture, co-workers, and policies in the job, etc. For someone, expected source of income in that job but for someone it's more than that. Working condition and good environment is important for a psychological health.

Review of literature:

Rezai et al., (2021) found that gender, levels of education, and teaching experience were explored in relation to job satisfaction among teachers in higher education levels highly positive correlated with job satisfaction. Topchyan and Woehler, (2021) investigate that full-time and part time teachers explored the influenced of gender and experience on job satisfaction full-time lecturer and female lecturer shows higher levels of job satisfaction and engagement. Sharma, Daga, and Ameeri, (2023) reported that private school instructors generally have experience higher Working-Related Quality of Life. And also study found that despite differences in certain domains like working environment and stress, teachers from both side exhibited same levels of general well-being. Juhji et al., (2022) found that work motivation was significantly correlate with job satisfaction among madrasah teachers, the study shows and analysed the importance of motivation in enhancing job satisfaction. Katebi et al., (2022) conducted a study on understand the relationship between job performance and job satisfaction across different cast and communities, it emphasized the role of culture and job nature in influencing this relationship, providing insights valuable for managers across institutions. Maheshwari, (2022) this study revealed that a positive correlation between transformational leadership style and job satisfaction among lecturers. Mugira, (2022) found that teachers and lecturers satisfaction was highly significant influenced by the Head of

Department's leadership style, and behaviours particularly in the equal distribution of opportunities and academic activities and work. Nuzulia and Saputra, (2022) investigated that the determinations of job satisfaction among male and female teachers included job traits and position it's highlighted the significant influence of meaningful work and individual development opportunities.

Purpose of the study:

In the present society and social life cycle, every person after attaining maturity is force to accept and obey the responsibilities and obligations of their family. In view of the more problem of unemployment and population explosion an individual is highly forced to adjust his aspirations to the available opportunities but lack of proper many occupational adjustments leads to distress, consequences in terms of loss human energy and efficiency. Job satisfaction has been referred to as a discrepancy of reward or incentives between one's expectations and actually there received by him. The present study may help to know the satisfaction level of permanent (Regular) and contractual lecturers of govt. degree colleges of Karnataka and special reference to Shivamogga district and the result of the study would also help to understand the psychological behaviour of lecturers of Karnataka. This study is very valuable for administrators and professionals who are concerned with prospective lecturers so that conduct the suitable training programmes in working place and may be developed in their training institutions.

Objectives of the study:

1. To assess the job satisfaction of govt. degrees college lecturers.
2. To compare the job satisfaction of contract/guest lecturers and regular/permanent lecturers.
3. To study the job satisfaction of contract/guest male and female govt. degree college lecturers.

Hypotheses:

1. There is no significant difference between the contractual/guest and regular/permanent govt. degree college lecturers regarding job satisfaction.
2. There is no significant difference between contract/guest male and contractual/guest female lecturers regarding job satisfaction.

Operational Definition:

Job Satisfaction: Job Satisfaction refers to an individual's happiness, fulfilment, positive feelings and emotions, satisfaction about their job or work-related activities, which are influenced by a variety of factors such as employment environment conditions, relationships, recognition, and possibilities for progress and development.

METHOD

Sample:

In the present study convenient sampling technique was used for collecting the data. The study was conducted by taking sample of 120 lecturers of Govt. degree colleges of

Shivamogga district. Karnataka state (60 permanent/regular lecturers and 60 contractual/guest lecturers). Further, 30 male and 30 female lecturers were selected from both the sides. There is no age limit in this study.

Tools used for the Study:

Job satisfaction scale developed by Dr. S.K. Saxena (1994). It consisting of 29 questions. Further, these questions were classified into four different aspects of job satisfaction in teaching 1. Satisfaction with work. 2. Satisfaction with salary. 3. Security and promotion policies. 4. Satisfaction with institutional plans and policies. 5. Satisfaction with authority including school management. This questionnaire measuring teacher job satisfaction. Scoring given 1 point for answers indicating satisfaction ('Yes' for positive items, 'No' for negative) and 0 for dissatisfaction. Highest scores indicate higher job satisfaction. Response should be given in Yes /No mode. Reliability is .95. Test- Retest reliability coefficient is .75. Validity: The face validity of the measures is very high. The content validity is ensured as the items for which there has been 100% agreement amongst judges regarding their relevancy to the school teacher's Job Satisfaction are included in the questionnaire.

Inclusion criteria:

Include only Govt. degree college lecturers.

Up to the age of 60 years.

Work experience of at least 4 years.

Exclusion criteria-

Other jobs or occupation peoples are not included.

Data collection procedure:

The investigator visited so varies Govt, degree colleges around Shivamogga district and takes 120 lecturers both permanent and guest faculties for collecting data. Then he explained about the purpose of the psychological test to the sample and thus administered the test. After the data collection, the questionnaire is scored as per the scoring pattern prescribed in the manuals.

Statistical analyses:

Mean, SD, 't' test is used for the data analysis.

RESULTS AND DISCUSSION

Table 1: shows the Mean, SD, and 't' value of overall job satisfaction of contract/guest lecturers and regular/permanent lecturers of govt. degree colleges.

Variable	Contract/Guest Lecturers (N=60)		Regular/Permanent Lecturers (N=60)		t value
	Mean	SD	Mean	SD	
Job satisfaction	124.20	12.64	126.37	13.95	3.14**

****Significant at 0.01 level**

Table no-1 reveals the result of job satisfaction among contract/guest lecturers and regular/permanent lecturers of govt. degree colleges. The overall job satisfaction of contract/guest lecturers mean score is 124.20 and SD= 12.64. And the regular/permanent

lecturers mean score is 126.37 and SD= 13.95. The obtained 't' value is 3.14, which is very highly significant at 0.01 level. The result shows that the regular/permanent lecturers have very high level of job satisfaction than compared to contract/guest lecturers of govt. degree colleges. Hence, few studies are available to related job satisfaction are quoted by Topchyan and Woehler, (2021) investigate that full-time and part time teachers explored the influenced of gender and experience on job satisfaction full-time lecturer and female lecturer shows higher levels of job satisfaction and engagement.

Table 2: shows the Mean, SD, and 't' value of overall job satisfaction of male and female contract or guest lecturers of govt. degree colleges.

Variable	Contract/Guest Male (N=30)	Lecturers	Contract/Guest Female (N=30)	Lecturers	t-value
	Mean	SD	Mean	SD	
Job satisfaction	51.16	4.45	52.00	4.87	0.34 NS

NS: Not Significant,

Table no-2 reveals the result of job satisfaction among contract/guest lecturers of male and female faculties of govt. degree colleges. The result shows that there is no significant gender difference between contract/guest lecturers of male and female of govt. degree colleges, both male and female lecturers of contract basis have same level of job satisfaction.

Suggestions:

1. The Study may be extended large sample to obtain reliable results.
2. The study can be made comprehensive by expanding to other areas for validity and reliability.
3. Private aided and unaided degree colleges also should include in future research.
4. Should include other districts govt. colleges should also be taken for future research.

Conclusion:

1. There is a significant difference between contract/guest lecturers and regular/permanent lecturers on job satisfaction.
2. The regular/permanent lecturers have very high level of job satisfaction than compared to contract/guest lecturers of govt. degree colleges because of their job security and different type of facilities provided to regular/permanent lecturers.
3. There is no significant difference between females and males of contract/guest lecturers on job satisfaction.

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INNOVATION AND SUSTAINABILITY THROUGH DIGITISATION: A MULTIDISCIPLINARY ANALYSIS OF MSME FORMALISATION, DIGITAL POLICY INITIATIVES, AND CONTEMPORARY CHALLENGES IN INDIA (2007– 2025)

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Abstract

India's Micro, Small, and Medium Enterprises (MSME) sector contributes approximately 30.1% to GDP, over 45% to exports, and employs nearly 300 million people as of October 2025 making it second only to agriculture in employment scale. Situated at the intersection of innovation and sustainability, the sector's digital transformation represents a multidisciplinary challenge spanning economic policy, information technology, social equity, and institutional governance themes central to contemporary discourse on inclusive development. Despite its centrality, the sector grapples with limited finance access, delayed payments, and persistent informality, with an estimated 87% of enterprises operating outside the formal regulatory framework. This article synthesises secondary data from MSME Annual Reports (2007–2025), the NSS 73rd Round, the Udyam Portal, and peer-reviewed literature to examine three interconnected dimensions: (i) enterprise registration trajectories across three regulatory regimes — Entrepreneurship Memorandum II (EM II), Udyog Aadhaar Memorandum (UAM), and UDYAM; (ii) employment distribution by category and region; and (iii) the efficacy of key digital policy platforms — CHAMPIONS, GeM, Samadhaan, Sambandh, and Sampark. Findings reveal a 110.80% CAGR in registrations post-UDYAM launch, a sustained 82.61% CAGR through October 2025, and a 647-fold growth in GeM MSME sellers since 2019. Persistent structural gaps, a \$300 billion credit deficit, a 79.63% male ownership concentration, and a 63% adjudication backlog in delayed-payment cases, underscore the limits of formalisation without commensurate credit inclusion and gender equity interventions. The paper recommends AI-augmented verification systems, gender-targeted digital tools, and ERP-integrated payment enforcement to sustain India's trajectory toward a 50% MSME contribution to GDP, advancing the dual imperatives of digital innovation and long-term economic sustainability.

Keywords: MSMEs, Digitalization, Udyam Portal, Formalization, Economic Growth, Policy Initiatives, GeM, CHAMPIONS, Samadhaan

1. INTRODUCTION:

India's MSME sector is the engine of its economy — a mosaic of over 69 million enterprises spanning roadside stalls, artisan workshops, technology firms, and export houses. By October 2025, the sector boasts 6.9 crore registered units, contributing 30.1% of GDP,

more than 45% of exports, and employment for approximately 300 million people, second only to agriculture (MSME, 2024–25; PIB, 2025). The sector commands 92% of India's retail value, anchoring supply chains from raw material procurement to distribution and services (RBI, 2019). Examined through the lens of innovation and sustainability, the MSME sector's digitisation journey exemplifies a contemporary challenge that is at once technological, institutional, and socioeconomic demanding multidisciplinary approaches that bridge governance, finance, and digital infrastructure.

Yet its scale conceals deep structural vulnerabilities: limited access to formal credit, delayed payments from large buyers, inadequate digital literacy, and an estimated 87% of enterprises operating informally (Kowadkar, 2022). These frictions suppress productivity, restrict market integration, and limit the sector's contribution to the national economy. The government has responded with a suite of digital policy interventions, anchored by the MSME Development (MSMED) Act 2006 and accelerated through the AatmaNirbhar Bharat blueprint of May 2020.

The central thesis of this article is that targeted information technology (IT) initiatives particularly the UDYAM registration portal, GeM, CHAMPIONS, Samadhaan, Sambandh, and Sampark — have collectively constituted the most significant formalisation push in India's post-independence economic history, converting informal enterprise data into a formal, verifiable credit and procurement identity. This transformation is not merely a technology story; it is a case study in sustainable institutional innovation, where digital tools serve as the mechanism through which millions of informal enterprises are integrated into the formal economy, generating tax revenues, employment data, and supply-chain visibility that compound toward long-run economic sustainability. The article further argues that while formalisation metrics are compelling, structural gaps in credit access, gender inclusion, and payment enforcement remain the principal barriers to the sector's ascent from a 30% to a 50% GDP contribution and that closing these gaps requires exactly the kind of multidisciplinary policy design that bridges digital infrastructure, financial regulation, and social equity.

2. LITERATURE REVIEW

Existing scholarship confirms digitalization's transformative potential for MSMEs in emerging economies. Venkatesh and Lavanya Kumari (2018) demonstrate how tools like Google My Business and Digital India have improved market access, while revealing persistent rural-urban disparities requiring infrastructure and training investment. Kulkarni (2020) positions digitalization as a bulwark against declining GDP contributions, linking e-commerce adoption to resource optimisation and emissions reduction. Deb (2019) quantifies the economic cost of low digital uptake at 1.7% of GDP in cash transaction costs (2014–15), framing UPI-based financial inclusion as a structural gateway for MSME credit.

Recent systematic reviews deepen this empirical base. Panduwinata et al. (2025), synthesising 35 studies from 2014–2024, demonstrate that AI, IoT, and cloud technologies collectively enhance MSME efficiency by up to 30%, with e-commerce accelerating global market access

particularly in post-COVID recovery contexts. NITI Aayog (2025) identifies digital strategies as the primary lever for addressing MSME resource constraints and supply-chain vulnerabilities. Schrieck et al. (2024) identify eight core enablers of SME digital transformation including leadership alignment, IT-business integration, and collaborative funding that are especially salient for India's resource-scarce informal sector.

A critical gap in the literature still persists. While technology adoption is well-documented, implementation barriers in the unorganised sector where 99.7% of firms operate informally remain understudied (Kowadkar, 2022). Similarly, gender dynamics in digital adoption and long-term sustainability metrics are underexplored (World Bank, 2023). This article addresses these gaps by empirically linking registration, employment, and policy data across the period 2007–2025.

From a sustainability perspective, Elkington's (1997) Triple Bottom Line framework where people, planet, and profit provides a powerful lens through which MSME digitisation must be evaluated. The "people" dimension encompasses financial inclusion, gender equity, and rural employment; the "planet" dimension relates to the resource efficiency and carbon-footprint reduction enabled by e-commerce and digital payments (Kulkarni, 2020); and the "profit" dimension is reflected in productivity gains, tax formalisation, and GDP contribution growth. The United Nations Environment Programme (UNEP, 2021) further affirms that digital transformation in small enterprise ecosystems is a critical enabler of Sustainable Development Goal (SDG) 8 which is decent work and economic growth is particularly important when digitisation reduces informality and unlocks access to formal financial services. India's MSME digitisation programme, examined through this lens, is therefore not merely an economic policy exercise but a sustainability intervention with long-run social and environmental co-benefits.

The concept of Digital Public Infrastructure (DPI) has emerged as a defining innovation framework for developing economies. Nandan et al. (2023) conceptualise DPI as a "societal-scale digital platform" that enables a country to offer foundational, interoperable, and reusable digital capabilities across identity, payments, and data exchange which is precisely the architecture embodied by India's Aadhaar-UPI-Account Aggregator stack. The G20 DPI Framework (2023), endorsed during India's presidency, positions DPI not merely as a technology stack but as a governance innovation that lowers the cost of economic participation for the poorest and most informal actors in an economy. For MSMEs, DPI provides the institutional backbone for formalisation by replacing discretionary, relationship-based access to credit and markets with rule-based, data-verified access. This literature underscores that India's UDYAM portal is best understood as a DPI endpoint, not merely a registration website, with downstream effects on credit, procurement, and market integration that extend well beyond the act of registration itself.

The institutional economics literature on formalisation provides a third critical frame. North (1990) established that institutions with the formal rules, informal norms, and enforcement

mechanisms that structure economic interactions are the primary determinant of whether individuals and firms participate in formal economic activity. Informality, in this view, is not irrational but a rational response to high formalisation costs relative to formalisation benefits. La Porta and Shleifer (2014) extend this argument empirically, demonstrating that informal firms in developing countries are predominantly small, low-productivity, and owner-operated a profile that precisely characterises India's MSME micro segment (99.1% of registered enterprises). The policy implication is clear: formalisation accelerates only when the institutional cost of remaining informal exceeds the institutional cost of registering. India's transition from EM II (high-friction physical registration) to UDYAM (zero-cost, Aadhaar-linked digital registration) is a textbook case of institutional cost reduction producing a non-linear formalisation response is reflected in the jump from 13.74% to 110.80% CAGR across the three registration phases analysed in this article.

3. THEORETICAL FRAMEWORK

This article is anchored in three complementary theoretical frameworks that together explain the mechanism, adoption, and sustainability of MSME digitisation in India. Each framework addresses a distinct dimension like institutional, behavioural, and developmental and their integration provides a multidisciplinary foundation consistent with the conference theme of innovation and sustainability in contemporary policy challenges.

3.1 Institutional Theory of Formalisation (North, 1990)

Institutional Theory postulates that economic actors including enterprises make participation decisions based on a cost-benefit calculus of formal versus informal operation, shaped by the quality of institutions (North, 1990). In contexts where registration is costly, slow, and opaque, informality is the rational equilibrium. Government policy can shift this equilibrium by lowering formalisation costs, raising the value of formal status, or increasing the penalty for informality. India's three-phase registration evolution is a direct institutional intervention along all three dimensions: UDYAM reduced registration cost to zero and processing time to minutes; MSMED Act benefits (priority-sector lending, GeM access, Samadhaan protection) raised the value of formal status; and DPDP Act 2023 and GST compliance create escalating informal costs. This framework predicts that the observed CAGR acceleration from 13.74% (EM II) to 110.80% (UDYAM) is a direct and expected institutional response, not an anomaly. It further predicts that formalisation will plateau unless credit access (the largest outstanding benefit gap) is resolved, since the marginal informal enterprise faces a registration-benefit calculus that registration alone cannot satisfy.

3.2 Technology Acceptance Model (Davis, 1989; Venkatesh et al., 2003)

The Technology Acceptance Model (TAM), originally formulated by Davis (1989) and extended by Venkatesh et al. (2003) through the Unified Theory of Acceptance and Use of Technology (UTAUT), explains why individuals and organisations adopt or resist digital tools. TAM identifies perceived usefulness and perceived ease of use as the two primary determinants of technology adoption intention. For MSME digitisation, this framework has

direct explanatory power: UAM's single-page, zero-fee, mobile-accessible form dramatically increased perceived ease of use relative to EM II's physical filing process, explaining the near-5-fold surge in registrations in 2016–17. UDYAM further increased perceived usefulness by embedding registration within a broader benefit ecosystem in priority lending, GeM access, Samadhaan protection, that made the value of digital formalisation tangible and immediate. Conversely, low adoption rates in women-owned and rural enterprises reflect UTAUT's social influence and facilitating conditions factors: where digital infrastructure is absent (BharatNet gaps) or where social norms suppress women's entrepreneurship, perceived ease of use and social endorsement are insufficient to drive adoption without complementary interventions.

3.3 Sustainable Livelihoods Framework (DFID, 1999; Chambers & Conway, 1991)

The Sustainable Livelihoods Framework (SLF), developed by Chambers and Conway (1991) and operationalised by DFID (1999), conceptualises livelihood sustainability across five capital types i.e., human (skills, education), social (networks, trust), natural (resources, environment), physical (infrastructure, technology), and financial (savings, credit, income flows). Applied to MSME digitisation, the SLF reveals that each policy platform addresses a distinct capital deficit: UDYAM builds social capital by conferring formal identity; GeM and Sambandh build financial capital through market and procurement access; Sampark addresses human capital through skills linkage; Samadhaan protects financial capital from predatory payment delays; and Digidhan/UPI interventions build physical capital by embedding digital payment infrastructure into the micro-enterprise's operating environment. This framework enables a holistic assessment of MSME policy beyond single-metric indicators such as registration CAGR, anchoring the evaluation in the lived, multi-dimensional livelihood reality of India's 6.9 crore registered enterprises and identifying credit access and gender inclusion as the most critical unresolved capital deficits.

4. RESEARCH METHODOLOGY

This descriptive-analytical study employs secondary data triangulation. Primary data sources include MSME Annual Reports (2015–2025), the NSS 73rd Round (2015–16), the Udyam Portal dashboard, GeM transaction records, and Economic Survey 2025–26. Supplementary sources include RBI reports, PIB circulars, CAG 2020 findings, and peer-reviewed literature. Data spans 2007–2025, enabling trend analysis via compound annual growth rates (CAGR) and proportional distribution analysis.

Limitations include: (i) the absence of a national MSME census since 2006–07, creating a 19-year data gap; (ii) potential underreporting of informal units in NSS estimates; and (iii) partial-year data for 2024–25. These are mitigated by cross-verification with real-time portal dashboards and triangulation across multiple official sources. The three research objectives are registration trends (Obj. 1), employment dynamics (Obj. 2), and policy efficacy (Obj. 3) which directly structure the findings and analysis sections.

5. MSME SECTOR LANDSCAPE: SCALE AND STRUCTURE

5.1 Enterprise Distribution by Activity (NSS 73rd Round, 2015–16)

The NSS 73rd Round estimates 633.88 lakh enterprises nationwide, distributed across manufacturing (196.64L, 31%), trade (230.35L, 36%), other services (206.85L, 33%), and a negligible electricity segment (0.04L). The rural-urban split is near-parity: 324.88 lakh (51%) rural versus 309.00 lakh (49%) urban. However, sectoral composition diverges significantly where manufacturing is predominantly rural (58%), while trade is slightly urban (53%), and services are balanced. Employment totals 1,109.89 lakh across all activities, with trade (387.18L, 35%) slightly exceeding manufacturing (360.41L, 32%) and other services (362.22L, 33%).

Table 1: Estimated MSME Enterprise & Employment Distribution by Activity (NSS 73rd Round, 2015–16)

Activity	Rural Ent. (L)	Urban Ent. (L)	Total Ent. (L)	Share (%)	Total Emp. (L)
Manufacturing	114.14	82.50	196.64	31%	360.41
Electricity	0.03	0.01	0.04	<1%	0.07
Trade	108.71	121.64	230.35	36%	387.18
Other Services	102.00	104.85	206.85	33%	362.22
Total	324.88	309.00	633.88	100%	1,109.89

5.2 Ownership Pattern and Gender Distribution:

Of the 633.88 lakh estimated enterprises, 608.41 lakh (95.98%) are proprietary concerns. Male ownership dominates at 79.63% nationally, with a pronounced urban premium — urban male ownership (81.58%) exceeds rural (77.76%) by 3.82 percentage points. Conversely, female ownership is marginally higher in rural areas (22.24%) than urban (18.42%), suggesting that urban formal economies present additional structural barriers to women entrepreneurs. This gender asymmetry which is reflecting a 3.9-fold male ownership advantage has direct implications for inclusive credit and procurement policy design.

Table 2: Gender Ownership of Proprietary MSMEs **Table 3: MSME Employment by Gender (2025)**

Area	Male (%)	Female (%)
Rural	77.76%	22.24%
Urban	81.58%	18.42%
All India	79.63%	20.37%

Demographic	Employment (L)	% of Total
Male	2,034.50	76%
Female	642.50	24%
Total	2,677.00	100%

6. MSME REGISTRATION TRAJECTORY: EM II, UAM AND UDYAM (OBJECTIVE 1)

Tracking MSME registrations serves as the primary barometer of formalisation velocity.

Three distinct regulatory regimes define India's registration landscape, each characterised by successively lower barriers to entry, higher digital uptake, and steeper CAGR.

6.1 Phase I — Entrepreneurship Memorandum II (2007–2015): CAGR 13.74%

Before 2006, small industries relied on rudimentary registers at Regional Industrial Centres. The MSMED Act 2006 introduced the Entrepreneur's Memorandum (EM-I pre-setup; EM-II post-production), creating the first systematised registration database. Filings grew steadily from 1,72,703 (2007–08) to 4,25,358 (2014–15), a CAGR of 13.74%. Medium enterprises recorded the highest CAGR (50.64%) from a low base, while micro enterprises grew at 12.36%.

6.2 Phase II — Udyog Aadhaar Memorandum (2015–2020): CAGR 24.72%

Introduced September 2015, UAM replaced physical filing with a single-page online form: self-certified, mobile accessible, document-free, and zero-cost. This reduced friction drove a near-5-fold surge in 2016–17 (23,73,058 registrations) following demonetisation, which pushed millions of informal enterprises to formalise. The overall CAGR for Phase II was 24.72%, approximately 1.8 times Phase I.

6.3 Phase III — UDYAM (July 2020–2025): CAGR 110.80% → 82.61% (sustained)

Launched June 26, 2020, UDYAM replaced UAM with composite investment-and-turnover classification criteria, Aadhaar-PAN-GST auto-verification, and a lifelong registration number. Existing EM-II/UAM holders faced a December 2021 migration deadline. The initial two-year CAGR reached 110.80%, driven by COVID-era incentives, expanded retail/wholesale inclusion, and street-vendor access to priority-sector lending. By October 2025, registrations totalled 6,93,67,135 a sustained 82.61% CAGR from 2021 to 2025, with micro enterprises comprising 99.1% of the total.

Table 4: MSME Registration Data — All Three Phases (2007–2025)

Year / Period	Micro	Small	Medium	Total	Regime
2007–08	1,53,110	16,730	467	1,72,703	EM II
2010–11	2,05,112	29,125	1,263	2,38,429	EM II
2014–15	3,46,206	70,933	8,219	4,25,358	EM II
CAGR 2007–15	12.36%	22.92%	50.64%	13.74%	Phase I
2015–16	4,21,516	70,866	2,631	4,95,013	UAM
2016–17	21,47,908	2,16,558	8,592	23,73,058	UAM (surge)
2019–20	16,32,644	2,22,226	8,506	18,63,376	UAM
CAGR 2015–20	25.32%	20.98%	21.60%	24.72%	Phase II
2020–21 (Dec)	60,62,213	8,14,150	34,090	69,10,453	UDYAM
2021–22 (Apr)	78,85,831	3,58,049	36,141	82,80,021	UDYAM
CAGR 2020–22	119.77%	26.93%	106.13%	110.80%	Phase III
Oct 2025	6,88,48,849	4,82,054	36,232	6,93,67,135	UDYAM
CAGR 2021–25	88.59%	–12.79%*	1.68%	82.61%	Phase IV

**Small enterprise negative CAGR reflects reclassification under revised composite criteria,*

not an actual decline in enterprise activity.

Analysis (Objective 1): The exponential formalisation trajectory from 1.72 lakh EM II filings (2007) to 6.9 crore UDYAM registrations (2025) represents the largest single formalisation event in any emerging economy. The 110.80% initial CAGR reflects the compound effect of zero-cost digital registration, Aadhaar-linked auto-verification, and pandemic-era incentives. The sustained 82.61% CAGR through 2025 signals enduring policy efficacy. However, with 633.88 lakh enterprises estimated by NSS (2015–16) versus 693.67 lakh registered by 2025, the apparent surplus demands caution the registration base now includes retail and wholesale trades added post-2021, which were previously excluded from MSME definitions. Integrating AI-based verification and real-time migration tracking is essential to sustain formalisation momentum toward the 50% GDP target.

7. EMPLOYMENT DISTRIBUTION IN REGISTERED MSMES (OBJECTIVE 2)

MSME employment has grown from 11.09 crore (2016–17) to approximately 30 crore (October 2025), more than doubling in under a decade. This growth has been propelled by digital formalisation, PMEGP-supported micro-enterprise creation, and expanded registration coverage. As Table 5 shows, micro enterprises dominate employment at 97%, employing 2,910 lakh workers across 683.8 lakh enterprises on an average of 4.26 workers per firm. Small enterprises, despite accounting for only 0.7% of registered units, employ 18 workers per firm on average, reflecting their higher labour intensity. Medium enterprises, at just 0.05% of units, contribute only 0.12% of MSME employment.

**Table 5: MSME Employment by Category
(Oct 2025)**

Category	Enterprises (L)	Employment (L)	% Share
Micro	683.8	2,910.0	97.0%
Small	4.8	86.4	2.88%
Medium	1.3	3.6	0.12%
Total	690.0	3,000.0	100%

Table 6: Rural-Urban Employment Split

Area	Micro (L)	Small (L)	Medium (L)
Rural	2,016.50 (78%)	7.88 (24%)	0.60 (34%)
Urban	581.20 (22%)	25.22 (76%)	1.16 (66%)

Rural-urban employment dynamics reveal a structural divergence: micro employment is predominantly rural (78%), while small and medium employment is concentrated in urban areas (76% and 66% respectively). This pattern reflects the labour-market characteristics of each tier in which micro enterprises are typically household-based or community-anchored, while small and medium enterprises cluster around urban supply chains, industrial estates, and formal procurement channels. The 80% rural composition of PMEGP-supported units reinforces this geography, contributing to migration reversal and inclusive rural growth.

Analysis (Objective 2): Micro enterprise dominance at 97% of employment underscores a critical scalability challenge. The average micro firm employs 4.26 workers barely above the household threshold limiting output per unit and compressing sector-level productivity. Bridging this gap requires tailored interventions: access to working capital (via OCEN and

UPI-based credit rails), market integration (via ONDC and GeM), and skills laddering (via AI-enhanced Sampark placement systems). Gender representation with women at only 24% of MSME employment, despite comprising 48% of India's workforce, demands specific policy levers including gender-sensitive apprenticeships and digital literacy modules for women-led micro enterprises in rural areas.

8. DIGITAL POLICY PLATFORMS: EFFICACY AND GAPS (OBJECTIVE 3)

8.1 Udyam Registration Portal and Digidhan Mission

The Udyam portal's contribution to formalisation has been documented in Section 5. Complementing registration, the Ministry's Digidhan Mission embedded digital payment protocols across all affiliates (KVIC, Coir Board, NSIC, MGIRI, NIMSME), equipping Udyog Aadhaar-registered MSMEs with BHIM, UPI, and Bharat QR tools. Digital transaction volume grew from 82.48% (2018–19) to 89% (2021–22) with value capture exceeding 99% earning the Ministry the Platinum Icon Award at Digital India Awards 2021–22. By 2024–25, national digital transactions exceeded ₹65,000 crore, with 6.98 lakh PM Vishwakarma beneficiaries enabled for up to 100 monthly digital payments.

8.2 MSME Sambandh — Public Procurement Monitoring

Launched December 8, 2017, the Sambandh Portal monitors CPSE procurement, enforcing the mandate of a minimum 25% allocation to MSEs. MSME procurement grew from ₹14,334 crore (108 CPSEs, 2017–18) to ₹98,500 crore (200 CPSEs, 2024–25), a 587% increase. The MSE procurement share consistently exceeded the 25% mandate, reaching 28.19% in 2020–21 and 28.14% in 2024–25. Women-enterprise procurement grew 13-fold from ₹231 crore (2018–19) to ₹3,029 crore (2024–25), though it still constitutes only 1.21% of total procurement, signalling the continued marginalisation of women-owned enterprises in formal procurement chains.

Table 7: CPSE Procurement from MSEs via Sambandh Portal (2017–2025)

Year	CPSEs	MSE Procurement (₹ Cr)	MSEs Benefited	SC/ST (₹ Cr)	Women Ent. (₹ Cr)
2017–18	108	14,334	50,427	267	NA
2018–19	161	40,463.91	1,26,553	822.75	231.19
2019–20	115	26,545.81	1,04,766	425.91	228.70
2020–21	153	40,738.16	1,76,031	756.99	718.82
2021–22	109	24,497.98	1,17,984	572.09	582.31
2024–25	200	98,500	2,50,000+	3,500	3,029.43

8.3 MSME Samadhaan — Delayed Payment Redressal

Launched October 30, 2017, the Samadhaan portal (samadhaan.msme.gov.in) provides real-time visibility into pending buyer dues. Under Section 18 of the MSMED Act, buyers must settle invoices within 45 days; defaults attract compound interest at thrice the RBI benchmark rate. State-level MSEFCs adjudicate disputes. Applications grew from 2,927 (₹744.65 crore, 2017–18) to 2,50,000 (₹65,000 crore, 2024–25) an 85-fold increase in volume and 87-fold in claimed value. However, mutual settlement rates remain critically low at 10% in 2021–22, with 63% of cases lingering in adjudication, predominantly against public-sector buyers. The ₹30,000 crore pending docket represents a structural liquidity drain on MSEs.

Table 8: MSME Samadhaan — Delayed Payment Applications and Resolution (2017–2025)

Year	Applications	Amount (₹ Cr)	Mutual Settlements	Settlement Amt (₹ Cr)	Cases Converted
2017–18	2,927	744.65	105	8.87	264
2018–19	18,509	4,797.81	1,407	0.53	4,682
2019–20	32,483	855.09	2,891	348.90	9,033
2020–21	65,142	18,466.49	5,798	885.07	15,943
2021–22	1,00,152	26,200.58	9,735	1,401	26,869
2024–25	2,50,000	65,000	25,000	15,000	60,000

8.4 CHAMPIONS Portal — Grievance Resolution

Launched June 1, 2020, the CHAMPIONS portal (Creation and Harmonious Application of Modern Processes for Increasing Output and National Strength) operates on a Hub-and-Spoke ICT model, enabling MSMEs to raise and resolve grievances in finance, markets, technology upgrades, and skills. Resolution rates have been consistently high at 98.7% for 25,855 queries (December 2020), 99% for 41,742 queries (December 2021), and 99.5% for over 1,00,000 cumulative queries (October 2025). The 2025 integration of AI-powered grievance handling now processes over 50,000 queries, reducing resolution time and enabling proactive, predictive enterprise support.

8.5 GeM Portal — Market Access Democratisation

The Government e-Marketplace (GeM) portal has been the most transformative market-access instrument for MSMEs. Initial uptake was negligible at 38,609 MSME registrations by June 2019. The COVID-19 crisis catalysed mass adoption: MSME sellers grew from 1 lakh (May 2020) to 6.91 lakh (May 2021), and to 25 lakh by October 2025 (out of 60 lakh total sellers), a 647-fold increase from the 2019 baseline. MSME-attributed orders on GeM reached ₹1.2 lakh crore in 2024–25, against total GeM annual transactions of ₹4.5 lakh crore. Staggered delivery systems introduced during the pandemic and COVID-19-specific vendor categories remain institutionalised features.

8.6 MSME Sampark — Skill-to-Employment Bridge

Launched in June 27, 2018, the Sampark portal links Technology Centre graduates to industry recruiters. Jobs offered grew from 2,124 (2018–19) to 33,593 (2022–23), a 15.8-fold increase. However, by 2024–25, with 4.75 lakh cumulative registered trainees and only 2,926 jobs

offered, the placement rate has fallen to approximately 6%, reflecting a structural mismatch between supply and recruiter capacity. AI-driven skill-matching algorithms being deployed in 2025 are projected to improve placement rates, particularly for underserved rural graduates.

Table 9: MSME Sampark — Trainees, Recruiters and Placements (2018–2025)

Year	Reg. Trainees	No. of Recruiters	Resumes Shared	Jobs Offered	Placement Rate
2018–19	35,819	5,060	7,090	2,124	~30%
2019–20	53,295	5,397	15,935	2,538	~16%
2020–21	NA	5,947	NA	28,019	NA
2021–22	88,190	6,264	39,243	30,253	~34%
2022–23	NA	NA	49,415	33,593	NA
2024–25	4,75,349	6,268	NA	2,926	~6%

Analysis (Objective 3): The six digital platforms collectively deliver a 20–30% efficiency gain (Panduwinata et al., 2025) across formalisation, procurement, grievance redressal, and market access. GeM's 647-fold MSME seller growth is the most striking market-access achievement. However, three structural deficiencies persist: (i) Samadhaan's 63% adjudication backlog (₹30,000 Cr pending) signals that digital transparency alone cannot resolve asymmetric bargaining power between MSEs and large public buyers; (ii) Sampark's 6% placement rate reveals a talent-supply/recruiter-demand mismatch; and (iii) women-enterprise procurement at 1.21% of CPSE totals underperforms the 25% mandate by a factor of 20. ERP integration, AI-led case prioritisation, and gender-focused digital literacy drives are the primary recommended interventions.

9. FINDINGS AND DISCUSSION

The data reveal three overarching findings that reframe the policy narrative on MSME digitisation.

First, digitisation has been the primary and not merely supplementary is the driver of formalisation. The progression from 13.74% CAGR (EM II, manual) to 24.72% (UAM, digital self-declaration) to 110.80% (UDYAM, Aadhaar-auto-verified) demonstrates that each successive reduction in registration friction produced a non-linear acceleration. This is consistent with Deb (2019) and Panduwinata et al. (2025) on the compounding returns of digital infrastructure.

Second, formalisation is necessary but insufficient for economic transformation. Despite 6.9 crore registrations, the \$300 billion credit gap persists, 63% of Samadhaan cases remain unresolved, and only 13% of the estimated enterprise universe (NSS 73rd Round, 633.88 lakh) was formally registered at the time of the survey. The gap between registration and credit/market integration represents the 'second wall' of formalization the one that requires the Account Aggregator (AA) framework, OCEN-based cash-flow lending, and mandatory GeM sourcing mandates to breach.

Third, gender and spatial equity remain the primary unresolved dimensions. Female

ownership (20.37%), female employment (24%), and women-enterprise procurement (1.21%) are uniformly well below equitable levels. Rural micro-enterprise employment (78%) contrasts sharply with urban concentration of formal credit and procurement flows. Policies targeting these dimensions such as gender-sensitive MUDRA products, rural GeM onboarding, and BharatNet-enabled digital literacy which are necessary conditions for the sector's GDP contribution to reach 50% by 2030.

10. POLICY RECOMMENDATIONS

1. **AI-Augmented UDYAM Verification:** Integrate AI-based real-time verification on the UDYAM portal to cross-validate GST, ITR, and bank data, reducing ghost registrations and enabling dynamic credit profiling for newly formalised enterprises.
2. **ERP-Integrated Samadhaan Enforcement:** Mandate ERP system uploads from all CPSEs to the Samadhaan portal for real-time payment tracking, enabling automated interest computation and reducing the 63% adjudication backlog through algorithmic case prioritisation.
3. **Gender-Inclusive Digital Tools:** Design and deploy gender-targeted digital literacy modules (vernacular, mobile-first) linked to MUDRA credit products, GeM seller onboarding, and PMEGP applications with a specific target of doubling women-owned enterprise procurement from 1.21% to 3% by 2027.
4. **OCEN-UDYAM Credit Integration:** Formally link UDYAM registration IDs to the Open Credit Enablement Network (OCEN), enabling UPI transaction histories of registered MSMEs to serve as collateral-free creditworthiness evidence, targeting a \$100B reduction in the \$300B credit gap by 2028.
5. **Sampark AI Matching Scale-Up:** Expand the AI-driven skill-matching algorithm on the Sampark portal with sector-specific and geography-specific recommendation engines, prioritising rural Technology Centre graduates and targeting a placement rate recovery from 6% to 20% by 2027.
6. **National MSME Census (Decennial):** Commission a comprehensive MSME census the first since 2006–07 to establish a reliable baseline for informal enterprise counts, sector composition, and regional credit gaps, enabling evidence-based policy calibration for the 2030 target.

11. CONCLUSION

India's MSME digitisation journey from 1.72 lakh EM II filings in 2007 to 6.93 crore UDYAM registrations in October 2025 represents the largest and fastest enterprise formalisation programme in the history of any emerging economy. The 110.80% initial CAGR and sustained 82.61% CAGR reflect the compound effect of zero-cost, Aadhaar-authenticated, self-declared registration, amplified by pandemic-era policy intensity and expanded enterprise coverage. GeM's 647-fold growth in MSME sellers, CHAMPIONS' 99.5% grievance resolution rate, and Sambandh's consistent 28%+ procurement share all signal a digital ecosystem that is structurally functional.

Yet the \$300 billion credit gap, the 63% Samadhaan adjudication backlog, the 20.37% female ownership share, and the 6% Sampark placement rate collectively define the boundaries of formalisation-as-registration and identify the terrain where formalisation-as-integration must begin. The sector's ambition to grow from 30% to 50% of GDP is achievable, but only if the second generation of digital policy closes the credit, gender, and payment-enforcement gaps that the first generation opened for visibility. The India Stack like Aadhaar, UPI, and Account Aggregator provides the infrastructure. The remaining imperative is the institutional will and targeted policy design to deploy it equitably.

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FROM CASH TO CLICK: RISE OF PAYMENT APPS IN SHAPING CASHLESS DIGITAL ECONOMY

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Abstract

The rapid advancement of information and communication technology has significantly transformed the financial landscape, leading to the widespread adoption of digital payment applications. This study examines the transition from traditional cash-based transactions to digital payment systems and explores the role of popular payment applications such as Google Pay, PhonePe, and Paytm in shaping the digital economy. The research focuses on understanding user awareness, usage patterns, and the influence of these applications in promoting digital transactions and supporting the vision of a cashless economy. The study adopts a descriptive research design and collects primary data through a structured questionnaire administered to users of digital payment applications. The findings indicate that digital payment apps have enhanced convenience, speed, and accessibility in financial transactions. These platforms enable users to perform various activities such as money transfers, bill payments, online purchases, and merchant payments with ease. Furthermore, incentives like cashback offers, secure authentication methods, and user-friendly interfaces have contributed to their growing popularity among users. The present study provides compelling evidence that digital payment applications have emerged as a transformative force in reshaping the financial ecosystem and accelerating the transition towards a cashless economy. The empirical findings reveal a high degree of awareness, widespread adoption, and frequent usage of digital payment platforms, particularly among young and educated users, indicating a significant behavioural shift from traditional cash-based transactions to digital modes. The results of the chi-square analysis further substantiate that digital payment applications exert a statistically significant influence on promoting digital transactions and reinforcing the vision of a cashless economy.

Key words: Digital Payments, Cashless Economy, Mobile Payment Applications

Introduction

In recent years, India has witnessed a major shift from traditional cash-based transactions to digital payment systems. This transformation has been driven by increased smartphone penetration, internet accessibility, and supportive government initiatives promoting a cashless economy. Digital payment applications have emerged as convenient, fast, and secure alternatives to physical cash, enabling users to perform transactions anytime and anywhere. The move towards a cashless economy is not only a technological advancement but also a strategic step towards improving transparency, reducing corruption, and enhancing financial inclusion. As a result, digital payments have become an integral part of everyday life, especially among the younger population and urban users.

The shift from cash to digital transactions gained momentum after the 2016 demonetization initiative, which encouraged individuals and businesses to adopt digital modes of payment. Since then, the use of payment applications such as Google Pay, PhonePe, and Paytm has grown rapidly. These platforms offer user-friendly interfaces, cashback incentives, and secure transaction systems, making them highly popular among consumers. The importance of a cashless economy in India lies in its ability to enhance financial transparency, reduce the cost of cash handling, and bring more people into the formal financial system. It also supports economic growth by improving efficiency in transactions and reducing dependency on physical currency.

Objectives of the study

- To understand the concept of digital payment applications in the digital economy.
- To examine the role of payment apps in facilitating digital transactions and promoting a cashless economy.
- To analyse the usage and adoption of popular payment apps such as Google Pay, PhonePe, and Paytm among users.
- To identify the advantages and challenges associated with the use of digital payment applications.

Limitations of the Study

- The present study is confined to the responses of the respondents of Uttara Kannada District. Hence it cannot be generalized.
- Due to time constraint elaborate and exhaustive study cannot be undertaken.
- A comparative analysis of different payment applications could not be undertaken.

Hypotheses for the Study

a) Statement: Digital payment apps promote a cashless economy

Null Hypothesis (H_0): Digital payment apps do not significantly promote a cashless economy.

Alternative Hypothesis (H_1): Digital payment apps significantly promote a cashless economy.

b) Statement: Do you think payment apps will replace cash transactions in the future?

Null Hypothesis (H_0): Payment apps will not replace cash transactions in the future (no significant preference among respondents).

Alternative Hypothesis (H_1): Payment apps will replace cash transactions in the future (significant preference among respondents).

Research Methodology

- **Sample and sampling technique:** The present research is purely based on Questionnaire method using Google forms. The data have been collected from 100 respondents of Uttara Kannada district.

- **Sources of Data:** The primary data were collected through structured questionnaire from 100 respondents using Google form and secondary data was collected through the secondary sources like journals websites etc.
- **Tools for Data Analysis:** The study employed various data analysis tools such as tabulation, graphical representation, and statistical techniques chi-square test to interpret the results.

Literature Review:

- Darbi and Srinivas (2026) analyze the impact of UPI on consumer spending patterns in India, highlighting its significant role in promoting cashless transactions. The study finds that UPI has enhanced the ease, speed, and convenience of payments, leading to increased usage, especially for small and daily transactions. It observes a shift in consumer preferences from cash to digital modes, along with a rise in spending frequency and impulse buying due to instant payment features and reward incentives. The research also emphasizes that UPI contributes to financial inclusion and helps users track and manage their expenses through digital records.
- Giridhar (2025) examines India's digital payment revolution, emphasizing the transformative role of UPI in driving a rapid increase in digital transactions, particularly after demonetization in 2016. The study identifies key factors such as rising internet penetration, the impact of COVID-19, improved financial literacy, and strong government initiatives as major drivers of digital adoption. It highlights changes in consumer behaviour, increased trust in contactless payments, and enhanced financial inclusion, especially among rural and unbanked populations.
- Pal and Kumar (2023) examine the growing importance of digitalization in India, with a particular focus on digital payment systems. The study highlights the initiatives taken by the Reserve Bank of India (RBI) to promote digital payments and enhance financial inclusion. It analyzes trends in various digital payment modes such as UPI, IMPS, NACH, and others over recent years, indicating a steady rise in adoption. However, the authors note that cash continues to remain relevant due to inadequate infrastructure and technological challenges.
- Javaid and Ahmed (2017) highlight that a cashless economy presents both significant opportunities and challenges for the financial and business environment. The study emphasizes that increased adoption of digital payment systems can expand the tax base, reduce counterfeit currency, and help curb illegal activities such as terrorist funding.

Data Analysis and Interpretation Analysis of survey statements Analysis & Interpretation:

Table No. 1 – Frequency Analysis

Variables	Category	Frequency	Frequency (%)
Gender	Male	44	44
	Female	56	56
Age (years)	Below 18	2	2
	18-25	48	48
	26-35	26	26
	36-45	13	13
	Above 45	11	11
Education Level	SSLC	2	2
	PUC	5	5
	Undergraduate	56	56
	Postgraduate	36	36
	Other	1	1
Occupation	Student	40	40
	Employee	26	26
	Self-employed	11	11
	Business	18	18
	Other	5	5
Are you aware of digital payment applications?	Yes	98	98
	No	2	2
How frequently do you use digital payment apps?	Daily	63	63
	Weekly	20	20
	Occasionally	8	8
	Rarely	9	9
For what purposes do you mainly use digital payment apps?	Less than 6 months	19	19
	6 months – 1 year	14	14
	1–3 years	16	16
	More than 3 years	51	51

Source: Primary Data

Table No. 1 – Frequency Analysis Interpretation

Variable	Analysis & Interpretation
Gender	The data shows that 56% of respondents are female and 44% are male. This indicates slightly higher participation of females, suggesting that digital payment adoption is not limited by gender and is widely accepted across both groups.
Age-wise	Majority (48%) belong to the 18–25 years age group. This indicates that young adults are the primary users of digital payment apps, showing higher adaptability to technology.
Education Level	Undergraduates (56%) form the largest group. This suggests that educated individuals are more inclined to use digital payment apps, likely due to better digital literacy.

Occupation	Students (40%) are the largest group, followed by Employees (26%) and Business (18%). This shows that students and working professionals are the key users, indicating that digital payments are common in both academic and professional environments.
Awareness of Digital Payment Apps	98% of the respondents are aware of digital payment apps, while only 2% are unaware. This clearly indicates very high awareness, which is a strong foundation for a cashless economy.
Usage Frequency	63% use apps daily. This shows high dependency and regular usage, meaning digital payments are becoming a routine part of life.
Duration of Using Digital Payment Apps	A majority of respondents (51%) are long-term users, having used digital payment apps for more than three years. This suggests that digital payment systems are well-established and widely accepted among users.

Table No. 2 – Frequency Analysis of Statements

Statements	Options	Frequency	Frequency (%)
Digital payment apps make transactions faster.	Strongly Disagree	1	1
	Disagree	2	2
	Neutral	12	12
	Agree	39	39
	Strongly agree	46	46
Digital payment apps are easy to use.	Strongly Disagree	1	1
	Disagree	1	1
	Neutral	9	9
	Agree	53	53
	Strongly agree	36	36
Digital payment apps reduce the need to carry cash.	Strongly Disagree	4	4
	Disagree	1	1
	Neutral	14	14
	Agree	50	50
	Strongly agree	31	31
Digital payment apps promote a cashless economy.	Strongly Disagree	2	2
	Disagree	3	3
	Neutral	15	15
	Agree	50	50
	Strongly agree	30	30
Digital payments are secure and reliable.	Strongly Disagree	3	3
	Disagree	2	2
	Neutral	38	38
	Agree	33	33
	Strongly agree	24	24
Digital payment apps improve transparency in transactions.	Strongly Disagree	1	1
	Disagree	3	3
	Neutral	12	12
	Agree	62	62
	Strongly agree	22	22
	Strongly Disagree	6	6

Digital payments are difficult to use when internet connectivity is poor.	Disagree	1	1
	Neutral	8	8
	Agree	38	38
	Strongly agree	47	47
Some shops or service providers do not accept digital payments.	Strongly Disagree	1	1
	Disagree	7	7
	Neutral	24	24
	Agree	48	48
Transaction limits in payment apps restrict my ability to make large payments.	Strongly agree	20	20
	Strongly Disagree	2	2
	Disagree	8	8
	Neutral	25	25
Lack of digital knowledge prevents people from using payment apps effectively.	Agree	46	46
	Strongly agree	19	19
	Strongly Disagree	2	2
	Disagree	3	3
Sometimes payment apps are difficult to understand or operate.	Neutral	20	20
	Agree	49	49
	Strongly agree	26	26
	Strongly Disagree	1	1
	Disagree	27	27
	Neutral	26	26
	Agree	35	35
	Strongly agree	11	11

Source: Primary Data

Table No. 2 – Frequency Analysis of Interpretation of Statements

Statement	Analysis & Interpretation
Digital payment apps make transactions faster	Majority (85%) agree/strongly agree, indicating strong perception that digital payments significantly improve transaction speed.
Digital payment apps are easy to use	A dominant 89% agreement shows users find digital payment apps highly user-friendly.
Digital payment apps reduce the need to carry cash	With 81% agreement, respondents clearly believe digital payments reduce cash dependency.
Digital payment apps promote a cashless economy	80% agreement indicates strong support that digital apps contribute to a cashless economy.
Digital payments are secure and reliable	Mixed response with 57% agreement and 38% neutral suggests moderate trust but some uncertainty about security.
Digital payment apps improve transparency in transactions	High agreement (84%) reflects strong belief that digital payments enhance transaction transparency.
Digital payments are difficult to use when internet connectivity is poor	85% agreement highlights that poor internet connectivity is a major challenge in using digital payments.
Some shops or service providers do not accept digital payments	68% agreement indicates limited acceptance of digital payments still exists in some areas.

Transaction limits restrict large payments	65% agreement shows users face constraints due to transaction limits in payment apps.
Lack of digital knowledge prevents effective usage	75% agreement suggests digital illiteracy remains a significant barrier to adoption.
Payment apps are sometimes difficult to understand or operate	Mixed opinion with 46% agreement and 27% disagreement indicates usability issues exist for some users.

Hypothesis Testing Result:

Hypothesis 1 - The chi-square test was applied to analyze whether Digital payment apps promote a cashless economy. The calculated chi-square value ($\chi^2 = 81.90$) is greater than the table value ($\chi^2 = 9.488$) at 5% level of significance with 4 degrees of freedom.

Since the calculated value exceeds the table value, the null hypothesis is rejected. This indicates Digital payment applications significantly influence digital transactions and play a vital role in promoting a cashless economy.

Hypothesis 2 - The chi-square test was applied to analyze whether payment apps will replace cash transactions in the future. The calculated chi-square value ($\chi^2 = 29.16$) is greater than the table value ($\chi^2 = 5.99$) at 5% level of significance with 2 degrees of freedom.

Since the calculated value exceeds the table value, the null hypothesis is rejected. This indicates that there is a significant difference in responses, and it can be concluded that respondents believe payment apps are likely to replace cash transactions in the future.

Major Findings

- High awareness (98%) and frequent usage (63% daily) indicate strong adoption of digital
- Payment apps.
- Young users (18–25 years) and students are the primary adopters, showing the role of digital literacy.
- A majority (80%) believe that digital payment apps promote a cashless economy and reduce cash dependency.
- Apps are mainly used for money transfer, recharges, and merchant payments, while usage for other services is limited.
- Time-saving (83%) and ease of transfer (80%) are the most valued advantages of digital payments.
- Most respondents find apps fast (85%) and easy to use (89%), indicating high user satisfaction. ➤ Security perception is moderate, with some users still uncertain about reliability.
- Major challenges include poor internet connectivity, limited acceptance, transaction limits, and digital illiteracy.
- Google Pay and PhonePe dominate the digital payment ecosystem.
- Chi-square results confirm that digital payment apps significantly promote a cashless economy and may replace cash in the future, leading to rejection of the null hypothesis.

Suggestions / Recommendations

1. The following recommendations are made based on the analysis and interpretation of the data collected from respondents, along with the insights. These suggestions aim to enhance the effectiveness of digital payment applications and promote the development of a cashless economy.
2. Digital payment applications should strengthen security measures by adopting advanced encryption, biometric authentication, and real-time fraud alert systems to enhance user trust and safety.
3. The applications should be designed with simple, user-friendly interfaces and multi-language support to ensure accessibility for users of all age groups and literacy levels.
4. There is a need to improve internet connectivity and digital infrastructure, particularly in rural and remote areas, to facilitate uninterrupted digital transactions.
5. Service providers should focus on improving transaction speed and reducing technical issues such as server failures, app crashes, and payment delays to ensure reliability.
6. Transaction limits should be increased and associated costs reduced to make digital payments more flexible and convenient for users.
7. Government initiatives and technological innovations should be encouraged to strengthen the digital payment ecosystem and accelerate the transition towards a cashless economy.
8. Introduce and promote offline digital payment options (such as USSD-based or NFC-enabled payments) to overcome challenges of poor internet connectivity.
9. Encourage adoption of emerging technologies such as AI, blockchain, and digital identity systems to enhance security, efficiency, and scalability.
10. Establish centralized fraud monitoring mechanisms and early warning systems to detect and prevent digital payment frauds at a systemic level.
11. Conduct regular impact assessments and user feedback studies to evaluate the effectiveness of digital payment systems and update policies accordingly.

Conclusion

The present study provides compelling evidence that digital payment applications have emerged as a transformative force in reshaping the financial ecosystem and accelerating the transition towards a

Cashless economy. The empirical findings reveal a high degree of awareness, widespread adoption, and frequent usage of digital payment platforms, particularly among young and educated users, indicating a significant behavioural shift from traditional cash-based transactions to digital modes. The results of the chi-square analysis further substantiate that digital payment applications exert a statistically significant influence on promoting digital transactions and reinforcing the vision of a cashless economy.

Despite the overwhelmingly positive perception regarding convenience, speed, and transparency, the study also highlights critical challenges, including concerns over security, infrastructural limitations such as poor internet connectivity, restricted merchant acceptance,

and gaps in digital literacy. These issues underline the need for a more robust and inclusive digital payment ecosystem.

In conclusion, while digital payment applications have successfully laid a strong foundation for a cashless economy, their long-term sustainability and universal acceptance will depend on continuous technological innovation, strengthened regulatory frameworks, enhanced user trust, and targeted policy interventions aimed at bridging existing gaps. The study thus emphasizes that a collaborative effort between government, financial institutions, and technology providers is essential to fully realize the potential of a digitally empowered and financially inclusive economy.

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WOMEN ENTREPRENEURSHIP IN INDIA: OPPORTUNITIES, CHALLENGES AND GROWTH PROSPECTS & A CRITICAL STUDY OF WOMEN ENTREPRENEURSHIP

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Abstract

As the growth of Women Entrepreneurship in India continues to drive social & Economic growth in addition to achieving Gender Equality, women have begun participating in entrepreneurial ventures with the help of an increase in education, government policies, a changing socio/cultural structure, & many other factors. Women have had a major impact in creating jobs, innovating new products & technologies, preventing poverty, & many other ways in all industries including Agriculture, Manufacturing, and Service & Technology. Still, Women entrepreneurs in India face many barriers including: Limited access to finance; the lack of ability to develop managerial & technical skills; Gender Bias; and other limitations & constraints set by society. Government programs such as Startup India; Stand Up India; Self-Help Groups (SHG) & other initiatives, have provided Women entrepreneurs with access to financial assistance, training and mentorship; therefore, helping to promote Women-owned businesses. This paper discusses the growth opportunities and obstacles for women entrepreneurs within the country of India; along with providing insight on the need for creating supportive policies and providing capacity-building opportunities to create a supportive entrepreneurial environment to enable sustainable economic development for Women Entrepreneurs.

Keywords: *Women entrepreneurship, Reasons for entrepreneurship, Government initiatives*

Introduction

Beginning Entrepreneurship is a vital component of economic growth for developed and developing countries. It represents the base of a nation's economy. Entrepreneurship uses existing resources of production and assembles them in a novel manner; thus, producing goods and/or services that meet customer and client needs better than before. Entrepreneurs act as a catalyst, creating opportunities for change, as well as supporting economic development over time. Nations want to provide economic development for prosperity and a higher standard of living for their citizenry. Economic, Social and Political Development is viewed as a holistic approach; women's development must be included because women make up approximately one-half of the world population.

Women's contributions are vital to economic growth and development in a healthy nation. Entrepreneurs are people that take on and accept all kinds of risks associated with an enterprise. Entrepreneurs organise inputs for production, provide new ideas, concepts, strategies and techniques in business regularly. Women entrepreneurs are just as capable as

men in developing new businesses; they assume a great deal of risk by starting new businesses, introducing new innovations, managing and running a business successfully and providing quality leadership across a business. This Report examines the definition of women entrepreneurs in India, their skills and abilities for running a successful business, the barriers that women entrepreneurs encounter when establishing and growing their own businesses and provides recommendations for future growth of the Women Entrepreneur sector in India.

The entrepreneurial movement began many centuries ago and has evolved into a successful sector; Female Entrepreneurs will increase greatly as India's economy continues to grow. Women entrepreneurs have a tremendous impact throughout the economy. According to the Government of India's definition, "Women Entrepreneur" is a woman, who has an interest of at least 51% in the capital of a business and who creates at least 51% of the jobs created by the business. According to Kamala Singh, "A woman entrepreneur is a confident, creative and innovative woman who has achieved economic independence through her own efforts and through collaborations and who creates jobs for others by establishing and running her own business." women's entrepreneurship.

Women entrepreneurs have a major impact on the economy. "Women Entrepreneur" is a woman who has at least 51% of the capital of a business and creates at least 51% of the jobs generated by the business. According to Kamala Singh, "A woman entrepreneur is a creative, confident and innovative woman who has achieved economic independence through her own efforts and through collaborative efforts and creates job opportunities for others by establishing and running her own business."

Women entrepreneurs are having a positive effect on the economy and creating jobs for others. "Women Entrepreneur" is a woman who has an ownership share of at least 51% of a business and creates at least 51% of the jobs created by the business. A few examples would be Faith Hill, Jen Dice and many others. Women entrepreneurs impact all areas of the economy, as women increasingly take ownership of businesses and create jobs for other women, they are empowering themselves and their families to become more economically self-sufficient.

BACKGROUND OF THE STUDY:

Since the early 1990s, gender development has emerged as a new theory behind economic development. Gender development has been identified as one of the components of the Human Development Index and therefore, the increasing importance of women in terms of development has led to new indices of developmental measurement; i.e., Gender Empowerment Measure (GEM), Gender Inequality Index (GII), etc. As a model of new social capital and entrepreneurial opportunity for women, the role of women in developing their own social capital has led to significant increases in the level of female education, the rate of female employment and the establishment of self-help groups as well as an increasing number of women employed in corporate sectors. In reality, presently in India, 98% of female-owned businesses are micro businesses and only 6% of new venture start-ups in Bengaluru, India's

capital for technology and innovation, are female-led. Today, women are predominantly employed in low-wage jobs, routinely work in lengthy shifts and manage dual work responsibilities while quietly performing many labor-intensive, thankless jobs. For women to improve their socioeconomic standings, women must be given the same opportunities and support as men to create, develop and manage their own entrepreneurial businesses. The best way to create an environment for women to succeed in these endeavors is to give women the same level of respect, value and authority as men. By empowering and enabling women to create their own businesses and empower other women, the gender equity gap will close.

METHODOLOGY:

The present study is based on the collection of data from secondary sources. Secondary data is obtained from various published and unpublished records, books, magazines and journals.

Reasons for women to become entrepreneurs

In India, women's participation in business has been gradual. Women have gradually moved from being homemakers and preparing food at home to becoming involved in businesses due to increased access to education and technological advancements. The skills and knowledge required to run a successful business are vital to the success of women-owned businesses. A female entrepreneur is a woman who takes on an active role in her own life and becomes economically independent. Female entrepreneurs have an intrinsic motivation to create positive change and can bring value to their companies and communities. The rise of media has raised awareness of women's personal characteristics, rights and working environments. Women's ability to thrive in the digital age has produced large numbers of job creation and also positive job opportunities. A traumatic event — divorce, pregnancy discrimination, the corporate glass ceiling, family members' health issues and layoffs — often causes women to start businesses and become business owners. Today, there is a new crop of women entrepreneurs who are leaving their jobs in corporate America to create their own destiny. Women are beginning to build new careers as designers, decorators, exporters, publishers, garment manufacturers and to investigate many other avenues to add to their participation in the economy. Women who have experienced trauma may not require any push or pull to start a business, as they were forced by their circumstances to do so. In contrast, women with a good financial background often require both a push and a pull before they will attempt to start a business, as many of these women were not aware of their inner strength, potential and resources. Many women from the upper classes of society are also reluctant to pursue non-traditional careers because they fear pursuing a non-traditional career will result in the loss of respect and acceptance from their peers and families.

Current trends of women entrepreneurship in India

The sixth Economic Census was published by the Ministry of Statistics and Programme Implementation and shows there are many concerns about Women Entrepreneurs in India based on their participation level (see Figure 1 for further analysis based on 6th Economic Census Data). The Women Entrepreneurs account for only 13.76% of all entrepreneurs (i.e.,

8.05 million out of 58.50 million total).

Figure 1: gender concentration in entrepreneurial activities
women entrepreneurs



In total, women own and operate these establishments and employ 13.45 million individuals combined. In addition, according to Figure 2, both groups of Women Entrepreneurs in total employ 13.45 Million Individuals combined. The remaining information provided in Figure 2 depicts that of these Women Entrepreneurs, approximately 2.76 million Women (around 34% of all Women Entrepreneurs) are employed by the Agricultural Industry, while approximately 5.29 million Women (around 66% of all Women Entrepreneurs) are employed by the Non-Agricultural Industry.

Figure 2: women entrepreneurs and their field of work
women entrepreneurs

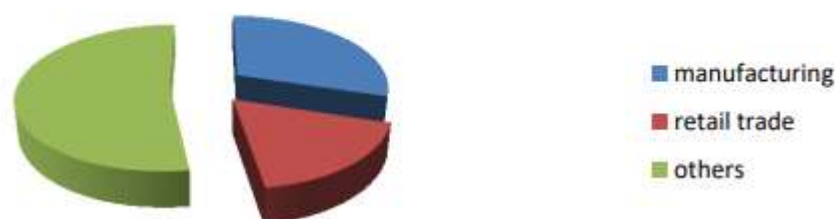


Source: Sixth economic census, Govt. Of India, 2013-14

Livestock farming accounts for 31.6% of total agricultural production within the sector; it is therefore the largest share of agricultural production. The two dominant non-Agricultural sectors of production owned by Women Entrepreneurs are Manufacturing and Retail Trade as seen in figure 3, which make up 29.8% of production and 17.8% of production respectively.

Figure 3: women's participation in business

Women entrepreneurs



Source: Sixth economic census, Govt. Of India, 2013-14

Out of the total establishments under women entrepreneurs, percentage share of various social religious groups OBC: 40.60%, SC: 12.18%, ST: 6.97% and Others (40.25%); Hindus: 65.6%, Muslim: 12.84% and Christian: 5.2%

Figure 4: women entrepreneur and their belongingness to social groups

Women entrepreneur



Source: Sixth economic census, Govt. Of India, 2013-14

Among the states, the largest share in number of establishments under women entrepreneurship is of Tamil Nadu (13.51%) followed by Kerala (11.35%), Andhra Pradesh (10.56%), West Bengal (10.33%) and Maharashtra (8.25%).

Figure 5: entrepreneurs and their religious affiliation

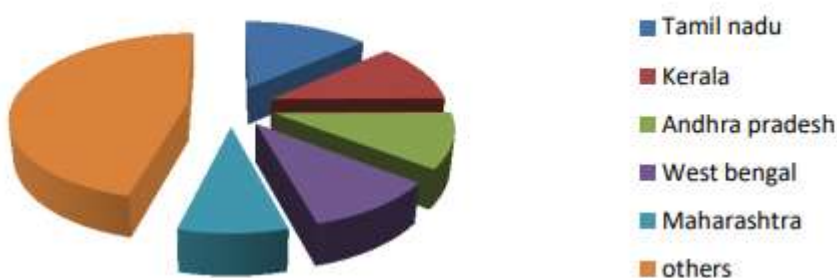
women entrepreneur



Source: Sixth economic census, Govt. Of India, 2013-14

Figure 6: women entrepreneurs and their regional concentration

Women entrepreneur



Source: Sixth economic census, Govt. Of India, 2013-14

The results from the census clearly indicate a very small number of women who have engaged in entrepreneurship when compared to men; with only approximately 25% of women having participated as opposed to 75% of men. Additionally, it appears as though most women

entrepreneurs operate within the service sector as compared to the manufacturing and retail sectors. As for women of backward castes, it is interesting to note that they make up the largest portion of female entrepreneurs. The states in Tamil Nadu, Kerala Andhra Pradesh, West Bengal and Maharashtra are showing the highest percentages of female entrepreneurial initiatives. In other words, women living in the more developed regions of India have a greater tendency to view entrepreneurship as an opportunity for increased economic opportunities, compared to women who are living in the less developed regions of India.

Obstacles affected for Women Entrepreneurs in India

Several studies conducted earlier found that obstacles in the path of the women entrepreneur take the shape of personality phenomenon, social denial and deficiency in environmental support. Among them the most prominent are:

- Lack of Self-Confidence** Women in India have very low selflessness, which reflects in both their capacity and confidence in their strengths/abilities. Additionally, communities and family members do not support them in terms of growth through self-employment opportunities created by businesses. However, there has been and is still a considerable movement towards changing this situation for Indian women; however, women will need to continue to make progress through entrepreneurial opportunities, rather than exclusively using traditional means of support..

- Socio-Cultural Barriers** Regardless of whether women are employed as a working woman or as an entrepreneur, their roles in society as well as with their families are diverse and demanding. Society generally views men as the more important gender than women. Women suffer due to limited opportunities for education and training, resulting in continued barriers to women's success in the labour market and beyond.

- Mobility Constraints** In India, mobility restrictions for women still continue; our society remains relatively conservative towards women's role in society. The Woman's place is still considered largely as the kitchen. Employment opportunities for women include primarily being involved in household activities, as well as entrepreneurial activity. Although women are still experiencing mobility restrictions, through the increased level of education and awareness, a great deal of these mobility limitations have been reduced since the initiation of the Entrepreneurial Movement.

- Lack of financial assistance** Financial institutions are uncertain regarding women's business acumen. There is a mismatch between the facts in the United Nations Industrial Development Organization (UNIDO) regarding the successful repayment of loans by men compared to women when the fact that women have higher rates of successful payment than men is accounted for. Due to discriminatory attitudes toward women at banks and informal lending networks, they experience discrimination when they require a loan or other forms of credit to grow their businesses.

- Exposure to training programs** The majority of women in developing nations lack the education and knowledge necessary to create successful businesses. The majority of women

in the developing world are unaware of new technologies and have little, if any, experience with them or the training required to perform the necessary research to establish themselves as entrepreneurs. Even though technological advancement is progressing at a rapid pace, barriers such as women's illiteracy, structural inequities and limited access to technical training inhibit or preclude the advantages and availability of technology to women ("Women Entrepreneurs in Poorest Countries" 2001).

•**Lack of Knowledge in business administration** For women to excel within the Decision Making Process and build solid Business Networks, it is imperative that they receive education and training on a continuous basis that provides an understanding of all the functional areas of Management.

•**Market oriented risks** Due to the intense competitiveness of the market along with women being physically unable to work or travel as easily, female entrepreneurs rely heavily on intermediaries to sell products and market them; until they develop mobility, confidence and mobility to interact with their customers, female entrepreneurs will never develop these abilities due to social conditioning. While females may have the management capacity over their businesses, many females continue to rely upon male relatives to assist them in marketing their businesses — resulting in the continued underdevelopment of women business owners' ability to establish the marketplace for their products or build a customer base.

•**Lack of Motivational factors** Compared to their male counterparts, females are generally believed to be motivated less by achievement than they are by themselves. The lack of education and confidence tends to limit the level of both achievement motivation and achievement orientation exhibited by female entrepreneurs. The motivations for starting and operating a successful business come through establishing a vision of success, being willing to take business risks and demonstrating positive social responsibility, i.e., handling social issues in the local community. In addition to these elements, females also benefit from the assistance and encouragement received from their families, the policies offered by local and national governments, the access to funding from public and private lending institutions and living within a business-friendly environment.

•**Unavailability of raw material** The uncertainty surrounding women's access to production inputs makes them reluctant to seek this information. A lack of understanding about the availability of raw materials and limited skills in negotiation/bargaining impede the ability of women entrepreneurs to pursue successful business ventures. Despite the growing number of associations, institutions and government programs available for women, women do not appear to be utilizing these resources in an entrepreneurial or proactive fashion.

Problems and challenges that they face are as follows:

•**Male Dominated Society** The biggest barrier that female entrepreneurs face is the fact that they are female. Male-dominated social systems are the greatest obstacles to female entrepreneurs' success. The male gender perceives it as a large risk to invest in female-run

businesses.

•**Distrust in the Entrepreneurial abilities of Women** Women entrepreneurs have difficulty obtaining loans because of the distrust that financial institutions have in them as entrepreneurs. Women are required to put up ridiculous and unreasonable security to get loans. Women are also discriminated against in terms of credit as shown in a report published by UNIDO which states that "despite having a much higher loan repayment rate than men, women still face greater challenges than men in obtaining credit" due mainly to the bias of bankers and money lenders towards women entrepreneurs.

•**Inadequate Financial Resources and Working Capital** Most entrepreneurs require some type of funding in order to begin their businesses, whether it is through a traditional bank loan, a personal savings account, or other means. As a result, many female entrepreneurs face significant barriers based on limited access to capital resources and working capital. Many female entrepreneurs lack access to external funding sources because they cannot provide any form of collateral that can be converted into cash to secure a loan. In addition, only a small percentage of women currently hold tangible property.

•**Family Obligations** In both developed and developing countries, the family obligations of women act as a barrier for them to become successful entrepreneurs. As stated, "The primary caregiver role (children, house and elderly dependent relatives) prevents most women from dedicating their full attention/time and energy toward their business." Furthermore, women entrepreneurs are often given negative feedback from financial institutions for being viewed as an individual who will likely abandon her business to return to being a homemaker; thus the only financial support available to these women is through their own savings and/or loans from friends and relatives.

•**More Importance to Family Ties and Relationship** In India, women are generally very close to their families and relationships with others. Married women must balance their family obligations with their work obligations, while the success or failure of their business largely depends on the support of the family members of the married women's business activities and management.

•**Inability to take risks** A low-risk-taking mentality is another aspect that impacts women entrepreneurs' success as a business owner. Women must have a high appetite for risk, along with bravery and self-esteem in managing their business's finances, running their day-to-day operations and reinvesting profits into their companies.

•**Inefficient arrangements for Marketing and Sales** Women entrepreneurs are often dependent on middlemen for the purpose of marketing their products, resulting in the middleman taking a large share of the profit associated with those products. Additionally, women entrepreneurs face significant challenges in marketing their products and gaining market share. These obstacles can be particularly pronounced for women who are operating food production and processing businesses.

•**Trade related entrepreneurship assistance and development scheme for women (TREAD)** The Indian Government has developed a new programme called Trade Related Entrepreneurship Assistance & Development (TREAD), this was introduced to help women

start their own businesses by empowering them economically and helping them develop the necessary entrepreneurial skills through non-farm activities. There are three main aspects to the programme: The first part is that the Government provides up to 30% of the overall project cost to non-governmental organisations (NGOs) to support women entrepreneurs; the second part is that NGOs can apply for loans from lending agencies to cover 70% of the project cost; and finally, the Government will give Rs.1 lakh to NGOs/training institutions for providing training to women entrepreneurs who participate in the TREAD programme.

●**Micro & Small Enterprises Cluster Development Programme (MSE-CDP)** A cluster comprises a group of enterprises that produce or provide a similar product or service (normally 20 or more). The Cluster Development Programme implements a diagnostic study of identified clusters of traditional skill-based MSEs to determine the most appropriate types of technology (and their suppliers) and facilitate the use of these available technologies by the target end users. The Cluster Development aims to improve competitiveness, enhance technology, adopt world-best practices for manufacturing and selling products, create new jobs, etc. The scheme may support capacity building activities, provide common facilities and assist with marketing activities. It also supports the transfer, assimilation and diffusion of technology from producers to the recipients of the small-enterprise cluster.

This Ministry implemented the IID Scheme to provide developed sites with infrastructural facilities like exhibition/display centers, telecommunications, drainage and pollution control facilities power distribution network, roads, water, raw materials, common service facilities storage and marketing outlets and technological back-up services, etc. This scheme has been subsumed in the MS-ME Cluster Development Programme. All the features of IID Scheme have been retained. To create physical infrastructure for women enterprises central grant of 40% of the project cost subject to a maximum of Rs.2 crore is available. The Ministry of MSME is trying to enhance the quantum of grant to 80% in a project of Rs.10 crore.

●**Credit guarantee fund scheme** The Credit Guarantee Fund for Small Industries was created by the Government of India in May 2000 to help Small Scale Industries get financing. The Goal of this program is to provide financing for Small Scale Industries, especially Micro and Small Scale Industry, through an unsecured loan of Rs. 25 Lakh or less without the need for additional collateral or third-party guarantees. The Credit Guarantee Fund Trust for Small Industries (CGTSI), which was established through a partnership between the Government of India and the Small Industries Development Bank of India (SIDBI), runs the programme. The programme also provides women-owned enterprises with an financing guarantee of 80% of the financing with a maximum limit of Rs. 20 Lakh on the guarantee. The member lending institutions (MLI) who are using the guarantee from the CGTSI Trust are responsible for paying a one-time guarantee fee of 1.5% of the total amount lent to a borrower at the time of origination and an annual fee of 0.75% on the amount funded to a borrower that is covered under the programme.

●**Help for Entrepreneurial and Managerial Development** MSME's DIs offer a programme for both existing and potential entrepreneurs called Entrepreneur Development Programmes

(EDP) and Management Development Programmes (MDP). These courses have a fee attached for participants, but in the case of SC/ST, Women and Individuals with Disabilities, MSME will waive all applicable fees and provide participants with a stipend of Rs. 500 per person per month while they are enrolled in these courses. Additionally, MSME has the goal of training 50,000 entrepreneurs in the areas of IT, Fashion Technology, Agro& Food Processing, the Caterer's Business, Biotechnology and Pharmaceutical, using specialized courses offered through MSME DIs. The Institutions will also earmark 20% of their enrolment in this programme to Women.

•**Scheme for Women Entrepreneurs to Encourage Small & Micro Manufacturing Units** DC (MSME) has formulated a scheme for women entrepreneurs to support Small & Micro manufacturing units owned by women in their efforts at developing overseas markets, to enhance participation of representatives of small/micro manufacturing enterprises under SIDO stall at International Trade Fairs/Exhibitions, to enhance export from such units. Under this scheme participation of women entrepreneurs in 25 international exhibitions is envisaged during the 11th Plan. For the year 2007-08 a good number of outstanding women entrepreneur associations have been requested to sponsor their members for participation in 5 international exhibitions scheduled during the months of Jan.-March, 2008, With a view to give confidence to women entrepreneurs for participating in the International Exhibitions.

•**Entrepreneurship Development Programme (EDP)** The Government also announce from time to time Entrepreneurship Development Programme (EDP) especially for the first generation of women who desire to be entrepreneur. For the purpose of training and skill development there are three important institutions namely National Institute of MSME, Hyderabad, National Institute of Entrepreneurship and Small Business Development (NISESBUD, Noida and Indian Institute of Entrepreneurship (IIE), Guwahati and NISC, Delhi. All the institutions taken to gather had trained more than 20,000 women during the 2011-2012.

•**Prime Minister's Employment Generation Programme (PMEGP)** launched in 2008-09 also gives special attention to urban and rural women by providing them subsidy at the rate of 25 to 35 per cent of the project cost in urban and rural areas respectively. Bank finance in the form of loan is 95% of the project cost for women.

•**The Ministry of Women and Child Development** Government of India does play an important role for all round development of women and provides support to women to empower themselves. It has launched the National Mission for Empowerment of Women (NMEW) in March, 2010. The mission has the network of various State Mission Authority (SMAs) at state level. Besides that there are two important schemes of the ministry which can act as complement to the process of development of women entrepreneurship. These schemes are named as Rajiv Gandhi Scheme for Empowerment of Adolescent Girls-Sabla and Support to Training and Employment Programme (STEP) for women. 'Sabla' was launched in 2010 with one of the objectives to provide vocational training to girls aged 16 and above under

National Skill Development Programme. 'STEP' has been operational since 1986-87 with the objective to ensure sustainable employment and income generation for marginalised and asset less women across the country.

• **Other schemes operated by different departments and ministries are:** Management Development Programmes, Women's Development Corporations (WDCs), Marketing of Non-Farm Products of Rural Women, Assistance to Rural Women in Non-Farm Development (ARWIND) Schemes, Micro Credits Scheme etc.

Measures taken for the Promotion of Women Entrepreneurship in India

1. Direct and indirect financial assistance

- Nationalized banks
- State finance corporation
- State industrial development corporation
- District industries centres
- Differential rate schemes
- Small industries development bank of India (SIDBI)
- Mahila vikasnidhi
- Rashtriya mahila kosh

2. Technological training and awards

- Stree shakti package by SBI
- Entrepreneurship development institute in india
- Trade related entrepreneurship assistance and development (TREAD)
- National institute of small business extension training (NSIBET)

3. Yojna schemes and programmes

- Assistance to Rural Women in Non-Farm Development (ARWIND) schemes Entrepreneurial Development programme (EDPs)
- Indira Mahila Yojana
- Indira Mahila Kendra
- Integrated Rural Development Programme (IRDP)
- Khadi And Village Industries Commission (KVIC)
- Management Development programmes
- Women's Development Corporations (WDCs)
- Marketing of Non-Farm Products of Rural Women (MAHIMA)
- Mahila Vikas Nidhi
- Mahila Samiti Yojana
- Mahila Vikas Nidhi
- Micro Credit Scheme
- Micro & Small Enterprises Cluster Development Programmes (MSE-CDP).
- NGO's Credit Schemes

- NABARD- KfW-SEWA Bank project
- National Banks for Agriculture and Rural Development's Schemes
- Priyadarshini Project- A programme for Rural Women Empowerment and Livelihood in Mid Gangetic Plains'
- Prime Minister's Rojgar Yojana (PMRY)
- Rashtriya Mahila Kosh
- Rajiv Gandhi Mahila Vikas Pariyojana (RGMVP)
- SIDBI's Mahila Udyam Nidhi
- SBI's Stree Shakti Scheme
- Trade Related Entrepreneurship Assistance and Development (TREAD)
- Working Women's Forum
- Training of Rural Youth for Self-Employment (TRYSEM)

4. Federations and associations

- India council of women entrepreneurs
- Self-employed women's association (SEWA)
- Association of women entrepreneurs of Karnataka
- World association of women entrepreneurs (WAVE)
- Association country women of the world (ACWW)
- FICCI ladies organisation (FLO)

Suggestions

Right efforts in all areas are required in the development of women entrepreneurs and their greater participation in the entrepreneurial activities. Following efforts can be taken into account for effective development of women entrepreneurs.

- Consider women as specific target group for all developmental programmers.
- Better educational facilities and schemes should be extended to women folk from government part.
- Adequate training programme on management skills to be provided to women community.
- Encourage women's participation in decision-making.
- Vocational training to be extended to women community that enables them to understand the production process and production management.
- Training on professional competence and leadership skill to be extended to women entrepreneurs.
- Training and counselling on a large scale of existing women entrepreneurs to remove psychological causes like lack of self-confidence and fear of success.
- Counselling through the aid of committed NGOs, psychologists, managerial experts and technical personnel should be provided to existing and emerging women entrepreneurs. Continuous monitoring and improvement of training programmers.

- Activities in which women are trained should focus on their marketability and profitability. Making provision of marketing and sales assistance from government part.
- To encourage more passive women entrepreneurs the Women training programme should be organised that taught to recognize her own psychological needs and express them.
- State finance corporations and financing institutions should permit by statute to extend purely trade related finance to women entrepreneurs.
- The financial institutions should provide more working capital assistance both for small scale venture and large scale ventures.
- Making provision of micro credit system and enterprise credit system to the women entrepreneurs at local level.
- Repeated gender sensitization programmers should be held to train financiers to treat women with dignity and respect as persons in their own right.
- Infrastructure, in the form of industrial plots and sheds, to set up industries should be provided by state run agencies.
- Industrial estates could also provide marketing outlets for the display and sale of products made by women.
- A Women Entrepreneur's Guidance Cell set up to handle the various problems of women entrepreneurs all over the state.
- District Industries Centres and Single Window Agencies should help in assisting women in their trade and business guidance.
- Programmers for encouraging entrepreneurship among women are to be extended at local level.
- Training in entrepreneurial attitudes should start at the high school level through well-designed courses, which build confidence.
- More governmental schemes to motivate women entrepreneurs to engage in small scale and largescale business ventures.
- Involvement of Non-Governmental Organizations in women entrepreneurial training programmes and counselling.

Conclusion: The rising trend of women opening their own businesses creates not only an increased degree of financial success for women but also contributes significantly to their households and society at large. Historically, the majority of leadership roles within our society have been male-dominated. Due to societal pressures, many women have been hesitant to follow in the footsteps of their predecessors (male counterparts). It has now been demonstrated that women entrepreneurs have equal capability as men to provide leadership and direction to the economy through entrepreneurial growth. The success of women entrepreneurs requires the identification and cultivation of entrepreneurial traits and skills through a structured approach in order to successfully adapt to changes in the world around them, compete in a global marketplace and remain competitive within the entrepreneurial sector. As indicated, the current nationwide policies and programs developed to eliminate

barriers for women entrepreneurs have been recognized by numerous sources as being insufficient to fully address these issues at the level of government. This research paper represents a 'meta' analysis based on existing research obtained through a variety of sources and thus can be considered an indication of the strengths or limitations of this area of study without being exhaustive. The paper covers multiple themes associated with women entrepreneurs, including different authors and their respective works over a period of time. The results from this study are primarily based on a limited number of papers and do not represent a complete analysis of the many papers available in this area of study. Therefore, the authors would advise that all researchers studying women entrepreneurship use this document as a reference; however, this article has significant limitations due to the selective nature of papers referenced. Promoting entrepreneurship among Indian women is certainly a short-cut to rapid economic growth and development. Let us try to eradicate all kinds of gender bias and thus allow 'women' to be a great entrepreneur at par with men.

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SUSTAINABLE TEACHING PRACTICES AND STUDENT PSYCHOLOGY: EVIDENCE FROM UNDERGRADUATE STUDENTS IN INDIA

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Abstract

Sustainable teaching is increasingly recognised as a way to address environmental crises while simultaneously supporting student wellbeing and meaningful learning in higher education. This paper examines how undergraduate students in India perceive sustainable teaching practices and how these practices interact with student psychology, including motivation, concentration, emotional connection, and future orientation. The study is based on a survey administered to undergraduate students from commerce, science, and management programmes in a college in Karnataka, using Likert-scale questions (1 = strongly disagree to 5 = strongly agree) and short qualitative reflections on the meaning and impact of sustainable teaching. The empirical findings are interpreted in light of existing work on education for sustainable development, innovative pedagogies, and psychological factors such as eco-anxiety, perceived behavioural control, social norms, and social identity. Across items, most students report that sustainable teaching methods reduce boredom, make learning more meaningful, promote environmental awareness, and strengthen motivation to contribute positively to society. Students frequently describe sustainable teaching as protecting the environment, reducing paper usage, integrating environmental themes into regular subjects, and learning “with” the environment through activities rather than rote memorisation. At the psychological level, students link sustainable teaching to greater confidence in expressing ideas, stronger emotional connection to the environment, and a sense of hope about the future, although a minority remain neutral or sceptical. The paper argues that sustainable teaching can act as a protective factor in a context marked by post-pandemic learning loss, mental-health pressures, and curriculum irrelevance, particularly when it is activity-based, culturally contextualised, and supported by visible institutional green practices. Implications are proposed for Indian higher education: integrating sustainability across the curriculum, training teachers in psychologically informed education for sustainable development, designing assessment that values projects and reflection, and using simple data visualisations to continuously track student perceptions over time.

Introduction

Globally, education systems are under sustained strain due to pandemic learning loss, mental-health deterioration among students, digital divides, and chronic teacher shortages. These pressures threaten the ability of schools and colleges to deliver education that is both academically rigorous and oriented toward long-term sustainability. In India, the National Education Policy (NEP) 2020 explicitly calls for a shift from rote learning to inquiry-based, experiential and holistic education, with sustainability and ethical citizenship as central aims. Within this broader transformation, sustainable teaching refers to both what is taught (content on environment, equity and long-term thinking) and how it is taught (methods that conserve resources, connect learning with real-world issues, and nurture student wellbeing). At the

same time, student psychology in contemporary India is shaped by competitive examinations, family expectations, social media, and uncertainty about climate and employment futures, all of which influence how young people respond to sustainability-oriented education. Understanding the interaction between sustainable teaching practices and student psychological responses is therefore essential for designing courses that are not only eco-friendly on the surface but also transformative in deeper cognitive, emotional, and behavioural terms.

This paper focuses on undergraduate students in one Indian college and asks: How do students perceive sustainable teaching practices in their classrooms and campus? How do these practices relate to boredom, motivation, concentration, emotional connection, and perceived future prospects? By combining survey data with existing research on education for sustainable development and student psychology, the paper aims to offer a grounded, contextually relevant picture of Indian students' mentality toward sustainable teaching.

Conceptual Background

Sustainable teaching and education for sustainable development

Education for Sustainable Development (ESD) has been defined as education that empowers learners to take informed decisions for environmental integrity, economic viability, and a just society for present and future generations. Within higher education, this has translated into innovative pedagogies such as project-based learning, inquiry-led learning, experiential fieldwork, gamification, STEAM integration, ICT-enabled learning, and culturally contextualised teaching. These approaches encourage students to work on real sustainability problems—such as waste management, energy audits, or local biodiversity—while developing critical thinking, collaboration, and ethical reasoning.

In this paper, sustainable teaching includes: eco-friendly classroom practices (reduced paper use, digital submissions, energy conservation), curriculum integration of environmental and social sustainability topics across disciplines, activity-based and project-based learning that links theory with local realities, institutional support for green practices such as waste segregation and tree planting, and role modelling by teachers who themselves practise sustainable behaviours.

Student psychology in a sustainability context

Research on the psychology of sustainability engagement highlights three interconnected dimensions: cognitive (knowledge and understanding), socio-emotional (feelings such as eco-anxiety, hope and belonging), and behavioural (actual pro-environmental actions). Studies show that environmental knowledge and awareness strongly predict sustainable behaviour among adolescents, but that social norms, perceived behavioural control, and social identity are equally important in determining whether knowledge translates into action. Young people often experience high eco-anxiety yet are also more likely to adopt visible lifestyle-based behaviours when they feel their peers and institutions support such actions.

In the Indian undergraduate context, student psychology is further shaped by exam pressure,

career concerns, and family expectations, which can compete with or reinforce sustainability goals. Sustainable teaching may reduce boredom and increase perceived relevance by connecting textbook content to real-life environmental and social challenges. At the same time, if poorly implemented, it risks being experienced as an additional burden or as superficial “green talk” disconnected from students’ lived realities.

Historical and Policy Trends

Globally, education for sustainable development has evolved from being a niche agenda in environmental education to a central pillar of international frameworks such as UNESCO’s ESD for 2030. These frameworks emphasise integrating sustainability into all levels and subjects, fostering systems thinking, and building competencies such as collaboration, critical reflection and future visioning.

In India, NEP 2020 marks a major policy shift by promoting multidisciplinary education, flexibility, skill development, and holistic learning, while explicitly referencing environmental awareness, sustainable development, and constitutional values. The policy encourages experiential and project-based learning, community engagement, and the use of local contexts—including local ecosystems and cultural practices—as learning resources. However, implementation is uneven across states and institutions, with many colleges still dominated by lecture-based teaching, syllabus-driven assessment, and limited infrastructure for innovative sustainability projects.

At the same time, research documents a mental-health crisis among students worldwide, with increased levels of anxiety and depression in the years following the pandemic. This has direct implications for sustainability education: students already under psychological strain may feel overwhelmed by narratives of climate catastrophe unless teaching methods are carefully designed to balance realism with agency and hope. Sustainable teaching thus has to navigate both global environmental crises and local psychological pressures.

Methodology

Research design and participants

The empirical component of this paper is based on a quantitative-dominant, mixed-methods design using a structured survey with both Likert-scale and open-ended questions. The survey was administered online in March 2026 to undergraduate students in a college in Karnataka, India. Respondents included students from Bachelor of Commerce (B.Com), Bachelor of Business Administration (BBA), Bachelor of Science (B.Sc) and pre-university science streams, across first, second, and third years, with ages mainly between 18 and 21 years. The sample can be characterised as a convenience sample of students accessible through classroom and peer networks.

Instrument and variables

The survey collected basic demographic details (age, course, year of study) followed by a series of closed-ended questions where students rated their level of agreement on a 5-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

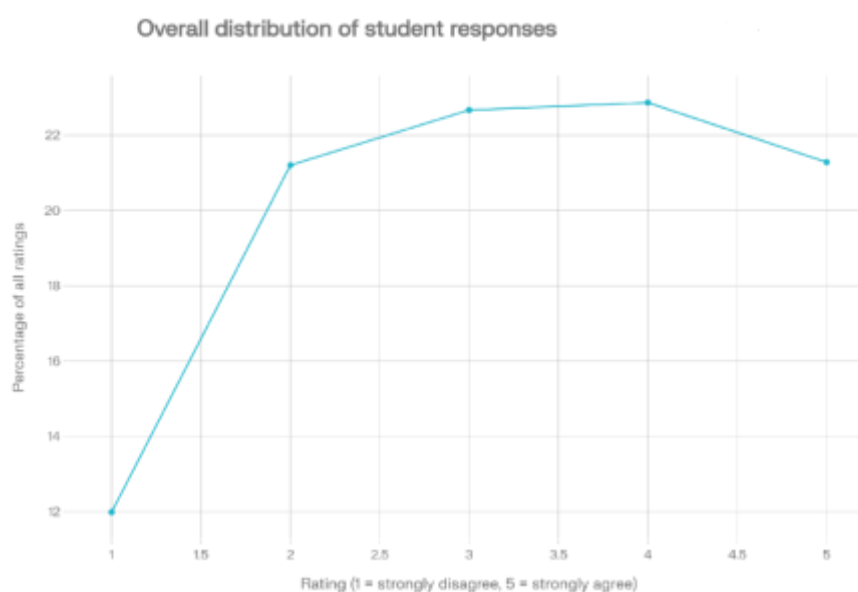
Key items covered the following domains: classroom experience (reduction of boredom, enjoyment, meaningfulness of learning), eco-friendly teaching (use of environmentally friendly methods, inclusion of sustainability topics in subjects, project work on real-life environmental issues), institutional culture (support for green practices such as waste management and resource conservation), role modelling and behaviour (whether teachers act as role models and whether students feel motivated to practise sustainability), and psychological outcomes (connection of subjects to real life, hopefulness about the future, emotional connection to the environment, concentration, mental freshness, motivation to contribute positively to society, teamwork, values and attitudes, and psychological satisfaction with sustainable learning).

The questionnaire concluded with three open-ended questions asking students to describe, in their own words: what they understand by “sustainable teaching”, how sustainable teaching has influenced their thoughts or behaviour, and their suggestions to improve sustainable teaching in their institution.

Data analysis and graphical representation

Responses were compiled and coded, and basic descriptive statistics were calculated for the Likert-scale items. For an overall view of student agreement levels, the frequency of each rating (1 to 5) across all items was calculated and converted into percentages. These percentages were then plotted on a line graph, with the x-axis representing the Likert points from 1 (strongly disagree) to 5 (strongly agree) and the y-axis representing the percentage of all ratings at each point.

Figure 1 presents this overall distribution of responses on the 1–5 scale, providing a visual snapshot of how often students chose low, neutral and high agreement categories in relation to sustainable teaching and related psychological outcomes.



Findings: Student Perceptions of Sustainable Teaching**Overall pattern of responses**

The overall distribution graph shows that ratings cluster more strongly around the higher end of the scale, with a noticeably larger share of responses at 4 (agree) and 5 (strongly agree) compared to 1 and 2. This indicates that, in general, students tend to view sustainable teaching practices positively rather than negatively or indifferently. Neutral responses (3) still appear with some frequency, suggesting that a segment of students either have mixed experiences or are not yet fully aware of sustainability-related initiatives in their classes.

The shape of the line thus reflects a broadly favourable attitude towards sustainable teaching and its psychological impact, while also highlighting that there is room to deepen understanding and engagement among less convinced students.

Classroom experience and boredom reduction

Across the sample, many students indicate that sustainable teaching methods—such as activity-based learning and integration of real-life environmental examples—help to reduce boredom in class. A large proportion of responses to the first set of Likert items fall in the “agree” or “strongly agree” categories, especially among B.Com and science students who explicitly comment that these methods make classes “very good”, “extraordinary” or help them to “gain knowledge” more effectively. A smaller group of respondents, particularly from later years, choose neutral or lower ratings and sometimes note that teaching is “ok ok” or “not good”, suggesting that sustainable methods are either not consistently implemented or not yet perceived as engaging by all.

Psychologically, boredom reduction is important because chronic classroom boredom is associated with disengagement, surface learning, and even dropout. By making learning more activity-oriented and linked to real environmental problems, sustainable teaching appears to support attention and relevance, key factors highlighted in contemporary motivation theories.

Eco-friendly methods, curriculum and institutional culture

Regarding eco-friendly teaching methods, many students report that their teachers use practices such as reducing paper use, adopting digital submissions, and integrating environmental or sustainability topics into lessons. Several open-ended responses define sustainable teaching as “to protect something”, “reduce paper usage”, “integration of environment and studies” or “learning with environment”, indicating that students strongly associate sustainability with resource conservation and environmental themes. Others note that sustainable teaching “promotes long term learning”, “increases awareness and critical thinking” and “encourages long term future focus” by connecting classroom content to real-world environmental challenges.

Students also comment on institutional support: some describe their institution as “good” or “very good” in terms of green practices and mention activities such as awareness programmes, tree planting, and the use of eco-friendly materials. At the same time, a subset of respondents suggest that more awareness and more concrete initiatives are needed, implying

that institutional culture varies across courses and years. This pattern is consistent with evidence that innovative sustainability practices often begin as small pilots and face challenges when scaling across an entire institution.

Motivation, concentration and mental freshness

Items relating to psychological outcomes indicate that many students feel more motivated, more able to concentrate, and mentally fresher when teaching is activity-based and sustainability-oriented. For example, several respondents state that sustainable teaching gives them “knowledge of education”, “a good understanding about concepts”, and motivates them to “save resources” and “contribute positively” to society. Students frequently connect sustainability-related activities (projects, group work, awareness programmes) with improved coordination, teamwork, and behaviour in class.

However, not all students report strong psychological benefits. Some choose neutral ratings across multiple items, particularly in periods when academic workload is high, suggesting that sustainable activities alone cannot fully offset general academic stress. A few students explicitly write that sustainable teaching “didn’t” influence them or say “don’t know”, pointing to a need for more explicit reflection and guidance on how classroom practices link to broader sustainability goals.

Emotional connection, hope and future orientation

Questions on emotional connection and future orientation show that many students feel emotionally connected to the environment and hopeful about contributing to sustainability when exposed to such teaching methods. Open-ended comments describe sustainable teaching as giving “mental peace”, making them more “aware of protecting the environment”, and helping them to see sustainability as a “good topic which everyone should learn about”. Some students mention that sustainable teaching encourages them to think about future generations and resource conservation, reflecting the ethical dimension of intergenerational justice.

At the same time, the presence of lower ratings and comments such as “grow up first” or “no words” suggests that a minority of students are either cynical, confused, or disengaged, perhaps reflecting wider eco-anxiety and scepticism noted in the literature. International research indicates that while young adults often experience high climate-related anxiety, this does not automatically translate into consistent pro-environmental behaviour; feelings of agency and social support are crucial mediators. The survey responses mirror this pattern: where teachers and institutions are seen as supportive role models, students express more hope, whereas where teaching is perceived as routine or tokenistic, enthusiasm appears lower.

Teamwork, values and psychological satisfaction

Most students agree that sustainable learning encourages teamwork and positively shapes their values and attitudes. Comments such as “behaviour”, “coordination”, “good thoughts” and “values” appear repeatedly in the open-ended responses, indicating that students link sustainability-related activities with social and moral development, not just environmental content. Several respondents state that they are “psychologically satisfied” with sustainable

learning, describing it as “super”, “extraordinary” or simply “good”.

Nevertheless, a subset of students, especially in some second-year cohorts, rate psychological satisfaction lower and ask for “more activities”, “more skills training” and “computer classes”, implying that they desire a richer, more skill-oriented sustainability curriculum that also enhances employability. This resonates with broader concerns about curriculum irrelevance and the skills gap, where students feel that current teaching does not fully prepare them for a sustainability-oriented job market.

Qualitative Themes: How Students Define and Experience Sustainable Teaching

The open-ended responses provide insight into how Indian undergraduates conceptualise sustainable teaching in their own words. Several recurring themes emerge across courses and years:

1. **Environmental protection and resource conservation** – students frequently describe sustainable teaching as “protecting the environment”, “saving resources”, “reducing paper usage”, and “using eco-friendly materials”.
2. **Integration of environment and curriculum** – many emphasise that sustainability should be integrated into regular subjects, not taught as a separate topic, and praise teachers who relate concepts to real-life environmental issues.
3. **Learning with the environment** – some students explicitly state that they “believe in learn with environment”, highlighting experiential and outdoor activities as central to sustainability education.
4. **Long-term learning and awareness** – sustainable teaching is seen as promoting “long term learning”, “awareness” and “critical thinking” that extends beyond exams.
5. **Mental and emotional impact** – references to “mental peace”, “psychological satisfaction” and “motivation” indicate that students experience sustainable teaching as emotionally supportive when done well.
6. **Need for more activities and awareness** – suggestions include more group activities, awareness programmes, digital teaching methods, skills training, quizzes, and campus-wide initiatives such as tree planting and waste segregation.

These themes are consistent with international research emphasising that effective sustainability education must be experiential, participatory, culturally contextualised, and emotionally supportive. They also reveal that students are not only passive recipients; they have concrete, practical ideas for improving sustainable teaching in ways that align with their everyday campus realities.

Applications and Implications for Indian Higher Education

The survey suggests that sustainable teaching practices can positively influence Indian students’ motivation, concentration, emotional connection, and hope about the future when implemented consistently and meaningfully. To strengthen these psychological benefits, higher-education institutions can embed sustainability across subjects through project-based and inquiry-led learning that addresses local environmental and social issues, use experiential

activities such as field visits and community projects to build a sense of agency, create safe spaces for discussing eco-anxiety and climate fears, and encourage teachers to act as role models in everyday sustainable behaviours.

Simple graphs such as the overall Likert-scale distribution presented in this paper can be generated from routine survey data and used by departments to monitor student perceptions of sustainable teaching over time. Changes in the shape of the distribution—for example, a shift from neutral responses toward stronger agreement on items related to motivation or psychological satisfaction—can help educators evaluate the impact of new initiatives and adjust their strategies.

These practices align with NEP 2020's emphasis on holistic, multidisciplinary and experiential learning, as well as UNESCO's ESD 2030 framework calling for cognitive, socio-emotional and behavioural competencies. By paying explicit attention to student psychology—motivation, emotional connection, and sense of agency—Indian colleges can ensure that sustainability is not only present in policy documents but is lived in classrooms and campus culture.

Conclusion

This paper explored the relationship between sustainable teaching practices and student psychology among undergraduate students in an Indian college using survey data and existing literature on education for sustainable development and psychological engagement. Overall, students report that sustainable teaching reduces boredom, enhances meaningfulness, fosters environmental and social awareness, and supports motivation, teamwork and psychological satisfaction, though a minority remain neutral or unconvinced. The qualitative responses show that students understand sustainable teaching in practical, concrete terms—protecting the environment, saving resources, learning with the environment—and that they value more activities, skills training and digital integration.

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A STUDY ON CYBER SECURITY AWARENESS IN MODERN SOCIETY

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Abstract

The concept of cyber security is being increasingly recognised as the use of the internet in our daily lives continues to grow. The internet has become, in many ways, the lifeblood of our society and communication; therefore, the number of cybersecurity threats is also increasing. Cyber security, therefore, is more important than ever as technological advancements continue to change ICT and we become increasingly reliant on the internet. This study investigated the level of cyber security awareness among higher education students, with respect to some key demographic and educational variables including gender, location of residence and level of study. Data for this study was collected through the internet from various graduates, postgraduates, and research students at multiple universities and colleges on a regional level. No differences were found with respect to gender or course type among students. However, significant differences in cyber security awareness existed based on students' residential status, with urban students more aware than rural students; and also between students studying in different disciplines. However, no significant

Keywords- Awareness, Cyber-crime, Cyber-security, Higher Education students

Introduction:

to incidents of cybercrime. By raising the level of awareness of cyber threats and thus encouraging safer behaviours online, cybersecurity awareness contributes greatly to the overall security of both individuals and society as a whole. Awareness-raising campaigns are known to be an effective means of promoting behavioural change and thus reducing the risk of becoming a victim of cybercrime.

Establishing a culture of cybersecurity within organizations complements the approach of raising awareness among users in reducing the risk of cybercrime. An organizational culture that encourages employee engagement and embraces a commitment to protecting sensitive information creates a highly supportive environment for the implementation of appropriate technical controls and policies to safeguard against cybercrime. Organizations that participate in the development of a cybersecurity culture will be better positioned to achieve results through enhanced user compliance, thereby reducing overall risk and vulnerability to cybercrime.

The impact of a comprehensive organizational cybersecurity culture combined with an awareness-raising program regarding the risks associated with the use of digital technologies can significantly reduce an organization's exposure to cybercrime. An effective organizational cybersecurity culture will incorporate engaging employees through ongoing awareness training, promoting best security practices for information handling, providing regular updates on new threats, and providing access to up-to-date security tools and resources. Organizations that develop an effective cybersecurity culture will be well positioned to mitigate the risks posed by cybercrime.

Objectives for Research

The primary goals of the research study include:

- Understanding "Cyber Security Awareness"
- Identifying the Various Types of Cyber Crime in Today's Society
- Evaluating the Role of Awareness in Preventing Cyber Threats
- Recommending Effective Techniques for Raising Cyber Awareness

Literature Review:

To developing an organizational culture of safety, and being prepared with cyber incident recovery plans. Another goal is to develop cybersecurity leaders who have the knowledge, skills, and abilities to manage their organization's security program (Shaw, 2009). Cybersecurity leaders play a key role in promoting and improving an organization's overall security posture through education and employee development initiatives (Eminağaoğlu et al., 2009).

By incorporating security education into an organization's culture, it can effectively close the gap between available resources and the awareness of individuals regarding online threats (Shaw, 2009; Poepjes & Lane, 2012). With knowledge of these gaps, organizations are better prepared for potential attacks. With proper training, employees are better equipped to report suspicious activity; thus, providing an organization with additional avenues to prevent future incidents (Yeo, 2007).

Security education provides organizations with a means of identifying and addressing areas requiring further attention. Employees have an obligation to their organization's security program and must take part in security education through awareness training, employee development, and certifications (Rivera & Nwankwo, 2017). Additionally, organizations that implement effective security education will have the opportunity to measure their success in closing gaps in knowledge within their employee base (Shaw, 2009; Yeo, 2007). An organization that does not provide security education is unlikely to realize the full potential of its security posture.

Methodology:

To evaluate what individuals know about cyber security, how they feel about it, and how they actually conduct themselves with respect to being safe online, the research methodology to study cyber security awareness in contemporary society will consist of an organized methodology to analyze, evaluate and interpret data as it relates to people's knowledge, attitude and behaviour regarding online safety. As people continue to become more reliant on the internet for various necessities in today's technological age, it is imperative to investigate how individuals can take proactive measures to protect themselves from cybercrime including the act of hacking, being victimized by phishing scams, identity theft and the numerous types of malware attacks.

This research study employed both quantitative and qualitative research methodologies to examine the above variables and conduct analysis using a mixed methods research design.

The quantitative component of this study will utilize surveys employing predetermined questionnaires to collect quantitative data (the number of users, the number of users who are aware of their own level of cyber security, the number of users that utilize various password/working practices, the number of users that utilize different security tools and the number of users that have experienced a cyber security breach) and the qualitative component of this study will be accomplished by employing interviews, discussions, etc. to provide an in-depth understanding of users' perceptions, behaviours, and obstacles to achieving adequate cyber security.

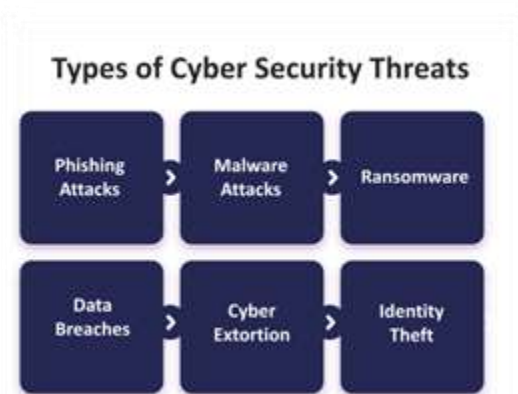
The target population for this study includes different groups of people from the community or society (e.g. students, employees, the general public that uses the internet). Utilization of an appropriate sample selection strategy such as random or stratified sampling will ensure the representativeness of the sample used, with respect to age and background of individuals. The primary source of data collection will be conducted using internet-based platforms such as Google Forms, while the secondary data will come from other sources such as government websites, research articles and past research studies.

Summary of Cybercrime

Cybercrime can refer to any illegal act committed by computer, digital device, or over the internet. Cybercrimes can be directed against people and organizations at home and abroad.

Examples of Cybercrime

Examples of specific types of cybercrimes are as follows:



1. **Phishing Attacks:** This involves the fraudster impersonating a legitimate company in an attempt to steal personal or financial information, usually through email.
2. **Malicious Software (Malware):** Malware consists of programs (e.g., viruses, worms, ransomware, etc.) that are made to damage computer systems or provide a means of accessing your computer systems without authorization.
3. **Identity Theft:** This involves someone (the fraudster) stealing your personal information so they can impersonate you for financial gain.
4. **Internet Fraud:** Examples include bogus websites (e.g., eBay, PayPal, etc.), scams, and fraudulent transactions.

5. Data Breaches: Organizations in possession of confidential data may suffer a data breach in which the confidential data is accessed without authorization.

The Influence of Human Behavior on Cybersecurity

One of the key factors influencing Cybersecurity is individuals' responses to attacks against them. Many of these attacks succeed because users are either unaware of their environment, or fail to recognize or manage their cyber environment.

Common Errors Made by Users

- Using weak passwords
- Clicking links that come from sources that cannot be verified
- Publicly sharing sensitive information
- Ignoring security warnings
- Psychological Factors Used by Cybercriminals
- Cybercriminals will often use psychological means to get someone to act, including:
- Urgency (i.e. your account will be locked)
- Fear (i.e. you will go to jail, or have your debt charged to you)
- Trust (i.e. the organization you know sends you this email)
- Cybercriminals exploit these psychological means and create vulnerabilities in users.

Cyber Security Education Helps Stop Cyber Crime

- Finding the Threats: Awareness allows users to identify threats, such as phishing emails, links that look suspicious, or attempts by others to gain access without permission.
- Safe Practices When Using the Internet
 - Educated users follow safe habits when using the internet, such as:
 - Using strong passwords,
 - Not using wireless networks that aren't protected by a password,
 - Updating software regularly.
- Protecting Your Personal and Financial Information: Users will think twice before sharing personal or financial information on the internet.
- Workplace Security

The levels of awareness in the workplace lower the chances of being a victim of an insider threat (an employee taking advantage of his/her position) and strengthens overall security.

How to Increase Awareness for Cyber Security

- Educate / Train Suggested to begin by implementing Cyber Security education into school and college curriculum from an early age.
- Conduct Awareness Campaigns Governments and Organizations should conduct campaigns throughout the media and on the internet.
- Hold Workshops/Seminars the interactive nature of the sessions will allow individuals to learn more about cyber threats that may occur.

- Utilize Technology By using applications and online means, users can be educated and made aware of how to protect themselves online.

Cyber Crime Impacts on Society Cybercrime can also have a severe impact on society, and a variety of ways:

- Some consequences include
- Monetary loss
- Loss of Personal Information
- Damaged Reputation, Organizational, And Individual
- Potential National Security Risk
- This indicates a necessity for a stronger cyber security and public awareness.

Cybersecurity has shown to be a successful way to reduce basic security risks and improve user behavior. One of the benefits of having cybersecurity awareness is that it reduces human error, which is often a significant cause of cyber incidents. An educated user will be able to better identify phishing emails, suspicious links and other fraudulent activity, allowing them to stop the attack before it becomes too serious.

Awareness programs also contribute to a strong security culture in the workplace where all employees feel that they share the responsibility for protecting the organization's information systems. This results in greater compliance with security policies, quicker reporting of incidents and enhanced co-ordination when there are cyber threats. In addition, the security provided by technical measures such as firewalls and multi-factor authentication are enhanced with the addition of awareness.

Another benefit of cybersecurity awareness is that it helps to reduce costs to the organisation. By preventing attacks, organisations avoid financial losses, legal costs and damage to their reputation. Individuals benefit from increased protection of their personal data, as well as being encouraged to adopt safer online practices which increases their overall digital wellness. Cybersecurity awareness has some limitations even though it has a lot of advantages. One significant limitation is the knowledge-behaviour gap; there are users who know about security, but do not behave in accordance with this knowledge. For example, some users will still choose to use weak passwords or will not adjust their settings when alerted to a security risk, even when they have been made aware of the risks and their consequences.

Another limitation of awareness is the propensity for oversimplification. Some employees may believe that they understand something, without fully appreciating the level of complexity involved. In these situations, it is important to encourage an individualized approach to awareness, in order to create an understanding and appreciation for the complexity of any particular security-related subject, as well as creating a desire to learn more.

Conclusion: Cybersecurity has now transcended beyond that of diligence only by professionals and experts to become part of everyone's collective effort on a daily basis. The results of this research demonstrate the fact that the first and strongest defence against current

and evolving digital threats is education and awareness. Although technology is advancing at an unprecedented rate, human awareness, human behaviour, and human commitment to vigilance are still instrumental in establishing our shared security on a global basis. Establishing awareness of cybersecurity within organisations, governments, and among each individual is not a one-time endeavour. Education, adaptability and collaboration with all group participants must be supported by an ongoing commitment from each individual. As we continue to expand upon the digital economy and technology continues to evolve, our commitment to better understand how to mitigate risks to our respective data is paramount. Cybersecurity education and training will ultimately provide safe and secure data and resources. However, it will also provide for the protection of trust, privacy and the overall integrity of modern society. In addition, our ability to create a secure digital economy is reliant on both effective systems as well as the establishment of educated and responsible users—recognising that any single act of a person will create a ripple effect, whereby many will be affected by that persons act.

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REVIEW OF RELATED LITERATURE OF IMPACT OF DIGITAL AND TRADITIONAL APPROACHES ON MATHEMATICS LEARNING: A COMPARATIVE STUDY OF ATTITUDE, ANXIETY AND ACADEMIC ACHIEVEMENT AMONG SECONDARY SCHOOL STUDENTS IN SHIVAMOGGA DISTRICT

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Abstract

The integration of digital technology in education has brought significant changes to teaching and learning processes, particularly in mathematics education. Along with modern digital learning tools, traditional teaching approaches such as lecture methods, textbook-based instruction, and teacher-centered explanations continue to play an important role in secondary school classrooms. The effectiveness of these two approaches has been widely discussed in educational research, especially in relation to students' attitudes toward mathematics, mathematics anxiety, and academic achievement. The present study focuses on reviewing the related literature concerning the impact of digital and traditional approaches on mathematics learning among secondary school students. Previous research indicates that digital learning environments such as multimedia tools, educational software, and online learning platforms can enhance students' engagement, conceptual understanding, and motivation in mathematics. These technologies provide interactive learning experiences, immediate feedback, and opportunities for individualized learning, which may help in reducing mathematics anxiety and improving positive attitudes toward the subject. On the other hand, traditional teaching methods offer structured guidance, direct teacher interaction, and systematic explanation of mathematical concepts, which are essential for building fundamental knowledge and problem-solving skills. However, studies also suggest that exclusive dependence on conventional teaching methods may not fully address the diverse learning needs of students in the modern educational context. This review of related literature highlights the comparative effectiveness of digital and traditional instructional approaches in influencing students' attitudes, anxiety levels, and academic performance in mathematics. The study specifically focuses on secondary school students in Shivamogga District and aims to provide a theoretical foundation for further empirical research. The findings of this literature review will help researchers understand the role of different teaching approaches in improving mathematics learning outcomes.

Keywords: *Review of Related Literature, Digital and Traditional Instructional Approaches, Students' Attitudes, Anxiety and Academic performance.*

Introduction

Review of literature related to any field of study or problem is a very important and crucial step in the entire research activity undertaken by a researcher as it helps him/her in arriving at certain explanations providing description & developing understanding about or establishing casual relationships between variables relevant to a problem or phenomenon. As Good states,

‘the key to the vast store house of published literature may open doors to sources of significant problems and explanatory hypotheses, and provide helpful orientation for definition of the problem, background for selection and procedure and comparative data for interpretation of results.

Investigator takes advantages of the knowledge which has accumulated in the past as a result of continuous human attempt. It can never be undertaken in isolation of the work that has already been done on the problem which are directly or indirectly related to a study proposed by an investigator. A suspicious review of the research journals, books, theses, dissertation and other sources of information on the problem to be examined is one of the important steps in the planning of any research study. Thus, a review of the related literature must be proceed on well planned research studies results.

The review of the literature helps an investigator to get into the frontiers of knowledge that are related to his area of interest. Research workers must be aware of what is known with some degree of certainty what is accepted as truth by some and not by others, must have some link of the nature of unexposed areas where additional research should be conducted.

The review involves locating, realizing and evaluating research reports as well as reports of observation and opinion that are related to the 31 individuals planned research project. As such the investigator cannot have an insight into the problem to be investigated, unless and until he learnt what others have done and what remains to be done in a particular area of interest. Thus the related literature, besides forming one of the early chapters in the research report for orienting the readers, also serves some other purposes which are given by Good, Barr and Scates as follows:

- a. To know whether the evidence already available solves the problem adequately without further investigation and thus to avoid the risk of duplication.
- b. To provide idea, theories, explanations or hypothesis valuable in formulating the problem.
- c. To suggest methods of research appropriate to the problem.
- d. To locate comparative data useful in the interpretation of results.
- e. To contribute to the general scholarship of the investigator.

The topic you are considering for research, "Impact of digital and traditional approaches on mathematics learning: a comparative study of attitude, anxiety, and academic achievement among secondary school students in Shivamogga district," is highly relevant and impactful for several reasons:

- ✓ With the rise of digital learning technologies and the growing integration of tech tools in education, understanding their impact compared to traditional methods is vital. In this way my research will contribute to the ongoing conversation on how technology affects learning outcomes.
- ✓ The Covid pandemic accelerated the adoption of online learning. The comparison between digital and traditional approaches is timely and addresses the lasting effects on students' learning experiences.

- ✓ Mathematics is often perceived as a challenging subject by students, and identifying how different approaches influence their performance can directly impact teaching methodologies and academic policies.
- ✓ Attitudes toward math, including anxiety, can greatly affect academic performance. This research would help educators develop strategies to reduce math anxiety and improve student engagement.
- ✓ **Targeted Population (Secondary School Students) Adolescent Development:** Secondary school students are at a crucial stage in their education and personal development. Studying this demographic will provide valuable insights into how teaching methods influence students' mental and emotional states regarding learning.
- ✓ **Gap in Existing Literature:** While there is research on digital versus traditional learning approaches, there may be fewer studies focusing on how these approaches specifically impact students' attitudes, anxiety, and academic achievement in the context of mathematics. my research would help fill this gap, especially with its focus on a specific districts of Karnataka State.

This topic not only addresses important issues related to learning and technology but also offers practical insights that can benefit educators, students, and policymakers. Its localized focus on Shivamogga district allows for depth while still contributing to broader educational discourse.

A. INDIAN STUDIES

1. Sunita Badola (2013). Studied the effect of school's on academic achievement motivation of secondary level students. This study has been conducted to study the academic achievement, motivation and different administrative setups of secondary school students. Sample of 480 students of secondary level were taken from Pauri and Tehri Garhwal, (Uttarakhand State). The data was collected on the basis of Academic Achievement Motivation Test developed and standardized by Dr. T.R. Sharma (1984). Analysis of variance showed that there was significant difference among Government, Public and Convent Secondary school students on their mathematics achievement. The major findings are; (i) Private management is more efficient than public management in achieving academic quality. (ii) Private funding also improves efficiency whether.

Observation: Sunita Badola (2013) studied the effect of different school administrative setups on the academic achievement motivation of secondary-level students. A sample of 480 students from Pauri and Tehri Garhwal in Uttarakhand was selected. The Academic Achievement Motivation Test, developed by Dr. T.R. Sharma (1984), was used to collect data. Analysis of variance revealed significant differences in mathematics achievement among students from Government, Public, and Convent schools. The key findings showed that private schools, both in management and funding, were more efficient in fostering higher academic quality compared to public schools.

2. Sridevi K V (2013). Analyzed the "Relationship among General Anxiety, Test Anxiety and Academic Achievement of Higher Secondary Students" in the present study an attempt was made to find out the relationship between anxiety and academic achievement of higher secondary school students. This area of research has been of considerable interest to teachers who have observed that some children appear to perform below their best in situations characterized by a high degree of stress. It was expected that students with high anxiety would be more likely to perform less adequately throughout their studies than would nonanxious students. The Higher secondary level is a revolving point in the life of the teenagers. The students and their parents take the choices of their career selection during this transition period. Adolescents of our schools have many troubling problems that often restrict with their academic achievement. Anxiety and anxiety correlated problems are very common during adolescence. The researcher casually selected a total number of 12 schools for the study that included Government, Private aided and Private unaided schools. Sample comprised 180 students for the study. The result of the study are: 1) Positive high correlation between general anxiety and test anxiety. 2) There is a negative low correlation between general anxiety and academic achievement. 3) There is a negative low correlation between test anxiety and academic achievement of higher secondary student's.

Observation: Sridevi K V (2013) analyzed the relationship between general anxiety, test anxiety, and academic achievement among higher secondary students. The study aimed to explore how anxiety affects academic performance, particularly in high-stress situations. A sample of 180 students from 12 government, private aided, and private unaided schools was selected. The findings revealed a strong positive correlation between general anxiety and test anxiety, indicating that students with high general anxiety also experienced higher test anxiety. Additionally, there was a low negative correlation between both general anxiety and test anxiety with academic achievement, suggesting that higher anxiety levels were associated with lower academic performance.

3. Sanci, R. (2014). This research evaluated (a) the correlation between math anxiety, math attitudes, and achievement in math and (b) comparison among these variables in terms of gender among grade I students in a high school located in southern Ontario. Data were accumulated from participant answers to the Attitudes towards Math Inventory and the Math Anxiety Rating Scale for Adolescents (MARS-A), and achievement data were gathered from contributors' grade 9th academic math course marks and the EQAO Grade 9th Assessment of Mathematics. Nonparametric tests were conducted to determine whether there were relationships between the variables. Results indicated that mathematics anxiety was not related to mathematics achievement but was a strong correlate of attitudes toward mathematics.

Observation: A Study reveals research to evaluate the correlation between math anxiety, math attitudes, and math achievement, as well as to compare these variables by gender among grade 9 students in a high school in southern Ontario. Data were collected using the Attitudes

towards Math Inventory, the Math Anxiety Rating Scale for Adolescents (MARS-A), and students' grades from academic math courses and the EQAO Grade 9 Assessment of Mathematics. Nonparametric tests revealed that while math anxiety was not significantly related to math achievement, it was strongly correlated with attitudes toward mathematics. Gender differences in these variables were also examined.

4. Benipal et. al, (2014). “ Study investigated the academic achievement of 200 adolescents in relation to their perception of classroom environment from different Government and Private in Punjab. The present study of the results indicates that there is positive relationship between academic achievement and classroom environment among adolescent and a significant relationship between academic achievement and classroom environment among adolescents with respect to locale and gender and another showed that academic achievement of Urban student is greater than rural students and in the favour of male adolescents of urban school adolescent. Further also found that there is significant difference classroom environment of male and female adolescents with respect to locale. Another also found that classroom environment was positive significant in the favour of urban female adolescents than their counter parts and male adolescents higher than that of female adolescents”.

Observation: A study investigated the academic achievement of 200 adolescents in relation to their perceptions of the classroom environment across different government and private schools in Punjab. The study found a positive relationship between academic achievement and classroom environment, with significant differences observed based on locale and gender. Specifically, urban students outperformed rural students, and male adolescents in urban schools had higher academic achievement compared to their female counterparts. Additionally, there were significant differences in classroom environments between male and female adolescents, with urban female adolescents reporting a more positive classroom environment than their male peers. Overall, the study highlighted the impact of both locale and gender on academic achievement and classroom perceptions.

5. Geyik, S.K. (2015). The aim of this study is to determine the relationship between mathematics anxiety and parent's socio-economic status (parent's education, parents age and family income). In accordance with this purpose, exploratory factor analysis was applied on 25 items. MARS developed by Alexander and Martray (1989) and its reliability and validity was tested with confirmatory factor analysis process. As results of the analysis, a modified scale with 3 factors (Test Anxiety, Numerical Anxiety, and Course Anxiety) and 11 variables was developed and 12 hypotheses were tested to determine the relationship between parent's socio economic status variables. For this, Kruskal- Wallis H test and Dunn's post-hoc test were used. The sample for this research includes 325 undergraduate students of Istanbul University, Turkey. As a result of the study, it is concluded that Total Math Anxiety, Numerical Anxiety and Course Anxiety variables are affected from family income and parent's education level while Test Anxiety are not affected from these variables.

Observation: A study aimed to explore the relationship between mathematics anxiety and parents' socio-economic status, including parental education, age, and family income. The study employed exploratory factor analysis on a 25-item Mathematics Anxiety Rating Scale (MARS), originally developed by Alexander and Martray (1989), validating it through confirmatory factor analysis. The analysis resulted in a modified scale comprising three factors—Test Anxiety, Numerical Anxiety, and Course Anxiety—and 11 variables, allowing for the testing of 12 hypotheses regarding the relationship with parents' socio-economic status. Data were collected from 325 undergraduate students at Istanbul University using the Kruskal-Wallis H test and Dunn's post-hoc test. The findings indicated that Total Math Anxiety, Numerical Anxiety, and Course Anxiety were influenced by family income and parental education level, while Test Anxiety was not significantly affected by these factors.

6. Putech, M., and Khalin ,S.Z. (2016). This study aims to identify the mathematics anxiety and its association with the achievement of form four students in Perak Tengah District, Malaysia. The design of the study is using quantitative method and the data was collected by using a questionnaire of students Math Anxiety Scale (SKMP). A total of 190 form four students were selected as a research sample. The results showed that the level of mathematics anxiety of the students were at moderate level with $M=2/55$, $SD = 0.72$. Analysis of the t-test results for gender show that there is no significant difference with $t=0.889$, $P < 0.05$ between the level of mathematics anxiety of girls students compared to the boy's students. The correlation test showed a significant and negative relationship between student's achievement and their mathematics anxiety with correlation value $r=0.237$.

Observation: A study aimed to investigate mathematics anxiety and its association with the achievement of Form Four students in the Perak Tengah District of Malaysia. The study utilized a quantitative design, collecting data through a questionnaire based on the Mathematics Anxiety Scale (SKMP) from a sample of 190 students. The results indicated that students exhibited a moderate level of mathematics anxiety, with a mean score of 2.55 and a standard deviation of 0.72. The t-test results revealed no significant gender differences in mathematics anxiety, with a t-value of 0.889 ($p < 0.05$) indicating similar anxiety levels among male and female students. Furthermore, the correlation analysis demonstrated a significant negative relationship between students' achievement and their mathematics anxiety, with a correlation value of $r = 0.237$.

7. Kumar (2016). conducted of the academic achievement in relation to their anxiety and depression among 200 high schools from Walaja Taluk in Vellore district of Tamilnadu. The main finding of the study resulted that there was no significant difference between the academic achievement of high school students among anxiety depression.

Observation: A study examining the relationship between academic achievement, anxiety, and depression among 200 high school students from Walaja Taluk in the Vellore district of Tamil Nadu. The main finding indicated that there was no significant difference in the academic achievement of high school students concerning their levels of anxiety and

depression. This suggests that anxiety and depression may not directly impact students' academic performance in this specific context.

B. FOREIGN STUDIE

8. Gambari, Falode and Adegbenro (2014). conducted a study to compare the academic achievement and retention of the junior secondary school students of Mathematics through computer animation and geometry instructional model in Minna, Nigeria. The perusal of the study concluded that mean achievement scores and retention scores of the junior secondary school students exposed to computer animation was higher than the students who taught through instructional model and conventional method of teaching. It can also be concluded that with the inclusion of computer animation in geometrical concept could enhance the meaningful learning in Mathematics.

Observation: A study conducted a study comparing the academic achievement and retention of junior secondary school students in mathematics through computer animation versus a traditional geometry instructional model in Minna, Nigeria. The findings revealed that students exposed to computer animation had significantly higher mean achievement and retention scores compared to those taught using conventional methods. The study concluded that incorporating computer animation into the teaching of geometric concepts enhances meaningful learning in mathematics, suggesting that innovative instructional approaches can positively impact students' understanding and retention of mathematical concepts.

9. Abebe, G. (2015). The aim of this study was to examine differences in attitudes towards mathematics, mathematics anxiety, and mathematical achievement due to sex, and school type, and to show how well anxiety and attitude towards mathematics determine student's mathematics achievement controlling for sex and school type. Attitude and anxiety mathematics scales were administered to 307 tenth grade students (128 private and 179 government) and the data collected were analysed using statistical technique of mean, standard deviation, independent samples t-test and multiple regression analyses. Results revealed significant differences in attitude, in anxiety and in mathematics scores with respect to type of schools, but no significant sex difference. Government schools learn best practices from private schools especially in the use of instructional time and teachers create student-centered teaching method.

Observation: A study aimed to examine the differences in attitudes toward mathematics, mathematics anxiety, and mathematical achievement based on sex and school type, while also analyzing how these factors predict students' mathematical achievement. The study involved 307 tenth-grade students, including 128 from private schools and 179 from government schools, who completed attitude and anxiety scales. The data were analyzed using means, standard deviations, independent samples t-tests, and multiple regression analyses. The results indicated significant differences in attitudes, anxiety levels, and mathematics achievement scores related to school type, but no significant differences were found based on sex. The findings suggested that government schools could benefit from adopting best practices from

private schools, particularly in utilizing instructional time and fostering student-centered teaching methods.

10. Dursun, S. (2015). The purpose of this study was to investigate Turkish high school students attitude and anxiety levels towards mathematics in terms of some variables (gender, school type, class level). The participants of the study consisted of 361 high school students from three different high school types from a province in Turkey during 2014-2015 fall term. The Mathematics Attitude Scale and the Mathematics Anxiety Assessment Scale were used as the measuring instruments. The data was quantitatively analysed by using t-tests and one way Anova. Findings showed that gender and class levels had no significant effect on the student's attitude and anxiety levels towards mathematics, whereas school type had significant effect on the attitude and anxiety.

Observation: The study investigated the attitudes and anxiety levels of Turkish high school students towards mathematics, focusing on variables such as gender, school type, and class level. The study involved 361 students from three different types of high schools during the 2014-2015 fall term, utilizing the Mathematics Attitude Scale and the Mathematics Anxiety Assessment Scale for measurement. Quantitative analysis through t-tests and one-way ANOVA revealed that neither gender nor class level significantly influenced students' attitudes or anxiety levels towards mathematics. However, the findings indicated that school type had a significant impact on both attitude and anxiety, suggesting that the educational environment plays a crucial role in shaping students' perceptions and feelings about mathematics.

11. Anne study (2015). "Relationship between student's academic achievement and students learning flairs in a multicultural. 240 senior school student's from the University of Pretoria, South Africa. The main objectives of the study were to gather information on the learning style preferences of the students at the school, the relationship between academic achievements in English and mathematics and their learning style and finally, the relationship between nationality, gender, form and age and their learning styles as well as their academic achievements in English and mathematics. The main findings of the study found that there was significant related to academic achievements in English and mathematics of students and the predominant learning style, and further revealed that there was no significant relation between influence students' learning styles nationality but gender and age did".

Observation: A study explored the relationship between academic achievement and learning styles among 240 senior school students at the University of Pretoria, South Africa. The research aimed to gather insights on students' learning style preferences, the connection between their academic achievements in English and mathematics, and how factors such as nationality, gender, form, and age influenced these learning styles and academic performance. The findings revealed a significant relationship between students' predominant learning styles and their academic achievements in both English and mathematics. However, while gender and age were found to significantly influence students' learning styles, nationality did not

have a notable impact. This indicates that understanding students' learning preferences can be crucial in enhancing their academic success, particularly in a multicultural educational context.

12. Domien, N. (2016). The determination of this study was to establish the relationship between the nature of schools and the academic performance of pupils in primary schools in Gasabo district Rwanda. Specifically the study wanted to compare the academic performance of pupils in public and private primary schools in Gasabo district Rwanda; to establish the effect of availability of school facilities on pupil's academic performance and to establish the effect of teacher Quality on pupil's academic performance in Gasabo district Rwanda. The study was done by developing a conceptual framework relating the nature of schools to pupil's academic performance. Using a descriptive cross-sectional survey design, data were collected from 40 teacher and 10 head teacher using questionnaires and interview guide as the main data collection instruments. Also data on PLE results for 300 pupils in the selected primary schools was obtained which was used in comparing pupils' performance in the two categories of schools. Data were analysed using occurrence tables and summary statistics and lastly using t-test in comparing Student's performance in private and public primary schools in Gasabo. The study exposed that there is a difference in the academic performance of Student's in public and private primary pupils in Gasabo district with pupils in private primary schools performing better than their counterparts.

Observation: A study conducted a study to investigate the relationship between school type and academic performance among primary school pupils in the Gasabo district of Rwanda. The research aimed to compare the academic performance of students in public versus private primary schools, assess the impact of available school facilities on student performance, and evaluate the effect of teacher quality on academic outcomes. Utilizing a descriptive cross-sectional survey design, the study collected data from 40 teachers and 10 head teachers through questionnaires and interviews, as well as Performance Level Examination (PLE) results from 300 pupils. Analysis using occurrence tables, summary statistics, and t-tests revealed that pupils in private primary schools outperformed those in public schools, indicating significant differences in academic achievement linked to the nature of the school. This highlights the importance of school type, facilities, and teacher quality in shaping educational outcomes in Rwanda.

13. UGO (2017). conducted a study to find out the impact of Computer Assisted Instruction on academic achievement of secondary school students in Agricultural Science in state Bayelsa, Nigeria. The results of the study indicated that both male and female students exposed to CAI achieved significantly higher scores than the students taught through conventional lecture method.

Observation: A study investigated the impact of Computer Assisted Instruction (CAI) on the academic achievement of secondary school students in Agricultural Science in Bayelsa State, Nigeria. The study found that both male and female students who received instruction through

CAI scored significantly higher than those taught using traditional lecture methods. This suggests that CAI is an effective instructional strategy that enhances student performance in Agricultural Science, indicating its potential for broader application in secondary education.

Conclusion :

A review of the literature on concussions typically encompasses various aspects, including definitions, causes, symptoms, diagnosis, treatment, and long-term effects. It often highlights the importance of understanding the mechanisms of injury, particularly in sports and recreational activities, where concussions are prevalent.

Overall, a comprehensive review of the literature on concussions is essential for advancing understanding, improving management strategies, and enhancing prevention efforts.

ENTREPRENEURSHIP AND STARTUP CULTURE IN THE POST-MODERN BUSINESS ECOSYSTEM: DRIVERS OF INNOVATION AND ECONOMIC TRANSFORMATION

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Abstract

Entrepreneurship and start up culture have become essential catalysts for innovation, job creation, and economic expansion in the contemporary business landscape. The post-modern economy is defined by digitalization, globalization, platform-centric business models, and knowledge-based industrial processes. Start-ups are essential in this ecosystem by offering disruptive technologies, enhancing competitiveness, and expediting technological progress. This study investigates the influence of entrepreneurship and start up culture on the post-modern business environment and evaluates recent trends in company expansion, funding, and job creation. The research relies on secondary data sourced from governmental papers, international organizations, and contemporary literature published from 2019 to 2025. An analytical and descriptive methodology was employed to synthesis evidence about innovation, digital entrepreneurship, and ecosystem growth. The results demonstrate that start up ecosystems play a crucial role in economic dynamism, digital transformation, and inclusive growth. Nonetheless, obstacles including financial limitations, legal impediments, market volatility, and talent deficiencies persist. The research underscores the necessity for supportive legislative frameworks, innovation infrastructure, and entrepreneurial education to enhance the post-modern business ecosystem.

Keywords: Entrepreneurship, start-up ecosystem, digital economy, innovation, post-modern business, India

1. Introduction

The global business landscape has experienced a profound upheaval in recent decades, propelled by swift technical breakthroughs, digitalization, globalization, and evolving consumer behavior. This change has led to the emergence of the post-modern business ecosystem, defined by adaptable organizational frameworks, platform-centric business models, knowledge-driven production, and perpetual innovation. In this context, conventional large-scale hierarchical organizations are progressively supplemented by nimble, technology-oriented start-ups that function with elevated agility and inventiveness.

Entrepreneurship has become a vital element in the contemporary economic environment. In contrast to traditional company models that prioritize scale and stability, post-modern entrepreneurship highlights creativity, disruption, risk-taking, and swift experimentation. Start-ups utilize emerging technologies, like artificial intelligence, cloud computing, big data, and digital platforms, to develop innovative products, services, and business models. These innovations enhance productivity and consumer experience while also revolutionizing entire sectors.

The emergence of start-up culture signifies extensive structural transformations inside the global economy. The enhancement of digital connectivity has diminished entrance barriers for new enterprises, allowing entrepreneurs to access worldwide markets with comparatively minimal initial expenditure. The expansion of venture capital, angel investment networks, incubators, and accelerators has bolstered entrepreneurial ecosystems. The Global Entrepreneurship Monitor (2023) reports a substantial increase in start-up activity globally, especially within technology-driven industries.

In India, entrepreneurship has received robust policy backing through initiatives like Start-up India, Digital India, Make in India, and Atmanirbhar Bharat. These programs seek to foster innovation, facilitate business operations, enhance financial accessibility, and cultivate a supportive environment for emerging enterprises. India has become one of the foremost start-up hotspots globally, with swift expansion in industries including fintech, e-commerce, edtech, healthtech, and software services (DPIIT, 2024).

Startup ecosystems are essential for economic development as they create jobs, draw investment, foster innovation, and improve global competitiveness. They also facilitate structural transformation by enabling the transition from conventional sectors to knowledge-based and technology-driven enterprises. Furthermore, digital entrepreneurship fosters financial inclusion, enhances service accessibility, and promotes regional development.

Nonetheless, the post-modern entrepreneurial landscape poses numerous challenges. Startups encounter significant unpredictability, fierce competition, fluctuating finance, regulatory intricacies, and a scarcity of skilled personnel. Numerous startups have challenges related to scalability, business viability, and technology integration. Enhancing the entrepreneurial ecosystem necessitates synchronized policy support, infrastructure advancement, and capacity enhancement.

In this setting, comprehending the influence of entrepreneurship and startup culture on the post-modern business environment is crucial for formulating effective development plans. This paper analyzes contemporary trends, economic impacts, problems, and policy ramifications related to the expansion of startup ecosystems.

2. Review of Literature

Recent studies underscore the significance of startups as catalysts for innovation and economic expansion. Audretsch and Belitski (2021) discovered that entrepreneurial ecosystems substantially impact regional economic development and innovation efficacy. The World Bank (2022) indicated that digital entrepreneurship enhances productivity and generates employment in developing economies.

The Global Entrepreneurship Monitor (2023) indicates that startup ecosystems bolstered by robust institutions, financial resources, and innovation networks have elevated business survival rates. NASSCOM (2024) observed that India's startup environment has proliferated swiftly owing to digital infrastructure, talent accessibility, and policy endorsement. The

OECD (2023) highlighted significant restrictions including access to funding, regulatory uncertainties, and talent deficiencies, particularly affecting early-stage companies.

3. Objectives of the Study

The research has two main objectives. The primary aim is to analyze the influence of entrepreneurship and startup culture on innovation, economic development, and structural transformation in the contemporary business environment. The second purpose is to examine recent trends and evidence to identify critical issues and policy initiatives necessary for enhancing sustainable and inclusive startup ecosystems.

4. Methodology

The research utilizes secondary data obtained from credible sources, including the Department for Promotion of Industry and Internal Trade (DPIIT), NASSCOM, Startup India reports, World Bank, OECD, Global Entrepreneurship Monitor, and industry publications. Furthermore, peer-reviewed research articles produced from 2019 to 2025 were examined to integrate contemporary empirical and conceptual advancements.

A descriptive and analytical research design was employed. The gathered data was categorized into thematic domains including startup growth trends, funding patterns, job creation, digital entrepreneurship, and ecosystem development. A theme synthesis method was employed to discern patterns and correlations between startup activity and economic results.

5. Trends in Startup Ecosystem Development

Table 1: Growth of Startup Ecosystem in India

Indicator	2016	2024
Recognized startups	500	1,17,000+
Unicorns (valuation \$1B+)	4	110+
Startup employment (million)	0.1	1.2

Source: DPIIT (2024); Startup India Report.

The figures indicate a swift growth of India's startup ecosystem over the last ten years. The rise of acknowledged startups and unicorns signifies heightened investor confidence and innovative potential. The creation of employment signifies the substantial role of startups in job production and economic vitality.

Table 2: Sector-wise Distribution of Startups in India

Sector	Share (%)
IT & Software	20
Fintech	14
E-commerce	12
Healthtech	8
Edtech	7

Source: NASSCOM (2024)

The prevalence of startups in technology-driven sectors underscores the digital character of the post-modern business landscape. These industries propel innovation, enhance productivity, and improve service accessibility.

6. Challenges in the Post-Modern Startup Ecosystem

Despite the swift expansion of entrepreneurship and startup culture, the contemporary business ecosystem poses numerous structural, financial, and institutional hurdles that impact the viability and scalability of new enterprises.

A major barrier is restricted access to early-stage financing. Despite the rise in venture capital and private equity investments in recent years, funding continues to be concentrated in select metropolitan areas and technology-centric industries. Early-stage businesses, especially those situated in smaller towns or engaged in conventional industries, can encounter challenges in obtaining seed funding and operational cash. The funding landscape has become increasingly volatile due to global economic instability, resulting in prudent investment practices and diminished valuations (NASSCOM, 2024).

A significant issue is the elevated failure rate of companies. Numerous startups have challenges pertaining to market fit, income creation, customer acquisition, and business scalability. The contemporary corporate landscape is very competitive and swiftly changing, necessitating ongoing innovation and flexibility. Startups that do not rapidly scale or distinguish their products frequently encounter termination during the first few years of business. Market volatility and evolving customer tastes exacerbate business risks (Global Entrepreneurship Monitor, 2023).

Regulatory and compliance intricacies present hurdles, especially for small and nascent enterprises. Despite programs like Startup India streamlining certain processes, businesses continue to encounter numerous legal obligations concerning taxation, labor legislation, intellectual property, and sector-specific authorizations. Compliance expenditures and administrative delays can redirect managerial resources from essential corporate operations.

The deficiency of proficient human capital constitutes another significant limitation. Startups necessitate a diverse skill set encompassing technology, product development, digital marketing, data analytics, and business management knowledge. Many locations experience skill mismatches, and startups frequently encounter difficulties in attracting and retaining talented experts due to budgetary constraints and rivalry from larger corporations.

Moreover, infrastructural inequalities among regions influence the development of the startup environment. Major cities possess robust digital infrastructure, incubation networks, and investor presence; conversely, smaller towns and rural locations may lack dependable internet connectivity, co-working spaces, mentoring networks, and innovation support systems. This disparity restricts the geographical distribution of entrepreneurial endeavors and exacerbates regional inequality.

The post-modern ecosystem subjects startups to swift technical obsolescence and international competition. Emerging technologies, like artificial intelligence, automation, and platform-based business models, necessitate ongoing investment in innovation. Simultaneously, digital markets facilitate the rapid entry of global competitors into domestic markets, intensifying pressure on local companies.

Sustainability and long-term corporate viability have become significant concerns. Numerous businesses emphasize swift growth and market proliferation at the expense of profitability, rendering them susceptible to funding contractions. Subpar corporate governance, insufficient financial planning, and reliance on external financing exacerbate business risks (OECD, 2023).

7. Policy Implications

A comprehensive and supportive policy framework is essential for entrepreneurship and startup culture to effectively contribute to economic transformation and innovation.

- a) Enhancing financial accessibility at various phases of the business lifecycle is crucial. Governments can enhance seed funding initiatives, loan guarantee programs, and co-investment frameworks in collaboration with private investors. Particular emphasis must be placed on startups in non-metropolitan areas and in industries including agriculture, manufacturing, and social enterprises to foster equitable ecosystem development.
- b) Regulatory simplicity and the facilitation of corporate operations should be enhanced. Optimizing registration processes, minimizing compliance obligations, and offering integrated digital platforms can alleviate administrative burdens. Consistent and foreseeable tax policies, coupled with incentives for innovation and research and development, will stimulate entrepreneurial investment.
- c) Investment in innovative infrastructure is essential. Enhancing incubators, accelerators, technology parks, and research partnership platforms will furnish businesses with mentorship, technical assistance, and networking prospects. Robust connections among universities, research institutes, and business can enhance information transfer and the commercialization of inventions.
- d) Prioritization of human capital development and entrepreneurship education is essential. Incorporating entrepreneurship, digital competencies, and innovation management into higher education and vocational training curricula will effectively mitigate skill deficiencies. Ongoing reskilling and upskilling activities are essential to equip the workforce for emerging technology-driven business models.
- e) Advancing localized startup ecosystems can facilitate inclusive economic development. Establishing startup hubs in Tier-II and Tier-III cities, enhancing digital infrastructure, and offering localized mentoring and finance assistance can mitigate regional differences and broaden entrepreneurial prospects.
- f) Policies ought to promote sustainable and responsible enterprise. Incentives for sustainable innovation, circular economy business models, and socially responsible firms will synchronize startup growth with environmental and social goals. Assisting companies that tackle issues in healthcare, education, agriculture, and climate resilience can foster equitable development.

g) Enhancing global integration and market access is crucial for sustained competitiveness. Enabling international collaborations, promoting exports, and engaging in global innovation networks will assist startups in scaling and competing in foreign markets. A unified policy strategy that integrates financial assistance, institutional enhancement, skill acquisition, and infrastructure investment is essential for establishing a robust and innovation-oriented post-modern corporate ecosystem.

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EXPLORING STUDENTS' PERCEPTION OF DAILY ENGLISH NEWSPAPERS AS A LEARNING RESOURCE: A STUDY IN SHIVAMOGGA CITY

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Abstract

*Newspapers are often regarded as a valuable source of knowledge that contributes significantly to individuals' intellectual development and awareness of current affairs. Developing the habit of reading newspapers can enhance students' academic performance, language proficiency, and career opportunities. As **Shivamogga** has emerged as a prominent educational hub, this study aims to examine students' perceptions toward reading daily English newspapers in Shivamogga city. The study focuses on understanding students' reading habits, accessibility to newspapers, level of interest, awareness of current affairs, satisfaction levels, and the challenges they encounter while reading newspapers. A descriptive research design was adopted for the study. Data were collected using primary sources through structured questionnaires distributed among students in Shivamogga city. The study employed a non-probability snowball sampling technique to select respondents. The study suggests that educational institutions should take proactive initiatives to cultivate newspaper reading habits among students by encouraging the use of newspapers in academic activities. Furthermore, newspaper agencies may consider providing affordable or free digital subscription platforms for students to promote wider readership.*

Keywords: *Students' perception, Reading habits, English newspapers, Current affairs awareness*

Introduction:

In the modern information-driven society, newspapers continue to play a significant role in disseminating knowledge and keeping individuals informed about current events at both national and international levels. With advancements in communication and increasing accessibility, newspapers have become an important medium through which people stay updated with developments in politics, business, education, science, and global affairs. Among various sources of information, newspapers remain one of the most reliable and credible platforms for acquiring authentic and structured information.

For students in particular, newspapers serve as a valuable educational resource that contributes to their intellectual and academic development. Developing the habit of reading newspapers helps students enhance their knowledge, improve vocabulary, and strengthen language proficiency. Regular exposure to news and analytical articles enables students to build critical thinking abilities, remain informed about current affairs, and gain a broader understanding of socio-economic and political developments. In addition, reading newspapers helps students apply their theoretical knowledge to practical situations and better prepare

themselves for academic and professional challenges.

Therefore, the present study aims to explore students' perceptions towards daily English newspapers in Shivamogga City. The study seeks to understand the reading habits of students, their preferences for different newspapers and news sections, and the role newspapers play in their academic and personal development. The findings of the study may provide valuable insights for educators, students, and media organizations in promoting effective newspaper reading habits among students and enhancing their awareness of current affairs and societal developments.

Review of Literature:

Dr. Rupesh Gaur, Anju Saini and Pardeep Kumar conducted research on Newspaper Reading Habit among students of degree colleges in Haryana (2018) to examine the reading patterns and habits. For obtaining necessary data structured questionnaire was designed and distributed to 150 students, in that 118 were collected, data have been analyzed by using statistical package for the social science for descriptive statistics this study is considered factors such as gender, source, time, choice, preferred section, problems faced by readers. By using above all aspects research find that 49.2% students have reading habit, 25.4% students facing high price for purchase, 46.6% students have habit of reading e-newspaper and it Introducing newspaper has a teaching tool in academic journey.

Dr. M. Vadivel and Pranesh R conducted a study on consumer perception of reading English newspaper with special reference to Coimbatore city(2025) this study examined readers attitudes, preference and factors influencing the choice of English newspaper .this study used structured questionnaire and adopting non-probability convenience sampling research methodology it looks over variety of factors, such as demographic, reading patters, age, socio-economic, time spending. Their findings highlighted that content quality, credibility of news; language clarity, format preferred and price play a significant role in purchasing power. 36.1% will read for improving language skills and 33.7% consumer's purpose is to stay update with current affairs. This research provides valuable insights into readers behavior, which is relevant to the present study as it helps in understanding how perception towards English newspaper may vary among different groups of readers.

Mintu Halder (2020) conducted a study on the newspaper reading habits of post graduate students in west Bengal state university. This study focuses only on postgraduate students of West Bengal State University who are pursuing their master's degrees in different specializations. For collecting data 280 questionnaire were distributed among PG students by visiting personally to different departments, it was found that newspapers are valuable tool for PG students which will helps to enhance their creativity power. This study particularly explores the time spend, preference made towards selection, purpose of reading daily English newspaper, source of newspaper. It found out that students facing language barriers while reading among students it's finally concluded by giving some suggestions to students that how to overcome those barriers.

Research Methodology:

The present study aims to examine students' perceptions, accuracy of information, consistency in reading habits, and overall attitudes toward English newspapers. For the purpose of the study, a structured questionnaire was designed and distributed among students in Shivamogga city to collect the required primary data. A total of 400 valid responses were obtained for analysis. The study adopted a descriptive research design and employed the snowball sampling technique to select respondents and achieve the objectives of the research.

Objective of the study:

- a. To examine the reading habits of students towards daily English newspapers in Shivamogga City.
- b. To study students' perception regarding the importance of English newspapers for improving knowledge and language skills.
- c. To identify the factors that influence students to read or avoid daily English newspapers.
- d. To evaluate the role of English newspapers in enhancing students' current affairs knowledge and academic learning.
- e. To examine the preference of students towards different sections of English newspapers (education, sports, business, editorial, etc.).
- f. To suggest measures to encourage students to read daily English newspapers regularly.

Data collection:

For collecting necessary data Primary and secondary sources of data has been used

- a. **Primary data:** Primary data has been collected by distributed questionnaire among all students in Shivamogga city through Google forms in that four hundred responses were chosen.
- b. **Secondary data:** Secondary data has been collected by visiting online websites, referring journals, research scholar's webpage.

Sample Size: The questionnaire was distributed among all students of Shivamogga city who are pursuing different course, and that 400 responses were received. Respondents were participated voluntarily. Therefore, total sample size of study is 400.

Sample area: This study is only limited students who are studying in Shivamogga city.

Sampling Method: Non-Probability sampling

Sampling Technique: Snow ball and Convenience sampling.

Sample Instruments: questionnaire

Data Analysis and Interpretation

Analysis of Demographic Profile of the Respondents

Variable	Category	Frequency (N)	Percentage (%)
Gender	Male	165	41.25
	Female	235	58.75
Age Group	Below 20 Years	145	36.00
	20– 25 Years	187	58.25
	25 – 30 Years	60	18.70
	More than 30	11	3.00
Educational Qualification	PUC	34	8.50
	UG	248	62.00
	PG	101	25.25
	Others	19	4.75
Place of Residence	Rural	206	51.50
	Urban	171	42.75
	Semi-Urban	23	5.75

Source: Primary Data

Analysis and interpretation: the above table includes the demographic profile of the respondents, which contain gender, age group, educational qualification, place of residence, the data indicates majority (58.75%) respondents are female, fall under age group between 20-25(58.25%) and most are pursuing undergraduate (62%), majority of respondents are residing in rural areas. Overall, demographic profile details help to understand the participants' characteristics.

Table 2. Type of Institute in which Respondents are Studying:

Institute type	No of respondents	Percentage
Government	69	17.25
Private	287	71.75
Aided college	44	11.00
Total	400	100

Source: Primary Data

Analysis and Interpretation: From the above table it is clear that out of 400 respondents, 287 are pursuing their studies in private colleges, 69 are from government and 44 are in aided college. So, by this we can interpret that (71.75%) majority of the respondents who participated in the survey are pursuing their studies from private college.

Table 3. Newspaper reading habits among respondents

Particulars	No of respondents	Percentage
Yes	261	65.25
No	139	34.75
Total	400	100

Source: Primary Data

Analysis and Interpretation: From the above table it is clear that out of 400 respondents 261(65.25%) read newspaper; while 139 (34.75%) do not read newspaper. So, by this we can interpret that majority of the respondents have the habit of reading newspaper.

Table 3.1 Preferred Daily English Newspaper of Respondents:

Particulars	No of respondents	Percentage
Times of India	115	44.06
The Hindu	77	29.50
Deccan Herald	53	20.31
Others	16	6.13
Total	261	100

Source: Primary Data

Interpretation: It is observed from the above table that out of 261 respondents, 115 prefer Times of India, 77 prefer The Hindu, 53 prefer Deccan Herald, and 16 prefer others newspapers like Indian express, Economics Times. So, by this we can interpret that majority of the respondents prefer times of India as their daily English newspaper.

Table 3.2 Reasons for Not Reading Newspapers:

Particulars	No of respondents	Percentage
Unavailable at home	55	39.56
Prefer digital sources	40	28.78
Lack of time	32	23.02
Outdated or boring	12	8.63
Total	139	100

Source: Primary Data

Interpretation: the above table shows the reasons for not reading newspaper among respondents, out of 139, 39.56% (55) stated that unavailable at home, 28.78% (40) prefer digital sources, 23.02% (32) reported as lack of time, 8.63 (12) feels outdated or boring. So, by this we can interpret those main reasons for not reading newspaper among respondents is the unavailability of newspapers at home.

Table 4. Frequency of reading newspapers among respondents

Particulars	No of respondents	Percentage
Daily	81	31.03
Rarely	48	18.39
Sometimes	67	25.67
Occasionally	65	24.90
Total	261	100

Source: Primary Data

Interpretation: the above table shows the frequency of reading newspaper among respondents. Out of 261 respondents, 81 read newspaper daily, 48 rarely. 67 sometimes, 65 occasionally, by this we can interpret that majority of 81(31.03%) respondents have habit of reading newspaper daily.

Table 5. Duration of Newspaper Reading among Respondents:

Particulars	No of respondents	Percentage
From childhood	81	31.03
More than a year	62	23.75
One year	52	19.92
Less than 6 months	62	23.75
Total	261	100

Source: Primary Data

Interpretation: it is clear from the above table that 81(31.03%) respondents started reading newspaper from childhood, 62(23.75%) for more than a year, 52(19.92%) for one year, and 62(23.75%) for less than 6 months. By this we can interpret that majority of the respondents started reading newspaper from childhood.

Table 6. Preferred Type of News Read by Respondents:

Particulars	No of respondents	Percentage
Local news	116	44
Cinema	33	13
Business	91	35
Others	21	8
Total	261	100

Source: Primary Data

Interpretation: From the above table it is clear that 116 respondents prefer local news, 33 prefer cinema section, 91 prefer business news and 21 prefer other news. So, by this we can interpret that majority (116) of the respondents prefer local news in the newspaper.

Table 7. Challenges Faced by Respondents While Reading Newspapers:

Particulars	No of respondents	Percentage
Language Difficulties	76	29.12
Lack of Time	56	21.46
Lack of interest / Habit	30	11.49
Lengthy articles	52	19.92
None	47	18.01
Total	261	100

Source: Primary Data

Interpretation: From the above table it is clear that out of 261 respondents 76 (29.12%) facing language difficulties, 56 (21.46%) lack of time, 30(11.49%) stated lack of interest, 52(19.92%) reported has lengthy articles, 47(18.01%) has no difficulties. So, by this we can interpret that majority (29.12%) of the respondents facing language difficulties.

Table 8. Preference mode of reading newspapers

Particulars	No of respondents	Percentage
Printed newspaper	122	46.74
Online websites	25	9.58
Social media	82	31.42

TV News	32	12.25
Total	261	100

Source: Primary Data

Interpretation: It is clear from the above table that out of 261 respondents 122 prefer printed newspaper, 25 prefer online websites, 82 prefer social media, and 32 through TV news. By this we can interpret that (122) majority of the respondents prefer printed newspaper

Table 9. Newspapers are still relevant in today's digital age:

Particulars	No of respondents	Percentage
Yes	201	77.01
No	29	11.11
Not sure	31	11.88
Total	261	100

Source: Primary Data

Interpretation: The table indicates that, out of 261 respondents, 201 respondents agreed, 29 respondents disagreed and 31 respondents were not sure about the statement. This implies that the majority of the respondents (201) believe that newspapers continue to play a significant role even in the digital age.

Table 10. Reading newspaper will help for career development:

Particulars	No of respondents	Percentage
Agree	181	69.35
Disagree	15	5.75
Neutral	65	24.90
Total	261	100

Source: Primary Data

Interpretation: from the above table it is clear that 181(69.35%) are agreed, 15(5.75%) are disagreed and 65(24.90%) were neutral regarding the opinion that reading newspaper helps in students career development. By this we can conclude that majority (69.35%) of the respondents agree to newspaper will support for career development among students.

Table 11. Factors that influence students to stay engage in reading newspaper:

Particulars	No of respondents	Percentage
Youth centered content	101	38.70
Short and visually appealing articles	70	26.82
Free online access	44	16.86
Regular activities in college	46	17.62
Total	261	100

Source: Primary Data

Interpretation: Above table explains among 261 respondents 101(38.70%) selected youth centered content, 70(26.82%) preferred short and visually appealing articles, 44(16.86%) feel free online access, 46(17.62%) believed that regular activities in college will influence them.

By this we can interpret that majority (38.70%) of respondents believe that content related to youth plays a most important in attracting students to stay engage in newspapers.

Table 12. Newspaper should have separate section for readers:

Particulars	No of respondents	Percentage
Yes	166	63.60
No	50	19.16
May be	45	17.24
Total	261	100

Source: Primary Data

Interpretation: above table shows that among 261 respondents, 166 answered yes for newspaper should have separate section for students. Around 50 students answered no, while other 45 were not sure about it. By this we can interpret that majority (63.60%) of the respondents agreed for newspaper may have separate section for students.

Table 13. Purpose of reading newspapers as a student:

Particulars	No of respondents	Percentage
To stay updated about current affairs	174	66.67
To get useful information regarding job vacancies	44	16.86
To solve puzzles given in it	41	15.71
Others	2	0.77
Total	261	100

Source: Primary Data

Interpretation: it is clear from the above table that among 261 respondents 174(66.67%) were read newspaper to stay update with current affairs. 44(16.86%) to get information regarding job vacancies, 41(15.71) respondents to solve puzzles, and while 2(0.77%) for other. So, by this we can interpret that most of the respondents read newspaper for the purpose to stay engage with current affairs.

Table 14. Value of English newspaper will brings changes in academics

Particulars	No of respondents	Percentage
Yes	208	79.69
No	20	7.66
May be	33	12.64
total	261	100

Source: Primary Data

Analysis and interpretation: it is clear from the above table among 261 respondents 208(79.69%) respondents were agreed, 20(7.66%) respondents disagreed with the statement. While 33(12.64%) respondents were not sure. So, by this we can interpret that majority of the respondents believe that English newspaper will bring changes in academics.

Table 15. Initiatives that can educational institution take to Create Newspaper reading habits among students

Particulars	No of respondents	Percentage
Providing free access to newspaper on campus	117	44.83
Promoting digital newspaper subscriptions by college	51	19.54
Conducting quizzes on current affairs to creates presence of mind in students	35	13.41
Encouraging discussion on news articles	58	22.22
Total	261	100

Source: Primary Data

Analysis and interpretation: Table shows that, out of 261 respondents, 117(44.83%) stated to provide free access to newspaper on campus, 51(19.54%) are reported to promote digital newspaper subscriptions, 35(13.41%) confesses conduct quizzes, 58(22.22%) opinion to conduct discussion on news articles. So, By this we can interpret that majority (44.53) of respondents are suggested to provide free newspaper access on campus.

Table 16. Efforts taken by Newspapers to attract readers:

Particulars	No of respondents	Percentage
Make newspapers more interactive (quizzes, opinion columns by students)	52	19.92
Free subscription in digital platform for students	82	31.42
Include skill career-oriented articles	56	21.46
Add students focused content (college life, youth issues, achievement)	30	11.49
Use more picture, figures and give summarized news	41	15.71
Total	261	100

Source: Primary Data

Analysis and interpretation: From the table it is clear that, 52 respondents think's that Make newspapers more interactive, 82 opinioned Free subscription in digital platform for students, 56 Include skill career-oriented articles, 30 Add students focused content, 41Use more picture, figures and give summarized news. So, by this we can interpret that the majority of the readers opted Free subscription in digital platform for student's initiative can be taken by newspaper to attract the students.

Findings of the study:

- 58.75% are respondents are female
- 55 % are between the age group of 20-25
- 62% are UG students
- 51% are residing in rural area
- 71.75% respondents involved in survey are perusing in private colleges
- 65.25% are having a reading habits of newspapers
- 44.00% respondents are readers of Times of India

- 39.56% are not reading because of non-availability of newspaper at home
- 31.03 % readers reading newspapers from childhood
- 44% are prefer local news
- 29% respondents face language difficulties while reading newspaper
- 46.74% preferred Printed newspaper mode of reading newspapers
- 77% readers opinion that Newspapers are still relevant in today's digital age
- 59.48% believe that reading newspapers will improve the language
- 44% expressed that Providing free access to newspaper on campus will improve reading habits in the campus
- 31% readers opinioned that newspapers can offer Free subscription in digital platform for students s

Suggestions:

- **Encourage Language Development through Newspapers:**

Regular reading of English newspapers can help students improve vocabulary, grammar, communication skills, and critical thinking.

- **Improve Awareness about Educational Content in Newspapers:**

Students should be guided to focus on sections such as editorials, business news, education, and career opportunities, which enhance knowledge and analytical skills.

- **Integrate Newspaper Reading with Academic Activities:**

Faculty members can incorporate newspaper articles into classroom discussions, assignments, and presentations to improve students' awareness of current affairs.

- **Collaborate with Media Organizations:**

Educational institutions can collaborate with **newspaper agencies or media professionals** to conduct **debates, panel discussions, and seminars** workshops on journalism, media literacy, and news analysis.

Conclusion:

The study concludes that newspapers remain one of the most important forms of mass media and a vital communication platform for accessing information on national and international affairs. Newspapers play a significant role in the academic journey of students by providing reliable first-hand information and enhancing their awareness of current events. However, the findings indicate that many students do not regularly read newspapers due to several factors such as the complexity of vocabulary, unavailability of newspapers at home, and a growing preference for social media as a source of information.

The study further reveals that students show greater interest in youth-oriented content, as well as local, national, and international news. Respondents also suggested that newspapers should introduce separate sections dedicated to students and adopt a simpler language style to make the content more accessible and engaging. Educational institutions should also take initiatives to cultivate newspaper reading habits among students.

Moreover, providing free or affordable digital access and making newspaper content more

interactive could help attract a larger student readership. Therefore, newspapers need to adopt student-friendly strategies to attract and retain young readers, thereby strengthening their relevance and increasing readership among the younger generation.

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A STUDY ON INNOVATION AND TECHNOLOGY ADOPTION IN MICRO, SMALL AND MEDIUM ENTERPRISES IN INDIA

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Abstract

Micro, Small and Medium Enterprises (MSMEs) are considered the backbone of the Indian economy as they contribute significantly to employment generation, GDP growth, industrial production, and exports. The MSME sector plays a crucial role in promoting inclusive and sustainable economic development in both rural and urban areas. This study explores the role of innovation in strengthening the MSME sector in India and highlights how technological advancements and innovative practices support business growth and competitiveness. The paper also examines various innovation schemes and initiatives introduced by the Government of India under the Ministry of MSMEs to encourage innovation, entrepreneurship, and technological development. The study is based on both qualitative and quantitative information collected from secondary sources. It emphasizes the importance of digital adoption, modern technology, and innovative strategies in improving operational efficiency, expanding market opportunities, and enhancing productivity in MSMEs. At the same time, the study identifies several challenges faced by entrepreneurs while adopting new technologies, such as lack of digital literacy, inadequate infrastructure, limited financial resources, and low awareness of government schemes. The findings of the study highlight the need for greater awareness, skill development, and policy support to promote innovation in MSMEs. The paper concludes with suggestions to strengthen innovation practices and improve the overall growth and competitiveness of the MSME sector in India.

Keywords: MSMEs, Economic Development, Innovations, Technological Advancement, Job creation.

1.Introduction

Innovation is a fundamental concept in every sector and plays a vital role in achieving advancement and development. In order to sustain growth and remain competitive in a dynamic market environment, innovation is essential. For this reason, innovation is considered one of the major pillars for the development of various sectors. Innovations provide significant opportunities for Micro, Small and Medium Enterprises (MSMEs), as these enterprises are generally more flexible and capable of adapting quickly to market changes. Innovation acts as a key driver for MSMEs, enabling them to enhance competitiveness, improve product efficiency, and expand their market reach. Therefore, innovation and MSMEs share a strong and direct interconnection.

Micro, Small and Medium Enterprises (MSMEs) are considered the backbone of the nation, contributing significantly to the economic development of India. MSMEs contribute nearly 30% to the country's Gross Domestic Product (GDP) and about 40% to total exports. These

enterprises operate in various sectors such as services, manufacturing, processing, and production. Through their activities, MSMEs play a crucial role in employment generation, industrial output, economic development, and export growth. Innovation and MSMEs are interdependent, and the integration of these two elements can lead to sustainable development in the business sector. A proper understanding of the importance and functioning of MSMEs also helps in identifying market demand and supply opportunities.

The Government of India, through the Ministry of MSME, has introduced several schemes to promote innovation and technological advancement among MSMEs. Some of the major initiatives include the MSME Innovation Scheme, the Scheme for Promotion of Innovation, Rural Industries and Entrepreneurship (ASPIRE), and the Credit Linked Capital Subsidy Scheme (CLCSS) for technology upgradation. These schemes support entrepreneurs in adopting innovative practices, improving technology, and strengthening their business operations. With the support of such innovation-driven schemes, entrepreneurs can achieve their business goals more effectively and improve their standard of living. Furthermore, innovation and technological advancement enhance the operational efficiency of organizations and facilitate market expansion through digital adoption.

2. Objectives of the study

The present study mainly focuses on the following objectives:

- To examine the impact of innovation on the MSME sector.
- To study the different innovation schemes and initiatives designed to support Micro, Small and Medium Enterprises (MSMEs).
- To identify the problems faced by entrepreneurs regarding technology.

3.Scope of the study

The present study focuses on a study on innovation and technology adaptation in micro, small and medium enterprises in Karnataka. It specifically gives attention to several innovation schemes that have been introduced as initiatives for the development of MSMEs and mainly examines how technological advancement helps to improve the performance of MSMEs.

4.Need for the study

Many MSM enterprises do not have awareness about innovation schemes and their importance, and they continue to operate with outdated technology. In order to provide broader understanding and encourage them to adopt innovation, this study plays an important role. Thus, this study highlights how innovation can help in the development of MSMEs as well as entrepreneurs.

5.Review of Literature

Jean and Merta (2013) suggested that innovation and entrepreneurship are closely related. They stated that innovation is one of the major features of entrepreneurship and plays an important role in the development of small business enterprises. The authors also suggested that entrepreneurs can easily identify and utilize opportunities in their respective fields, and they emphasized that cultural conditions influence entrepreneurial activities.

Mohammad and Hanil Zainal (2019) in their study *The Role of Creativity and Innovation in Entrepreneurship*, focused on how entrepreneurs grow by taking risks, adopting innovation, and implementing emerging ideas and creativity. The study demonstrated how new ventures develop through creative thinking and innovative ideas. It concluded that entrepreneurs serve as the backbone of the market, playing a crucial role in fulfilling customer needs.

Shrinivasan and Shrisha (2015) in their study *Strategic Marketing and Innovation Performance of Indian MSMEs*, highlighted that entrepreneurs are the backbone of national development. They emphasized the importance of proper allocation of investment and labor, noting that improper allocation often occurs. The study also pointed out that MSMEs compete at domestic and global levels and provided details on the rules and regulations governing them.

Sharma and Namitha (2016) highlighted that SMEs play a significant role in national development, contributing over 45% of the gross turnover and providing employment to 31.2 million people across urban and rural areas. The study also suggested that managing innovation through proper resources, customer focus, and teamwork enhances both product and organizational development.

6. Research gap

An overview of the literature indicates that numerous studies have been conducted on innovation and the MSME sector. Existing literature primarily focuses on the importance of MSMEs and the opportunities available to them in India. However, it does not provide sufficient information about awareness of innovation schemes, digital adoption in the MSME sector, or the challenges and issues faced by MSMEs. Therefore, keeping this in view, the present study has been undertaken to examine innovation in the MSME sector.

Concept of MSMEs and Innovation:

Micro, Small and Medium Enterprises (MSMEs) are managed under the Ministry of MSMEs and are officially defined by the MSMED Act of 2006. MSMEs primarily consist of manufacturing and production of goods and commodities. These two major components contribute to the holistic development of the nation, including both rural and urban areas. MSMEs make a significant contribution to the Indian economy, accounting for around 30% of GDP and 40% of exports.

Businesses are classified as 3 categories on the basis of the investment are as follows:

Category	Net investment in plant and machinery and equipment	Net turnover
Micro	Less than Rs 2.5 crore	Less than Rs 10 crore
Small	Less than Rs 25 crore	Less than Rs 100 crore
Medium	Less than Rs 125 crore	Less than Rs 500 crore

According to MSMEs, there are two types of enterprises:

1. **Manufacturing Enterprises:** These are business enterprises engaged in the production of goods with the help of plants and machinery.

2. **Service Enterprises:** These enterprises provide services and fall under the MSMED Act. They generate income or revenue through intangible labor, expertise, and services rather than the manufacture of physical goods. Examples include hospitality services, healthcare providers, and similar service-oriented businesses.

Innovation

The word “innovation” is derived from the Latin term “**innovare**,” which means to renew. It refers to the process of translating ideas, inventions, and improvements into valuable solutions that provide insights into problems and help meet market needs. Innovation emphasizes the execution of creative ideas through several stages, each of which holds its own significance.

Process of Innovation:



Innovation always provides cost-effective solutions for businesses and promotes continuous improvement in product development. The government has taken several steps to support and develop MSMEs, creating a positive business environment. Innovation enables quick responses to customers and helps businesses adapt easily to market changes.

There are four types of innovation: Incremental, Radical, Architectural, and Disruptive, categorized based on their technological impact. In the MSME sector, innovation acts as a lifeblood, helping businesses adapt to market volatility and optimize operational activities. Through innovation, MSMEs can create value by implementing creative ideas.

Impact of Innovation in MSMEs Sector:

Innovation is an integral part of MSMEs, as it significantly drives operational effectiveness, organizational growth, and market competitiveness. Several innovation activities are being undertaken in the MSME sector, as outlined below:

- **Product Innovation:** Product innovations play a major role in MSMEs. For example, they help in producing eco-friendly products, biodegradable cutlery, and handicraft items. Such innovations contribute to a sustainable environment.
- **Technological Upgradation and Automation:** Technological innovation is critical for increasing productivity and operational efficiency. The adoption of AI and robotics improves organizational performance and aids in waste management, such as converting waste into compost, ink, diesel, or other reusable products.
- **Agriculture and Agro-based Innovations:** Innovations in agriculture directly support precision farming, post-harvest technologies, and poultry management, enhancing productivity and efficiency in the agro-based sector.
- **Digital Adoption:** Digital adoption involves the use of modern technology to optimize

workflow and efficiency. This includes digital and online payment systems like UPI apps, which allow entrepreneurs to complete transactions quickly compared to manual payments. Many MSMEs have also embraced digital marketing using social media, e-commerce platforms, and websites, which help reach target customers and manage customer data effectively through CRM software.

- **Green Innovation:** Green innovations focus on energy efficiency and sustainability. Examples include adopting energy-efficient motors, LED bulbs, and solar systems that reduce electricity consumption and costs. Schemes like the Surya Ghar initiative help Indian MSMEs reduce greenhouse gas emissions. In the current era of pollution, green innovation is essential to achieve environmental sustainability.

- **Smart Manufacturing:** Smart manufacturing combines advanced technologies such as AI and robotics in the production process. It has become an integral part of the MSME sector because it enhances production performance, optimizes resource utilization, reduces energy costs by nearly 30%, and helps predict production outcomes. Smart manufacturing enables MSMEs to remain competitive. An example of this approach is Industry 4.0.

Different Innovation Schemes: Initiative design to support MSMEs

There are several schemes introduced under the Ministry of the MSMEs and government of India are as follows:

MSMEs Innovative Scheme (MIS): The MIS consists of three major components: Incubation, Design, and Intellectual Property Rights (IPR). The Incubation component focuses on providing innovative concepts, offering financial support of up to Rs 15 lakh per idea and funding for plant and machinery up to Rs 1 crore. Such financial assistance encourages entrepreneurs to develop new ideas and supports the growth of MSMEs. The Design component focuses on project design, providing funds up to Rs 2.5 lakh for student projects and new project ideas. IPR support under the scheme includes reimbursement of up to Rs 5 lakh for foreign patents and up to Rs 1 lakh for domestic patents.

ASPIRE (A Scheme for Promotion of Innovation, Rural Industries &

Entrepreneurship): Launched by the Ministry of MSMEs in 2015, this initiative focuses on setting up incubators to promote rural entrepreneurship and innovation. The scheme aims to reduce unemployment and generate new jobs by providing grants of up to Rs 1 crore for establishing livelihood businesses, incubators, and technology incubators.

MSME Champion Scheme: Introduced by the Ministry of MSMEs on June 1, 2020, this initiative is designed to drive technological adoption and implement zero-defect, zero-effect (ZED) manufacturing practices, which are recognized through the ZED certification. The scheme promotes high-quality production with minimal environmental impact and provides a 15–20% subsidy for technology adoption. Its main objective is to enhance global competitiveness.

Problems Faced by Entrepreneurs in Technology Adoption:

- Lack of skills is a major issue; in the modern era, skill development is crucial, and low digital literacy is a significant challenge for MSMEs.
- Technical problems such as poor connectivity and network issues are common, particularly in rural and semi-rural areas.
- Many MSMEs continue to operate with outdated technology and have limited awareness of government support programs, causing them to miss out on available benefits.

Findings of the Study

Innovation occurs in all sectors, but its contribution is particularly significant in the MSME sector. Technological advancements enable MSMEs to engage in developmental activities and improve their performance. To support the growth of MSMEs, the Ministry of MSMEs has introduced several schemes, which directly help these enterprises expand and develop.

Suggestions: There is a lack of awareness regarding technology adoption, and many entrepreneurs continue to use outdated technology. Therefore, awareness programs and affordable training initiatives should be provided to entrepreneurs. The government should also encourage MSMEs to develop and implement emerging ideas, as this is essential for achieving a higher competitive advantage.

Conclusion: This research paper provides significant insights into innovation in the MSME sector. The study highlights how the MSME sector is developing through various innovations and its contribution to the Indian economy. Many entrepreneurs face challenges such as technological barriers, family responsibilities, lack of funding, low literacy levels, and limited skills. The main aim of this paper is to demonstrate how innovation activities can support the development of the MSME sector and to raise awareness about the schemes specifically introduced for MSMEs.

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A COMPARATIVE STUDY ON EMOTIONAL MATURITY AMONG MALE AND FEMALE UNDERGRADUATE STUDENTS

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Abstract

Emotional maturity plays an important role in the psychological well-being and academic adjustment of students. The present study aimed to examine the differences in emotional maturity between male and female undergraduate students. Emotional maturity refers to an individual's ability to manage emotions effectively, maintain emotional stability, and respond to situations in a balanced and responsible manner. A comparative research design was used for the study. The sample consisted of 60 undergraduate students, including 30 male and 30 female undergraduate students, selected through a convenient sampling method from a college. A standardized Emotional Maturity Scale was used to measure the level of emotional maturity among the participants. Emotional Maturity scale developed by Y. Singh and B. Bhargava, [2005] was used for the present study. The collected data were analysed by using mean, SD and 't'-test was applied. The results of the study indicated that there is significant difference between emotional maturity among male and female undergraduate students. The findings suggest that gender may influence emotional maturity, which can affect students' emotional regulation and interpersonal relationships. The study highlights the importance of developing emotional maturity among undergraduate students through counselling, emotional skills training, and supportive educational environments to promote better mental health and academic success.

Keywords: Emotional maturity, Male, Female, Undergraduates.

Introduction:

All of us at some point of time or the other in our everyday life feel happy, sad, angry, love, pity, jealousy, hatred, fear, agony etc. What are these feelings which we experience in our lives, what makes us feel these, imagine our lives without these feelings or experiences, These are actually emotions. Our life would have been absolutely boring and meaningless without emotions. Our emotions and how we feel about certain things most often influences our thinking. Even our perception is not always determined by the outside stimulus but by our internal feelings, emotions, desires, and aversions. Thus feelings and emotions are dynamics of our behaviour, and thus are very important. In our practical life, feelings and outside behaviour are closely related. It is therefore very essential to know the difference between emotions and feelings which are highly inter related and both together and individually affect our behaviours. Emotions and feelings often appear just as different stages of one phenomenon. If the person has a positive attitude about his surrounding environment and avoid from the negative thoughts, he can control his emotions and feelings better, and this helps him improve his social relationships. A person who has reached the full emotional

growth, is able to make a true relationship with others in social life and also obtain the ability of responsibility acceptance against him-self and others, and will be successful in interaction with others. Person is not egoist and self-oriented and is able to adapt his surrounding environment conditions and have enjoyment capacity, also that person is heterosexual fond, have understanding of others behaviour, acceptance of others attitudes and habits. One who has not reached the emotional maturity always needs love and attention and hides his weakness, he is a vulnerable person and cannot forgive and has not Stable behaviour and is irritable. During adolescence one gets excited very soon. Adolescents burst into laughter on flimsy things or loose temper soon but an emotionally mature is free from this defect. As one grows mature his emotional stability and depth of social adjustment, vocational and professional aptitude, life's ambitious etc. go on developing. A mature person is expected to understand a situation without any one's helped and realize his duties and responsibilities himself. He will have more positive than negative attitude towards life. Cole (1954) says, 'The chief index of emotional maturity is the ability to bear tension'. This view lays stress upon 'self-control' and not on 'self-fulfillment'. Dosanjh (1956) says, 'Emotional maturity means a balanced personality. It means ability to govern disturbing emotions, show steadiness and endurance under pressure and to be tolerant and free from neurotic tendencies'. Good (1981) has stated that emotional maturity refers to emotional patterns of an adult who has progressed through the inferior emotional stages characteristic of infancy, childhood and adolescence and is not fit to deal successfully with reality and in adult love relationship without under emotional strain.

Review of literature:

Subbarayan and Visvanathan (2011) found that emotional maturity of UG college students was extremely unstable. Kushvinder Kumar (2011) investigated that the emotional intelligence has gender-biased. Mishra (2012), Preeti (2012) found that the absence of emotional intelligence indicates a weak personality. Aumugam (2014) revealed the result of emotional maturity of B.Ed. trainees to be below average. Wani and Masih (2015) reported that majority of postgraduate students and research scholars of Jamia Milia Islamia University are emotionally unstable. Bhatnagar and Gill (2015) conducted a study and revealed that there was no correlation between emotional intelligence and emotional maturity of higher secondary students. Das and Ghosh (2014) revealed that emotional maturity and academic achievement of college student rural and urban areas there is no significant difference. Arumugam (2014) found that emotional maturity of B.Ed. trainees was below average. Puar (2014) revealed that the emotional maturity played no significant role in the academic achievement of high school students. Ajit Chandanshive [2014] that found there is significant gender difference in emotional maturity and adolescent girls have high emotionally matured compared to adolescent boys. Balchandra bhava [2012] and Sunil kumar [2014] revealed that adolescent boys have significantly high emotional maturity compare to girls. Bhavne [2012] compare the emotional maturity of adolescent males and females. kaur [2000] also reported

that rural students have more emotional maturity than urban students. Mahendra and thakur [2018] conducted a study on emotional maturity of adolescents in relation to their type of school. The finding of the study reveled that adolescents studying in private schools possess more emotional maturity than the adolescent studying in government schools. However, there is no significant difference in the emotional maturity was found between the girls studying in private and government schools.

Purpose of the Study:

Adolesent eduction is an important stage in scholastic journey. Student face issues like social incompetence, emotional immaturity, social immaturity, family conflicts memory dysfunction attention deficits, academic related stress, learning problems and so on in the present study the researcher is trying to assess the student's emotional maturity factors in boys and girls. Hence the present study is undertaken to know the level of emotional maturity among undergraduate student of boys and girls.

Statement of the problem:

The statement of the problem is as follows *“A comparative study of emotional maturity among male and female undergraduate students”*.

Objective of the Study;

1. To study the significant difference between emotional maturity in undergraduate students of boys
2. To study the significant difference between emotional maturity in undergraduate students of girls.
3. To study the significant difference between emotional maturity of dimension wise undergraduate students of boys.
4. To study the significant difference between emotional maturity of dimension wise undergraduate student of girls.
5. To study the significant difference between to compare the emotional maturity in undergraduate students of boys and girls.

Hypotheses of the Study;

1. There will be significant difference in emotional stability among boys and girls of undergraduate student.
2. There will be significant difference in emotional progression among boys and girls of undergraduate student.
3. There will be significant difference in social adjustment among boys and girls of undergraduate student.
4. There will be significant difference in personality integration among boys and girls of undergraduate student.
5. There will be significant difference in independence among boys and girls undergraduate student.

6. There will be significant difference in emotional maturity among, boys and girls of undergraduate students.

Research design;

Psychological test used for this study. The research was carried out on 60 students out of all undergraduate students of Shivamogga district. In this study Emotional Maturity of the respondents was assessed through Emotional maturity scale Y. Singh and M. Bhargava (2005).

Sample of the Study;

For the study a sample of 60 undergraduate student of boys and girls. Studying in B.SC first, second and final year Sahyadri science college Shivamogga. 30 undergraduate boys and 30 undergraduate girls studying in Sahyadri Science College were random selected from one college of Shivamogga district of Karnataka. The age of the students 19-21 years.

Tools for the Study;

Emotional Maturity scale developed by Y. Singh and B. Bhargava, [2005] was used for the present study. EMS is a standardized Questionnaire consisting of 48 items under five categories that is Emotional stability, Emotional progression, Emotional adjustment, Personal integration (each consisting of 10 items) and Independence consisting of 8 items. It is a five point scale in which items of the scale are in questionnaire form and the information of each item has 5 alternatives like very much, much, undecided, probably and never.

Data collection procedure;

The investigator sought permission respected authorities then visit a Sahyadri Science College in Shivamogga to collect data information. Then she explained about the purpose and psychological test to the sample and thus administered the test, after the data collection, the questionnaire was scored as per the scoring pattern prescribed in the manual.

RESULTS AND DISCUSSION

Table 1: shows, the total score and mean score of all dimensions in emotional maturity of undergraduate boys.

Total no, of boys[30]	Emotional stability	Emotional progression	Social adjustment	Personality integration	independence	Total
Total score	395	447	440	342	324	1.948
Mean score	26.3	29.8	29.3	22.8	21,6	129.86

Table-2 shows, the total score and mean score of all dimensions in emotional maturity of undergraduate girls.

Total no, of girls [30]	Emotional stability	Emotional progression	Social adjustment	Personality integration	independence	Total
Total score	460	438	424	410	306	2,038
Mean score	30.3	29.2	28.2	27.3	20.4	135.86

Discussion;

Table 1 and table 2 Shows the result of dimension wise emotional maturity of undergraduate students of boys and girls.

Sub-Dimension wise analysis reveals that on emotional stability dimension the undergraduate boys total score =395 and mean score =26.3 and undergraduate girls total score =460 and mean score =30.3. It shows that undergraduate boys high emotional stability than compare to undergraduate girls.

Sub-Dimension wise analysis reveals that on emotional progression dimension the undergraduate boys total score =447 and mean score =29.8 and undergraduate girls total score =438 and mean score =29.2. It shows that undergraduate girls high emotional progression than compare to undergraduate boys.

Sub-Dimension wise analysis reveals that on social adjustment dimension the undergraduate boys total score =440 and mean score =29.3 and undergraduate girls total score =424 and mean score =28.2. It shows that undergraduate boys high social adjustment than compare to undergraduate girls.

Sub-Dimension wise analysis reveals that on personality integration dimension the undergraduate boys total score =342 and mean score =22.8 and undergraduate girls total score =410 and mean score =27.3. It shows that undergraduate boys high personality integration than compare to undergraduate girls.

Sub-Dimension wise analysis reveals that on independence dimension the undergraduate boys total score =324 and mean score =21.6 and undergraduate girls total score =306 and mean score =20.4. It shows that undergraduate girls high independence than compare to undergraduate boys.

The overall Emotional maturity of undergraduate boys total score=1.948, mean score=129.86 and undergraduate girls total score=2.038, mean score=135.86. It shows that undergraduate boys have high emotional maturity than compare to undergraduate girls.

Summary and conclusion;

The results from this study conclude that the emotional maturity in undergraduate students of boys is higher than that of students of girls. Dimension of Emotional stability, Emotional progression, Social adjustment, Personality integration and Independence were found higher in the students of boys. The difference between students of boys and girls are considerable regarding emotional maturity.

Major findings of the present study:

The following findings have emerged from the analysis and data collected for the present study;

1. The boys of undergraduate student possessed a high level of emotional stability then compare to girls.
2. The girls of undergraduate student possessed a high level of emotional progress then compare to boys.

3. The boys of undergraduate student possessed a high level of social adjustment then compare to girls.
4. The boys of undergraduate student possessed a high level of personality compilation then compare to girls.
5. The girls of undergraduate student possessed a high level of freedom than compare to boys.
6. The over all boys of undergraduate student possessed a high level of emotional mature than compare to girls.

Limitation of the study:

1. Present research study sample is only restricted to shivamogga district of the south Karnataka , india
2. The findings of the study cannot be generalized because of small sample [N=60] taken only from the shivamogga district of south Karnataka, india.
3. The present study sample age range is restricted to 19 to 21 years only undergraduate boys and girls from shivamogga district of south Karnataka, india.
4. The sample of the study is limited to only the undergraduate boys and girls studying in emotional maturity.

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IMPACT OF DIGITAL TRANSFORMATION ON BUSINESS PERFORMANCE AND CUSTOMER SATISFACTION

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Abstract

Digital transformation has become one of the most significant drivers of organizational growth and competitiveness in the modern business environment. The integration of advanced digital technologies such as cloud computing, artificial intelligence, big data analytics, mobile applications, and e-commerce platforms has significantly transformed business operations and customer engagement. This study examines the impact of digital transformation on business performance and customer satisfaction using secondary data collected from academic journals, research reports, books, and industry publications between 2019 and 2025. The findings indicate that digital transformation improves organizational efficiency, productivity, and strategic decision-making by enabling automation, data analysis, and improved communication systems. Furthermore, digital platforms help organizations provide faster services, personalized experiences, and effective communication channels for customers. Despite these advantages, organizations face several challenges such as cybersecurity risks, high implementation costs, technological complexity, and shortage of skilled professionals. The study concludes that successful digital transformation requires strategic planning, technological infrastructure, skilled workforce, and continuous innovation to achieve sustainable competitive advantage in the digital economy.

Keywords: *Digital Transformation, Business Performance, Customer Satisfaction, Innovation, Digital Technology, Digital Economy*

1. Introduction

The rapid advancement of digital technologies has significantly transformed the global business environment. Organizations across various sectors are increasingly adopting digital technologies to improve operational efficiency, productivity, and competitive advantage. Digital transformation refers to the integration of digital technologies into all aspects of business operations, including production, communication, marketing, and customer service. In recent years, technologies such as artificial intelligence (AI), cloud computing, big data analytics, Internet of Things (IoT), and blockchain have played a crucial role in reshaping business strategies and organizational structures. These technologies enable businesses to automate processes, collect and analyze large volumes of data, and improve decision-making capabilities.

Digital transformation also plays a vital role in enhancing customer satisfaction. Customers today demand faster services, personalized products, and convenient online interactions. Businesses that adopt digital platforms such as mobile applications, e-commerce websites, and digital payment systems can better meet customer expectations.

Moreover, digital technologies allow organizations to communicate directly with customers through social media platforms and customer relationship management systems. This enables

businesses to understand customer preferences, respond to feedback quickly, and provide improved services.

However, the process of digital transformation is not without challenges. Organizations must invest significant financial resources, upgrade technological infrastructure, and train employees to adapt to new digital systems. Therefore, understanding the impact of digital transformation on business performance and customer satisfaction is essential for modern organizations.

2. Review of Literature

Digital transformation has been widely studied by researchers in the fields of management, information systems, and business strategy.

Westerman, Bonnet, and McAfee (2014) highlighted that organizations adopting digital technologies achieve higher operational efficiency and improved customer engagement. Their study emphasizes the importance of digital leadership in successful transformation initiatives. Brynjolfsson and McAfee (2014) explained that digital technologies and automation are transforming industries by increasing productivity and enabling innovative business models. They also suggested that organizations must develop digital capabilities to remain competitive.

Porter and Heppelmann (2015) discussed how smart and connected products are transforming companies by generating valuable data that can improve decision-making and customer experience.

Ross, Beath, and Sebastian (2016) emphasized that digital transformation requires strong technological infrastructure, leadership commitment, and organizational culture that supports innovation.

Kane et al. (2019) found that companies that invest in digital innovation and employee training achieve higher levels of organizational performance and adaptability.

Vial (2019) described digital transformation as a process that improves organizational performance by leveraging digital technologies to create new business models and enhance customer value.

Verhoef et al. (2021) explained that digital transformation enables organizations to improve customer relationships through digital platforms and data-driven marketing strategies.

These studies collectively highlight that digital transformation positively influences productivity, innovation, and customer satisfaction.

3. Objectives of the Study

The major objectives of the study are:

1. To examine the impact of digital transformation on business performance.
2. To analyze the role of digital technologies in improving customer satisfaction.
3. To identify the benefits and challenges associated with digital transformation.
4. To evaluate how digital technologies contribute to organizational competitiveness.

4. Research Methodology

The present study is based on **secondary data** collected from credible sources such as academic journals, books, government reports, industry publications, and research databases. The data used in this study were published between **2019 and 2025**, ensuring that recent developments in digital transformation are considered.

A **descriptive and analytical research design** was adopted to analyze the impact of digital transformation on business performance and customer satisfaction. The collected data were systematically reviewed and interpreted to identify major trends, benefits, and challenges associated with digital technology adoption.

5. Major Digital Technologies Used in Businesses

Technology	Business Application
Cloud Computing	Remote data storage, scalability, and collaboration
Artificial Intelligence	Automation and predictive decision-making
Big Data Analytics	Customer behavior analysis and strategic planning
Internet of Things	Real-time monitoring and smart operations
E-commerce Platforms	Online sales and digital marketing
Blockchain	Secure transactions and data transparency

6. Impact of Digital Transformation on Business Performance

Digital transformation significantly enhances organizational efficiency and productivity. Automation technologies reduce manual tasks and enable employees to focus on strategic activities. Data analytics tools allow organizations to analyze market trends and develop effective business strategies.

Another important benefit of digital transformation is cost reduction. Cloud computing reduces infrastructure costs, while digital communication tools improve collaboration within organizations. These technologies help businesses operate more efficiently and effectively.

Digital transformation also encourages innovation by enabling organizations to develop new products and services. Companies can use digital platforms to experiment with new business models and expand into global markets.

7. Impact on Customer Satisfaction

Customer satisfaction is one of the most important outcomes of digital transformation. Digital platforms allow organizations to provide faster and more convenient services to customers.

E-commerce platforms enable customers to purchase products online, while digital payment systems provide secure and convenient transactions. Mobile applications allow customers to access services anytime and anywhere.

Furthermore, digital marketing tools enable businesses to deliver personalized advertisements and recommendations based on customer preferences. This improves customer engagement and loyalty.

Customer relationship management (CRM) systems also help organizations maintain strong relationships with customers by storing customer data and tracking interactions.

8. Challenges of Digital Transformation

Despite its numerous benefits, digital transformation also presents several challenges for organizations:

- High cost of technology implementation
- Cybersecurity threats and data privacy concerns
- Lack of skilled digital workforce
- Resistance to organizational change
- Technological complexity and integration issues

Organizations must address these challenges by investing in training programs, strengthening cybersecurity systems, and developing effective digital strategies.

9. Conclusion

Digital transformation has become a crucial factor for organizational success in the modern digital economy. The integration of digital technologies improves business efficiency, enhances innovation, and strengthens customer relationships. Organizations that successfully adopt digital technologies can achieve higher productivity, improved customer satisfaction, and sustainable growth. However, companies must also address challenges such as cybersecurity risks, technological complexity, and skill gaps. Therefore, businesses should invest in digital infrastructure, employee training, and strategic planning to fully realize the benefits of digital transformation.

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ARTIFICIAL INTELLIGENCE IN SUSTAINABLE WORKFORCE MANAGEMENT: OPPORTUNITIES AND CHALLENGES

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Abstract

Artificial Intelligence is affecting the current organizational world in several ways, such as making it more efficient, automated, etc. When we talk of human resource management as a field of study, it can be said that Artificial Intelligence has already been put to use in several ways, such as during recruitment, performance evaluation, etc. However, there is a growing need to look at sustainable workforce management, which has been defined as a workforce that is sustainable. This is a conceptual study that aims to explore the concept of Artificial Intelligence in sustainable workforce management through an in-depth study of literature and other related perspectives. This study also points to the opportunities that can arise through the use of Artificial Intelligence, such as an increase in productivity, employee engagement, etc., as well as challenges such as ethical issues, data privacy issues, etc. This study concludes that Artificial Intelligence has a high potential to increase workforce sustainability; however, it is also important to use responsible Artificial Intelligence technology, such as transparency in decision-making. A balanced use of human intelligence and Artificial Intelligence technology is important to increase sustainable workforce development.

Keywords: Artificial Intelligence, Human Resource, Human Resource Management, Workforce Sustainability, Sustainable Workforce Management.

1. Introduction:

Technological advancements are significantly transforming the way organizations manage their workforce. Artificial Intelligence (AI) has emerged as one of the most influential technologies of the modern digital era. AI refers to computer systems and machines capable of performing tasks that normally require human intelligence such as learning, reasoning, problem-solving, and decision-making.

In recent years, organizations have increasingly adopted AI technologies to enhance operational efficiency and improve decision-making processes. Human resource management is one of the key functional areas where AI is rapidly gaining importance. AI-based tools are widely used in recruitment processes, employee performance management, training and development, and workforce planning.

At the same time, organizations are emphasizing the concept of **sustainable workforce management**, which focuses on maintaining a productive, skilled, and motivated workforce for long-term organizational success. Sustainable workforce management aims to balance organizational performance with employee well-being, work-life balance, and continuous skill development.

Artificial Intelligence has the potential to support sustainable workforce practices by improving decision-making, enhancing employee engagement, and optimizing workforce planning. However, the increasing use of AI also raises concerns related to data privacy, ethical issues, and potential job displacement.

Therefore, this study examines the **opportunities and challenges of Artificial Intelligence in sustainable workforce management** through a conceptual analysis of existing research.

2. Objectives of the Study

The study is conducted with the following objectives:

1. To understand the concept of Artificial Intelligence in workforce management.
2. To examine the role of AI in promoting sustainable workforce practices.
3. To identify the major opportunities of AI in sustainable workforce management.
4. To analyse the challenges associated with the adoption of AI in workforce management.

3. Research Questions

1. How can Artificial Intelligence contribute to sustainable workforce management?
2. What opportunities does AI provide for improving workforce sustainability?
3. What are the major challenges faced by organizations while implementing AI in workforce management?

4. Literature Review

Several scholars have discussed the role of Artificial Intelligence and digital technologies in organizational management and workforce development.

- John McCarthy introduced the concept of Artificial Intelligence and defined it as the science of creating intelligent machines capable of performing tasks that require human intelligence.
- Michael Porter and James Heppelmann emphasized that smart technologies and digital innovations significantly transform organizational competition and operational efficiency.
- Erik Brynjolfsson and Andrew McAfee discussed how AI technologies reshape the future of work by improving productivity while also creating concerns regarding job displacement.
- Thomas Davenport and Julia Kirby highlighted the importance of collaboration between humans and AI systems in organizational decision-making.
- Wayne Cascio and Ramon Montealegre examined the influence of digital technologies on employment patterns and workforce transformation.
- Klaus Schwab explained that the Fourth Industrial Revolution, driven by technologies such as AI and robotics, is reshaping industries and workforce structures globally.
- Nigel Guenole and Jonathan Ferrar emphasized that HR analytics and AI-driven insights support better workforce management decisions.

- Dirk Helbing highlighted ethical challenges associated with AI systems, particularly issues related to data privacy and algorithmic bias.
- Erik van Vulpen discussed the growing use of AI technologies in recruitment, workforce analytics, and employee engagement.
- Peter Cappelli emphasized the need for sustainable workforce strategies to manage technological changes in modern organizations.

4. Research Methodology

4.1 Research Design

The study adopts a **conceptual research design** focusing on theoretical analysis of Artificial Intelligence and sustainable workforce management.

4.2 Nature of the Study

The research is **qualitative and descriptive** in nature and aims to analyse existing literature related to AI applications in workforce management.

4.3 Data Sources

The study is based on **secondary data** collected from:

- Academic journals
- Books and research publications
- Conference papers
- Reports and online academic sources

4.4 Method of Data Analysis

The collected data was analysed using **literature review and conceptual analysis** to identify key opportunities and challenges of AI in sustainable workforce management.

Theoretical Background

The application of Artificial Intelligence in workforce management can be explained through various management and technology theories. The **Technology Acceptance Theory** explains how individuals adopt new technologies in organizational environments. Similarly, the **Human Capital Theory** highlights the importance of employee skills, knowledge, and development in achieving long-term organizational success. AI technologies support these theories by improving employee training, talent identification, and workforce productivity. Therefore, the integration of AI and human resource practices plays a significant role in developing sustainable workforce strategies.

5. Concept of Artificial Intelligence

Artificial Intelligence refers to the development of computer systems capable of performing tasks that normally require human intelligence. AI technologies include machine learning, natural language processing, robotics, and predictive analytics.

In organizations, AI is used to automate routine tasks, analyze large volumes of data, and support strategic decision-making. In human resource management, AI tools assist in resume screening, employee performance evaluation, workforce analytics, and personalized employee training programs.

6. Concept of Sustainable Workforce Management

Sustainable workforce management refers to organizational practices that aim to maintain a healthy, skilled, and motivated workforce over the long term. It emphasizes employee well-being, skill development, diversity, work-life balance, and long-term workforce stability.

Organizations that focus on workforce sustainability are better positioned to achieve long-term productivity and competitive advantage.

7. Opportunities of AI in Sustainable Workforce Management

1. Improved Decision-Making: AI systems analyse large datasets and provide valuable insights that support effective HR decisions.
2. Increased Productivity: Automation of repetitive tasks allows employees to focus on strategic and creative work.
3. Talent Optimization: AI helps organizations identify employee strengths, skill gaps, and training needs.
4. Enhanced Employee Experience: AI-based chatbots and HR systems improve employee engagement and service delivery.
5. Data-Driven Workforce Planning: Predictive analytics helps organizations forecast future workforce needs and develop sustainable HR strategies.

8. Challenges of AI in Sustainable Workforce Management

1. Job Displacement: Automation may replace certain routine jobs, creating concerns among employees.
2. Ethical Issues: AI-based decisions may lack transparency and fairness.
3. Data Privacy Risks: AI systems rely heavily on employee data, which raises privacy and security concerns.
4. Algorithmic Bias: AI systems trained on biased data may produce unfair outcomes.
5. Technological Dependency: Excessive reliance on AI may reduce human judgment in organizational decision-making.

9. Research Gap

Although several studies have examined AI in organizational performance and HR practices, limited research specifically focuses on the relationship between AI and sustainable workforce management. Most studies emphasize efficiency and automation rather than long-term workforce sustainability. Therefore, this study attempts to bridge this gap by examining both the opportunities and challenges of AI in achieving sustainable workforce management.

10. Implications of the Study

This study provides insights for organizations and HR professionals on the strategic use of AI in workforce management. It highlights the importance of integrating AI technologies to improve recruitment efficiency, employee development, and workforce planning. At the same time, organizations must address ethical concerns and ensure responsible use of AI systems.

11. Recommendations

Organizations should adopt a balanced approach while implementing Artificial Intelligence in

workforce management. First, companies should ensure transparency and fairness in AI-based decision-making processes. Second, organizations must invest in employee training programs to help workers adapt to AI-driven technologies. Third, proper data protection policies should be established to safeguard employee information. Finally, AI systems should be used as supportive tools rather than replacements for human judgment in HR decisions.

12. Future Research Directions

Future research can explore empirical studies on AI adoption in workforce management using surveys or case studies. Researchers may also examine the long-term impact of AI on employee satisfaction, job security, and organizational culture.

13. Conclusion

Artificial Intelligence is transforming workforce management practices by enabling organizations to make data-driven decisions and improve HR efficiency. AI technologies offer several opportunities for building a sustainable workforce, including improved productivity, talent optimization, and enhanced employee engagement. However, the adoption of AI also presents challenges such as ethical concerns, data privacy risks, and job displacement fears. Therefore, organizations must adopt responsible AI practices and ensure that AI systems complement rather than replace human capabilities. The integration of AI and human intelligence will play a critical role in achieving sustainable workforce management and long-term organizational success.

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TRANSFORMING MARKETS: THE ROLE OF INNOVATION IN TRADE ENTREPRENEURSHIP AND MSMEs

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Abstract

The importance of innovation is apparent in improving have advanced trade entrepreneurship, as well as development for micro, small, and medium-sized enterprises (MSMEs). MSMEs develop innovative approaches and strategies related to product development, service delivery, marketing, and integration with digital technology that leads to improved productivity and competitive advantage, as a result of the increasingly competitive and global market environment. The value created from trade entrepreneurship through new business models and creating opportunities for cross-border trade, through the use of e-commerce platforms, drives innovation. The use of digital payment systems, automated supply chain processes, and data-driven decision-making allows MSMEs to reduce their operational costs while enabling them to reach a larger customer base. Innovations in organizational practices and ways in which MSMEs interact with their customers contribute to their resilience and sustainability. Additional assistance from the public sector in the form of government support, access to finance, and initiatives aimed at building the capacity of MSMEs to develop and implement innovative practices/initiatives helps create an innovative ecosystem that enhances the continuing improvement of MSMEs. Thus, supporting innovations in trade entrepreneurship plays a major role in generating new jobs, contributing to a diversified economy, and supporting inclusive economic growth.

Introduction

Innovation has increasingly become one of the main drivers of economic growth in India, especially within trade and entrepreneurship. India has a huge number of micro small & medium enterprises (MSMEs), which provide employment, regional development and export revenue, and these businesses form the backbone of the nation's economy. Given the rapid pace of change in global markets, traditional business techniques are no longer adequate; MSMEs must employ innovative production, marketing and supply chain management strategies if they wish to maintain their competitiveness and long-term viability.

Advancements in technology together with digitalisation have greatly changed trade in India. MSMEs can now take advantage of e-commerce platforms, fintech products and digital payment systems that provide them access to both national and international marketplaces in an efficient manner. Entrepreneurs can now also use technologies such as Artificial Intelligence (AI), data analytics and cloud computing to streamline their processes, understand consumer preferences, and deliver customised services. This has allowed for the resolution of many issues affecting MSMEs, such as limited market access, high operational expenses, and poor infrastructure.

In addition to new businesses and businesses with high potential for growth, a large number of new entrepreneurs in India have been through the Indian entrepreneurship

ecosystem through MSMEs, which contribute to social innovation and frugal innovation. These new businesses provide solutions that meet local, affordable needs. For example, some MSMEs produce affordable products for rural and/or low-income communities, and thus create new business opportunities while positively impacting the community.

Government initiatives, such as Startup India, Make in India, and Digital MSMEs, promote innovation by providing financial incentives for new ventures, mentorship opportunities, and creating an infrastructure to support innovation and entrepreneurship, developing India's entrepreneurial environment.

Innovative MSMEs are also crucial to increasing India's global presence in global export markets. MSMEs are typically in a better position to implement sustainable business practices, respond quickly to changing market conditions, and access export opportunities. Collaborative efforts between the government, industry, and academic institutions will ensure that the innovative MSMEs will not only be adopted by the broader MSME community and the all MSME must develop the capacity necessary to compete successfully in the global trade market.

To conclude, innovation in trade and entrepreneurship is essential for developing and improving the competitiveness and capacity of MSMEs in India. Technology-based innovation, innovative, creative business models, and supportive policies are enabling Indian entrepreneurs to convert their challenges to opportunities and will create a competitive advantage in the world's most dynamic entrepreneurship and global trade marketplace.

Research Methodology

A particular research methodology utilized in this study comprised an analysis through narratives, where authors synthesized current knowledge about their subject area by integrating personal insights alongside evaluations derived from previous scholarly works.

Definition of MSME

MSMEs (Micro, Small, and Medium Enterprises) are businesses with specific characteristics in a country's economy. The definition of MSMEs may vary from country to country. Still, in general, MSMEs can be identified based on specific criteria, including the business scale, the number of employees, and the revenue generated.

Theoretically, MSMEs are categorized based on asset size, total sales, and number of employees. Based on the World Bank's definition, MSMEs can be categorized by asset size, with the micro category having assets less than or equal to a certain amount. In contrast, small businesses have assets between a certain amount and a higher amount. Medium-sized enterprises have more significant assets than small enterprises but are still below the scale of large enterprises.

In addition, MSMEs are also characterized by the criteria of the number of employees. In categorizing MSMEs based on the number of employees, micro enterprises have a limited number of employees, usually less than ten people. Small enterprises have between 10 and 50 employees, while medium-sized enterprises can have a more significant number of employees

but still need to reach the number at the large enterprise scale.

Revenue generated is also a determining factor in the categorization of MSMEs. MSMEs generally have lower income levels than large-scale enterprises. MSME revenues may vary depending on the business sector and other factors such as geographic region, target market, and level of competition.

MSMEs play an essential role in a country's economy. In Indonesia, for example, MSMEs are the backbone of the economy, with significant contributions to creating jobs, strengthening economic competitiveness, and reducing socioeconomic disparities. The growth and sustainability of MSMEs are directed through various policy schemes, supporting access to capital and financing and providing training and mentoring for MSME entrepreneurs.

MSMEs need to adapt to technological change and innovation in the current digital era. Using information technology, e-commerce, and other digital capabilities opens up new opportunities. It enables MSMEs to expand their markets, improve efficiency and productivity, and enhance their competitiveness at the national and global levels.

In this regard, continuous encouragement for the development of MSMEs is essential in terms of government regulations and policies, entrepreneurship education, access to markets, business mentoring, and the development of an ecosystem conducive to the sustainable growth of the MSME sector.

Hypothesis Development

1. Innovation and Market Transformation

Innovations are an essential part of transforming markets through providing opportunities for companies to create and sell additional products or services, or introduce new ways to do business, thereby affecting competitive dynamics and changing how consumers behave. In the case of Micro, Small and Medium Enterprises (MSMEs), innovation is a major factor in overcoming limitations of available resources by increasing operational efficiency; enhancing differentiation of their offerings; and allowing for entry into different markets. Trade entrepreneurship is characterized by the identification of opportunity and market-based business activities that are largely dependent on the use of innovative practices to generate value and maintain a competitive advantage.

Based upon the innovation theory and entrepreneurship literature, firms that consistently invest in new ideas are more likely able to disrupt current structures of traditional markets and take advantage of new market opportunities. For MSMEs, innovation can take many forms: technological; business model; marketing; or process. All of these types of innovation have a lasting impact on how MSMEs engage in trade and respond to changes in their respective marketplaces.

2. Innovation and Trade Entrepreneurship

Entrepreneurs who engage in trade entrepreneurship (or any type of entrepreneurial activity based on trade, whether international or domestic) benefit from innovations in their ability to: Find new trade opportunities; develop unique value propositions; create efficiency

improvements in their supply chains.

On the other hand, innovative micro, small and medium-sized enterprises (MSME's) will also have greater capabilities of adapting to the requirements of international markets and trade such as; quality standards, digital trade platforms and rapidly changing consumer preferences. In addition to this, by implementing innovative practices, MSMEs can more easily adopt new technologies (including the use of e-commerce platforms and use of advanced logistics systems) that are required to conduct international trade.

Therefore, not only are innovative MSMEs in a better position to enter into international trade, but they are also in a better position to expand their current levels of trade.

3. Trade Entrepreneurship and MSME Market Performance

Trade entrepreneurship helps to develop and grow the performance of MSMEs by providing access to new, expanded markets that provide a diverse revenue stream in addition to competitive advantage. Trade entrepreneurs enable MSMEs to access broader markets thus providing the means to reduce their dependence on their local market and to mitigate the expected risks due to fluctuations in the marketplace.

In creating relationships with suppliers, distributors, and international partners, trade entrepreneurs create networks that increase the reach and scalability of the business. Therefore, trade entrepreneurship is expected to contribute to the overall market success of MSMEs.

4. Innovation as a Driver of MSME Competitiveness

Competitive advantage in today's global market is being driven by how creative a company can be with its market offerings. Firms that continuously create new product types and/or business processes are able to establish themselves as different than competitors and respond to changes in consumer demand more effectively than if they just copied traditional business models and did the same as everyone else.

Innovation can also lead to improvements in the cost structure and efficiency of MSMEs resulting in improvements to their ability to compete not only inside their home countries but outside of their home market as well.

5. Mediating Role of Trade Entrepreneurship

To turn innovative ideas into tangible benefits for consumers, businesses must commercialise product innovations successfully via an entrepreneurial pathway. Trade entrepreneurship provides a way to convert innovative ideas into additional commercial market opportunities.

Trade entrepreneurs utilise innovation to create new products, access new markets, and create strategic alliances. Therefore, it can be said that trade entrepreneurship plays a mediating role between innovation and the market transformation of MSMEs.

Challenges Faced by MSMEs in Transforming Markets through Innovation and Trade Entrepreneurship

MSMEs (Micro, Small and Medium Enterprises) contribute significantly to the

economy, job creation and trade growth. While MSMEs hold significant promise in terms of market innovation and entrepreneurship for trade, they face many challenges including structural, financial and operational obstacles. These issues can restrict the ability of MSMEs to implement innovative practices, enter new markets and remain competitive over the long term. In this next section, we will highlight some of the major issues that MSMEs have experienced in their efforts to use innovation for trade entrepreneurship and transform the market place.

1. Limited Access to Finance

Limited access to financial resources is one of the most pressing issues that MSMEs face today. Innovation activities (which involve investment) such as R&D, technology adoption, product design and market development will be very hard to fund. Financial institutions are not typically willing to lend to MSMEs because of lack of collateral, lack of credit history, or perceived high-risk status.

Consequently, many MSMEs resort to personal savings or informal lending, which restricts their ability to finance innovation and entrepreneurial trade activities. Insufficient financial resources also limit their ability to grow their business and compete against larger companies in both national and international markets.

2. Technological Constraints

Innovation-focused economic expansion is reliant on technological capability. High capital investment, insufficient employee skill set to purchase new systems/technologies and insufficient digital infrastructure has left several micro/small/medium-sized enterprises (MSMEs) at a competitive disadvantage when trying to adopt new/advanced technological means of production, such as automated production technologies, digital platforms and/or digital automation tools. Without these tools, MSMEs will continue to struggle to maximize productivity, offer higher-quality products and meet once only global standards for their job production. Furthermore, many entrepreneurs and employees lack basic digital literacy skills to fully utilize e-commerce platform and/or digital trade tools which restricts their ability to grow their businesses into new markets.

3. Lack of Skilled Human Resources

The success of trade entrepreneurship and innovation depends on skilled labour, management prowess and strategic decision-making. Unfortunately, many MSMEs face acute shortages of skilled workers and qualified personnel. With little or no financial resources available to them, they are unable to attract or retain highly-skilled employees.

This gap in skills has an impact on several areas of operation including product development, marketing, technology, and international trade practices, thereby limiting the ability of MSMEs to successfully implement innovative solutions and compete in fast-changing markets.

4. Limited Market Access and Market Information

In order to be successful in trade entrepreneurship, having reliable access to good

information about your market and connecting to international networks is extremely important. However, many micro, small, and medium-sized enterprises (MSMEs) experience difficulties when it comes to identifying new opportunities within their respective markets, understanding what consumers want, and figuring out how to comply with foreign regulations for doing business.

Furthermore, MSMEs typically do not have strong relationships with distributors and suppliers or buyers located in other countries. This lack of access to global markets significantly reduces MSMEs' abilities to grow beyond their immediate communities and maximize the benefits associated with being involved in international trade.

5. Regulatory and Institutional Barriers

For MSMEs, complex regulations, bureaucracy and compliance act as large barriers. Entrepreneurs experience difficulty acquiring licenses, addressing tax obligations and complying with import and export laws.

Additionally, inconsistent regulatory policies, along with little institutional support generally lead MSMEs to refrain from innovation and international trade. These types of entries contribute to increased operational costs and decreased competitiveness.

6. Inadequate Innovation Ecosystem

An innovation ecosystem should contain research facilities, tech hubs i.e. governments, like incubators and angel groups, etc., and networks to assist their success. Unfortunately, many MSME's find themselves without the support of these types of organizations due to lack of connection between universities and other organizations providing technology, etc.

MSME's depend heavily on understanding how to develop new products, improve current products, and build on existing business models depending upon the level of collaboration they experience with research institutions and other technology providers. Therefore, lacking a good innovation ecosystem will make it difficult for MSME's to achieve their goals of creating new products and improving their current business model.

7. Supply Chain and Infrastructure Constraints

For trade-oriented enterprises, it is of utmost importance for them to operate within an efficient supply chain as well as have access to sufficient infrastructure.

The small-medium Enterprises (SMEs) often encounter many challenges when dealing with transportation logistics truck; therefore, they are liable to delays, increased costs, and less reliability regarding their trading.

8. Intense Market Competition

Small and Medium Enterprises (SMEs) compete against large enterprises; however, they will be up against significant competition given that large enterprises have substantial financial resources, technological advantages, and brand recognition. This creates a unique challenge for SMEs to retain their market share and continue to be profitable.

While innovation will help an SME achieve a competitive edge, the lack of resources

limits an SME's ability to continue investing in new product, process and market innovation.

Impact of MSME Transformation on Growth and Sustainability in India

The transformation of Micro, Small and Medium Enterprises (MSMEs) has important implications for India's economic development and sustainability. MSMEs create jobs, produce industrial products, generate exports, and help to grow the Indian economy by being a key component of it. With government efforts like the Udyam Registration Portal allowing for greater transparency and access to additional government assistance, more enterprises are entering the formal economy. With modern technologies and improved management practices being implemented by MSMEs, productivity and efficiency of MSMEs have improved resulting in additional economic output and contributing to economic growth nationally.

Transformation of MSMEs creates large scale Employment Opportunities. MSMEs are Labour intensive & provide millions of Employment Opportunities to Millions of people (particularly Rural & Semi urban) who work in MSMEs. The Pradhan Mantri Kaushal Vikas Yojana Skill Development initiative provides workers with technical & digital skills needed in today's Industries. As MSME's grow & modernise they create new jobs, reduce unemployment & contribute to Regional Development across India through Inclusive & Balanced methods.

The transformation of MSMEs enhances their financial stability and access to credit. The Trade Receivables Discounting System and other digital financial services provide MSMEs with a means of receiving prompt payment and a positive cash flow. Financial assistance programs such as the Credit Guarantee Fund Trust for Micro and Small Enterprises provide banks with more security when lending to small firms, leading to additional loan financing. Improved access to finance allows MSMEs to invest in growth, technology improvement, and innovation.

MSME transformation creates another significant effect: enhanced market access and global competitiveness for MSMEs. Digitized government procurement through the Government's e-Marketplace has increased MSME participation in government contracting, and, therefore, improved their access to new customers. Additionally, export promotion programs, which will be administered by Export Promotion Councils, enable MSMEs to join global supply chains and be more competitive as they expand into international markets. This ultimately generates more foreign exchange and strengthens the current export sector.

In conclusion, the transformation of MSMEs will support both environmental sustainability and economic stability. Through the use of more energy-efficient solutions, along with cleaner production approaches, MSMEs can help to reduce waste, conserve natural resources and lessen their impact on the environment. Government initiatives such as the Micro and Small Enterprises Cluster Development Programme encourage the development and application of modern technology and implementation of sustainable manufacturing processes as well as expanding the use of shared infrastructure, therefore, the transformation of MSMEs is essential to achieving both economic development, as well as environmentally-

friendly and responsible industrial development in India.

Strategy and Implementation Steps for MSME Transformation in India

The transformation of MSME (micro, small and medium enterprises) in India aims at the improvement of productivity, competitiveness, adoption of digital technologies, access to finance and integration into the global marketplace. A pragmatic approach would include a combination of policy support, technology adoption, financial access and ecosystem development.

1. Digital Transformation of MSMEs Strategy

Enable MSMEs to adopt **digital tools, automation, and Industry 4.0 technologies** to improve efficiency and market reach.

Implementation Steps

- Promote **digital platforms for business operations** (ERP, CRM, e-commerce).
- Expand use of government platforms like **Udyam Registration Portal** for formalization.
- Encourage MSMEs to sell through marketplaces such as **Government e-Marketplace (GeM)**.
- Provide **subsidies for digital tools and cloud adoption**.
- Launch **digital literacy and cybersecurity training** for MSME owners.

2. Improving Access to Finance Strategy

Increase availability of **affordable credit and financial inclusion** for MSMEs.

Implementation Steps

- Expand credit guarantee schemes like **Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE)**.
- Strengthen digital lending through **Udyam Assist Platform**.
- Promote fintech lending platforms using GST and transaction data.
- Encourage venture capital and private equity participation in MSMEs.
- Improve invoice financing using **Trade Receivables Discounting System (TReDS)**.

3. Technology Upgradation and Innovation Strategy

Promote modernization of manufacturing and encourage innovation.

Implementation Steps

- Expand the **Credit Linked Capital Subsidy Scheme (CLCSS)** for technology adoption.
- Establish **common facility centers and technology hubs** in industrial clusters.
- Encourage collaboration with **research institutes and startups**.
- Promote adoption of **AI, IoT, robotics, and advanced manufacturing** in MSMEs.
- Provide tax incentives for **R&D investment**.

4. Skill Development and Workforce Upgradation Strategy

Improve workforce skills to match evolving technology and industry requirements.

Implementation Steps

- Expand skill training under **Pradhan Mantri Kaushal Vikas Yojana**.
- Launch specialized programs for **digital manufacturing and automation**.
- Promote **apprenticeships and industry-institute partnerships**.
- Create **entrepreneurship training programs** for MSME founders.

5. Market Access and Export Promotion Strategy

Help MSMEs access **domestic and international markets**.

Implementation Steps

- Promote MSME participation in **global value chains**.
- Provide export support through **Export Promotion Councils**.
- Expand the **Market Access Initiative Scheme**.
- Encourage use of digital export platforms and cross-border e-commerce.
- Provide branding and marketing assistance.

6. Infrastructure and Cluster Development Strategy

Develop **industrial clusters and shared infrastructure** to reduce costs.

Implementation Steps

- Expand **MSME industrial clusters and plug-and-play facilities**.
- Improve logistics and supply chain infrastructure.
- Implement cluster development programs like **Micro and Small Enterprises Cluster Development Programme (MSE-CDP)**.
- Establish **sector-specific parks** (textiles, electronics, food processing).

7. Ease of Doing Business and Regulatory Reforms Strategy

Simplify regulatory compliance and improve the business environment.

Implementation Steps

- Simplify tax compliance through **Goods and Services Tax Network**.
- Reduce licensing and inspection requirements through **single-window systems**.
- Promote faster dispute resolution mechanisms.
- Implement **paperless compliance systems**.

Policy Implications and Recommendations to Support MSME Transformation in India

India's Micro, Small and Medium Enterprises (MSMEs) need a robust policy framework to tackle critical structural issues like finance accessibility, low productivity levels, and low levels of formalisation. A critical policy focus for MSMEs is to improve the availability of credit as many enterprises are not able to access finance because of poor collateral or lack of adequate financial statements. Strengthening financial support mechanisms such as the Credit Guarantee Fund Trust for Micro and Small Enterprises will reduce the risk of lending and incentivise banks to lend money to small businesses. Additionally, by expanding digital financing and invoice discounting services via the Trade Receivables Discounting System (TReDS), MSME businesses can improve their cash flow and working capital.

Another major policy implication is to promote digitalization and formalisation of the MSME sector. A significant number of small businesses still exist in the informal economy, using traditional methods of doing business which restrict their potential for growth and their ability to obtain institutional support. Encouraging MSMEs to register on the Udyam Registration Portal will assist in moving them into the formal economy and allow them access to government programs and financial assistance. Providing MSMEs access to government procurement through digital platforms like the Government e-Marketplace will provide them with additional market opportunities and increase transparency of business transactions.

Upgrading and innovating technology are also extremely important policy areas for MSMEs to be transformed. In the case of India, there are still many MSMEs that are using old machines, and low (or no) investment in automation, therefore their productivity and ability to compete is very limited. Governments should continue the development of programs to expand on current programs (for example, the Credit Linked Capital Subsidy Scheme) to incentivise MSMEs to purchase new machines and improved technology. There should also be an establishment of technology centres, innovation hubs and common facilities in industrial clusters for MSMEs to gain access to new and innovative manufacturing processes, as well as improve product quality.

Skill Development as well as enhancing the Human Capital in the Micro Small and Medium Enterprises (MSMEs) are both essential components to strengthening the MSME sector. A large portion of the workforce within the sector do not have adequate Technical Skills to operate modern Machinery or adapt to Digital Technology. Increasing Training and Capacity Building efforts that support the rollout of programs such as the Pradhan Mantri Kaushal Vikas Yojana will positively impact the Workforce's Output and create an environment conducive to Entrepreneurs. Furthermore, cooperation between educational institutions, training centres and industry will provide a mechanism to align Skill Development with the requirements of the MSME sector.

To encourage the expansion of micro, small and medium enterprises (MSMEs), it is critical that policymakers pursue two key areas of improvement: (i) improving market access; and (ii) simplifying regulatory compliance. Export promotional programs, implemented through organisations such as the Export Promotion Councils and Market Access Initiatives, will support MSMEs in expanding globally, thereby increasing their competitiveness in the export market. Beyond export initiatives, regulatory simplification (via digital regulatory regimes such as GSTN) and cluster development initiatives (via the Micro and Small Enterprises Cluster Development Programme) will lower operational barriers and develop an ecosystem that supports the transformation of MSMEs within India.

conclusion

Innovation is key to transforming markets, increasing trade entrepreneurship, and supporting the growth of micro, small and medium enterprises (MSMEs). MSMEs can become more productive, create new goods and services, adopt digital technologies, and enter

new markets all by using innovation as a driver for enhancing their competitiveness in both domestic and international trade. Entrepreneurs can use digital platforms, modern manufacturing processes, and innovative business models to break down barriers to trade such as limited resources, lack of access to markets and inefficient operations. Supportive policies, enhanced access to finance, skills development and the adoption of technology are key components in accelerating this transformation of MSMEs to play a greater role in creating jobs, increasing exports and fostering inclusive economic growth. Therefore, developing innovation in trade entrepreneurship and MSMEs will be critical for creating resilient markets, driving sustainable economic growth and increasing the overall competitiveness of the economy.

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STRATEGIC ROLE OF GREEN HRM IN ORGANISATIONAL PERFORMANCE AND TALENT RETENTION

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Abstract

All organizations are increasingly influenced by environmental factors, which play a crucial role in achieving sustainable developments. In recent years, Green Human Resource Management emerged as a vital approach that integrates environmental policies, rules and regulations into human resource practices. Human resources represent one of the most important assets of an organization, as organizational goals cannot be achieved without effective workforce management. Aligning environmental considerations with core HR functions-such as recruitment, selection and training which provides multiple benefits including enhanced organizational sustainability, improved corporate image, regulatory compliance and increased attractiveness to environmentally conscious customers. Therefore, Green HRM contributes significantly to promoting environmental responsibility while supporting long term organizational success.

This paper examines how Green HRM practices contribute in achieving organizational goals, enhancing talent retention and securing first mover advantage. My present paper is purely based on secondary data, drawing from existing research papers and articles.

Keywords; *Green Human resource Management, sustainable development, HR functions, Talent retention, First mover advantage.*

Introduction

In today's growing business environment, organizations are focusing not only on profit but also on demonstrating their commitment to environmental sustainability and social responsibility. Rapid industrialization, environmental degradation, and climate change have forced companies to adopt green-oriented strategies. In this context, the concept of Green Human Resource Management (Green HRM) has emerged as an important managerial and strategic approach for organizations. This approach helps align human resource practices with environmental sustainability. Nowadays, many organizations operate under the concept of "go green" to enhance their competitive advantage and ensure long-term sustainability. Green HRM is not only an environmental initiative but also a strategic tool through which organizations can gain competitive advantages and sustain themselves in the market for a longer period. By training employees about environmental goals and responsibilities, organizations can increase awareness and encourage eco-friendly behavior at the workplace.

In addition, talent retention has become a major challenge for today's competitive organizations because employees play a very important role in achieving organizational goals. Without employees, organizations cannot accomplish their objectives. Therefore, Green HRM focuses on educating and motivating employees regarding ecological importance, which leads

to higher job satisfaction and stronger employee commitment. As a result, Green HRM can reduce employee turnover and help organizations retain talented employees.

Literature Review

Renwick, Redman, and Maguire (2013), who emphasized that HR departments play a crucial role in promoting environmental management through various HR practices such as green recruitment, training, performance appraisal, and reward systems. According to the authors, organizations can encourage environmentally responsible behavior among employees by incorporating sustainability objectives into HR policies. Their study highlighted that Green HRM practices not only improve environmental performance but also enhance employee commitment and organizational effectiveness.

Jabbour and Santos (2008) examined the role of human resource management in supporting environmental management systems within organizations. The study found that effective HR practices such as environmental training, employee participation, and performance evaluation significantly contribute to the successful implementation of environmental strategies. The researchers argued that employees are key drivers of environmental initiatives, and organizations that integrate environmental values into HR practices can achieve better sustainability outcomes.

Dumont, Shen, and Deng (2017) investigated the relationship between Green HRM practices and employee workplace behavior. Their research indicated that Green HRM practices positively influence employees' voluntary environmental behavior and organizational citizenship behavior. The study concluded that organizations implementing green HR initiatives are more likely to develop a culture of environmental responsibility, which ultimately contributes to improved organizational performance.

Longoni, Golini, and Cagliano (2018) found that organizations adopting Green HRM practices experience improvements in operational efficiency, innovation, and environmental performance. Their study suggested that environmentally oriented HR practices help organizations achieve sustainable competitive advantage by improving resource utilization and promoting environmentally responsible employee behavior.

Mamta Arora (2020) examined the implementation of Green HRM practices in Indian organizations and emphasized that modern businesses must focus not only on economic growth but also on environmental sustainability. The study highlighted that Green HRM practices such as environmental training, green recruitment, and eco-friendly workplace initiatives help organizations reduce their ecological footprint while improving overall organizational performance.

Kanwar Pravir Singh and Krishna Nath Pandey (2020) examined the impact of Green HRM practices on employee engagement in Indian organizations. Their findings indicated that environmentally oriented HR practices positively influence employee motivation and engagement, which ultimately improves organizational performance. The study suggested that organizations that integrate environmental values into HR policies can create a sustainable

work culture and strengthen employee commitment.

Rishita Mohanty, Jayashree Jethy, and Sweeta Agrawal (2025) investigated awareness and adoption of Green HRM practices among employees in India. The study found that employees are increasingly aware of green initiatives such as energy conservation, waste reduction, and environmentally friendly workplace policies. The researchers concluded that the successful implementation of Green HRM practices depends largely on employee awareness and participation.

Vartika Singh, Gaura Chauhan, and Enid Masih (2025) emphasized that Green HRM has become a crucial requirement for organizations in the twenty-first century. Their research highlighted that increasing industrialization and environmental challenges have forced organizations to adopt sustainable HR practices that promote environmental responsibility and organizational sustainability

Objectives

1. To understand the concept and key practices of Green HRM in organizations.
2. To analyze the impact of Green HRM practices on organisational performance.
3. To evaluate the relationship between Green HRM and employee retention.
4. To assess the role of Green HRM in attracting and retaining talented employees.

Research Methodology

This present conceptual paper is based on secondary data collected from various academic and professional sources. The research follows a conceptual and descriptive approach to analyse the relationship between Green HRM, organisational performance, and talent retention.

Secondary data analysis enables the researcher to review existing literature and theoretical concepts related to Green HRM and sustainable development. By analyzing previous studies, the research aims to understand how Green HRM practices contribute to environmental sustainability, employee retention and overall development of the organization.

Meaning of Green HRM

Green Human Resource Management can be understood as the process of integrating environmental management into human resource policies and practices. It involves designing HR strategies that encourage employees to adopt environmentally responsible behaviors and contribute to the achievement of organizational sustainability goals..

Green HRM also focuses on creating an organizational culture that values environmental responsibility. By incorporating sustainability into HR policies, organizations can encourage employees to reduce waste, conserve energy, minimize environmental impact, and support green innovations. Thus, Green HRM plays a strategic role in linking human resource management with environmental sustainability and organizational performance

Definitions of Green Human Resource Management

1. Definition by Sanjay Kumar Mandip (2012)

According to Mandip (2012), Green Human Resource Management refers to the use of human

resource management policies and practices to promote the sustainable use of resources within business organizations and to encourage employees to support environmental sustainability initiatives.

This definition highlights that Green HRM promotes the efficient utilization of organizational resources while motivating employees to support environmental sustainability initiatives.

2. Definition by Deepak Arora and Upasna Sharma (2016)

Arora and Sharma defines Green HRM as the integration of environmental management into human resource practices such as recruitment, training, performance appraisal, and compensation to create environmentally responsible employees and organizations.

This definition throws lights on linking human resources functions of the organization with green initiative and creating awareness about green environment to employees and making employees responsible to create and understand green environment of the organization.

3. Definition by A. A. Opatha and Anton Arulrajah (2014)

Opatha and Arulrajah describe Green HRM as the set of HRM policies, practices, and systems that make employees of an organization green for the benefit of individuals, society, the natural environment, and the business.

This definitions explains that Green Human Resource Management (GHRM) is a set of human resource policies and practices designed to support environmental sustainability within organizations. These practices encourage employees to adopt environmentally responsible behaviour while simultaneously addressing employee needs and expectations. At the same time, Green HRM enables organizations to fulfil their social and environmental responsibilities by protecting natural resources and promoting sustainable business operations.

Green HRM Practices

Green Human Resource Management practices refer to HR policies and procedures that encourage employees to adopt environmentally responsible behavior and support organizational sustainability goals. These practices integrate environmental management into human resource functions and help organizations reduce their ecological footprint while improving efficiency and corporate reputation.

The major Green HRM practices include the following:

1. Green Recruitment and Selection

- Organizations attract candidates who value for environmental issues.
- Job descriptions include detailed role and duties aligned with environmental environment.
- Recruitment advertisements highlight the company's GO GREEN concept and commitment towards environmental values.
- Organizations select candidates through online interview rather than offline interview to reduce the use of paper and encouraging green initiative.

2. Green Training and Development

- Employees are provided training on the concept of environmental management practices and sustainability policies.
- Training programs provided by the organization focus on energy conservation, waste reduction, and sustainable resource usage.
- Organisations are conducting workshops and seminars to create awareness among the employees regarding environmental issues.
- Organizations provide skill development programs for implementing green technologies.
- Continuous learning programs helps the employees to adopt go green concept in their work.

3. Green Performance Management

- Environmental objectives are incorporated into employee performance appraisal systems.
- Employees are evaluated based on their contribution to environmental goals.
- Key performance indicators include energy saving, waste reduction, and sustainable practices.
- Feedback systems encourage employees to improve environmental performance and motivates them to put their efforts for environmental protection.
- Managers monitor employee participation by keeping in mind the green initiatives.

4. Green Compensation and Rewards

- Organizations provide incentives for employees who actively support environmental initiatives.
- Monetary and non-monetary rewards are offered for green innovations and eco-friendly ideas.
- Recognition programs highlight employees who contribute to sustainability goals.
- Green bonuses motivate employees to participate in environmental management activities.
- Reward systems encourage continuous environmental improvement.

5. Green Employee Involvement and Participation

- Employees are encouraged to participate in environmental decision-making.
- Organizations create green teams or committees to promote sustainability initiatives.
- Employees are invited to suggest eco-friendly solutions and innovations.
- Participation programs increase environmental awareness and organizational commitment.
- Collaborative activities strengthen the sustainability culture within the organization.

6. Green Workplace Practices

- Organizations promote paperless offices and digital documentation.

- Energy-efficient equipment and technologies are adopted to reduce energy consumption.
- Recycling programs and waste management systems are implemented.
- Employees are encouraged to follow environmentally responsible workplace behaviors.
- Sustainable workplace design improves environmental performance.

7. Green Employee Relations

- Organizations promote a culture of environmental responsibility among employees.
- Open communication encourages employees to share ideas for environmental improvement.
- Environmental awareness campaigns are conducted regularly.
- Strong employee relations support long-term sustainability initiatives.

Theories of Green HRM

1. Resource-Based View (RBV) Theory

Human resources are the internal and most useful resources of the organization. This theory explains that the organizations can achieve strategic and competitive advantage by proper utilizing the human resources and to achieve sustainable competitive advantage by effectively utilizing their internal resources. Human resources are considered one of the most valuable strategic resources of an organization.

In the context of Green HRM, organizations develop environmentally responsible employees through green recruitment, training, and performance management practices. These green skills, knowledge, and competencies become valuable organizational resources that competitors cannot easily imitate. As a result, Green HRM practices help organizations improve environmental performance and gain a sustainable competitive advantage.

2. Stakeholder Theory

Stakeholder theory emphasizes that organizations must consider the interests of all stakeholders such as employees, customers, government, society, and environmental groups. Organizations are expected to operate in a socially responsible and environmentally sustainable manner.

Green HRM supports stakeholder expectations by promoting environmentally responsible employee behavior and sustainable workplace practices. By implementing green HR policies, organizations demonstrate their commitment to environmental protection and social responsibility, which improves corporate reputation and stakeholder trust.

3. Institutional Theory

Institutional theory suggests that organizations adopt certain practices due to external pressures such as government regulations, social expectations, and industry norms.

In the context of Green HRM, organizations implement green HR practices to comply with environmental laws and regulations, meet societal expectations, and maintain legitimacy in the market. Environmental policies, sustainability reporting, and corporate environmental

responsibility often influence organizations to adopt Green HRM initiatives.

4. Ability–Motivation–Opportunity (AMO) Theory

The AMO theory explains that employee performance depends on three factors: **ability, motivation, and opportunity**.

Green HRM practices contribute to these factors in the following ways:

- **Ability** – Green training programs develop employees' environmental knowledge and skills.
- **Motivation** – Green rewards and incentives motivate employees to participate in environmental initiatives.
- **Opportunity** – Employee involvement programs provide opportunities for employees to contribute to sustainability activities.

Through these mechanisms, Green HRM encourages employees to actively participate in environmental management and sustainability initiatives.

5. Social Identity Theory

Social Identity Theory explains that employees develop a sense of identity and pride when they are associated with organizations that have positive values and social responsibility.

Organizations that adopt Green HRM practices often build a strong reputation for environmental responsibility. Employees feel proud to be associated with such organizations, which increases their commitment, job satisfaction, and loyalty. As a result, Green HRM practices can improve employee engagement and talent retention.

6. Sustainable Development Theory

Sustainable development theory focuses on meeting present needs without compromising the ability of future generations to meet their own needs.

Green HRM contributes to sustainable development by encouraging organizations to adopt environmentally responsible policies and practices. Through employee awareness, training, and participation, organizations can reduce environmental impact and promote sustainable business operations.

Green HRM and Organisational Performance

Green HRM refers to the application of environmental friendly practices in day to day operations of the organization. It mainly focuses on creating awareness among the employees regarding Go green and carbon free footprints concepts.

Employees performance are measured on the basis of their achieving goals relating to environmental factors. It also aims to reduce environmental impact by promoting practices such as energy conservation, waste reduction, recycling and sustainable use of resources within the workplace.

There is a direct relationship between green HRM and organizational performance. Now a days all the organizations shifting their concerns from profit motive to green initiative and they adopt green initiative in their day to day operations by encouraging and motivating

employees. As a result organizational overall performance improved.

Green HRM contributes to organizational performance in several ways. First it improves resource efficiency, which reduces operational costs related to energy, paper and other materials. Second, it enhances the corporate image and reputation of the organization, as customers and stakeholders prefer environmentally responsible companies. Third, it increases employee motivation and engagement, as employees feel proud to work for organizations that care about environmental protection.

Furthermore, organizations that adopt Green HRM practices often achieve sustainable competitive advantage. Employees become more committed to organizational goals, and the organization gains recognition for its environmentally responsible behavior. This not only improves productivity but also strengthens long-term business sustainability.

Green HRM highlights the strategic role of human resource practices in promoting environmental sustainability while simultaneously improving organizational performance. By aligning HR policies with environmental goals, organizations can achieve both economic success and ecological responsibility.

Impact of Green HRM on Organizational Performance

1. Environmental Sustainability

- Promotes energy conservation, waste reduction, and eco-friendly workplace practices.
- Helps organizations meet regulatory requirements and sustainability certifications.

Result: Improved compliance and reduced environmental footprint.

2. Employee Performance & Engagement

- Training employees in green practices increases awareness and motivation.
- Employees feel more connected to organizational values, boosting job satisfaction.

Result: Higher productivity and lower turnover.

3. Financial Performance

- Cost savings from reduced energy consumption and efficient resource use.
- Long-term profitability through sustainable operations.

Result: Better return on investment and competitive advantage.

4. Corporate Image & Reputation

- Enhances brand value by demonstrating commitment to Corporate Social Responsibility (CSR).
- Attracts environmentally conscious customers and investors.

Result: Stronger market position and stakeholder trust.

- Despite these, long-term benefits outweigh short-term challenges

Green HRM and Employee Retention

In recent years, organizations across the globe have recognized the importance of sustainability as a strategic priority, not only to comply with environmental regulations but also to strengthen their competitive advantage. Within this context, Green Human Resource Management (GHRM) has emerged as a vital approach that integrates environmental

management into HR practices. GHRM encompasses recruitment, training, performance appraisal, and reward systems that encourage eco-friendly behavior among employees. While much of the literature emphasizes its impact on organizational performance and environmental outcomes, an equally important dimension is its influence on employee retention. Retaining talented employees is a critical challenge for modern organizations, and GHRM provides a unique pathway to enhance loyalty, satisfaction, and long-term commitment. By embedding sustainability into HR policies, organizations create a sense of purpose that resonates with employees, particularly younger generations who value environmental responsibility.

Employee retention is closely tied to how individuals perceive the values and culture of their workplace. GHRM practices such as green recruitment signal to potential employees that the organization is committed to sustainability, which attracts candidates who share similar values. Once hired, green training programs equip employees with knowledge and skills to contribute to eco-friendly initiatives, fostering a sense of empowerment and belonging. Performance appraisal systems that recognize contributions to sustainability further reinforce the importance of green behavior, while reward mechanisms—such as bonuses for energy-saving ideas or recognition for waste-reduction efforts—strengthen motivation. These practices collectively build a culture of environmental stewardship, which enhances employees' emotional attachment to the organization. When employees feel that their personal values align with organizational values, they are more likely to remain loyal, reducing turnover rates. Thus, GHRM not only supports environmental goals but also nurtures a workforce that is engaged and committed.

The psychological contract between employer and employee plays a crucial role in retention. Employees expect organizations to provide meaningful work, fair treatment, and opportunities for growth. GHRM contributes to fulfilling this contract by offering employees a chance to participate in sustainability initiatives that go beyond traditional job roles. For example, when employees are involved in green projects such as energy conservation campaigns or community environmental programs, they perceive their work as socially significant. This sense of purpose enhances job satisfaction and reduces the likelihood of seeking employment elsewhere. Moreover, organizations that adopt GHRM often cultivate a positive reputation in the market, which instills pride among employees. Working for a company known for its environmental responsibility strengthens employees' identity and loyalty. Studies have shown that employees are more likely to stay with organizations that demonstrate corporate social responsibility, and GHRM is a concrete manifestation of such responsibility. Therefore, the psychological bond created through green practices directly contributes to retention outcome

Conclusion

The exploration of the Strategic Role of Green Human Resource Management (GHRM) in Organisational Performance and Talent Retention underscores the increasing relevance of

sustainability in modern HR practices. In today's competitive environment, organizations are judged not only by their financial outcomes but also by their environmental and social contributions. GHRM has therefore evolved into a strategic framework that integrates ecological responsibility into HR functions, positioning sustainability as a driver of long-term success.

The study reveals that GHRM significantly strengthens organisational performance. Practices such as environmentally conscious recruitment, sustainability-focused training, performance evaluations tied to ecological goals, and employee participation in green initiatives collectively enhance efficiency and resource optimization. These measures reduce waste, cut operational costs, and encourage innovation. Employees who are trained and rewarded for eco-friendly contributions become more aware of their role in achieving sustainability objectives, which translates into higher productivity and improved organisational effectiveness.

In summary, Green HRM emerges as a strategic instrument that simultaneously enhances organisational performance and talent retention. It creates a mutually beneficial scenario where organisations achieve efficiency and competitiveness, employees gain satisfaction and purpose, and society benefits from sustainable practices. As environmental concerns intensify globally, the role of GHRM will only grow in importance, making it a cornerstone of modern HR strategy.

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A CONCEPTUAL STUDY ON ESG INVESTMENT AND PORTFOLIO MANAGEMENT

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Abstract

Environmental, Social and Governance practices are very important in today's world. Companies are supposed to make money. They should also do business in a way that is ethical and responsible. When companies follow Environmental, Social and Governance principles they can keep a reputation be sustainable in the long run and gain the trust of investors and society. Environmental, Social and Governance practices make sure that companies do not hurt the environment and control pollution. Being means treating employees with respect protecting their rights and contributing to society in a positive way. Companies that do not care about sustainability face risks from the government. They need to link ESG with their performance. Over the years the global finance system has come to realize how important it is to invest in a way. Investors from around the world are now considering Environmental, Social and Governance factors when making decisions. The main goal of this study is to understand why Environmental, Social and Governance practices are important. It also wants to see how ESG affects how well a portfolio performs. The study looks at the role of Environmental, Social and Governance in making sure development is sustainable. This study is based on ideas. Uses secondary resources like research articles, reports and guidelines from the government. The study found that Environmental, Social and Governance practices help promote investment and long-term growth for companies. Companies that follow Environmental, Social and Governance principles are more likely to be stable have investor confidence manage risks well and develop in a way that succeeds in the business world. Environmental, Social and Governance practices are key to all this. By following Environmental, Social and Governance principles companies can ensure that they are doing business in a way that's good, for everyone, including the environment, employees and society.

Keywords: ESG Practices, Portfolio performance, Sustainable development, corporate governance, Responsible investment.

INTRODUCTION

In the business world today many companies focus on making the profit as their main goal. However people have started to realize that profit is not the thing that matters for a company to be successful in the long run. Companies are expected to do the thing, not just for themselves but also for the world around them. Inside the company this means having a management system being fair and honest and making sure everyone knows what they are responsible for. Outside the company it means taking care of the environment and helping people in need.

To really be successful companies need to balance making money with doing what is right. People who have a stake in the company like owners and employees are expected to act in an ethical way. This means considering the impact of their actions on the environment, society and how the company is run. So companies are starting to think about how their actions affect the environment, people and how they are managed.

There are rules to help measure how well companies are doing these things. Investors should think about more than money when they decide where to put their money. They should consider things like protecting the climate stopping pollution using resources wisely and making sure people are treated fairly. Companies should also be transparent have leaders and follow the rules. In the few years investors have started to care more about these things when they make decisions. As a result thinking about the environment, society and governance has become a part of making good investment choices and having a successful business.

Companies like to call this way of thinking Environmental Social Governance or ESG for short. It is a way to make sure companies are responsible and do the thing. ESG is important for companies that want to be, for a long time and have a good reputation. It helps them make money while also taking care of the planet and the people.

OBJECTIVE OF THE STUDY

1. To understand the components of Environmental, Social, Governance practices.
2. To examine the importance of ESG practices in the corporate sector.
3. To study how the ESG based investment strategies contribute to the long term growth.
4. To identify the emerging ESG trends in the Indian corporate environment.

LITERATURE REVIEW

Radzi studied the role of PSG practices in the business world in 2023. How they affect investment decisions. The study focused on ESG integration and its effects on investors' confidence and long term stability and growth. The author talked about the three parts of PSG: taking care of the environment being socially responsible and following good governance standards. Each part shows how companies can work in a way. The study found that using ESG effectively can improve how companies and investments perform by promoting management and reducing risk.

Niguel Ma analyzed the growth of EST investments in 2023 and their increasing importance in financial markets. The study looked at both non-financial indicators of companies that focus on ESG. The author said that ESG factors play a role in making investment decisions by giving extra information beyond traditional financial metrics. The findings suggested that considering ESG factors helps with risk assessment and contributes to business growth globally.

Jiayi Huang discussed the bad points of using ESG in the business world in 2023. The study talked about how good ESG practices help companies succeed in the run by being transparent managing risk and building trust with stakeholders. At the time the author pointed out some challenges like high costs, no standard way to measure ESG and difficulties in comparing ESG performance, between companies. The findings showed that using ESG can have term benefits but also faces operational and structural challenges when it is adopted.

Sadhana ganesh awate has analysed the hypothesis about the ESG in the method of surveys and questions from this I got to know about the Trends of ESG . How the research problems are identified for the long term impact of ESG practices.

CONCEPT FRAMEWORK OF ESG

Environmental social and governance is a framework that companies use to evaluate their performance beyond how money they make. In the corporate world businesses are not just assessed on how profitable they are, but also on their ethical responsibilities sustainability practices and transparency in management. Environmental social and governance provides an approach to measure how responsibly a company operates and how it manages its impact on society and the environment. This helps investors, regulators and stakeholders understand whether a company is focused on creating term value rather than just making a lot of money in a short time.

The environmental part of social and governance focuses on how a company interacts with nature and natural resources. This includes things like controlling pollution reducing carbon emissions, managing waste using energy efficiently and using resources. Companies are expected to minimize the harm they cause to the environment and help protect the climate. If a company takes care of the environment it reduces the risk of getting in trouble with the law. Makes the company look good.

In today's world environmental sustainability is a factor that affects whether a company survives and what investors decide to do. The social part of social and governance is about how a company treats its employees, customers, suppliers and the community. This includes making sure employees are treated fairly keeping them safe at work being diverse and inclusive protecting rights and being socially responsible. Companies that treat their employees well and contribute to society build trust and loyalty that lasts a time. When companies treat their employees well they work better. Have stronger relationships with the people they work with.

The governance part of social and governance is about the rules, controls and leadership practices inside a company. This includes things like being transparent having leaders making sure audits are done correctly following the law and protecting the rights of shareholders. Regulatory bodies, such as the Securities and Exchange Board of India encourage companies to be transparent and follow governance practices. When companies have governance they are accountable and less likely to have problems, with fraud or mismanagement.

Overall environmental social and governance is a framework that brings together protection, social responsibility and good governance to promote sustainable growth and long term development of companies.

ESG AND PORTFOLIO PERFORMANCE

In the few years Environmental Social and Governance factors or ESG factors for short have become really important when people make investment decisions. Investors are now looking at more than how well a company does financially. They are also looking at the responsibility of companies, their social practices and how well they follow government standards.

When we talk about the performance of a portfolio we are talking about the return on investment and the risk involved. When investors use ESG criteria to choose which

companies to invest in they can find companies that're financially stable, responsible and less likely to have problems in the long run. Companies that do well with ESG factors often manage risks better. Run their operations more efficiently.

If a company is responsible when it comes to the environment they are less likely to get in trouble with the government or have to pay for damage. When companies treat their employees well and follow social practices their employees work harder and customers are more loyal. Good governance also helps companies make financial decisions and avoid problems. All these things together help companies make money and grow in a sustainable way, which is good for investors.

Nowadays more big investors and asset management companies are using ESG based investment strategies. When the economy is not doing well investments that focus on sustainability and the environment do okay. Research shows that portfolios that invest in companies with ESG factors tend to be less volatile and do better in the long run than traditional investments. However how much ESG factors affect portfolio performance can vary depending on the type of industry market conditions and how well ESG is integrated.

Despite these differences the overall trend is that investing with ESG factors, in mind helps create value in the run rather than just trying to make quick money. Therefore using ESG factors to make investment decisions is seen as a way to manage a portfolio while also promoting sustainable development.

ESG TRENDS IN INDIA

The way companies in India think about the environment and social issues is changing a lot. Indian businesses are starting to care about more than making money. They are trying to balance making money with being good to the environment and society. This change is happening because of rules and investors who want companies to be more responsible.

The government and investors are pushing companies to be more transparent about what they're doing to help the environment and society. One big step in this direction is that companies now have to report on what they're doing to be more sustainable. The Security Exchange Board of India is making sure that big companies do this. This means that companies have to think about the environment and social issues when they make plans.

Many companies in India are now using energy and trying to reduce their carbon footprint. They are also trying to make their supply chains more sustainable. Companies are treating their workers better. Trying to have more women in important positions. They are also giving back to the community. The government is making sure that companies are being responsible and following the rules.

People who invest money are starting to care more about the environment and social issues. They want to invest in companies that're good for the environment and society. There are now investment funds that focus on companies that are sustainable. This shows that people are starting to think that companies that are good for the environment and society are an investment.

All of these changes mean that companies in India are starting to take the environment and social issues seriously. They are not just doing it because they have to. Because they want to. This is a step towards making sure that companies grow in a way that is good for everyone. Environmental social and governance practices, in India are becoming more important. Companies are starting to see the value in being sustainable.

DISCUSSION

The analysis of environment, social and governance practices shows that responsible corporate behaviour is closely linked to term financial sustainability.

A review of existing studies suggests that companies that integrate ESG principles into their strategy are more likely to achieve stability gain investors confidence and improve their reputation.

In today's business environment adopting ESG practices is no longer a choice but a necessity. The study finds that environmental responsibility helps companies run efficiently by reducing waste, energy consumption and regulatory risks.

Social practices like taking care of employees promoting diversity and inclusion and engaging with the community build trust among stakeholders and boost productivity.

Good governance, including reporting and effective board oversight improves financial management and accountability.

When it comes to portfolio performance the findings show that ESG-oriented investments focus on creating long-term value than short-term gains.

Investors are increasingly using -financial indicators as tools to manage risks.

Sustainable investment strategies seem to help portfolios weather market uncertainties by reducing exposure to penalties, social controversies and governance failures.

The Indian corporate sector is slowly aligning with ESG standards through regulatory reforms and sustainability reports.

However, challenges like the lack of measurement tools and limited awareness, among smaller firms still exist.

Overall, the discussion highlights that ESG integration positively impacts stability and sustainability and investment decisions.

This evaluation confirms that responsible governance and ethical practices contribute not to societal welfare but also to sustainable portfolio growth.

CONCLUSION

From the study we can see that ESG is becoming really important in the business world today. Companies are not just thinking about making a profit they are also thinking about being responsible. This is very important if they want to be for a long time. ESG helps reduce risks and supports stability and long term returns. Because of this investors are starting to think about investment and growth. Things that are not about money are influencing the decisions investors make. In our country companies are starting to report on their ESG more and the government is encouraging them to be more sustainable. So investors in India are now

starting to adopt ESG investing. This means that ESG is helping to balance what is good for the economy, society and the environment, which leads to growth. It also promotes behavior in companies. In the future companies will be successful if they are responsible and do the thing. Investing in a way ensures that companies will be valuable for a long time. Using ESG is not something that is popular right now it is something that companies need to do. ESG is really important for the future of business. The ESG helps the companies to be more responsible. This is good, for everyone. The ESG is becoming a part of the business world

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INNOVATIVE AND SUSTAINABLE PERSPECTIVES IN HUMANITIES: CULTURAL, SOCIAL, AND ETHICAL DIMENSIONS OF CONTEMPORARY CHALLENGES

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Abstract

The twenty-first century is increasingly defined by environmental uncertainty, social transformation, and economic volatility. Climate disruption, biodiversity loss, rapid urbanization, technological acceleration, and persistent inequality have collectively reshaped the conditions under which societies function. These developments challenge traditional educational models that prioritize content delivery and standardized outcomes without sufficiently addressing ethical responsibility or systemic interdependence. In response, sustainability education has emerged as a transformative framework that seeks to align educational purpose with long-term ecological balance, social equity, and economic resilience. This paper explores innovative teaching–learning practices that integrate sustainability within educational institutions. It examines experiential and project-based learning, interdisciplinary pedagogy, inquiry-driven engagement, digital innovation, community partnerships, and institutional sustainability initiatives as mechanisms for cultivating reflective and responsible learners. Particular attention is given to the evolving role of educators, the structural barriers that complicate implementation, and strategic pathways toward institutional transformation. The study argues that sustainability education becomes meaningful only when it is embedded across curricular, pedagogical, and organizational dimensions. Through critical reflection, collaborative engagement, and ethical inquiry, education can prepare individuals not merely to adapt to change but to participate thoughtfully in shaping more sustainable futures.

Keywords: Sustainability Education; Transformative Pedagogy; Ecological Literacy; Interdisciplinary Instruction; Experiential Learning; Ethical Responsibility; Community Engagement

1. Introduction

Modern society exists within a paradox. Technological innovation has expanded communication, improved healthcare, and facilitated economic growth. At the same time, ecological degradation, climate volatility, and social inequality have intensified. Industrial production has accelerated resource extraction, urban expansion has transformed landscapes, and globalized markets have restructured social relations. These processes, though often framed as indicators of progress, carry consequences that demand careful reflection.

Environmental challenges such as rising global temperatures, deforestation, pollution, and freshwater scarcity are no longer abstract scientific concerns. They influence agriculture, migration patterns, public health, and geopolitical stability. Social issues—including economic inequality, displacement, and unequal access to resources—intersect with ecological pressures, revealing how sustainability cannot be confined to environmental protection alone.

Within this context, education occupies a position of significant responsibility. Educational

institutions shape intellectual development, social values, and civic engagement. If learners are to navigate increasingly complex global realities, education must equip them with more than technical knowledge. It must foster systems thinking, ethical reasoning, adaptability, and collaborative competence.

Traditional education models, while effective in organizing knowledge and establishing disciplinary foundations, often emphasize compartmentalization. Subjects are separated, learning is standardized, and assessment prioritizes measurable outputs. However, sustainability challenges resist compartmentalization. They require integrative understanding and reflective judgment. As a result, educators worldwide are reconsidering how teaching–learning practices might evolve to meet contemporary needs.

Sustainability education represents one such evolution. It seeks not merely to add environmental topics to existing curricula but to reshape educational purpose itself. By embedding sustainability principles within pedagogy, institutions can cultivate learners who are prepared to engage responsibly with the complexities of modern life.

2. Conceptual Foundations of Sustainability in Education

Sustainability, in its broadest sense, refers to the capacity of systems—ecological, social, and economic—to endure and flourish over time without undermining their own foundations. In educational discourse, sustainability encompasses a commitment to balanced development, intergenerational responsibility, and equitable participation.

At the heart of sustainability education lies the recognition of interdependence. Environmental processes influence economic productivity; economic systems affect social cohesion; social practices shape ecological impact. Understanding these relationships requires moving beyond isolated facts toward relational thinking. Students must learn to trace connections, identify feedback loops, and anticipate long-term consequences.

Sustainability education also foregrounds ethical inquiry. Questions about resource distribution, environmental justice, and technological responsibility involve value judgments as well as empirical analysis. Learners are encouraged to reflect on fairness, accountability, and stewardship. This dimension distinguishes sustainability education from purely technical environmental training.

Furthermore, sustainability education emphasizes participation. Rather than positioning students as passive recipients of predetermined solutions, it invites them to contribute ideas, examine alternatives, and engage in collaborative dialogue. By fostering agency, it strengthens democratic capacities alongside ecological awareness.

Importantly, sustainability education is culturally contextual. While global frameworks provide overarching goals, implementation must respond to local realities. Cultural traditions, regional ecosystems, and community priorities shape how sustainability is understood and practiced. Effective educational models therefore balance universal principles with contextual sensitivity.

3. Objectives of the Study

This study seeks to provide a comprehensive examination of innovative teaching–learning practices that support sustainability education. The specific objectives are:

1. To analyse the evolving significance of sustainability within educational theory and practice.
2. To identify and elaborate innovative pedagogical approaches that promote meaningful sustainability engagement.
3. To examine the expanded role of educators as facilitators of reflective and transformative learning.
4. To explore structural, conceptual, and practical challenges that hinder effective implementation.
5. To propose strategic pathways for embedding sustainability within institutional systems.

4. The Imperative for Innovative Teaching–Learning Practices

Sustainability challenges are inherently complex. Climate adaptation involves scientific modelling, economic planning, ethical evaluation, and political negotiation. Resource management intersects with cultural values and social equity. Addressing such issues requires more than disciplinary expertise; it demands integrative thinking and collaborative problem-solving.

Conventional instructional models, while structured and efficient, may limit opportunities for active engagement. Lecture-cantered approaches often position students as observers rather than participants. Although foundational knowledge is essential, sustainability education requires learners to apply knowledge within uncertain and evolving contexts.

Innovative teaching–learning practices respond to this need by creating dynamic learning environments. They encourage questioning, experimentation, and reflection. Students engage with real-world scenarios, analyse diverse perspectives, and develop solutions that acknowledge trade-offs and complexity.

Moreover, innovative approaches strengthen motivation. When students see the relevance of their studies to pressing societal concerns, engagement deepens. Learning becomes purposeful rather than procedural. This shift enhances retention and fosters a sense of responsibility.

5. Innovative Teaching–Learning Practices for Sustainability

- **Experiential Learning**

Experiential learning centres on learning through action and reflection. Students might participate in environmental monitoring projects, energy conservation audits, or community sustainability campaigns. These experiences provide concrete insights into abstract concepts.

Reflection transforms experience into understanding. Through guided discussion or written analysis, learners connect activities to broader theoretical frameworks. This process cultivates critical awareness and contextual understanding.

- **Project-Based Learning**

Project-based learning (PBL) encourages sustained inquiry into complex sustainability challenges. Students collaborate over extended periods to research issues, propose interventions, and evaluate outcomes.

For example, a PBL initiative might involve designing a campus waste-reduction strategy. Students would analyse consumption patterns, consult stakeholders, develop proposals, and assess feasibility. Such projects promote accountability, teamwork, and strategic planning.

- **Interdisciplinary Pedagogy**

Sustainability issues transcend disciplinary boundaries. Interdisciplinary pedagogy integrates insights from science, economics, ethics, history, and technology. This approach enables students to appreciate systemic relationships and avoid reductionist interpretations.

By engaging multiple perspectives, learners develop holistic understanding and intellectual flexibility.

- **Technology-Enhanced Engagement**

Digital technologies provide tools for simulation, data analysis, and global collaboration. Geographic information systems (GIS), climate modelling software, and interactive visualization platforms enhance analytical depth.

However, technology must complement—not replace—critical reflection. Its value lies in expanding inquiry and facilitating communication.

- **Inquiry and Problem-Based Learning**

Inquiry-based learning encourages students to formulate research questions and conduct investigations. Problem-based learning presents open-ended scenarios requiring evaluation of evidence and ethical considerations.

These approaches cultivate intellectual autonomy and research competence.

Community Partnerships

Community engagement bridges theory and practice. Service-learning initiatives connect students with local organizations, allowing them to contribute to sustainability efforts while gaining practical insight.

Such partnerships foster empathy, civic responsibility, and contextual awareness.

- **Institutional Sustainability Initiatives**

Educational institutions can model sustainability through operational practices such as renewable energy adoption, sustainable procurement policies, and green infrastructure development. When institutional operations align with sustainability principles, they reinforce classroom learning.

6. The Role of Educators

Educators serve as facilitators, mentors, and ethical guides within sustainability education. Their influence extends beyond content delivery to the shaping of classroom culture. Through dialogue, questioning, and modelling responsible behaviour, teachers create spaces where sustainability principles are lived rather than merely discussed.

Facilitating discussions on contested issues requires sensitivity and openness. Students encounter differing viewpoints and must learn to engage respectfully. Educators guide these conversations, ensuring that complexity is acknowledged rather than simplified.

Continuous professional development is essential. Teachers must remain informed about sustainability developments and innovative pedagogical strategies.

7. Challenges in Implementation

Several obstacles complicate sustainability integration. Curricular compartmentalization restricts interdisciplinary collaboration. Standardized assessment systems prioritize measurable outcomes over reflective learning. Resource constraints limit experiential opportunities.

Additionally, conceptual ambiguity may reduce sustainability to environmental awareness alone, neglecting social and ethical dimensions. Institutional inertia can slow reform efforts, especially when sustainability is perceived as an additional burden rather than a guiding principle.

8. Strategies for Effective Implementation

Effective sustainability education requires systemic alignment:

- Integrating sustainability across curricula
- Supporting experiential and inquiry-based approaches
- Providing ongoing teacher training
- Aligning institutional policies with sustainability goals
- Encouraging student leadership and innovation
- Establishing measurable sustainability benchmarks

Leadership commitment and collaborative planning are crucial for sustained progress.

9. Educational Implications

Sustainability education reshapes educational purpose by linking knowledge with responsibility. It encourages learners to think systemically, reflect ethically, and act collaboratively.

By fostering resilience and adaptability, sustainability education prepares individuals to navigate uncertainty and contribute constructively to societal transformation.

10. Future Scope of Sustainability Education

Emerging technologies such as artificial intelligence and immersive simulation will continue influencing pedagogy. Global environmental commitments and labour market shifts toward green industries will shape curricular priorities.

Inclusive access remains essential to ensure equitable participation. Sustainability education must empower diverse communities and foster cross-cultural collaboration.

Conclusion

Sustainability education represents a reorientation of educational vision. In an interconnected and rapidly changing world, learning must extend beyond disciplinary knowledge to cultivate ethical judgment, systems thinking, and collaborative competence.

Innovative teaching–learning practices create conditions where sustainability becomes embedded within institutional identity. Through reflective inquiry, experiential engagement, and community collaboration, education can nurture informed, responsible, and resilient citizens capable of contributing meaningfully to sustainable futures.

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SKILL DEVELOPMENT FOR SUSTAINABLE CAREERS

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Abstract

*The purpose of the study was to **SKILL DEVELOPMENT FOR SUSTAINABLE CAREERS**. Sustainability skills are a blend of technical expertise, strategic thinking, and leadership abilities needed to drive environmental and social change. Key competencies include systems thinking, ESG knowledge, data analysis, project management, and cross-functional collaboration, with rising demand for skills in renewable energy, carbon accounting, and sustainable product design. 21st-century skills—critical thinking, creativity, collaboration, and communication—have transformed education from rote memorization to a holistic, learner-centric approach. These skills enhance academic performance, boost student engagement, and foster adaptability, directly preparing students for rapidly evolving, technology-driven careers and complex, real-world challenges.*

Keywords : Skill Development, Sustainable careers,

1. Introduction

The 21st century is the century of innovation, development and ideation. Trends in technology, education and economics are moving towards automation. This revolution that the world is going through, and that is most felt in the workplace, would not have been possible without the preparation of a new generation who in the future will be the flourishing instruments of a dynamic modern world.

When we say the preparation of young people for a new society and new economy, we refer to some skills which are vital in the individual growth of each of them, physically and mentally, and the benefits of which are felt not only in the individual but also those who surround it.

These skills are also known as "21st Century Skills", a long list of soft skills, learning skills, literacy skills and life skills.

Learning skills

1. Critical thinking: to find unique solutions to modern problems
2. Creativity: thinking outside the box and engaging in innovations that help global development.
3. Collaboration: learning how to collaborate and work with others with a team spirit.
4. Communication: being able to communicate your ideas to others and understanding the perspective of others as well.

Literacy skills

1. Information literacy: understanding facts, data, statistics and illustrations.
2. Media literacy: understanding the media, procedures and platforms on which information is published and disseminated.
3. Technological literacy: understanding how technologies work are the real engines of the information age.

Life skills

1. Flexibility: being able to do a few things and having more than one plan A
2. Leadership: encouraging the team to achieve goals and keeping the threads together when they seem to be breaking
3. Initiative: start strategies, projects and planning
4. Productivity: make the best use of time and maintain efficiency in the era of distraction
5. Social skills: socialize with others for your own happiness and expand perspective.

In a world of fierce competition, mastering these 12 skills of the 21st century is more important than ever.

There is a big misconception with the "Everyone has to learn coding". Most people see learning to write computer code as their final destination and that their job is to write the code. But it really is not so. A programmer is capable of solving problems. Programming is about solving problems because it covers a set of skills that are usable in our daily lives. They are skills that the children of the new generation are losing in their education. Coding is a tool that develops the ability to solve problems. In short, even a doctor, a future sociologist, jurist or economist, must learn coding like any other necessary knowledge in life such as mathematics or mother tongue.

Sustainable development is growth that meets present needs without sacrificing future generations' ability to meet theirs, balancing economic prosperity, social inclusion, and environmental protection for long-term well-being. It involves creating a world with decent work, good health, quality education, and reduced inequality, while protecting the planet through sustainable resource use and climate action

Sustainable career development is an emerging concept in career literature. To define sustainable careers, scholars generally refer to van der Heijden and de Vos (2015) who define a sustainable career as "the sequence of an individual's different career experiences, reflected through a variety of patterns of continuity over time, crossing several social spaces, and characterized by individual agency, herewith providing meaning to the individual" (p. 7). In other words, a sustainable career is an ongoing career development process passing through different stages over time, influenced by social relations and shaped by personal circumstances (van der Heijden & de Vos, 2015).

Sustainability is the ability to maintain or improve the quality of life for present and future generations without compromising the ability of future generations to meet their needs. It strives to maintain an ecological balance in the environment by governing resource usage,

reducing waste and pollution and protecting natural resources. The field also considers social issues like equity and sustainable economic development. A career in sustainability involves preventing the depletion of natural resources, analyzing an organization's current ecological impact and advocating for the use of sustainable practices. It also involves policy analysis and knowledge of environmental regulations and climate change. A career in the field of sustainability typically requires at least a bachelor's degree, though certain positions may require more advanced educational process. Sustainable Skills Development refers to the process of equipping individuals with the competencies required to support environmental, social, and economic sustainability. This involves fostering skills that enable innovation, resource efficiency, and responsible practices across various sectors.

Skills remain an important component, but addressing these additional factors is crucial for creating a supportive environment that encourages workers to move to and stay in these communities. By taking a holistic view, we can better support the workforce and foster successful community development in line with our environmental goals. To address these challenges effectively, place-based approaches are essential. Lessons from a number of these projects highlighted that collaborating with local partners allows for a nuanced understanding of the unique problems faced by each community and facilitates the development of tailored solutions. By focusing on the specific needs and characteristics of local areas, more effective strategies to support a smooth transition can be created. Take, for example, the University of the Fraser Valley investigated emerging agricultural technologies and the future of food. In this research, project partners fostered relationships among a wide range of stakeholders involved in cellular agriculture. This helped to educate the public, diversify investment and drive broader participation in the industry, and help stakeholders better understand how emerging industries can contribute to environmental and social objectives.

2. Skills for sustainability:

1. **Sustainability / environmental literacy** - A basic understanding of issues such as climate change and biodiversity loss and how organisations will be affected by them, is important for all employees, not just those working in ESG. The ONS' Opinions and Lifestyle Survey found that around three in four adults (74%) reported feeling (very or somewhat) worried about climate change. Increasing employee literacy around the topic shows them how they can positively affect the climate, even if they're not in a 'green' job. This also has the effect of giving your employees a bit of agency, which is important for maintaining good mental health in the face of big challenges.
2. **Critical thinking and problem solving skills** - Critical thinking encourages us not to take things at face value, but instead to become proactive agents who are able to set aside our biases and assumptions, to analyse and reflect on available evidence and arguments to form rational judgments. It enables us to move past established ways of working (if necessary) and to solve challenges in a creative way, before they become major problems. For many people, this is not an especially comfortable way to work,

at least, to start with. Like most of the skills mentioned in this article, this one requires practice, ideally in a safe space where mistakes can be made without real-world consequences.

3. **Systems thinking skills** - Systems thinking is still rarely done in organisations, although it is slowly starting to become more widely used. In my opinion, this skill could have the biggest positive impact. The world we live in is getting more and more complex. There are so many interdependencies that are poorly understood. Systems thinking provides a powerful framework for seeing the interconnections and understanding the *whole* system, so that we can make more informed decisions. It prevents just the symptoms being fixed and enables us to focus on root causes.
4. **Creativity and innovation skills** - Big problems need creative solutions and this is something that us humans are really strong at. Unfortunately the school system, at least in the UK, doesn't really foster creativity and innovation, so people enter the workforce with skills gaps in this area. We're also often given the impression that creativity is innate and gifted to the chosen few but, in fact, that's not the case - it is definitely also something that can be learned. Critical to creativity is to listen and be open to different perspectives, experiences and opinions.
5. **Sustainable leadership skills** - Sustainable leadership isn't just for Heads of ESG, it's important for all leaders to have a level of competency in sustainability, not least, because it feeds into risk management and increasingly legal and financial areas. It's simply not enough to leave it to the ESG team. Without this, sustainability has little chance of achieving traction'. Sustainability needs to be baked into all the leadership training you do - it's that important.
6. **Design thinking skills** - Design-thinking is a human-centred approach to problem solving and innovation and another tool that we can use to find sustainable, workable answers to the considerable challenges we face. This approach enables us to challenge assumptions, experiment and prototype solutions. It also ensures that we're solving the right problems, not just what we think the problems are.
7. **Analytics and Data skills** - Data is important to sustainability efforts and analysis skills will help make the most of the insights it can offer. Data can help us understand where we currently are in our sustainability efforts, where we want to get to, where we can improve and how we're progressing. Data gives us tangible targets to aim at, whilst also helping to tell the story about our journey to improvement. Increasingly, there are also legislative demands around data reporting so these skills are only going to become more important.
8. **Communication skills** - Being able to effectively communicate what sustainability means within your organisation will create a common understanding and help people to coalesce around sustainability goals. Communicating to your customers, suppliers and other stakeholders is also really important BUT it absolutely must not just be

‘green washing’ (looking sustainable but with little real positive real-world impact), as they will see through that very quickly. Green washing carries a strong risk of reputational damage and the erosion of trust, neither of which are good for business. Communication skills need to be very well honed and on-point, as it’s so vital to get it right. Communication is such an important skill in propelling sustainable change forward for all our benefits. As climate scientist, Katharine Hayhoe, says in her Ted Talk, ‘the most important thing you can do to fight climate change is to talk about it’.

9. **Collaboration and teamwork skills** – No one can crack sustainability alone, it takes a community. From organizational initiatives, to industry initiatives, to wide-scale societal change. It takes all of us. We need to develop the skills that enable us to make the most of it when we come together and pool resources to solve problems better and really make an impact.
10. **Emotional intelligence** - Last but not least, according to Harvard Business School’s definition, emotional intelligence (EQ) ‘is the ability to understand and manage your emotions and the emotions of others’. Why is this important when it comes to sustainability? Well some aspects of sustainability, such as gender equality, are highly politicized and some, such as climate change, are nothing short of existential. These are not neutral topics and they require high levels of empathy, self-regulation and social skills in order to be able to address them effectively. Fortunately, there are a range of skills we can develop, such as self-awareness; self-reflection and active listening that can help us develop our EQ.

3. Core Sustainability Skills & Competencies

- **Systems Thinking:** Understanding the interconnectedness of complex environmental, social, and economic systems.
- **Data Analysis & Reporting:** Collecting, interpreting, and communicating data on ESG performance, including using tools like Excel or Power BI.
- **Environmental Literacy & Policy:** Knowledge of sustainability principles, environmental legislation, and compliance.
- **Strategic Thinking & Innovation:** Developing forward-thinking strategies to embed sustainability into business models and fostering creative problem-solving.
- **Project Management:** Planning, implementing, and monitoring sustainability initiatives, often involving cross-functional teams.
- **Stakeholder Engagement & Communication:** Advocating for sustainability across supply chains and effectively communicating purpose to diverse audiences.
- **Adaptability & Resilience:** Managing change and building resilience in the face of environmental shifts.

3. Sustainable Development Goals

End poverty in all its forms everywhere

- By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
- Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable
- By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance

End hunger, achieve food security and improved nutrition and promote sustainable agriculture

- By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round
- By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons
- By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment
- By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

- By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.
- By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education.
- By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university

- By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.
- By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations 6 By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy.

Conclusions

Sustainability is the ability to maintain or improve the quality of life for present and future generations without compromising the ability of future generations to meet their needs. It strives to maintain an ecological balance in the environment by governing resource usage, reducing waste and pollution and protecting natural resources. The field also considers social issues like equity and sustainable economic development. A career in sustainability involves preventing the depletion of natural resources, analyzing an organization's current ecological impact and advocating for the use of sustainable practices. It also involves policy analysis and knowledge of environmental regulations and climate change. A career in the field of sustainability typically requires at least a bachelor's degree, though certain positions may require more advanced educational process. Sustainable Skills Development refers to the process of equipping individuals with the competencies required to support environmental, social, and economic sustainability. This involves fostering skills that enable innovation, resource efficiency, and responsible practices across various sectors.

Skills remain an important component, but addressing these additional factors is crucial for creating a supportive environment that encourages workers to move to and stay in these communities. By taking a holistic view, we can better support the workforce and foster successful community development in line with our environmental goals.

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AI FOR SUSTAINABLE DEVELOPMENT

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Abstract

Artificial Intelligence (AI) has emerged as a transformative technology capable of accelerating global progress toward sustainable development. Sustainable development emphasizes balanced growth across economic, social, and environmental dimensions. AI technologies, including machine learning, deep learning, robotics, and predictive analytics—offer scalable solutions to complex global challenges such as climate change, poverty, healthcare access, and educational inequality. In environmental sustainability, AI improves climate modeling, optimizes renewable energy systems, enhances precision agriculture, and supports biodiversity conservation. In the social domain, AI strengthens healthcare diagnostics, enables personalized learning systems, and improves public service delivery. Economically, AI promotes industrial efficiency, supports financial inclusion, and contributes to smart urban planning. Despite these benefits, AI also presents ethical and operational challenges, including algorithmic bias, data privacy risks, digital inequality, and environmental costs of high computational energy use. To ensure AI contributes positively to sustainable development, strong governance frameworks, responsible innovation practices, and inclusive digital infrastructure are essential. Policymakers, researchers, and industry leaders must collaborate to align AI strategies with sustainability principles and human-centered values. AI can serve as a powerful enabler of sustainability if deployed ethically and inclusively.

Keywords: *Artificial Intelligence, Sustainable Development, smart Technologies, Digital, Transformation, AI Applications, Ethical AI*

1. Introduction to Artificial Intelligence

Artificial Intelligence refers to systems capable of performing tasks requiring human intelligence such as reasoning, learning, and decision-making. Core technologies include machine learning, deep learning, natural language processing, and robotics. Artificial Intelligence, or AI, is when computers and machines are taught to think and learn like humans. Instead of just following fixed instructions, AI systems can learn from data, recognize patterns, and make decisions. For example, voice assistants can understand what we say, recommendation systems suggest videos or songs we might like, and smart games can adjust their difficulty based on how we play. AI is used in many areas of daily life, such as smartphones, cars, hospitals, and schools. It helps make tasks faster, easier, and more efficient.

2. Concept of Sustainable Development

Sustainable development refers to meeting present needs without compromising future generations. It integrates environmental protection, social equity, and economic growth.

Sustainable education promotes lifelong learning opportunities beyond formal schooling. It ensures that future generations have equal access to quality education, preserving knowledge systems and promoting intergenerational justice. UNESCO promotes Education for Sustainable Development (ESD), which integrates environmental awareness, social responsibility, and economic understanding into curricula. ESD empowers learners to act responsibly toward climate action, biodiversity protection, and social justice. Sustainable education ensures equal access regardless of gender, socio-economic background, disability, or geographic location. Inclusive policies reduce educational disparities and promote social cohesion.

3. AI and Sustainable Development Goals

AI supports global goals including poverty reduction, health improvement, quality education, climate action, and sustainable cities through data-driven solutions.

No Poverty

AI supports poverty reduction by:

- Identifying vulnerable populations through data analytics
- Improving targeting of social welfare schemes
- Enhancing financial inclusion through AI-driven credit scoring
- Machine learning models can analyse socio-economic patterns to predict poverty risks and optimize resource distribution.

Zero Hunger

AI contributes to food security through:

- Precision agriculture
- Crop yield prediction
- Climate-resilient farming models
- Pest and disease detection
- AI-powered satellite imaging improves agricultural planning and reduces food wastage.

Good Health and Well-being AI enhances healthcare sustainability by:

- Early disease detection using diagnostic imaging
- Epidemic outbreak prediction
- Telemedicine in rural regions
- Drug discovery acceleration
- AI systems increase healthcare accessibility while reducing operational costs.

Quality Education

AI promotes inclusive education through:

- Adaptive learning platforms
- Automated assessment tools
- Predictive analytics for dropout prevention
- Multilingual translation systems

- These technologies improve access, equity, and learning outcomes.

Gender Equality

AI can:

- Analyse gender gaps in employment and education
- Support women entrepreneurs through fintech platforms
- Provide safety monitoring tools
- However, biased datasets may reinforce discrimination, highlighting the need for ethical AI design.

Clean Water and Sanitation

AI assists in:

- Water quality monitoring
- Predictive maintenance of water systems
- Leak detection and efficient water distribution
- Smart water management systems ensure sustainability in resource-scarce regions.

Affordable and Clean Energy

AI enhances renewable energy systems by:

- Forecasting solar and wind energy production
- Optimizing smart grid distribution
- Reducing energy wastage
- Predictive models increase efficiency and reduce carbon emissions.

Decent Work, Industry and Innovation

AI supports:

- Automation and industrial productivity
- Smart manufacturing (Industry 4.0)
- Innovation ecosystems
- Entrepreneurship through AI platforms
- While AI creates new opportunities, it also necessitates reskilling and workforce transformation.

Sustainable Cities and Communities

AI enables smart city solutions such as:

- Traffic management systems
- Waste management optimization
- Air quality monitoring
- Disaster risk reduction systems
- Urban sustainability improves through data-driven governance.

Responsible Consumption and Climate Action

AI supports:

- Carbon footprint tracking

- Climate modelling and prediction
- Sustainable supply chain management
- Circular economy initiatives
- AI improves environmental monitoring and promotes responsible production.

Life Below Water and Life on Land

AI helps in:

- Biodiversity monitoring
- Wildlife protection
- Ocean pollution tracking
- Forest fire prediction
- Satellite imagery and computer vision enhance conservation efforts.

Risks and Ethical Concerns in AI-SDG Alignment

Despite its benefits, AI poses risks:

- Algorithmic bias
- Data privacy violations
- Digital divide
- Energy-intensive computation
- Organizations like UNESCO advocate for ethical AI frameworks to ensure fairness, transparency, and accountability.

Governance, Policy and Global Collaboration

- International bodies such as the OECD and the World Economic Forum promote responsible AI principles aligned with sustainable development.
- Effective AI governance requires:
- Multi stakeholder collaboration
- Regulatory frameworks
- Capacity building in developing countries
- Open data ecosystems

4. AI for Climate Change Mitigation

AI enhances climate modeling, predicts extreme weather events, and assists in carbon emission monitoring and reduction strategies. Artificial Intelligence also strengthens climate change mitigation through advanced carbon accounting and real-time emissions monitoring systems. By integrating satellite imagery, IoT sensor networks, and big data analytics, AI models can track greenhouse gas emissions across industries, transportation, systems, and urban infrastructures with high precision. These systems enable governments and organizations to design evidence-based climate policies, measure progress toward carbon neutrality, and ensure compliance with international agreements such as the Paris Agreement adopted under the United Nations Framework Convention on Climate Change. Furthermore, AI-driven optimization algorithms enhance energy efficiency in manufacturing processes,

reduce fuel consumption in logistics, and support climate-smart land use planning. By enabling predictive climate risk assessments and scenario modeling, AI empowers policymakers to evaluate long-term environmental impacts before implementing development projects. Thus, AI not only supports mitigation efforts but also enhances transparency, accountability, and strategic planning in global climate governance.

5. AI in Renewable Energy

AI optimizes smart grids, forecasts renewable energy production, and improves energy efficiency in distribution systems. Educational institutions contribute to sustainability by adopting eco-friendly infrastructure such as renewable energy use, waste management systems, water conservation practices, and green buildings. Artificial Intelligence helps make renewable energy like solar and wind power more efficient and reliable. For example, AI can study weather patterns to predict how much sunlight or wind will be available each day. This helps power plants decide how much electricity they can produce. AI also helps store extra energy in batteries when production is high and use it later when production is low. In homes and schools, smart meters powered by AI can reduce electricity waste by automatically turning off lights and devices when they are not needed. By using AI, renewable energy becomes smarter, more affordable, and better for protecting our environment.

6. AI in Sustainable Agriculture

Precision farming using AI-driven sensors and drones improves crop yield, reduces water consumption, and minimizes chemical usage. Artificial Intelligence helps farmers grow more food while protecting nature. For example, AI-powered drones can fly over fields and take pictures of crops. These pictures help farmers see which plants are healthy and which need water or nutrients. AI can also tell farmers the best time to plant seeds and harvest crops by studying weather reports and soil conditions. This reduces the use of too much water, fertilizers, and pesticides. By using AI, farmers can save money, grow healthy food, and take care of the environment at the same time.

7. AI in Healthcare

AI improves diagnostics, epidemic prediction, telemedicine services, and healthcare management systems. Artificial Intelligence helps doctors and nurses take better care of patients. For example, AI can look at X-ray or scan images and quickly find signs of diseases like infections or broken bones. It can also remind patients to take their medicines on time through health apps. In hospitals, AI systems help manage appointments and keep patient records organized. This saves time for doctors and helps patients get treatment faster. By using AI, healthcare becomes quicker, safer, and more helpful for everyone.

8. AI in Education

Adaptive learning platforms personalize education and increase access through digital platforms and translation technologies. Sustainability concepts should be embedded across disciplines—not only in environmental studies but also in economics, technology, health, and social sciences. Interdisciplinary approaches encourage systems thinking and problem-solving

skills. Artificial Intelligence makes learning more interesting and easier for students. For example, AI-powered learning apps can give extra practice questions when a student finds a topic difficult. If a student answers correctly, the app can move them to a higher level. AI can also help students learn new languages by correcting their pronunciation and grammar. Virtual assistants can answer simple questions anytime, even after school hours. This helps students learn at their own speed and feel more confident in their studies.

9. AI for Financial Inclusion

AI-based credit scoring and digital finance platforms expand access to financial services for underserved populations. Artificial Intelligence plays a crucial role in expanding financial inclusion by enabling innovative and data-driven financial services for underserved populations. Traditional banking systems often exclude individuals without formal credit histories or stable income documentation. AI-powered alternative credit scoring models analyze non-traditional data sources—such as mobile transaction history, utility payments, and digital behavior patterns—to assess creditworthiness more accurately. This allows banks and fintech companies to offer microloans, insurance, and savings products to small entrepreneurs, rural communities, and low-income groups. Additionally, AI-based fraud detection systems enhance trust and security in digital financial platforms, encouraging wider adoption of mobile banking services. By reducing operational costs and improving risk assessment, AI helps create more inclusive, accessible, and sustainable financial ecosystems.

10. AI in Smart Cities

AI manages traffic flow, waste management, water systems, and pollution control to enhance urban sustainability. Artificial Intelligence enhances smart cities by enabling real-time data analysis for efficient urban management and improved quality of life. AI systems collect and process information from sensors, cameras, and connected devices across the city to monitor traffic flow, energy consumption, air quality, and public safety. For example, AI-driven traffic control systems can reduce congestion by adjusting signal timings based on vehicle movement patterns. Smart waste management systems use AI to optimize garbage collection routes, reducing fuel consumption and pollution. Additionally, AI supports emergency response services by predicting high-risk areas and improving disaster preparedness. By integrating intelligent technologies into urban infrastructure, AI helps cities become more sustainable, resilient, and citizen-friendly.

11. Ethical Issues in AI

Concerns include bias, transparency, accountability, privacy risks, and workforce displacement. Another significant ethical concern in Artificial Intelligence is the lack of transparency and explainability in decision-making processes. Many AI systems, especially those based on deep learning, operate as “black boxes,” meaning their internal reasoning is not easily understood by users or even developers. When AI is used in critical areas such as healthcare, education, finance, or criminal justice, unclear decision-making can lead to unfair outcomes and reduced public trust. Therefore, developing explainable AI ensuring human oversight, and establishing clear accountability mechanisms are essential to promote fairness, responsibility, and ethical use of AI technologies.

12. Environmental Impact of AI

High computational power increases energy use therefore, green AI strategies are essential. Another important environmental concern related to AI is the high energy consumption required for training and operating large-scale AI models. Advanced machine learning systems, especially deep learning models, require powerful data centers that consume significant amounts of electricity, often generated from fossil fuels. This leads to increased carbon emissions and contributes to climate change. Additionally, the production and disposal of hardware components such as servers, GPUs, and electronic devices create electronic waste (e-waste), which can harm the environment if not properly managed. To reduce these impacts, researchers and companies are promoting “Green AI,” which focuses on developing energy-efficient algorithms, using renewable energy sources for data centers, and designing sustainable hardware solutions. By prioritizing environmental responsibility, AI development can align more closely with sustainable development goals.

13. Policy and Governance Frameworks

International guidelines promote responsible AI development aligned with sustainability principles. National AI strategies should promote innovation while safeguarding public interest, ensuring that AI benefits are distributed equitably across society. International cooperation is also critical, as AI systems operate across borders and require harmonized guidelines. Multistakeholder collaboration among governments, academia, industry, and civil society helps create balanced policies that encourage technological advancement while protecting human rights and environmental sustainability. Effective governance ensures that AI contributes positively to economic growth, social inclusion, and environmental protection.

14. Future Directions and Recommendations

Inclusive AI ecosystems, digital literacy, ethical governance, and cross-sector collaboration are key to maximizing AI’s sustainability potential. One important future direction is the promotion of inclusive digital infrastructure. Many regions, especially in developing countries, still lack reliable internet access, digital devices, and technical expertise. To ensure that AI contributes to sustainable development, governments and institutions must invest in affordable connectivity, digital literacy programs, and technological infrastructure. Bridging the digital divide will ensure that AI-driven solutions in education, healthcare, agriculture, and finance are accessible to all sections of society, not just urban or privileged populations.

Another key recommendation is the development of human-centred and ethical AI systems. Future AI innovations must prioritize transparency, fairness, accountability, and privacy protection. Establishing ethical review boards, impact assessment mechanisms, and explainable AI models will help build public trust. Educational institutions should also integrate AI ethics and sustainability into curricula, preparing future professionals to design technologies that align with social and environmental values. Responsible innovation will ensure that technological advancement does not widen inequalities or harm communities. Furthermore, sustainable AI development requires strong collaboration between governments, industries, researchers, and civil society. Public-private partnerships can accelerate research, funding, and practical implementation of AI solutions aligned with sustainable development goals. International cooperation is also essential for sharing best practices, datasets, and regulatory standards. Investing in green computing technologies, energy-efficient algorithms, and renewable-powered data centers will help minimize AI’s environmental footprint. Strategic long-term planning and interdisciplinary research will shape AI systems that are

resilient, adaptable, and socially beneficial.

Conclusion

The future of Artificial Intelligence in sustainable development depends on responsible governance, inclusive access, and environmental consciousness. While AI offers transformative potential to address global challenges such as climate change, poverty, healthcare inequality, and educational gaps, its benefits are not automatic. Careful planning, ethical oversight, and collaborative policymaking are necessary to ensure equitable and sustainable outcomes. By investing in digital infrastructure, promoting ethical innovation, fostering global partnerships, and adopting green technologies, societies can harness AI as a powerful tool for sustainable progress. Ultimately, AI must serve humanity and the planet, supporting long-term resilience, equity, and environmental protection for present and future generations.

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ENTREPRENEURSHIP IN EMERGING MARKETS IN INDIA, ECONOMIC GROWTH AND DEVELOPMENT

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Abstract

Entrepreneurship is a key driver for growth in every country, including provided jobs and increased GDP, supported development in rural communities, supported industry through innovation and research and helped export goods/services produced here by small businesses. The Government of India has worked to support entrepreneurship in India since at least 2000 and continues its work through various policy initiatives and programs. The launch of the "Startup India Program" is one such example of how the Government of India supports private companies across India.

"Entrepreneurship is neither a science nor an art. It is a practice." – **Peter Drucker**

1. INTRODUCTION

According to **A.H. Cole**, "Entrepreneurship is the purposeful activity of an individual or a group of associated individuals, undertaken to initiate, maintain or organize a profit-oriented business unit for the production or distribution of economic goods and services". conceptual approaches to entrepreneurship.

1. Novelty: This approach to innovation focuses on developing new types of goods or services that fill gaps or solve problems that have yet to be addressed by existing offerings in the marketplace.

2. Distinction: Entrepreneurs can take a different direction and focus on providing distinctive products to consumers. To this end, they adapt the products or services they provide to better suit the needs and/or desires of the consumer.

3. Philanthropy: Philanthropic entrepreneurship places the creation of social value above that of simple financial profit in terms of what an entrepreneur contributes to society. Many of these entrepreneurs build their business models while also tackling social issues.

4. Opportunist: Opportunistic entrepreneurs will identify new opportunities and take advantage of them as the opportunity arises, providing an advantage to their business.

II. OBJECTIVE OF THE STUDY

The current research looks at Entrepreneurship's history and future in the country of India. Specific goals are:

Analyse entrepreneurship on a worldwide level to gain a better understanding of its place within the global economy.

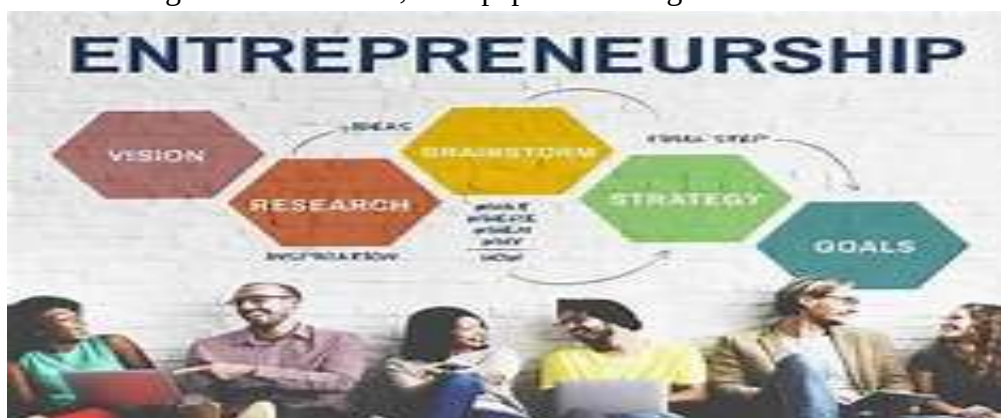
Look at the different kinds of functions and types that are associated with entrepreneurship.

- Identify characteristics that define an entrepreneur.

- Understand why entrepreneurship is important for economic growth and development procedures.
- Analyse the elements that significantly influence an increase in an Entrepreneur.
- Assess the role of youth in developing entrepreneurship and establishing an entrepreneurial culture.
- Examine the development of entrepreneurship within the nation of India as well as its future possibilities.
- Investigate what specific challenges exist for potential entrepreneurs before establishing their own business.

RESEARCH METHODOLOGY

In this study, the data for research has come from secondary sources. The current study is based on descriptive research and conceptual survey. This research employs an analytical approach using quantitative research methodology. The data used for this study has been obtained through online research, newspapers and magazines.



NEED FOR ENTREPRENEURSHIP

- Enhancement of national productivity
- Development of areas in a balanced manner
- Distribution of economic power among all
- Reinvestment of profits into the area where they were earned
- Development is driven by individuals and motivation
- Awareness of entrepreneurship

FACTORS AFFECTING ENTREPRENEURIAL GROWTH

- Economic Factors
- Social Factors
- Cultural Factors
- Personality Factors

CHALLENGES FACED BY INDIAN ENTREPRENEURS

An entrepreneur faces numerous obstacles to starting and managing their business. These difficulties include:

1.The lack of capital:The hardest part for many new or small businesses is finding the funding they need. Most of these entrepreneurs have difficulty raising funds due to the existence of stringent regulations regarding loans, the fact that most of them do not have anything to offer as collateral, and there are only limited opportunities to raise capital through venture capital firms.

2.The complex and time-consuming process of obtaining government approvals: creates roadblocks that result in wasted resources and money. The amount of time and effort needed to comply with the various tax laws, labor laws, and licensing requirements can take away from an entrepreneur's ability to invest in the growth of the business.

3. The lack of a robust infrastructure: Including insufficient transportation and power supply can hinder business growth, particularly in more rural and semi-rural areas.

4. Inadequate training and availability of skilled employees: Is another obstacle that many new businesses face in maintaining a workforce that will help them grow. The gap between what employers need and what employees have to offer is hindering employee productivity and innovation within these businesses, as well as creating a highly competitive environment.

5.Competition Within Markets: The competitiveness of New Business Owners in India can be attributed to established domestic companies and Multinational Corporations. The limited brand recognition and marketing resources that these New Business Owners possess also pose significant challenges for them as they attempt to create a foothold in the market.

6.Challenges in Technology: Indian entrepreneurs need to be continually innovative and adaptive to changing technology. Many small entrepreneurs do not have access to advanced technologies, have limited digital resources, and thus are at a disadvantage when competing in today's global economy.

FINDINGS OF THE STUDY

- Small enterprises dominate the entrepreneurship landscape in India.
- As per the Global Entrepreneurship and Development Institute (GEDI), India's ranking for entrepreneurship development is 68th of 137 countries, placing it in the "middle range" of performance.
- According to the Asia-Pacific region of GEDI, India is again in a middle position (14th out of 28).
- India has its best performance in product innovation, where it ranks equally to the top scorer in the world.
- The areas of weakness where India performs less well compared to the average GEDI index score include start-up skills, networks, and cultural support; technology absorption, which is by far the weakest area; high-growth potential; risk capital availability.
- To improve India's GEDI index ranking substantially, the country should focus more on those skills necessary for entrepreneurship like providing training for staff; having

the flexibility to hire the right people with the right skills at the right time; and enhancing the educational level of entrepreneurs.

- Entrepreneurship is an important factor in assisting to grow economies as well as creating jobs and enhancing innovation within the Indian economy.
- India has emerged as a growing entrepreneurial hub due to increased globalization, technological advancement, and digitalization.
- Government initiatives such as Startup India, Make in India, and MSME development schemes have positively influenced entrepreneurial growth.
- Youth participation in entrepreneurship has increased significantly, driven by education, exposure to global markets, and startup ecosystems.
- Access to finance remains a major challenge for startups and small entrepreneurs, despite the availability of various funding options.

CONCLUSION: Teach for India and Tata Jagriti Yatra are wonderful organizations that assist young people in becoming entrepreneurs by offering hands-on experience alongside other opportunities to promote entrepreneurship. The development of social enterprise as a tool for addressing social issues is gaining significant recognition. Entrepreneurs who develop business models for the benefit of the poor must feel that there are no barriers to creating their businesses. Governmental initiatives aimed at fostering entrepreneurial growth throughout India were enacted at different points in time. The expansion of entrepreneurial opportunities in India has received increased attention from policymakers. Recent high-level initiatives such as Startup India are just the beginning of what is being done to foster entrepreneurial development in the private sector. Yet, the role of entrepreneurship in development remains unclear to many in government and policy arenas.

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GREEN FINANCE IN INDIA: OPPORTUNITIES, CHALLENGES, AND THE WAY FORWARD & AN ANALYSIS OF GREEN FINANCE INITIATIVES

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Abstract

Green finance has become an important way to tackle environmental damage and climate change while supporting sustainable economic growth. It includes financial tools, policies, and investments that help eco-friendly projects like renewable energy, energy efficiency, sustainable infrastructure, and climate adaptation efforts. By directing private and public funds to low-carbon and resource-efficient actions, green finance is crucial for helping the world move toward a sustainable economy. This abstract looks at what green finance is, its reach, and its importance, emphasizing its role in reducing environmental risks, improving the resilience of the financial system, and encouraging innovation. However, green finance faces challenges, including inconsistent standards, the risk of greenwashing, lack of transparency in data, and poor policy coordination. To unlock the full potential of green finance, we need to strengthen regulations, improve how information is disclosed, and promote collaboration across different sectors. In conclusion, green finance is a key path to making financial systems work with environmental sustainability and long-term development goals. Green finance is really important for development strategies everywhere. It is about making sure that financial systems do what is best for the environment and help with climate goals. This means using money to support projects that're good for the environment like reducing the bad things we release into the air saving natural resources and helping us deal with climate change. We are seeing more and more that climate change is having an impact and that we are losing biodiversity and hurting the environment. Because of this the old ways of dealing with money are not enough to handle the environmental problems we will face in the long term. That is why green finance is so important. Green finance is the key, to making sure we have an environment. Green finance helps us make financial systems work with sustainability and climate objectives in mind.

Introduction to Green Finance

Green finance is really about helping us move away from an economy that relies much on carbon. We need to switch to an economy that uses carbon is more efficient with resources and is fair to everyone. This is going to take a lot of money to make happen. We need to put money into things like energy clean ways to get around and making cities more sustainable. We also need to invest in technologies.

Here are some tools that can help us do this. For example we have something called bonds. We also have equity, green insurance and special loans that are linked to sustainability. These tools are really good at getting money to projects that're good for the environment. Green finance is important because it helps us get money to the projects like renewable energy and clean transportation and that is what green finance is all, about. In parallel, public policy initiatives and regulatory frameworks play a critical role in encouraging financial

institutions to integrate environmental, social, and governance (ESG) factors into investment decisions.

Green finance also contributes to financial stability by incorporating environmental risk management into financial planning. Climate-related risks—both physical risks arising from extreme weather events and transition risks associated with policy and technological changes—pose significant threats to financial markets. By embedding environmental risk assessments and disclosure requirements into financial systems, green finance enhances transparency and promotes long-term resilience.

Despite its growing adoption, green finance faces several challenges, including the absence of universally accepted standards, limited availability of reliable environmental data, and the risk of greenwashing. Addressing these challenges requires coordinated efforts among governments, regulators, financial institutions, and international organizations. Strengthening policy frameworks, improving monitoring mechanisms, and fostering innovation in green financial products are essential to scaling up green finance.

In conclusion, green finance represents a transformative approach to financing that not only supports environmental protection but also promotes sustainable economic growth. As global economies strive to meet climate targets and sustainable development goals, green finance will continue to play a pivotal role in shaping a resilient and sustainable future.

Literature Review: Green Finance

Green finance has attracted significant scholarly attention in recent years due to its role in addressing climate change and promoting sustainable development. This literature review synthesizes key theoretical foundations, empirical findings, and emerging themes in the field.

1. Conceptual Foundations of Green Finance

Early literature on green finance emphasizes its definitional scope as the integration of environmental considerations into financial decision-making. According to **Zhang et al. (2019)**, green finance encompasses financial instruments, policies, and institutional mechanisms aimed at supporting environmentally sustainable activities while mitigating environmental risks. **Pereira and Da Silva (2021)** further define green finance as a tool to facilitate the transition to a low-carbon economy by mobilizing capital toward climate-resilient and resource-efficient investments.

Several scholars note that green finance integrates elements from related fields such as sustainable finance, corporate social responsibility (CSR), and environmental, social, and governance (ESG) criteria. While green finance specifically focuses on environmental outcomes, sustainable finance takes a broader approach by including social and governance considerations in investment decisions (Scholtens, 2017).

2. Financial Instruments and Mechanisms

A considerable body of research examines the development and effectiveness of various green financial instruments. **Green bonds** have emerged as one of the most widely studied tools. *Flammer (2021)* highlights that green bonds help reduce the cost of capital for

environmentally beneficial projects and improve investor confidence through earmarked funding and reporting requirements. Other instruments such as **green loans**, **sustainability-linked loans**, **carbon markets**, and **green equity funds** are also discussed in the literature. For example, *Tang and Zhang (2020)* find that sustainability-linked loans, which tie borrowing costs to ESG performance, can incentivize corporate commitment to sustainability targets.

3. Policy and Regulatory Frameworks

The role of policy frameworks in promoting green finance is a major theme in the literature. Regulatory initiatives such as the **European Union's Sustainable Finance Taxonomy** have been identified as crucial for standardizing definitions and preventing greenwashing. *Banga (2019)* emphasizes that policy interventions, including tax incentives, subsidies, and public guarantees, are essential for reducing investment risk and attracting private capital to green projects.

In emerging economies, however, scholars such as *Zeng et al. (2020)* note that regulatory frameworks are often less developed, which hampers market growth and investor confidence. This highlights the need for context-specific policy design to foster green finance in diverse economic environments.

4. Impact on Economic and Environmental Outcomes

Empirical studies have explored the impact of green finance on economic and environmental indicators. *Chen et al. (2021)* show that countries with more advanced green finance markets tend to have higher rates of renewable energy deployment and lower carbon intensities. Similarly, *Yuan et al. (2022)* find that green finance contributes to improved energy efficiency and reduced emissions in both developed and developing economies.

However, some researchers point out that the evidence is mixed. For instance, *Rajan and Rao (2022)* argue that the effectiveness of green finance in reducing carbon emissions depends on complementary factors such as technological innovation, institutional quality, and overall economic structure.

5. Challenges and Critiques

Several challenges in green finance are highlighted in the existing literature. A recurring concern is the **lack of standardized definitions and metrics**, which can lead to inconsistent reporting and **greenwashing**—the practice of making misleading claims about environmental benefits (Delis and Dafermos, 2021). Additionally, *Nguyen and Kundu (2021)* underscore the difficulties in obtaining reliable environmental performance data, which complicates risk assessment and investment decision-making.

Other critiques focus on the **equity implications** of green finance. Some studies suggest that financial flows may disproportionately favor larger firms or developed countries, potentially widening disparities in access to green capital (Okereke et al., 2020)

Need for Green Finance in India

1. To reduce the effects of Climate Change and Environmental Degradation

India is particularly susceptible to the effects of Climate Change such as extreme weather, flooding, droughts, heat waves, and rising temperatures. Green Finance is necessary to fund Climate Mitigation and Adaptation Projects, including Renewable Energy Projects, Climate Resilient Infrastructure Development, and Sustainable Water Management Systems.

2. Achieve Renewable Energy and Climate Goals

India is also committed to the ambitious Climate Goals set out in the Paris Agreement, including expanding Renewable Energy Capacity and reducing Carbon Intensity. To meet these goals, substantial investment over the long-term will be required that can be accessed via Green Bonds, Green Loans, and other Green Finance Instruments.

3. Support the Development of Sustainable Infrastructure

The high level of Urbanisation has created a demand for Sustainable Transportation, Energy Efficient Buildings, Waste Management Facilities, and Smart Cities. Green Finance will allow for the investment of funds into Sustainable Infrastructure Projects that will ultimately support a Low Carbon and Resource Efficient Growth Option.

4. Mobilizing Private Sector Investment

India's sustainability financing requirements cannot be covered through public funding alone. Green finance helps attract private and institutionally backed investments by reducing risk, providing an incentive, and increasing the bankability of projects. This is essential for scaling up green projects across all sectors.

5. Enhancing Financial System Resilience

Climate change poses a threat to the financial stability of India and therefore requires integration of environmental risk assessments with lending and investing decisions by institutions through Green finance, thus enhancing the resilience of the financial system.

6. Promoting Innovation and Green Technologies

The availability of Green finance facilitates the research, development and deployment of clean transportation technologies such as electric vehicles (EVs), green hydrogen, energy storage and carbon capture technologies. Targeted financing enhances both technological innovation and cost reduction.

7. Enhancing Employment Opportunities and Creating Productive Economies for All Citizens

Employment opportunities are being created through investment into renewable energy, sustainable agriculture, and green manufacturing. Green finance can help facilitate this transition by supporting small businesses, farmers, and communities through a fair and equitable process.

8. Promoting Economic Growth That Supports the Achievements of SDGs

Through financing mechanisms, green finance can help India meet several SDG targets,

including affordable and clean energy; building sustainable cities; support for responsible consumption patterns; and climate action objectives. Green finance helps to ensure the economic growth that is being achieved does not come at the expense of environmental sustainability.

The Challenges Facing Green Finance in India

Green finance is widely touted as a game-changing tool for India's sustainable development - but in reality, the country is facing a whole host of challenges when it comes to ramping up the mechanisms behind it. These obstacles are largely rooted in institutional, financial, regulatory and market problems - and they're starting to hold the entire green finance movement back.

1. Definition Disaster

One of the main hurdles in India is the complete lack of a clear, universally accepted definition of what's actually "green". There's a bunch of initiatives floating around - like the RBI talking about climate risk and SEBI's guidelines on green bonds - but the truth is, we're still waiting for a comprehensive taxonomy. The result is a bunch of confusion amongst investors - and a very real risk of greenwashing at the worst.

2. Financing Frustrations

Green projects - particularly in renewable energy, sustainable infrastructure and clean tech - often require you to stump up a lot of cash upfront. And in India, access to long-term, low-cost financing is painfully limited - especially for small and medium-sized enterprises. When you factor in all the perceived risks, it's no wonder borrowing costs go up and the whole thing becomes discouraging for the private sector.

3. Slow-Building Market

Green finance in India is still a pretty nascent market. Green bonds have got a bit of traction, but to be honest, they're still just a tiny cog in the overall financial machine. Investor awareness is low, there aren't many green financial products to choose from, and the secondary markets are pretty shallow - all of which is holding the whole thing back.

4. Policy Wobbles

India's got some good policies in place - like the National Action Plan on Climate Change - but the thing is, they're not always being implemented consistently. And it's not like the regulatory bodies are working super well together, either. Lack of clarity on long-term climate policies is sending shivers down the spines of investors and slowing the whole green finance thing right down.

5. The Transparency Trap

We can't get a handle on environmental performance, climate risks, or sustainability outcomes in India because the data just isn't available. And to make matters worse, ESG disclosure standards are laughably inadequate - making it basically impossible for investors and financial institutions to get an accurate read on green projects. No wonder transparency and risk assessment are basically non-existent.

6. Taking on Green Risks

Indian banks and financial institutions are getting cold feet about green projects - and its because they're worried about the risks. Technology uncertainty, policy changes, and long project timelines are all giving them the heebie-jeebies. And to make matters worse, the public sector banks are already struggling with bad debts - leaving them pretty stretched when it comes to green lending.

7. In a Word: Expertise

We're woefully short of technical expertise and awareness about green finance in India - and it's affecting everyone from banks to project developers to local governments. Lack of skilled professionals and a general misunderstanding of climate finance instruments is basically crippling project evaluation and implementation.

8. Inclusive Green Finance - Still an Oxymoron?

Green finance in India is basically concentrated in big projects and urban areas - and by and large, its ignoring the rural regions and marginalized communities completely. Which is not great - because it raises some pretty serious concerns about inclusive growth and access to green financing opportunities

The growth of the Indian economy, population increase and increasing demand for energy have put a lot of pressure on natural resources and the environment. With this in mind, Green Finance has become vitally important in supporting sustainable development by balancing both economic and environmental goals. To support sustainable development, Green Finance is needed for the following reasons in India:

The necessary steps to create and implement policies to help India achieve its commitments to sustainable development and climate change.

To achieve high levels of green finance in India and effectively support India's sustainable development and climate change objectives, Indian policymakers, financial institutions and private sector actors need to work together in a coordinated fashion. The following are four key elements that, when addressed, will enhance green finance in India.

1. Development of a National Green Taxonomy: India should work towards developing a comprehensive, standardised, legally recognised National Green Taxonomy outlining all of the activities that qualify for green financing. A standardised, legally recognised National Green Taxonomy will provide greater transparency, reduce greenwashing, and increase investor confidence through a more consistent classification of green projects.

2. Improved Regulatory and Policy Frameworks: The Reserve Bank of India (RBI) and the Securities and Exchange Board of India (SEBI) should create supervisory frameworks that consider climate-related financial risk when conducting their duties. Regulatory and Policy frameworks that require ESG reporting and Climate-related Financial Risk Disclosures that align with international standards will enhance accountability and market discipline.

3. Increasing the Diversity of Green Finance Products: India needs to create and promote additional types of green finance products beyond just green bonds, including sustainability

link bonds, green loans, green insurance, blended finance mechanisms and carbon market products. Providing a wider variety of Green Financing Products will help attract a larger pool of investors and address the financing requirements of specific sectors.

4. Financial incentives and the provision of risk mitigation assistance: The Government of India can leverage various financial incentive tools to motivate private sector investment in green projects, including tax incentives, interest rate subsidies, credit guarantees and viability gap funding. Public finance institutions can act as catalysts by de-risking Green Projects and crowding in additional private capital.

5. Enhance Availability and Transparency of Data: Centralizing environmental, climate and ESG data will allow for improved evaluation of projects as well as risk assessment. Improved transparency through enhanced reporting and sustainability will create greater trust in green financial markets.

6. Strengthen Institutional Capacity and Increase Awareness: Training programs should be developed for banks, regulators and project developers to enhance their knowledge of green finance instruments and climate risk assessment. Increasing stakeholder awareness will facilitate the development of the market for green finance.

7. Provide Access to Green Finance for MSMEs and Rural Areas: Financial products must be specifically created to provide access to green finance for micro, small, and medium-sized enterprises (MSMEs), farmers and rural communities, in order to promote inclusive growth and to ensure a just transition.

8. Enhanced Public-Private Partnerships (PPP): Building partnerships between government agencies, financial institutions and private investors can help facilitate large-scale implementation of green infrastructure projects. PPPs reduce funding gaps and enhance efficiency within projects.

9. Encourage Innovative Technology and Products: Using technology such as fintech platforms, blockchain and artificial intelligence will improve transparency, reduce transaction costs, and improve the monitoring of green investments. By investing in innovation, we will help accelerate the establishment and growth of the green finance ecosystem.

Conclusion

The Role of Green Finance in Supporting India's Transition to a Low-Carbon, Climate-Resilient Economy. As one of the fastest growth economies globally, India has a dual challenge of continuing to grow its economy while addressing the negative impact of environmental degradation and climate change. Green finance is a strategic means for balancing these competing objectives by directing financial resources into projects and technologies that promote environmentally sustainable practices.

India has made great progress over recent years in developing and implementing policies related to green finance, issuing green bonds, and developing awareness and understanding of Environmental, Social and Governance (ESG) factors for Investors. However, there still remains untapped potential for green finance in India because of various obstacles, including: no centralised green taxonomy, a lack of availability of long-term

capital, absence of suitable regulations, limited data and disclosure, and limited capacity of financial institutions. The need for green finance in India is evident through India's ambitious climate change commitments, increasing demand for energy, rapid urbanisation of communities, and the susceptibility of communities to risks caused by climate change. As a result, there are compelling reasons for strengthening Green Finance mechanisms in India for the purpose of meeting national/international climate change commitments, providing inclusive economic development and creating jobs, and sustaining a resilient financial system.

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INNOVATION, DIGITAL PLATFORMS, AND SUSTAINABILITY OUTCOMES: AN INSTITUTIONAL ANALYSIS OF EMERGING BUSINESS TRENDS

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Abstract

Digital platforms have become central to contemporary economic systems, yet their contribution to sustainability outcomes remains uneven across institutional contexts. This study examines how digital innovation interacts with institutional structures to influence sustainability outcomes, with a focus on emerging economies. Using secondary data from authoritative sources, including the Reserve Bank of India, Banco Central do Brasil, the World Bank, and the United Nations Conference on Trade and Development (2020–2025), the study adopts a comparative descriptive approach. The analysis is structured around three institutional dimensions: governance, interoperability, and incentives. Evidence indicates that publicly coordinated and highly interoperable systems—such as India’s Unified Payments Interface and Brazil’s Pix—achieve large-scale adoption, with UPI processing approximately 172 billion transactions in 2024 and Pix recording 42 billion transactions in 2023. However, sustainability outcomes remain mixed, as digital expansion is associated with rising energy demand, with the global ICT sector accounting for 6–12% of electricity consumption (United Nations Conference on Trade and Development, 2024). The study suggests that sustainability outcomes are contingent on institutional design rather than digital innovation alone, highlighting the importance of coordinated governance and incentive structures.

Keywords: Digital Platforms; Sustainability Outcomes; Institutional Analysis; Digital Public Infrastructure; Governance; Interoperability; Incentives; Financial Inclusion

1. Introduction

Digital platforms have become a defining feature of contemporary economic systems, transforming how transactions and services are delivered. According to the Reserve Bank of India (2024), India’s Unified Payments Interface processed approximately 172 billion transactions in 2024, while Brazil’s Pix recorded 42 billion transactions in 2023 (Banco Central do Brasil, 2024). These figures reflect the growing role of digital public infrastructure in enabling large-scale participation.

At the same time, sustainability has become a central concern in policy and business discourse. While digital platforms are associated with efficiency and financial inclusion, their environmental implications are increasingly significant. The United Nations Conference on

Trade and Development (2024) estimates that the ICT sector accounts for 6–12% of global electricity consumption.

Despite rapid adoption, sustainability outcomes vary across institutional contexts. Systems such as India and Brazil demonstrate high adoption, whereas others remain fragmented. This suggests that digital innovation alone does not determine outcomes. This study examines how governance, interoperability, and incentives shape the relationship between digital platforms and sustainability outcomes using a comparative secondary-data approach.

2. Conceptual Background

Digital platforms have evolved from simple transactional interfaces into complex socio-technical systems that structure economic activity. Unlike traditional linear business models, platforms operate as multi-sided networks, facilitating interactions between users, service providers, and institutions. This network-based architecture enables scalability and efficiency, but also introduces dependencies on regulatory frameworks and infrastructural design (Evans & Schmalensee, 2016).

In recent years, digital platforms have been increasingly embedded within national economic systems through the development of Digital Public Infrastructure (DPI). DPI refers to interoperable digital systems—such as payment platforms, identity systems, and data-sharing frameworks—that are designed to support inclusive and scalable service delivery (World Bank, 2024). India’s Unified Payments Interface and Brazil’s Pix exemplify this model, where public coordination enables private innovation within a standardized ecosystem. Such systems differ fundamentally from market-led platforms, where interoperability and access are often limited by competitive structures.

The relationship between digital platforms and sustainability outcomes is complex and multi-dimensional. On one hand, digitalization is associated with efficiency gains, reduced transaction costs, and improved access to financial services, which contribute to social dimensions of sustainability such as financial inclusion. For example, mobile money systems in Kenya have been linked to increased access to financial services and economic participation (World Bank, 2021). On the other hand, digital expansion is associated with rising environmental pressures, including increased energy consumption and electronic waste. The United Nations Conference on Trade and Development (2024) highlights that the rapid growth of digital infrastructure contributes significantly to global electricity demand.

This duality suggests that digital platforms are not inherently sustainable; rather, their outcomes depend on the institutional environments in which they operate. Institutional theory provides a useful lens for understanding these dynamics, emphasizing the role of governance structures, regulatory frameworks, and incentive mechanisms in shaping economic outcomes. As noted by North (1990), institutions define the “rules of the game,” influencing how actors behave within economic systems.

Recent studies have begun to integrate digitalization and sustainability through institutional perspectives. For instance, platform-based ecosystems can enable resource optimization and

dematerialization, but only when supported by appropriate governance and policy alignment (UNCTAD, 2024). Similarly, the effectiveness of digital platforms in achieving sustainability outcomes depends on how incentives are structured and whether interoperability is ensured across systems.

Despite these insights, existing literature often treats digital innovation and sustainability as separate domains. There remains limited comparative analysis of how institutional configurations influence the relationship between digital platforms and sustainability outcomes across different economic contexts. This study addresses this gap by linking digital platform adoption with sustainability outcomes through a structured institutional framework.

3. Analytical Framework

This study adopts an institutional analytical framework to examine how digital platforms influence sustainability outcomes across different economic contexts. Rather than treating digital innovation as a purely technological process, the framework positions outcomes as shaped by the structure and coordination of institutional arrangements. Three interrelated dimensions—governance, interoperability, and incentives—are used to guide the analysis.

Governance refers to the role of public institutions in designing, regulating, and coordinating digital platforms. This includes ownership structures, regulatory clarity, and policy direction. In systems such as India's Unified Payments Interface and Brazil's Pix, governance is characterized by strong central coordination through public or central bank institutions. This form of governance reduces uncertainty, standardizes participation, and enables system-wide scaling. In contrast, market-led systems, such as those in the United States, operate through fragmented governance structures, where multiple private actors shape platform evolution.

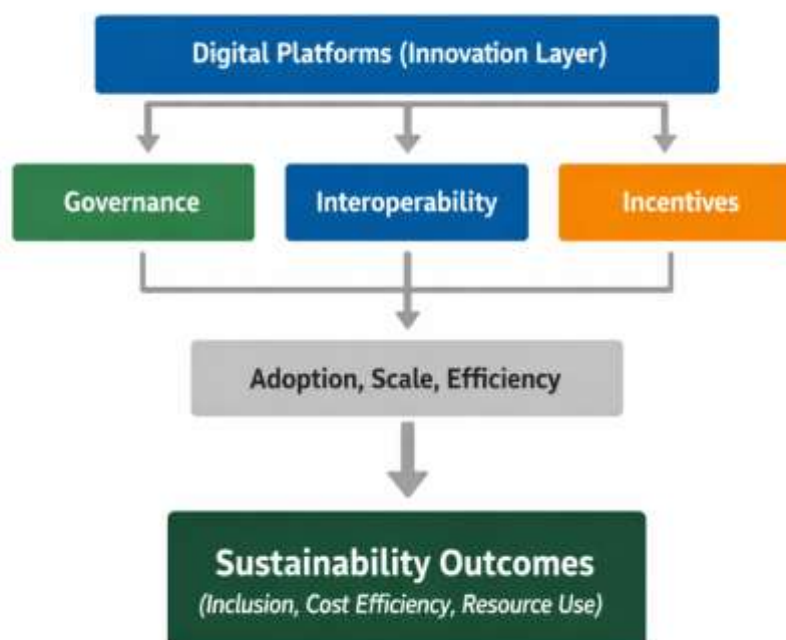
Interoperability captures the extent to which digital systems are open, standardized, and capable of integration across providers. High interoperability allows different banks, fintech firms, and service providers to operate within a unified ecosystem. For example, UPI enables transactions across more than 500 banks through standardized interfaces, while Pix facilitates real-time transfers across hundreds of financial institutions. In systems with lower interoperability, platform usage is often fragmented, limiting network effects and reducing efficiency gains.

Incentives represent the economic and policy mechanisms that drive adoption and usage. These include transaction pricing, subsidies, regulatory mandates, and behavioural incentives. In India, the zero merchant discount rate (MDR) policy for UPI transactions has played a critical role in encouraging adoption among small merchants. Similarly, Brazil's Pix system offers free transactions for individuals, lowering barriers to usage. In contrast, market-based fee structures in the United States create different adoption dynamics, often limiting the speed of transition toward real-time systems.

These three dimensions do not operate independently. Governance structures influence interoperability standards, while incentives shape how users and institutions engage with digital platforms. Sustainability outcomes—such as financial inclusion, cost efficiency, and

resource optimization—are therefore understood as contingent on the alignment of these institutional elements rather than on digital innovation alone.

Figure 1: Institutional Framework Linking Digital Platforms and Sustainability Outcomes



Source: Author's compilation based on conceptual framework developed for the study

4. Methodology

This study adopts a secondary-data-based descriptive and comparative research design to examine the relationship between digital platforms and sustainability outcomes across different institutional contexts. The analysis focuses on four countries—India, Brazil, Kenya, and the United States—selected to represent distinct institutional models of digital platform governance and adoption.

Data for the study are drawn from authoritative and publicly available sources, including the Reserve Bank of India, Banco Central do Brasil, Central Bank of Kenya, Federal Reserve System, World Bank, and the United Nations Conference on Trade and Development. The dataset covers the period from 2020 to 2025 and includes indicators related to digital payment adoption, transaction volumes and values, internet and mobile connectivity, and sustainability metrics such as carbon emissions and energy composition.

The analytical approach is structured around three institutional dimensions: governance, interoperability, and incentives. These dimensions are used as a comparative framework to interpret differences in digital platform adoption and associated sustainability outcomes across countries. The study relies on tabular comparison and cross-country interpretation rather than statistical modelling.

It is important to note that this study does not employ econometric techniques or attempt to establish causal relationships. The findings are based on descriptive patterns and associations observed in secondary data. This approach is appropriate given the exploratory objective of the study and the comparative nature of the analysis.

While efforts have been made to ensure data consistency, some indicators—such as country-level ICT energy consumption—are not uniformly available across all sources. In such cases, the study relies on globally reported estimates to maintain analytical coherence.

5. Results And Analysis

This section presents a comparative analysis of digital platform adoption and sustainability outcomes across India, Brazil, Kenya, and the United States, structured around the institutional dimensions of governance, interoperability, and incentives.

5.1 Digital Adoption and Infrastructure

The scale of digital platform adoption varies significantly across countries, reflecting differences in institutional design and infrastructure readiness.

Table 1: Digital Adoption and Infrastructure Metrics

Country	Platform	Users / Adoption	Internet Penetration (%)	Mobile Subscriptions (per 100)
India	UPI	350 million users (2024)	55.9 (2022)	80.56 (2023)
Brazil	Pix	153 million users (2024)	84.2 (2023)	98.9 (2022)
Kenya	M-Pesa & others	73.1 million accounts (2022)	35.0 (2023)	120.61 (2023)
USA	Cards + ACH	n.a.	93.1 (2023)	112.41 (2023)

Source: World Bank (2022–2023); ITU (2023); Reserve Bank of India (2024); Banco Central do Brasil (2024); Central Bank of Kenya (2022)

The data indicate that India and Brazil have achieved large-scale adoption despite differences in internet penetration. India’s relatively lower internet penetration (55.9%) compared to Brazil (84.2%) suggests that platform design and policy coordination, rather than connectivity alone, influence adoption outcomes. Kenya presents a distinct model, where high mobile penetration (120.61 subscriptions per 100 people) compensates for lower internet access, enabling widespread use of mobile money systems.

5.2 Transaction Scale and Economic Intensity

Digital transaction volumes further illustrate the scale and economic significance of platform-based systems.

Table 2: Digital Payment Transactions and Value

Country	Platform	Year	Transactions (billion)	Total Value
India	UPI	2024	172	₹247 trillion
Brazil	Pix	2023	42	BRL 17.2 trillion
Kenya	Mobile Money	2022	n.a.	KES 7.9 trillion
USA	Non-cash payments	2021	204.5	USD 128.51 trillion

Source: Reserve Bank of India (2024); Banco Central do Brasil (2023); Central Bank of Kenya (2022); Federal Reserve (2022)

India's UPI system demonstrates exceptional growth, processing 172 billion transactions in 2024, while Brazil's Pix has rapidly expanded to 42 billion transactions within a shorter period. Kenya's mobile money system shows high economic relevance, with transaction value equivalent to approximately 65% of GDP, indicating deep integration into everyday financial activity. In contrast, the United States exhibits high transaction value but operates through fragmented systems rather than a unified real-time platform.

5.3 Sustainability Indicators

The environmental dimension of digital expansion presents a contrasting pattern.

Table 3: Sustainability Indicators

Country	CO ₂ Emissions per Capita (t)	Renewable Energy Share (%)
India	2.05 (2023)	34.9 (2021)
Brazil	2.27 (2023)	46.5 (2021)
Kenya	0.40 (2022)	67.7 (2021)
USA	14.21 (2022)	10.9 (2021)

Source: World Bank (2021–2023); UNCTAD (2024)

The data suggest that higher digital adoption does not necessarily correspond to higher environmental efficiency. The United States, despite advanced digital infrastructure, records significantly higher per capita emissions (14.21 metric tons), whereas Kenya demonstrates low emissions (0.40 metric tons) alongside high renewable energy usage. These differences highlight that sustainability outcomes are influenced by broader energy systems rather than digital adoption alone.

5.4 Institutional Comparison

Institutional configurations provide critical insight into these variations.

- **India and Brazil:** Public-led, highly interoperable systems with strong incentives (zero or low transaction costs)
- **Kenya:** Hybrid system with moderate interoperability and regulatory support
- **United States:** Market-led system with fragmented governance and fee-based incentives

These differences align with observed adoption patterns. Systems with strong governance and interoperability tend to achieve rapid scaling and broader inclusion.

5.5 Integrated Analysis

Bringing these findings together, the analysis indicates that digital platforms contribute to sustainability outcomes primarily through efficiency gains and financial inclusion. However, these outcomes are conditional. Institutional alignment—particularly the combination of strong governance, high interoperability, and effective incentives—appears to be associated with higher adoption and system efficiency.

At the same time, environmental outcomes remain mixed. While digital platforms reduce transaction frictions, they also contribute to increased energy consumption at the systemic

level. This reinforces the argument that digital innovation alone is insufficient to ensure sustainability and that institutional design plays a central role in shaping outcomes.

6. Discussion

The findings of this study suggest that digital platforms do not produce uniform sustainability outcomes; rather, their effects vary depending on the institutional context in which they operate. The comparative analysis highlights that systems characterised by strong governance and high interoperability—such as India’s Unified Payments Interface and Brazil’s Pix—are associated with rapid adoption and broader financial inclusion. These systems demonstrate how coordinated institutional design can reduce transaction costs, standardise participation, and enable large-scale integration of users and service providers.

At the same time, the results indicate that adoption alone does not translate directly into sustainability. While digital platforms improve efficiency and reduce friction in transactions, their environmental implications remain complex. The observed variation in carbon emissions across countries suggests that sustainability outcomes are influenced more by underlying energy systems than by digital adoption itself. For instance, despite high digital maturity, the United States records significantly higher per capita emissions compared to Kenya, where digital adoption coexists with a higher share of renewable energy. This indicates that digital platforms can support sustainability goals, but only when aligned with broader environmental and energy policies.

The institutional dimensions identified in this study—governance, interoperability, and incentives—provide a useful framework for interpreting these differences. Governance structures shape the direction and coordination of digital systems, while interoperability determines the extent to which platforms can scale and integrate across stakeholders. Incentives, in turn, influence user behaviour and adoption patterns. The interaction of these dimensions appears to be critical in determining whether digital platforms contribute to inclusive and efficient outcomes.

Another important insight is the distinction between public-led and market-led systems. Publicly coordinated systems tend to prioritise accessibility and standardisation, which supports inclusion and scalability. In contrast, market-led systems may foster innovation but often result in fragmented structures, limiting interoperability and slowing adoption. This suggests that the balance between public coordination and market participation plays a significant role in shaping digital outcomes.

Overall, the findings reinforce the argument that digital innovation is not inherently aligned with sustainability. Instead, sustainability outcomes appear to be contingent on how digital platforms are embedded within institutional frameworks. This highlights the importance of policy coordination and system design in ensuring that digital transformation contributes meaningfully to sustainable development. Digital platforms may also contribute to indirect environmental impacts through data infrastructure expansion and energy-intensive processing systems.

7. Conclusion

This study examined the relationship between digital platforms and sustainability outcomes through an institutional analytical framework. The findings suggest that digital innovation, while enabling efficiency and financial inclusion, does not independently ensure sustainable outcomes. Instead, the effectiveness of digital platforms appears to be shaped by institutional configurations, particularly governance structures, interoperability standards, and incentive mechanisms.

Comparative evidence from India, Brazil, Kenya, and the United States indicates that publicly coordinated and interoperable systems are associated with higher adoption and broader inclusion. However, the environmental implications of digital expansion remain uneven, with sustainability outcomes influenced by broader energy systems and policy alignment rather than digitalization alone.

The study contributes to the literature by integrating digital platform analysis with sustainability considerations through an institutional perspective. It highlights the importance of coordinated policy frameworks in aligning digital innovation with sustainable development objectives. Overall, the findings indicate that achieving sustainable outcomes requires not only technological advancement but also carefully designed institutional support systems.

8. Limitations

This study is based on secondary data and adopts a descriptive and comparative analytical approach, which limits the ability to establish causal relationships between digital platforms and sustainability outcomes. The analysis relies on the latest available data from multiple sources, which are not always uniformly aligned across countries or time periods. In particular, indicators related to the environmental impact of digital systems, such as ICT-specific energy consumption, are not consistently available at the country level. Additionally, the study focuses on selected countries representing different institutional models, which may not fully capture the diversity of global digital ecosystems. Future research may address these limitations by incorporating primary data and applying quantitative methods to examine causal relationships in greater detail.

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THE EVOLUTION OF SUPPLY CHAIN MANAGEMENT IN THE DIGITAL ERA

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Abstract

The purpose of this research is to explore the relationship between supply chain management strategy and chain management practices on supply chain performance. The main tools of data collection instrument used was a questionnaire which was administrated to a total sample of 200 managers are classified by job title and respondents are also classified by their job functions are corporate executive, purchasing, manufacturing/production, distribution/logistic, SCM, transportation, material, and operation from Malaysia manufacturing industry. The response rate was 62% while 51% was usable questionnaires. Sample selection was based on convenience sampling. The data were analyzed using mean, standard deviation and correlation between independent and dependent variables. The analyses involved statistical methods such as reliability and validity tests and multiple regressions. The finding showed that supply chain management practices have a significant relationship with supply chain performance statically. However, supply chain management strategy is a weak predictor of supply chain management performance.

Key Words: *Supply Chain Management (SCM) Evolution of Supply Chains, Smart Supply Chains, Supply chain performance, Digital transformation, Data-Driven decision making.*

1. Introduction

Strategic supply chain management is essential in the current competitive world market, effectively assisting businesses in meeting and anticipating their consumers' demands in the most efficient way possible [1,2]. However, the challenges posed by emerging technologies, demand fluctuations, pandemics, and environmental turbulences affect supply chain decision-making processes [3,4,5]. In this respect, the conventional theoretical learning approach may not prepare the next generation of professionals to cope with real-life challenges, and this phenomenon is described as the “enigma of professionalism.” Skills development in this context is essential in order to effectively cope with the challenges mentioned above, particularly in supply chain management and other relevant fields. Simulations and game-based learning have shown promising results in providing an interesting and interactive environment in which learners can make real decisions and develop their creativity.

Previous research works have employed games, for instance, Beer Game for explaining concepts like supply chain coordination [9, 10, 11, 12]. Other games have dealt with different concepts of supply chains, for example, closed-loop supply chains [13], demand forecast, production plan, supplier selection based on cost and lead times, and inventory management [14, 15].

Although some of the games have addressed certain problems that exist within the supply chain, research indicates that more educational tools and models need to be developed, especially with the emergence of the Supply Chain 4.0 concept [16]. The current games have

concentrated more on technical stability rather than the learning capacity, and therefore, a more comprehensive view of the real-world problems is required. Perhaps one of the factors that contribute to this aspect is the need for more access to a more recent survey of the challenges that exist within this field, as the majority of the existing reviews have concentrated on strategic supply chain management individually. For example, various literature reviews have focused on certain aspects of the green supply chain management, such as performance measurement, supplier selection and evaluation, and analytical modeling [17, 18]. It becomes hard for them to visualize the big picture of the severe problems that may befall the supply chain and which need to be considered. The aspect of considering the recent challenges and uncertainties within the strategic supply chain management needs to be evident within the existing games and simulations.



Strategic Supply Chain Pedagogical Activities and Teaching Innovative Strategies:

This sub-section is dedicated to supply chain learning strategies. The information from existing research works is structured according to the following topics: (a) theories of games and simulation learning, (b) technical characteristics of existing games and business simulations, and (c) supply chain concepts addressed by teaching-based games and simulations.

With regard to theories, two major theoretical trends in the application of games and simulations in supply chain management education, as derived from literature, are problem-based learning (PBL) and Experimental Learning Theory (ELT). These theories focus more on action-oriented, participatory, and student-centred learning, derived from real experiences and critical reflection in a group context [96, 97, 98]. Problem-based learning promotes exploration in new knowledge among students, in a collaborative manner, with the teacher acting as a guide and facilitator [7, 98, 99]. Ref. [8] identified some critical elements in the process of problem-based learning. These include the open-ended problem, which initiates the process of learning, student engagement in independent and collaborative learning, and the role of the teacher in scaffolding, which promotes problem-solving skills in the domain, creativity, and critical thinking.

Simulations have emerged as a revitalization strategy for supply chain courses, which leverage the power of experiences to replace or reinforce real experiences with a positive learning outcome [98, 101, 102]. Simulations, based on Kolb's Experimental Learning

Theory, link practical skills with theoretical knowledge, thus increasing short-term engagement and long-term employability [103, 104]. The study points to the difficulty faced in communicating basic knowledge in the field of supply chain management using purely theoretical methods, with the effectiveness of role-playing games, simulations, exercises, and business case studies emerging as alternatives.

According to the literature, a game is characterized as a paradigm for competitive and cooperative behaviour within a framework that incorporates rules, which may be formal or informal in nature. On the other hand, the objective of a simulation is to comprehend and resolve “complex real-life problems” by developing a replica or a model that is simplified in nature [109]. Whether the game is played individually or in groups, the objective is to achieve goals through actions and decisions, which are part of business games or simulations that are associated with the business world [110, 111]. The simulation is a replica or model that is abstract, simplified, and has rules, enabling the participants to leverage the power of achieving common goals. The gaming process within the simulation environment provides individuals with the opportunity to witness the outcomes of different strategies without the involvement of a human competitor, which is a sense making process.

The literature has defined a game as “a paradigm of competitive and cooperative behaviour in a context of rules, ranging from the most formal to the least formal.” On the other hand, a simulation is defined as “an approach to understand and solve ‘complex real-life problems’ by creating a simplified version or model.” In both cases, whether as individuals or groups, the common goal is to achieve success through actions and decisions in a business game or simulation that involves the real world of business [110,111]. The simulation is a simplified and abstract representation with rules, and this allows the participants to “tap the power of achieving common goals.” In the context of the simulation, gaming helps the individual to “see the consequences of different strategies in the absence of a human competitor, and this is a sense making process.”

With regard to the existing simulation games’ technical characteristics, it is observed that supply chain simulation games literature includes paper-based games, for example, [112], and digital games, dealing with different supply chain and logistics aspects. These games, when implemented online, reduce the setup time, making it easier for an instructor to review and present results [113]. Additionally, they reduce students' coordination and increase the realism of the supply chain [113, 114, 115]. However, it is observed that the majority of games implemented in the industry are paper-based, and only 37.5% of them are digital web-based games [19]. New games implemented have dealt with different supply chain and logistics aspects, for example, sustainable aspects of supply chains, as observed in games such as Shortfall and X-Supply games.

Firstly, the concept of the bullwhip effect has been a major point of focus for various simulation and game developers in the education of supply chains. The Beer Game and many others have adequately addressed the bullwhip effect concept, thus becoming popular

platforms for the education of supply chain information value. The Beer Game can be used to illustrate the bullwhip effect concept as well as quickly disseminate knowledge for its mitigation. Out of the existing games in the supply chain education arena, including The Mortgage Service Game, SBELP "supply chain simulator," The SC-Mark Shark Tank Game, ECLIPS Game, Lean Leap Logistics Game, Quebec Wood Supply Game, Service Supply Chain Game, Think Log, among others, over ten games have supported this concept in supply chains.

Secondly, collaboration and contract concepts have been incorporated in existing games. This is a very important concept in the supply chain in terms of building relations and creating a competitive advantage. Games and simulations are effective in teaching this concept in the supply chain [136]. The games and simulations include BASE, the supply chain collaboration business game [10], The Fresh Connection [122], Service Supply Chain, Lean Leap Logistics, and Chain Game.

Third, the concept of the supply chain network is of interest to game developers in existing games. Production planning is a key concept in supply chain management that covers the entire production process. In the supply chain network, production planning plays a critical role. According to [13], a supply chain plan integrates and ensures the smooth operation of every component in an organization. In existing research, Logistic Simulator (LOST) is used as a game for supply chain production planning. The game helps students learn in a playful manner. In addition, another game called Responsive Learning Technologies focuses on critical factors in the supply chain and network design.

Implications and Further Development

The results from the analysed papers highlight the fact that the management of the supply chain is influenced by the current complex challenges, which can prevent the achievement of the set goals. The challenges associated with the decision-making process of the supply chain include disruptive technologies, demand changes, pandemics, and environmental turbulence [3,4,5]. The fact that these challenges are unpredictable and complex makes it difficult to pass the message to the younger generation of university students. The various and constantly changing teaching strategies have to be used to meet the mission of the business school, which requires the connection of the theoretical and practical aspects of the supply chain [104]. The use of the current and innovative teaching strategies and tools not only improves the students' short-term interest but also enhances their future employment prospects.

Although it is recognized that the findings of this study are only relevant to the studies covered in this review, further research in this subject should be initiated and additional documents that could yet have to be captured in this review should be included. Future research should be directed at areas of sustainable supply chain management that have yet to be fully explored and frameworks should be developed on how to teach and understand these areas for students and practitioners. Others should be directed at testing different sustainable

supply chain frameworks and assessing the efficacy of different teaching approaches, such as integrating knowledge management with supply chain methodologies.

Conclusions

This research was based on the systematic review of strategic supply chain challenges and instructional strategies. By employing the systematic literature review and bibliometric co-citation analysis, this research was able to identify 118 essential papers. From the research, there was a prominent focus on research studies on sustainable supplier selection and evaluation challenges in supply chain management. It was also evident that business simulation games are an effective strategy in addressing these challenges. These include quality, delivery, technological, sustainable, and cost factors. Fuzzy AHP and VIKOR are also essential tools in supplier selection. Other research studies include supply chain networks and sustainable supply chain management.

In educational settings, games and simulations can effectively teach supply chain concepts, and they cover different aspects of supply chains, such as the bullwhip effect, collaboration, supply chain networks, and sustainable supply chains. However, for it to match the intricacies of sustainable Supply Chain 4.0, more sophisticated games and simulations need to be created, especially for dealing with uncertainty and supply chain disruptions and incorporating sustainable supply chains, block chain, and artificial intelligence models.

Author Contributions

Conceptualization, P.-M.L. and L.C.; methodology, J.K.K.; software, J.K.K.; validation, J.K.K., L.C., and P.-M.L.; formal analysis, J.K.K.; investigation, J.K.K.; resources, P.-M.L.; data curation, L.C.; writing—original draft preparation, J.K.K.; writing—review and editing, J.K.K., L.C., and P.-M.L.; visualization, J.K.K.; supervision, L.C., and P.-M.L.; project administration

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INNOVATIVE TEACHING-LEARNING PRACTICES FOR SUSTAINABILITY IN INDIAN HIGHER EDUCATION

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Abstract

Global sustainability challenges, as highlighted by the United Nations Sustainable Development Goals (SDGs), demand significant transformations in higher education. Education for Sustainable Development (ESD) plays a vital role in equipping students with the knowledge, skills, values, and attitudes necessary to build a more sustainable future.

This review paper explores innovative teaching-learning practices for fostering sustainability competencies, with a specific focus on commerce and management programmes (B.Com and M.Com) in the Indian higher education context under the National Education Policy (NEP) 2020. Drawing from existing literature, policy documents, and pedagogical examples, the paper identifies six promising approaches: project-based learning, experiential and community-based learning, interdisciplinary collaboration, gamification and simulations, standards-integrated visual frameworks, and inquiry-based reflection.

These practices are illustrated through relevant commerce examples such as ESG integration in finance, circular economy models, sustainable supply chains, green marketing, and ethical leadership. The study demonstrates how these methods align with NEP 2020's emphasis on experiential learning, multidisciplinary education, and value-based environmental education. It further examines implementation challenges in the Indian setting, offers practical recommendations for faculty and institutions, and suggests directions for future research, particularly in Karnataka and other parts of India.

Key words: Education, Innovation, Sustainability, Teaching and Learning

1. Introduction

The 21st century presents formidable sustainability challenges, including climate change, biodiversity loss, resource depletion, and deepening inequalities. Addressing these issues requires a rapid transition towards low-carbon and circular economies. While businesses have significantly contributed to many of these problems, they also hold substantial potential to drive solutions. Therefore, preparing future business leaders with the right knowledge, skills, and mindset has become critically important.

Traditional approaches to commerce education, which often rely on compartmentalised subjects and lecture-based instruction, are increasingly inadequate. Students must develop the ability to tackle complex, ill-structured problems, make ethically sound decisions, and create long-term sustainable value (Fagerman, 2025; AACSB, 2021).

Education for Sustainable Development (ESD), as advocated by UNESCO, offers a more holistic and effective pathway. It equips learners with the necessary knowledge, skills, values, and behaviours to address sustainability challenges. Central to ESD are eight key

competencies: systems thinking, anticipatory, normative, strategic, collaboration, critical thinking, self-awareness, and integrated problem-solving (UNESCO, n.d.; UNESCO, 2017). India's National Education Policy (NEP) 2020 presents a timely and significant opportunity in this context. With over 58,000 colleges and approximately 43 million students (Kaur, 2026), the policy strongly promotes multidisciplinary learning, experiential and practical education, environmental awareness, constitutional values, and the development of 21st-century skills. Commerce and management education occupies a strategic position in this transformation. Graduates of these programmes will go on to influence financial decisions, marketing strategies, supply chains, and human resource management. It is therefore essential to integrate sustainability themes such as Environmental, Social and Governance (ESG) criteria, circular economy principles, green marketing, and green HRM into the core curriculum.

2. Conceptual Framework: ESD Competencies and Transformative Learning

UNESCO's Education for Sustainable Development (ESD) framework promotes learning that is holistic, transformative, and action-oriented. It goes beyond mere cognitive knowledge acquisition to include values clarification, socio-emotional development, and meaningful behavioural change.

The framework identifies eight key competencies for sustainability (UNESCO, 2017 and subsequent updates):

- **Systems thinking competency:** The ability to understand interconnections, feedback loops, and unintended consequences within complex social-ecological-economic systems. This is particularly relevant for analysing supply chain externalities and climate-business interdependencies.
- **Anticipatory competency:** Envisioning and assessing multiple future scenarios, including associated risks and opportunities. This competency is essential for climate scenario analysis in finance and long-term strategic planning.
- **Normative competency:** Reflecting on and negotiating values, principles, and ethical dilemmas, such as balancing profit motives with planetary and social concerns or ensuring fair labour practices in global value chains.
- **Strategic competency:** Designing and implementing interventions and transition pathways towards sustainability, for instance through circular business model innovation or ESG integration strategies.
- **Collaboration competency:** Working effectively across disciplines, cultures, and diverse stakeholder groups — a critical skill for interdisciplinary projects and multi-stakeholder partnerships.
- **Critical thinking competency:** Questioning dominant norms, assumptions, and paradigms, including the ability to identify greenwashing and challenge unsustainable business-as-usual models.

- **Self-awareness competency:** Reflecting on one's own role, biases, privileges, and potential to act as an agent of change, often developed through reflective practices and personal sustainability audits.
- **Integrated problem-solving competency:** Applying the above competencies in a holistic manner to address complex, real-world sustainability challenges.

These competencies are best cultivated through active, experiential, collaborative, reflective, and contextually grounded pedagogies — the very features that characterise the innovative teaching-learning practices (TLPs) discussed in this paper. Complementing this, transformative learning theory (Mezirow, 1997; Sterling, 2011) emphasises the role of disorienting experiences that challenge learners' existing frames of reference, ultimately leading to deeper perspective transformation and lasting behavioural change.

3. Innovative Teaching-Learning Practices for Sustainability

This section presents six innovative teaching-learning practices that are particularly effective for embedding sustainability in Indian commerce and management education. These approaches are practical, adaptable to large classes, and well-aligned with the resource realities of many Indian colleges. A brief overview is provided in Table 1, followed by a detailed discussion of each practice.

Table 1: Overview of Innovative Teaching Methods for Sustainability Education

Teaching Method	Simple Description	Commerce Examples	Main Skills Developed	Link to NEP 2020
Project-Based Learning	Students work on real projects and solve authentic problems	Designing circular business models, ESG assessments, carbon accounting	Problem-solving, systems thinking, teamwork	Hands-on learning, research, multidisciplinary
Experiential & Community Learning	Learning through direct experience and community engagement	Campus sustainability audits, collaboration with farmers (coffee/areca), green internships	Self-awareness, collaboration, ethical reasoning	Practical learning, community engagement
Interdisciplinary Learning	Integration of knowledge from multiple disciplines	Sustainable finance with data science, Bengaluru waste management business projects	Systems thinking, collaboration, critical thinking	Multidisciplinary education, flexibility
Gamification & Simulations	Use of games, simulations and digital tools	ESG investment decision games, SDG-based flipped classrooms, Indian company case simulations	Strategic thinking, anticipatory competency, critical thinking	Technology integration, experiential learning
Standards & Visual Frameworks	Application of sustainability standards	Mapping business operations using BRSR and GRI	Systems thinking, ethical awareness,	Quality standards, research skills

	through tools	visual	frameworks, analysis of company sustainability reports	strategic application	
Inquiry, Reflection & Transformative Learning	Student-driven inquiry combined with structured reflection		Studying climate impacts on Karnataka agriculture, personal sustainability journals, ethical debates	Critical thinking, self-awareness, normative competency	Value education, self-directed learning

3.1 Project-Based and Problem-Based Learning (PBL)

Project-Based Learning shifts the focus from the teacher to the student as an active learner. Students are given (or identify) ill-structured, real-world sustainability problems and work iteratively to research, develop solutions, and present their findings. In commerce education, this approach closely mirrors professional practice such as consulting assignments, business plan development, and policy analysis.

Examples include developing a sustainable packaging strategy for an e-commerce company, designing a green bond framework for a municipal body, or assessing the financial implications of net-zero transitions for MSMEs. PBL effectively builds integrated problem-solving, strategic thinking, and collaboration skills. In the Indian context, projects can be anchored in local issues — such as sustainable tourism models for the Western Ghats or water-positive campus initiatives — thereby supporting NEP 2020's emphasis on experiential and research-based learning.

3.2 Experiential, Service, and Place-Based Learning

These pedagogies anchor learning in real contexts. Service learning integrates academic goals with community service, while place-based education connects learning to the local environment and culture. For commerce students, suitable activities include conducting sustainability audits of college canteens or local businesses, partnering with Farmer Producer Organisations (FPOs) to strengthen sustainable market linkages, or leading plastic reduction drives that address packaging, logistics, and consumer behaviour.

Such experiences foster empathy, an understanding of ethical trade-offs, and greater self-awareness of one's role as a change agent. Karnataka's rich ecological and economic diversity — ranging from Bengaluru's tech ecosystem to coffee and spice plantations and coastal fisheries — provides excellent opportunities for locally relevant, place-based learning.

4. Alignment with NEP 2020 and the Indian Higher Education Context

The vision of the National Education Policy (NEP) 2020 aligns remarkably well with the principles of Education for Sustainable Development (ESD). By emphasising multidisciplinary programmes, multiple entry and exit options, research and innovation at the undergraduate level, experiential learning through internships and projects, integration of environmental education, and the development of constitutional values and global citizenship, NEP 2020 provides strong philosophical and structural support for the innovative teaching-

learning practices discussed earlier. The policy's focus on holistic, integrated, and engaging learning experiences strongly encourages a shift away from rote, examination-centric approaches.

This alignment offers several practical opportunities for commerce and management education:

- **Curriculum Design:** Sustainability concepts can be embedded across core, elective, and skill-enhancement courses rather than being limited to a standalone Environmental Studies paper. New Skill Enhancement Courses (SEC) or Discipline Specific Electives (DSE) could be developed on themes such as “ESG and Sustainable Business,” “Circular Economy and Business Innovation,” or “Climate Finance and Sustainable Investing.”
- **Pedagogical Shift:** Faculty can gradually replace or supplement traditional lectures with the active, student-centred methods outlined in this paper. A practical starting point is to pilot one or two innovative practices in a single course each semester.
- **Assessment Reform:** Moving towards authentic assessment methods — including project reports, portfolios, presentations, peer and self-assessment, and competency-based rubrics — which are consistent with NEP 2020's emphasis on formative and outcome-based evaluation.
- **Technology and Open Educational Resources (OER):** Utilising digital platforms and freely available resources on sustainability (from UNESCO, UN Global Compact, SWAYAM, and other Indian initiatives) to support flipped classroom and blended learning models.
- **Local Contextualisation:** Incorporating Karnataka-specific or India-specific cases, data, and challenges enhances student engagement and ensures cultural relevance.

While NEP 2020 provides a strong enabling framework, Kaur (2026) rightly cautions that translating policy intent into practice requires sustained faculty development, robust implementation mechanisms, and conscious attention to equity and inclusion. Commerce departments are well-positioned to take a leading role by fostering interdisciplinary collaborations and positioning their programmes as catalysts for green job creation and responsible business leadership — outcomes that simultaneously advance NEP 2020's employability goals and the broader sustainability agenda.

5. Challenges, Enablers, and Implementation Pathways

Despite their strong potential, several barriers hinder the widespread adoption of innovative sustainability teaching-learning practices in Indian commerce education.

Key Challenges

- **Faculty Capacity and Mindset:** Many educators were trained under traditional paradigms and may lack deep familiarity with ESD competencies, facilitation skills for project-based or reflective learning, or confidence in addressing complex and

sometimes contested sustainability issues. Professional development opportunities remain limited and sporadic.

- **Assessment and Accreditation Pressures:** High-stakes examinations and rigid syllabi often discourage experimentation with innovative pedagogies. Although outcome-based education is promoted in policy, it is not consistently implemented for higher-order competencies.
- **Resource and Infrastructure Constraints:** Activities such as field visits, live projects, simulation software, and small-group facilitation require time, funding, and adequate physical or digital infrastructure — resources that are often scarce, especially in smaller and rural-affiliated colleges.
- **Large Class Sizes and Student Diversity:** Undergraduate classes frequently exceed 60–100 students, creating logistical difficulties for intensive experiential and personalised learning, although creative solutions like team projects, peer facilitation, and technology can help.
- **Institutional Silos and Inertia:** Existing departmental structures, examination systems, and faculty promotion criteria do not always incentivise interdisciplinary or sustainability-focused teaching and scholarship.

Enablers and Implementation Pathways

Several enabling factors and practical strategies can help overcome these challenges:

- **Targeted Faculty Development:** Regular workshops, communities of practice, and action research initiatives focused on sustainability pedagogy. These could be organised at university or cluster levels and supported through platforms such as SWAYAM and NPTEL.
- **Institutional Support Structures:** Establishing green campus initiatives as living laboratories, creating dedicated sustainability cells, offering seed funding for innovative teaching projects, and instituting recognition and rewards for pedagogical innovation.
- **Strategic Partnerships:** Collaborations with industry (for live projects, internships, and guest lectures from ESG leaders), NGOs and civil society organisations (for service learning), other academic departments, and international networks such as PRME signatories.
- **Phased and Scaffolded Implementation:** A gradual approach starting with awareness-building and foundational modules, moving to application-oriented projects, and eventually leading to student-driven transformative initiatives. Existing courses can serve as effective entry points.
- **Policy and Regulatory Incentives:** The UGC and state higher education bodies could develop model curricula with clear sustainability competencies, provide dedicated funding for pedagogical innovation, and integrate ESD indicators into accreditation and quality assurance frameworks.

- **Student Voice and Agency:** Actively empowering student clubs, sustainability committees, and peer mentoring programmes can significantly enhance impact while reducing the burden on faculty.

Successful adoption in institutions such as Kumadvathi First Grade Degree College (KFGC) and other colleges affiliated to Kuvempu University can serve as powerful models for peer learning and broader scaling across Karnataka and India.

6. Conclusion and Recommendations

Innovative teaching-learning practices are essential for addressing the growing sustainability challenges facing India and the world. When effectively integrated into commerce and management education in alignment with NEP 2020, these approaches can equip students with the competencies needed to become responsible business leaders who make ethical decisions and contribute meaningfully to sustainable development.

Recommendations

For Teachers (Commerce Educators):

- Introduce one or two innovative methods per semester, beginning with relatively simple approaches such as project-based assignments or reflective journals.
- Continuously enhance your own understanding of sustainability issues and share successful practices with colleagues.
- Incorporate local Karnataka examples and contexts to make learning more relevant and engaging for students.
- Experiment with new methods, document the outcomes, and refine your approach based on classroom experiences.

For Colleges and Universities:

- Establish dedicated sustainability education teams or committees.
- Provide regular faculty development programmes on innovative pedagogies and NEP 2020 implementation.
- Reform assessment systems to give greater weight to projects, practical work, and competency-based evaluation.
- Transform the campus into a living laboratory through green initiatives that serve as sites for experiential learning.
- Build strong partnerships with industry, government, and local communities for real-world projects and internships.

For Government and Policymakers (UGC, Ministry of Education, and Universities):

- Explicitly integrate sustainability competencies into all commerce and management curricula.
- Offer funding schemes and awards to encourage pedagogical innovation and research in sustainability education.
- Develop comprehensive faculty training programmes and include ESD indicators in quality assurance and accreditation processes.

- Create and disseminate accessible teaching materials, Indian case studies, and open educational resources on sustainability.

Directions for Future Research Further studies should focus on classroom-based action research, measure improvements in students' sustainability competencies, track graduate outcomes in the workplace, compare implementation across different types of institutions, and identify key enablers and barriers to scaling these innovative practices.

Final Words Indian higher education stands at a critical juncture. By wholeheartedly embracing innovative, student-centred teaching methods, commerce educators can effectively implement the vision of NEP 2020 and play a pivotal role in preparing the next generation of business leaders to build a more sustainable and equitable India.

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THE FUTURE OF FARMING: LEVERAGING ARTIFICIAL INTELLIGENCE FOR SUSTAINABLE AGRICULTURE

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Abstract

Agriculture has always been the backbone of human civilisation, providing food, employment, and raw materials for industries. However, the agricultural sector is currently facing significant challenges such as climate change, water scarcity, declining soil fertility, labour shortages, unpredictable weather patterns, and increasing global food demand. According to international organisations, the world's population is expected to reach nearly 10 billion by 2050, creating enormous pressure on food production systems. Traditional farming methods alone are insufficient to meet these challenges while ensuring environmental sustainability. Therefore, the integration of Artificial Intelligence (AI) into agriculture has emerged as a revolutionary solution for improving productivity, efficiency, and sustainability. Artificial Intelligence enables machines to perform tasks that normally require human intelligence, including learning, decision-making, prediction, and problem-solving. In agriculture, AI technologies such as machine learning, computer vision, robotics, drones, satellite imaging, Internet of Things (IoT) sensors, and predictive analytics are transforming conventional farming into smart farming. These technologies assist farmers in monitoring crop health, detecting diseases, predicting weather conditions, optimising irrigation schedules, reducing pesticide use, improving soil management, and increasing crop yields. AI also supports precision agriculture by providing real-time recommendations based on data collected from farms. Despite its numerous benefits, the adoption of AI in agriculture faces several challenges, including high implementation costs, inadequate digital infrastructure, lack of technical knowledge among farmers, cybersecurity concerns, and limited accessibility for small-scale farmers. Governments, research institutions, and private organisations must work together to promote affordable AI technologies, digital literacy, and supportive agricultural policies. This paper examines the role of Artificial Intelligence in sustainable agriculture, discusses its major applications, analyses its benefits and challenges, and explores future opportunities for AI-driven farming. The study concludes that AI has the potential to transform global agriculture by ensuring higher productivity, efficient resource utilisation, environmental conservation, and long-term food security.

Introduction

Agriculture is one of the oldest and most important economic activities in the world. It not only provides food for the growing population but also supplies raw materials to industries, creates employment opportunities, and contributes significantly to national income. In developing countries, agriculture remains the primary source of livelihood for millions of people. However, modern agriculture is facing numerous challenges that threaten its long-term sustainability. Climate change has resulted in irregular rainfall, rising temperatures, droughts, floods, and frequent natural disasters, all of which negatively affect agricultural productivity. Rapid urbanisation has reduced the availability of agricultural land, while excessive use of fertilisers and pesticides has caused soil degradation and environmental pollution.

The increasing global population has intensified the demand for food production. According to estimates by international organisations, food production must increase substantially by 2050 to feed the world's population. At the same time, agricultural resources such as water, fertile land, and labour are becoming increasingly scarce. Farmers are therefore expected to produce more food using fewer resources while reducing their environmental impact. This situation has created an urgent need for innovative and technology-driven agricultural practices.

Artificial Intelligence (AI) has emerged as one of the most promising technologies for addressing these challenges. AI refers to computer systems capable of performing tasks that typically require human intelligence, including learning from data, recognising patterns, making predictions, and supporting decision-making. AI technologies can analyse vast amounts of agricultural information within seconds, enabling farmers to make informed decisions based on scientific evidence rather than intuition.

The application of AI in agriculture has led to the development of smart farming or digital agriculture. Smart farming integrates AI with advanced technologies such as drones, remote sensing, satellite imagery, IoT devices, robotics, and cloud computing. These technologies continuously collect data related to soil moisture, crop growth, weather conditions, pest infestations, and nutrient levels. AI algorithms process this information and provide recommendations that help farmers optimise irrigation, fertiliser application, harvesting schedules, and crop management practices.

One of the most significant contributions of AI is precision agriculture. Precision agriculture enables farmers to apply the right amount of water, fertiliser, and pesticides at the right place and at the right time. This not only improves crop productivity but also reduces production costs and minimises environmental damage. AI-based disease detection systems can identify plant diseases at an early stage using image recognition techniques, allowing timely intervention before significant crop losses occur. Similarly, AI-powered weather forecasting models help farmers prepare for adverse weather conditions and reduce agricultural risks.

Artificial Intelligence also plays an important role in improving sustainability. Sustainable agriculture aims to meet present food needs without compromising the ability of future generations to meet their own needs. AI contributes to sustainability by promoting efficient resource utilisation, reducing greenhouse gas emissions, conserving water, protecting biodiversity, and improving soil health. These outcomes support several Sustainable Development Goals (SDGs), including Zero Hunger, Clean Water and Sanitation, Responsible Consumption and Production, and Climate Action.

Although AI offers tremendous opportunities, its implementation is not without challenges. High investment costs, inadequate digital infrastructure, lack of awareness, insufficient technical skills, and data privacy issues remain major obstacles, especially in developing countries. Therefore, successful implementation requires collaboration among governments, universities, research institutions, technology companies, extension agencies, and farmers.

In recent years, countries such as India, the United States, Japan, China, Israel, and the Netherlands have made significant investments in AI-based agricultural technologies. Various start-ups and agritech companies are developing affordable AI solutions for farmers, including mobile applications for crop diagnosis, intelligent irrigation systems, autonomous tractors, and digital advisory services. These innovations demonstrate the growing importance of AI in modern agriculture.

Considering the increasing demand for sustainable food production, Artificial Intelligence has become an indispensable component of future farming. It enables farmers to make better decisions, increase productivity, reduce resource wastage, improve profitability, and protect the environment. Therefore, understanding the applications, benefits, challenges, and future prospects of AI in agriculture is essential for policymakers, researchers, educators, and agricultural practitioners.

Objectives of the Study

The major objectives of this research are:

- To understand the concept of Artificial Intelligence in agriculture.
- To examine the major applications of AI in sustainable farming.
- To analyse the contribution of AI towards improving agricultural productivity and resource efficiency.
- To identify the economic, environmental, and social benefits of AI-based farming.
- To study the challenges associated with the adoption of AI technologies in agriculture.
- To suggest suitable policy recommendations for promoting AI-enabled sustainable agriculture.
- To explore future opportunities for AI in achieving global food security and climate-resilient farming.

Research Methodology

The present study is based on secondary data collected from books, research journals, government publications, reports of international organisations, conference proceedings, and peer-reviewed academic articles. Information has also been gathered from publications related to Artificial Intelligence, sustainable agriculture, precision farming, and smart agricultural technologies. Relevant reports from international organisations have been reviewed to understand recent developments in AI-based agriculture. The collected information has been analysed using a descriptive research approach to explain current applications, benefits, challenges, and future prospects of Artificial Intelligence in sustainable agriculture.

Literature Review

Artificial Intelligence (AI) has emerged as a transformative technology in modern agriculture, attracting significant attention from researchers, policymakers, and agricultural practitioners worldwide. Numerous studies have highlighted the role of AI in improving agricultural productivity, enhancing resource efficiency, and promoting environmental sustainability. The existing literature indicates that AI technologies, including machine learning, computer

vision, robotics, drones, satellite imagery, and the Internet of Things (IoT), are revolutionising traditional farming practices and supporting the transition towards precision and climate-smart agriculture.

According to the Food and Agriculture Organization (FAO), global agriculture must significantly increase food production to meet the nutritional requirements of the rapidly growing population while conserving natural resources. The FAO emphasises that digital technologies, particularly Artificial Intelligence, can improve agricultural decision-making by enabling farmers to monitor crop health, predict weather conditions, optimise irrigation systems, and minimise production losses. The organisation also recognises AI as an essential tool for achieving sustainable agricultural development and ensuring global food security.

Wolfert et al. (2017) explained that the integration of big data, cloud computing, and Artificial Intelligence has transformed agriculture into a knowledge-based industry. Their study highlighted that AI enables real-time data collection and analysis, allowing farmers to make informed decisions regarding planting, fertiliser application, irrigation scheduling, and harvesting. The authors concluded that precision agriculture improves productivity while reducing the excessive use of natural resources and agricultural inputs.

Liakos et al. (2018) examined the application of machine learning techniques in agriculture and found that AI algorithms effectively support crop classification, disease diagnosis, soil analysis, irrigation management, and yield prediction. Their research demonstrated that machine learning models provide highly accurate predictions by analysing historical agricultural data together with real-time environmental information. The study also emphasised that AI-based predictive systems reduce uncertainty in farming operations and improve overall farm management.

Kamilaris and Prenafeta-Boldú (2018) reviewed the use of deep learning technologies in agriculture and observed rapid growth in AI applications across various agricultural sectors. Their study reported that computer vision techniques are widely used for identifying plant diseases, detecting weeds, monitoring fruit quality, and estimating crop yields. The researchers concluded that deep learning significantly enhances the accuracy and speed of agricultural monitoring systems compared with conventional methods.

Shamshiri et al. (2018) discussed the importance of smart farming technologies for sustainable agriculture. Their research highlighted that integrating AI with IoT devices, environmental sensors, drones, and automated irrigation systems enables continuous monitoring of agricultural fields. These technologies help farmers optimise water use, reduce fertiliser wastage, lower production costs, and minimise environmental pollution. The study further noted that AI-based farming practices contribute to climate resilience and efficient resource management.

Recent studies have also focused on the economic and environmental benefits of AI adoption in agriculture. Researchers have reported that AI technologies improve farm profitability by reducing labour requirements, increasing crop yields, and lowering operational costs. At the

same time, precision farming minimises greenhouse gas emissions, conserves water resources, protects soil fertility, and reduces excessive dependence on chemical pesticides and fertilisers. These outcomes directly support sustainable agricultural development and several United Nations Sustainable Development Goals (SDGs), including Zero Hunger, Responsible Consumption and Production, and Climate Action.

Despite these positive findings, the literature also identifies several barriers to AI implementation. High investment costs, inadequate digital infrastructure, poor internet connectivity in rural areas, lack of technical knowledge among farmers, and concerns regarding data privacy continue to limit widespread adoption, particularly in developing countries. Several researchers recommend increasing government support, improving digital literacy, strengthening agricultural extension services, and encouraging public-private partnerships to promote the adoption of AI technologies among small and marginal farmers.

Overall, the reviewed literature clearly demonstrates that Artificial Intelligence has the potential to transform agriculture by improving productivity, profitability, and sustainability. However, achieving the full benefits of AI requires collaborative efforts involving governments, research institutions, technology companies, financial organisations, and farming communities. Continuous investment in research, innovation, education, and infrastructure will be essential for ensuring the successful implementation of AI-driven sustainable agriculture across the world.

AI Applications in Sustainable Agriculture

Artificial Intelligence (AI) has become one of the most significant technological innovations in modern agriculture. It is transforming conventional farming into intelligent, data-driven, and sustainable agriculture by integrating advanced technologies such as machine learning, computer vision, robotics, the Internet of Things (IoT), drones, satellite imagery, and predictive analytics. AI enables farmers to make timely and accurate decisions that improve productivity, conserve natural resources, and minimise environmental impacts. The following sections discuss the major applications of AI in sustainable agriculture.

Precision Agriculture

Precision agriculture is one of the most important applications of Artificial Intelligence. It involves collecting and analysing real-time data related to soil conditions, crop health, weather patterns, and nutrient availability. AI systems process this information and provide accurate recommendations regarding irrigation, fertiliser application, pesticide usage, and harvesting schedules.

Unlike traditional farming, where the same quantity of fertilisers or water is applied across an entire field, precision agriculture allows farmers to treat each section of the field according to its specific requirements. This approach reduces unnecessary use of agricultural inputs, lowers production costs, and improves crop productivity. Precision farming also protects soil fertility, reduces water wastage, and minimises environmental pollution, making agriculture more sustainable.

Smart Irrigation Management

Water scarcity has become one of the greatest challenges facing global agriculture. AI-powered smart irrigation systems help farmers use water more efficiently by continuously monitoring soil moisture, temperature, humidity, rainfall, and crop water requirements through IoT sensors and weather data.

Machine learning algorithms analyse these data and automatically determine the appropriate quantity and timing of irrigation. Instead of following fixed irrigation schedules, farmers receive real-time recommendations based on actual field conditions. This technology prevents over-irrigation and under-irrigation, conserves freshwater resources, reduces electricity consumption for pumping water, and improves crop quality. Smart irrigation is particularly beneficial in drought-prone and water-scarce regions.

Crop Disease Detection and Pest Management

Crop diseases and pest attacks are major causes of agricultural losses worldwide. Artificial Intelligence enables early detection of plant diseases through image recognition and computer vision technologies. Farmers can capture images of leaves, stems, or fruits using smartphones or drones, and AI systems compare these images with extensive databases to identify diseases or pest infestations.

Early diagnosis allows farmers to take preventive measures before diseases spread across the field. AI also recommends suitable biological or chemical treatments based on the severity of the infection. This reduces excessive pesticide use, lowers production costs, protects beneficial insects, and minimises environmental contamination. Consequently, AI contributes to healthier crops and safer food production.

Weather Forecasting and Climate Prediction

Weather plays a critical role in agricultural production. Unexpected rainfall, droughts, floods, heatwaves, and storms often result in significant crop losses. Artificial Intelligence improves weather forecasting by analysing historical climate data together with real-time information collected from satellites, weather stations, and sensors.

AI-based forecasting models provide accurate short-term and long-term weather predictions, enabling farmers to plan sowing, irrigation, fertiliser application, and harvesting more effectively. Farmers can also receive early warnings regarding extreme weather events, allowing them to take protective measures to reduce crop damage. Improved weather prediction strengthens climate resilience and supports sustainable agricultural planning.

Yield Prediction and Crop Planning

Accurate estimation of crop yields is essential for farmers, governments, and agricultural markets. Artificial Intelligence analyses multiple factors such as rainfall, soil fertility, temperature, crop health, pest incidence, fertiliser usage, and historical production records to predict crop yields before harvest.

These predictions help farmers choose suitable crop varieties, estimate expected income, and plan storage, transportation, and marketing activities. Governments can also use AI-generated

yield forecasts for food security planning and agricultural policy formulation. Improved yield prediction reduces uncertainty, minimises financial risks, and supports efficient agricultural supply chain management.

Agricultural Robotics and Automation

Labour shortages and rising labour costs have increased the demand for automation in agriculture. Artificial Intelligence powers autonomous tractors, robotic harvesters, automatic seed planters, fruit-picking robots, and weed-removal machines capable of performing agricultural operations with high precision.

These intelligent machines operate continuously with minimal human intervention, increasing efficiency while reducing operational costs. Robotic technologies also improve workplace safety by performing hazardous agricultural tasks such as pesticide spraying. Automation helps overcome labour shortages and enables farmers to complete time-sensitive activities more effectively, thereby improving overall farm productivity.

Drone and Satellite-Based Farm Monitoring

Drones equipped with high-resolution cameras and AI software have become valuable tools for monitoring agricultural fields. They capture detailed aerial images that help assess crop growth, detect nutrient deficiencies, identify water stress, monitor pest infestations, and estimate plant populations.

Satellite imagery combined with Artificial Intelligence enables large-scale monitoring of agricultural land over extended periods. Farmers receive accurate information regarding crop conditions without physically inspecting every field. This saves time, reduces labour requirements, and enables quick corrective actions. Drone and satellite technologies also support precision agriculture by providing detailed spatial information for better farm management.

Soil Health Assessment and Nutrient Management

Healthy soil is the foundation of sustainable agriculture. Artificial Intelligence analyses soil samples and sensor data to determine nutrient levels, organic matter content, moisture conditions, soil pH, and fertility status. Based on these analyses, AI recommends the appropriate quantity and timing of fertiliser application.

Balanced nutrient management improves crop growth while preventing excessive fertiliser use that may contaminate water bodies and degrade soil quality. AI also assists in identifying soil degradation and erosion risks, enabling farmers to adopt suitable conservation measures. Consequently, AI contributes to maintaining long-term soil productivity and environmental sustainability.

Supply Chain and Market Intelligence

Artificial Intelligence improves agricultural supply chain management by predicting market demand, analysing price trends, optimising transportation routes, and reducing post-harvest losses. AI systems collect information from markets, weather forecasts, storage facilities, and consumer demand to provide farmers with valuable marketing insights.

Farmers can decide the most appropriate time to sell their produce, reducing distress sales and increasing profitability. AI also improves inventory management and logistics by ensuring efficient movement of agricultural products from farms to consumers. These improvements reduce food waste and strengthen the agricultural value chain.

Livestock Management

Artificial Intelligence is also widely used in livestock farming. Smart wearable sensors monitor the health, body temperature, feeding behaviour, movement, and reproductive cycles of animals. AI systems analyse these data to identify diseases, nutritional deficiencies, and abnormal behaviour at an early stage.

Early diagnosis improves animal welfare, reduces mortality rates, and increases milk, meat, and egg production. Automated feeding systems and health monitoring technologies reduce labour requirements while improving farm efficiency. AI-based livestock management supports sustainable animal husbandry and contributes to increased agricultural income.

AI-Based Agricultural Advisory Services

Artificial Intelligence has enabled the development of digital advisory platforms that provide farmers with real-time agricultural guidance through mobile applications and online platforms. These AI-powered systems answer farmers' questions regarding crop selection, fertiliser dosage, irrigation scheduling, pest management, weather forecasts, and market prices.

Such advisory services are particularly beneficial for small and marginal farmers who may have limited access to agricultural experts. Information is delivered quickly and in local languages, making scientific knowledge more accessible. AI-based advisory systems improve decision-making, increase productivity, and bridge the gap between agricultural research and practical farming.

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SUSTAINABLE BUSINESS MODELS AND GREEN FINANCE

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Abstract

Green finance and sustainable business models are significant in advancing the development of environmentally friendly economies. Sustainable models refer to those that create long-term value by focusing on cooperation with the three pillars of sustainability (environmental protection, social responsibility and the creation of economic growth). Under this model, companies will attempt to make efficient use of their natural resources, minimize their carbon footprint, utilize renewable energy resources and adopt (eco-friendly) production processes. Green finance provides financing for environmentally sustainable businesses, such as renewable energy, pollution prevention and building positive infrastructure (green infrastructure). Types of green finance include green bonds, green loans and sustainable investment funds. The use of these two approaches can allow businesses to operate profitably while maintaining environmental sustainability and contributing to the long-term sustainability of both current and future generations.

Introduction

Over the last several years, environmental protection and sustainable development have emerged as two of the top priorities facing the globe today. In addition, rapid industrialization, climate change, depletion of natural resources, and various forms of pollution have all created serious challenges for businesses and societies worldwide. To overcome these challenges, many corporations and organizations have developed sustainable business models and are implementing green finance strategies to balance their economic growth and success with environmental responsibility.

A sustainable business model creates economic value for the business while taking into account the environmental impact of the operations and providing social benefits to the stakeholders. Traditional business models emphasize profit maximization; whereas, sustainable business models have incorporated environmental sustainability and social responsibility into the business. Sustainable business models motivate businesses to reduce their waste, use renewable energy sources, become more energy efficient, and create sustainable products and services. By implementing sustainable business practices, businesses can decrease their negative effects on the environment while contributing to sustainable development.

Sustainable business models also include efficient use of natural resources, implementing circular economy practices, recycling, and managing responsible supply chains. By utilizing these methods, organizations can create value for themselves as well as their shareholders and all other stakeholders, such as customers, employees, communities, and the environment. Thus, these businesses will be less vulnerable, more innovative, and more competitive than other organizations doing business globally.

Additionally, green finance provides critical support for attaining sustainability goals.

Research methodology

This research is a literature review employing a qualitative approach and utilizing descriptive analysis. The qualitative approach was chosen to gain a deeper understanding of the role of green finance in sustainable business strategies and to analyze the data descriptively in detail. Data for this study were obtained through a search of articles on Google Scholar spanning from 2014 to 2024. The initial search yielded 60 relevant articles, however, through rigorous selection based on relevance and quality, 28 most pertinent and recent articles were chosen for this research

Challenges

Sustainable business models and green finance are essential for achieving environmental protection and long-term economic growth. However, despite their importance, many organizations face several challenges while implementing sustainable practices and accessing green financial resources. These challenges arise due to financial, technological, regulatory, and organizational factors. The major challenges are explained below.

- **High Initial Investment Costs** : One of the major challenges in adopting sustainable business models is the high initial cost. Implementing renewable energy systems, energy-efficient machinery, waste management technologies, and ecofriendly infrastructure requires large investments. Small and medium enterprises often find it difficult to bear these costs due to limited financial resources. Although sustainable practices provide long-term benefits and cost savings, the high starting investment discourages many companies from adopting them.
- **Limited Access to Green Finance** : Green finance is still developing in many countries, and businesses often face difficulties in obtaining funds for sustainable projects. Financial institutions may hesitate to provide loans or investments for green projects because they perceive them as risky or less profitable. In addition, there are limited financial instruments such as green bonds, green loans, and climate funds available in some markets. This lack of financial support slows down the growth of sustainable businesses.
- **Lack of Awareness and Knowledge** : Many business leaders, investors, and consumers are not fully aware of the benefits of sustainable business models and green finance. Lack of knowledge about sustainable technologies, environmental regulations, and green financial products can prevent organizations from adopting sustainable practices. Without proper awareness and education, companies may continue to follow traditional business models that focus only on short-term profits.
- **Technological and Innovation Barriers** : Sustainable development often requires advanced technologies such as renewable energy systems, green manufacturing processes, and energy-efficient equipment. However, many organizations lack access to these technologies or the technical expertise required to implement them. Research and

development in green technologies also require significant investment and skilled professionals, which may not be available in all regions.

- **Regulatory and Policy Challenges :** Government policies and regulations play a crucial role in promoting sustainable business practices. In some cases, weak environmental policies, lack of clear guidelines, and insufficient incentives discourage companies from investing in sustainable projects. Inconsistent regulations and slow policy implementation can also create uncertainty for investors and businesses.
- **Market Uncertainty and Consumer Behaviour :** Although awareness about environmental protection is increasing, the demand for sustainable products and services is not always consistent. Many consumers still prefer cheaper conventional products instead of environmentally friendly alternatives. This uncertainty in market demand makes businesses hesitant to shift toward sustainable production and green innovations.
- **Difficulty in Measuring Environmental Impact :** Measuring the environmental and social impact of sustainable business activities is another challenge. There is often a lack of standardized systems to evaluate sustainability performance. Companies may find it difficult to measure carbon emissions, environmental benefits, or long-term sustainability outcomes. This also makes it harder for investors to evaluate the effectiveness of green investments.
- **Resistance to Organizational Change :** Many organizations are used to traditional business practices and may resist adopting new sustainable models. Employees and management may be reluctant to change existing processes due to fear of increased costs, operational complexity, or uncertainty about results. Organizational resistance can slow down the transition to sustainable practices.

Literature review

Literature review provides an overview of the research and studies conducted by scholars on sustainable business models and green finance. Many researchers have highlighted the importance of integrating sustainability into business strategies and financial systems to promote environmental protection and long-term economic development.

1. Elkginton (1997) : John Elkginton introduced the concept of the Triple Bottom Line (TBL), which emphasizes that businesses should focus not only on profit but also on social and environmental responsibilities. According to this approach, companies must balance economic growth, environmental protection, and social well-being to achieve sustainable development.
2. Schaltegger, Lüdeke-Freund, and Hansen (2012) : Stefan Schaltegger and his colleagues studied the concept of sustainable business models and explained that businesses must integrate sustainability into their core value creation processes. They emphasized that companies should develop innovative models that create economic value while reducing environmental impacts.

3. Porter and Kramer (2011) : Michael E. Porter and Mark R. Kramer introduced the concept of Creating Shared Value (CSV). They argued that businesses can improve their competitiveness while also addressing social and environmental issues. According to them, sustainable business practices can generate both economic and societal benefits.

4. UNEP (2016) : United Nations Environment Programme emphasized the importance of green finance in supporting sustainable development. The organization highlighted that financial institutions should invest in renewable energy, sustainable infrastructure, and climate-friendly projects to reduce environmental risks.

5. OECD (2017) : Organisation for Economic Co-operation and Development studied green finance policies and suggested that governments should encourage sustainable investments through regulations, incentives, and financial support. The organization also stressed the role of green bonds and climate finance in supporting sustainable projects.

6. World Bank Research (2018): World Bank reported that green finance is essential for addressing climate change and promoting sustainable economic growth. The research highlighted that financial markets should support environmentally friendly investments to achieve global sustainability goals.

Opportunities

Sustainable business models and green finance create many opportunities for businesses, governments, and society. These approaches help organizations achieve economic growth while protecting the environment and promoting social welfare. As global awareness about climate change and sustainability increases, many new opportunities are emerging in this field.

- **Growth of Green Markets**

Sustainable business models open new market opportunities for ecofriendly products and services. Consumers are becoming more environmentally conscious and prefer products that are sustainable and energy efficient. This increasing demand encourages businesses to develop green products, organic goods, and environmentally friendly technologies.

- **Innovation and Technological Development**

The adoption of sustainable practices encourages innovation and technological advancement. Companies invest in renewable energy, energy-efficient systems, recycling technologies, and sustainable production methods. These innovations help businesses improve efficiency, reduce waste, and create competitive advantages.

- **Access to Green Investments**

Green finance provides new funding opportunities for businesses and projects that focus on environmental sustainability. Financial instruments such as green bonds, green loans, and sustainable investment funds help organizations obtain capital for renewable energy projects, green infrastructure, and clean technologies.

- **Long-Term Cost Savings**

Sustainable business practices often reduce long-term operational costs. Energy-efficient technologies, waste reduction, and resource conservation help companies save money over time. For example, using renewable energy sources and efficient production methods can lower electricity and raw material costs.

- **Improved Corporate Reputation**

Companies that adopt sustainable business models gain a positive image in society. Consumers, investors, and stakeholders are more likely to support organizations that demonstrate environmental and social responsibility. A strong reputation can lead to increased customer loyalty and investor confidence.

- **Government Support and Incentives**

Many governments encourage sustainable business practices by providing subsidies, tax benefits, and financial incentives for green projects. Policies supporting renewable energy, pollution control, and sustainable development create new opportunities for businesses to invest in environmentally friendly activities.

- **Job Creation and Economic Development**

The growth of green industries such as renewable energy, sustainable agriculture, and environmental services creates new employment opportunities. Green finance and sustainable businesses contribute to economic development while promoting environmental protection.

Conclusion

New economic paradigms have placed sustainable business models and green finance at the forefront of current economic development. Today, it is expected that businesses not only generate profit but also act in an environmentally responsible manner and contribute positively to social wellbeing. Due to the rapid pace of industrialisation, climate change and the depletion of natural resources, there is an increasing need for businesses to implement sustainable practices and use responsible financial systems. Sustainable business models allow businesses to incorporate environmental, social and economic objectives into their day-to-day operations and create long-term value for their respective companies and society.

Business models that are sustainable will encourage businesses to use their resources more efficiently and to reduce waste and pollution by using renewable energy sources and developing green products and services. The focus of a sustainable business model is to move from maximising short term profit to maximising long term sustainability and responsible growth. Many businesses that implement sustainable practices improve their operational efficiency, enhance their brand image and create competitive advantages in the global economy.

The development of green finance is critical in facilitating sustainable business development by providing the financial resources needed to implement environmentally sound technologies, renewable energy projects, sustainable infrastructure and initiatives to mitigate climate change. Financial instruments such as green bonds, green loans and sustainable investment funds will allow businesses and governments to invest in projects that will help to reduce the environmental impact of their operations.

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INNOVATION IN TRADE, ENTREPRENEURSHIP AND MSMEs**Ms. Sindhu M S***Student, Kumadvathi Post Graduation Centre, Shikaripura-577427*

Abstract

The modern economy relies heavily on innovation to support trade, entrepreneurship, and micro, small, and medium enterprises (MSMEs). Innovation modifies how organizations operate by increasing efficiency and generating new products/services to respond to changing market conditions. The economic development of any nation relies on MSMEs for their ability to create jobs, grow industries, and develop regions. MSMEs can original implement innovative solutions through the use of new technologies for production and expanding the reach of their business into other markets. All forms of digital transformation are allowing MSMEs to engage with local and global customers easily—e.g., e-commerce, online payments, online marketing, etc. Entrepreneurs lead the way in innovation by bringing new ideas to the table that create new opportunities and innovative business models that have enhanced value for customers and society. Government policy, grant assistance, business incubators, and a well-developed start-up ecosystem all support and drive innovation in MSMEs and entrepreneurs. Through innovation, small businesses can overcome the obstacles of limited resources and competition in a rapidly changing marketplace by providing higher productivity and more competitiveness. Furthermore, sustainable technological change in the areas of innovation will lead to sustainable growth and environmental sustainability. Therefore, creating a culture of innovation in trade, entrepreneurship, and MSMEs is critical to creating a more economically resilient, innovative, and sustainable future.

Introduction:

Innovation has become an important factor for economic growth (the global economy). The growth of innovation (whether it is from integrating into business and trade or practising entrepreneurship) has changed the way that companies do business and the way that companies compete against each other. The term innovation is defined as the introduction of one or more new ideas (technologies/products/services/business models etc.) that creates more value, is more productive and/or improves efficiency. In developing an understanding of how important innovation is in relation to progress in both trade and the development of businesses, MSMEs (Micro/Small/Medium Enterprises) are one of the largest shares of all business organisations within a country (in particular, they are a very significant share in a developing country). MSMEs are therefore considered to be significant in their contribution to economic advancement, job creation and regional development. Unfortunately, MSMEs also face barriers to become established due to access to finance, access (or lack thereof) to technology, poor or inadequate infrastructure and competition from much larger companies. In these situations, the use of innovation is essential to businesses in order to address these barriers and to achieve long-term sustainability. MSMEs can use innovative technologies and improve production processes and develop new innovative products/services to become more competitive and have a larger share of the marketplace in both the domestic and global marketplace.

Innovation is being driven throughout the business ecosystem because of entrepreneurship. Entrepreneurs are catalysts for change within an existing market by identifying opportunities where there are gaps in the current marketplace; providing innovative solutions; and building a new venture that creates economic value. Entrepreneurs who have successfully executed novel ideas are often able to re-imagine how traditional businesses operate by utilizing advanced technologies like digital platforms, automation, artificial intelligence, and data-based decision-making. As a result of the recent growth of online trade and e-commerce, entrepreneurs and micro, small, and medium enterprises (MSMEs) now have more options to access international marketplaces, decrease transaction costs, and expand their customer base. The introduction of various types of digital payment systems, online sales platforms, and transportation advances has enhanced the synergy between trade and technological advancement. Governments and policy organizations around the globe have also recognized the value of supporting creativity-driven entrepreneurship, leading to new initiatives being launched to assist in developing entrepreneurs' competitiveness. These include incubator programs for start-up companies; cash assistance for developing products; workforce development initiatives, and innovation centers. Ultimately, these programs support entrepreneurs and small businesses in order to create innovative products; increase productivity; and promote long-term sustainable business development.

In addition, innovation of trade and MSMEs run parallel to sustainable economic development and inclusive growth. With economies changing quickly businesses need to be able to adapt to the challenges of globalisation, environmental issues and technological advances. By being innovative MSMEs can adopt more sustainable production methods, use resources more efficiently and develop environmentally friendly products that are able to meet consumers' expectations as they continue to change. Furthermore, innovation contributes to the generation of employment, enhances industrial diversification and increases resiliency of the economy as a whole. As knowledge-based economies, research and development and digital transformation grow in prominence it is increasingly evident that the future of trade and entrepreneurship will be shaped by innovation. This makes it very important to define the role of innovation for strengthening trade, entrepreneurship and MSMEs. The extensive analysis of innovative practices, technology adoption and the supportive institutional arrangements can provide useful lessons regarding how MSMEs and entrepreneurs can contribute effectively to economic development and competitiveness of the global economy.

Research Methodology:

A particular research methodology utilized in this study comprised an analysis through narratives, where authors synthesized current knowledge about their subject area by integrating personal insights alongside evaluations derived from previous scholarly works.

Literature Review

1. Shilpa Kalathingal and Sunil Kumar Ambammal, National Institute of Technology Goa:

Innovation is the primary source of competitive advantage for an organization and offers long-term growth and sustainability. Firms and organizations consider developing innovative capabilities to survive in this competitive era. Considering the influence of firm size on enhancing innovation practices, special attention is directed toward small-sized firms, particularly MSMEs, recognizing their pivotal role in the economy. The present analysis emphasizes the necessity to address the concerns of small firms, as identified in various empirical studies, for improved performance through innovation. The study examines these concerns with the resource-based view (RBV), considering internal and external factors, and outlines future research directions for a deeper understanding. The research collected 145 articles from different databases from 2010 to 2022. Leveraging the insights from this review, entrepreneurs can bolster their growth prospects by enhancing their company's innovation capacity with the available resources.

2. Iman Supriadi, Rahma Ulfa Maghfiroh, Rukhul Abadi

This study aims to analyze the role of innovation and technology in the transformation of MSMEs and provide policy recommendations to support the development of MSMEs. This research uses a descriptive-analytical approach by conducting literature reviews and case studies. Data was collected through secondary sources and analyzed using a qualitative approach. This research identifies that innovation and technology can improve MSMEs' market access, operational efficiency, product development, and productivity. E-commerce, digital marketing, business management software, and cloud computing were identified as essential tools in transforming MSMEs. Policy recommendations include improving access to resources and financing, developing digital infrastructure, digital skills training, and creating a supportive regulatory environment. This research provides a better understanding of the importance of innovation and technology in MSME transformation and can present relevant policy recommendations to support the development of MSMEs.

3. Tuti supatminingsiha, Muhammad hasana

Innovation and technology are critical drivers of MSME performance. This study aims to investigate the role of innovation and technology on MSME performance through the entrepreneurial motivation of Muslim entrepreneurs using the perspective of open innovation theory. this study is a quantitative approach using an exploratory research method. the sample in this study was 458 Muslim MSME entrepreneurs in the manufacturing sector determined using the stratified random sampling technique. Data analysis used pls-SEM through smart pls software version 4. this study confirms that innovation and technology have an influence on MSME performance through the entrepreneurial motivation of Muslim entrepreneurs. this study has succeeded in building a new theoretical paradigm related to the internalization of open innovation theory, motivation theory, human needs theory, and self-determination

motivation theory to build a culture of innovation, provide resources to support innovation, and develop collaboration with external parties to obtain knowledge and resources that can improve MSME performance.

4. Babitha. M. N, Dr. Srinivasa Murthy

"MSMEs are recognized as vital drivers of economic growth, fostering equitable development, and offering innovative solutions for sustainability. They play a pivotal role in creating employment opportunities, supporting industrialization in underdeveloped rural areas, and contributing to the equitable distribution of national income and wealth. However, surviving in the evolving global market demands not only enhanced productivity but also sustained growth through continuous innovation. Business sustainability self-assessment to identify areas for improvement, capitalize on strengths, and generate ideas for future organizational development. In India, SMEs, while crucial to the economy, often encounter challenges that lead to closures or unsustainable operations. Numerous studies highlight factors such as poor management, lack of innovative approaches, and short-termism as contributors to these difficulties. Therefore, the primary objective of this paper is to explore approaches that foster a better understanding of sustainable models, enhancing innovation and ensuring the longevity of MSMEs."

5. M. Srikanth, G. Narendra Kumar, W. R. Reddy

Entrepreneurship and innovation are considered as key drivers for economic development. In this study, we made an attempt to answer the question as to what should be the policy framework to encourage entrepreneurship and foster innovative culture in India to achieve the desired level of economic development. Entrepreneurship is built upon pillars such as institutional and policy support, availability of capital and entrepreneurial culture. In an emerging economy like India, the government should institutionalise innovation and entrepreneurship and promote commercialisation of brilliant ideas by emulating the startup ecosystems in the developed nations. Besides the government, large and well-established companies in private sector and research institutes should nurture startups by extending hand-holding support and generous funding. If India wishes to be a leader in innovation, it needs to scale up its gross expenditure on R&D, that is, on par with the advanced economies by engaging more researchers, especially in the private sector. Our article has important implications for policymakers and all key stakeholders, as it can help in identifying and implementing the appropriate measures to eliminate the obstacles that entrepreneurs face and channels to support innovative entrepreneurial activities in India.

Trade, Entrepreneurship, and MSMEs: Challenges in Innovation

1. Lack of Financial Resources

Lack of access to financial resources is a significant challenge for MSMEs and entrepreneurs. Small businesses often struggle to obtain loans and venture capital because they do not have collateral, a credit history or have high-interest rate loans, which creates restrictions on their ability to invest in new business innovations and technology.

2. Technological Limitations

Many MSMEs use outdated technology and do not have access to digital platforms, advanced technology and modern production processes. This technology gap limits their capacity to remain innovative and compete with larger enterprises at the national and international level.

3. Shortage of Skilled Workers

Innovation requires skilled human capital that has a combination of technical expertise, management capabilities and innovative ideas. However, many MSMEs have difficulty recruiting and retaining qualified staff because of insufficient funds for training.

4. Regulatory and Policy Obstacles

Entrepreneurs and MSMEs encounter many barriers due to highly complex regulatory structures, licensing processes, tax regulations, and bureaucratic processes. This creates an environment that reduces their ability to operate businesses efficiently and reduce their ability to innovate and grow.

5. Limited Access to Markets

MSMEs often have challenges in accessing larger markets because they lack marketing strategies, brand recognition and do not have strong links to participate in global trade

6. Lack of Funds for R&D

Small businesses often do not have the funds or organizational capacity to undertake R&D, which is critical to launching and producing new and/or high-tech products and services.

7. Inability to Utilize Digital Technologies

In spite of the multitude of benefits provided through digital technologies, many small to medium-sized enterprises (SMEs) cannot fully utilize these tools due to a lack of digital infrastructure as well as poor digital literacy and/or training.

8. Intense Competition and Uncertainty About Markets

SMEs find themselves competing against larger companies and multinational companies, with changing and unpredictable market conditions and consumer preferences helping to make innovation difficult.

9. Inadequate Facilities

Inadequate physical facilities such as unreliable electrical service, inadequate transportation systems, and poor logistical support systems can all negatively impact SMEs' production and innovation.

Steps to Involve / Suggestions for Promoting Innovation in Trade, Entrepreneurship and MSMEs

1. Making Access to Finance Easier

Governments and the finance industry should enhance access to low-cost credit and investment for MSMEs and startups. Supporting entrepreneurs with low-interest loans, venture capital, and credit guarantees will help them make investments in new technologies and ideas.

2. Encourage Digital Transformation

Encourage MSMEs to use digital technologies such as ecommerce, digital payments, cloud computing, and analytics. Training programs and initiatives to promote digital literacy need to be developed to assist small businesses in applying technology to their operations.

3. Focus on R&D

More emphasis needs to be put on R&D to enhance innovation. Collaboration among universities, research institutions, and industries will allow MSMEs to have access to new technologies and innovations.

4. Skill Development and Entrepreneurial Education

Entrepreneurship training programs, vocational training workshops, and innovation boot camps can help improve the managerial abilities and technical skills of entrepreneurs. Skilled people are essential to driving innovation and increasing productivity in business.

5. Establishing Business Incubation and Innovation Centers

Incubation centers, startup incubators, and innovation labs may assist entrepreneurs in developing new and innovative products and services by giving mentorship, infrastructure, and networking opportunities.

6. Enhancing Logistics & Infrastructure

Improving logistics and infrastructure like transportation systems, communication systems, energy supply and logistics sites can increase trade efficiency and help MSMEs succeed domestically and globally by positioning them to compete better.

7. Encouraging Collaboration/Networking

MSMEs are encouraged to collaborate with large businesses, trade associations, and international organizations. Collaborating gives MSMEs access to new markets, technology transfer, and innovative business practices.

8. Regulatory Simplification

Regulatory agencies provide processes for registering MSMEs, licensing them, and assessing their taxes by streamlining these processes, governments establish a regulatory environment that enables new entrepreneurs to create innovative businesses.

9. Promoting Environmental Sustainability

Supporting MSMEs' adoption of green/energy efficient processes and technologies can improve their sustainability, provide long-term competitive advantages, and help address environment-related economic problems.

10. Increasing Access to Market

MSMEs have significant opportunities to access global markets and promote innovative products and services by providing assistance with various marketing options, export-promoting programs, and participation at global trade shows and events.

Schemes by the Government of India Supporting Trade Innovation, Entrepreneurship, and MSMEs

1. Pradhan Mantri Mudra Yojana (PMMY)

Under this scheme, financial support is made available to micro and small enterprises through the provision of loans without the requirement for security. The loan amounts range from Shishu (up to ₹50, 000), Kishor (₹50,000 to ₹5 Lakh), and Tarun (₹5 Lakh to ₹10 Lakh), with all categories intended to assist new starts and MSMEs in either starting or expanding their businesses. This scheme aims to promote an environment that encourages entrepreneurship in the non-corporate and non-farmer sectors.

2. Prime Ministers Employment Generation Programme (PMEGP)

This is a scheme that provides individuals with financial assistance to start a micro enterprise in order to create self-employment. Financial support is provided through a combination of bank loans and government subsidies, both of which will be available to assist individuals wanting to create their own business and generate jobs in rural and urban areas.

3. Stand-Up India Scheme

This is an initiative aimed at supporting women and SC/ST entrepreneurs (Scheduled Castes and Scheduled Tribes) who wish to start an industry; loans will range from ₹10 lakh to ₹1 crore, and will be used to establish new manufacturing, service or trading enterprises in the area of greenfield business.

4. Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE)

This is a scheme available to aid MSMEs in obtaining loans without the need for providing security, where the Government gives a guarantee to the banks in respect of liabilities of 75%-85% of the loans made thereby encouraging banks and other financial institutions to extend credit to such businesses.

5. ASPIRE (A Scheme for Promotion of Innovation, Rural Industries and Entrepreneurship)

A support system created for entrepreneurs and innovators in the rural sector through incubation centres and training institutions; to encourage innovation and entrepreneurship (new enterprises) to generate employment within the Rural Sector.

6. Credit Linked Capital Subsidy Scheme (CLCSS)

The CLCSS provides Capital Subsidy support to Micro, Small & Medium Enterprises (MSMEs) in adopting modern technology / upgrading equipment / machinery. The objective is to increase productivity, improve product quality and increase competitiveness, compared to other similar businesses, within both the domestic and global markets.

7. Micro and Small Enterprises Cluster Development Programme (MSE-CDP)

MSE-CDP is a programme that supports industrial cluster development through the provision of infrastructure, technology assistance, capacity building, and developing cooperative relationships between MSMEs within a cluster, leading to improved ability to innovate and increase productivity.

8. Raising and Accelerating MSME Performance (RAMP) Programme –

The RAMP programme has the goal of Strengthening the MSME Sector by providing improved access to Markets, Technology Adoption and Financial Assistance. The programme seeks to increase the competitiveness of Small Enterprises (Small Businesses) by enhancing Innovation.

9. Startup India Seed Fund Scheme (SISFS)

The SISFS will fund entrepreneurs who are developing products from their innovative ideas, prototype development and business commercialization. The programme focuses on early-stage entrepreneurs who want to establish Innovation-based enterprises.

10. The Atal Innovation Mission (AIM)

AIM is focused on promoting innovation along with entrepreneurship through several programs including Atal Tinkering Labs and Incubation Centers by providing financial support and mentorship for innovators, start-ups, and institutions that develop new technologies or business models.

Conclusion

Innovation in trade, entrepreneurship, and Micro Small & Medium Enterprises (MSMEs) is crucial for supporting sustainable economic growth and development. In today's global economy, innovation has emerged as a critical component for businesses to enhance productivity, improve their level of competition, and adapt to changing market demands.

MSMEs form the foundation of most developing countries' economies and contribute significantly to job creation, industrial development and balanced regional development. By implementing innovative practices such as digital technologies, superior production processes, and modern approaches to doing business, MSMEs can overcome their traditional barriers, including limited resources, market restrictions and operational inefficiencies.

Entrepreneurship provides the impetus for innovation through the development of creative ideas, identification of new business opportunities, and establishment of innovative business enterprises. The introduction of digital trade platforms, e-commerce systems, and new technologies has further enabled entrepreneurs and MSMEs to access broader markets and respond to participation in the global trading system. Additionally, governments are providing support for innovation through funding programs, promoting skills training, and establishing programs that support entrepreneurship through incubator centers for emerging businesses.

The innovative capabilities of MSMEs are still being limited by some challenges including difficulty accessing funding sources, technological impediments, scarce skilled labour, and complex regulations. Supporting policies, improving infrastructure and access to technology, and establishing collaborative networks, all required in order to strengthen the innovation ecosystem are critical initiatives to address these challenges. Therefore, supporting innovation in trade, entrepreneurship, and MSMEs will contribute positively to building economic resilience, enabling inclusive growth, and maintaining long-standing competitiveness in the global market.

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ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲಾ ವಿದ್ಯಾರ್ಥಿಗಳು ಹೊಂದಿರುವ ಮೌಲ್ಯಗಳ ವ್ಯತ್ಯಾಸ ಕುರಿತು ಅಧ್ಯಯನ

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ಸಾರಲೇಖ

ಶಿಕ್ಷಣವು ವ್ಯಕ್ತಿಯ ಸರ್ವಾಂಗೀಣ ಅಭಿವೃದ್ಧಿ, ಜ್ಞಾನಾರ್ಜನೆ ಮತ್ತು ಉಜ್ವಲ ಭವಿಷ್ಯಕ್ಕೆ ಅಡಿಪಾಯವಾಗಿದೆ. ಇದು ತಾರ್ಕಿಕ ಚಿಂತನೆ, ವ್ಯಕ್ತಿತ್ವ ವಿಕಸನ, ಸಾಮಾಜಿಕ ಜವಾಬ್ದಾರಿ ಮತ್ತು ಆರ್ಥಿಕ ಸ್ವಾವಲಂಬನೆಗೆ ದಾರಿಯಾಗಿದೆ. ಉತ್ತಮ ಸಮಾಜ ನಿರ್ಮಾಣ, ಅಜ್ಞಾನ ನಿರ್ಮೂಲನೆ ಮತ್ತು ಜೀವನದ ಸವಾಲುಗಳನ್ನು ಎದುರಿಸುವ ಶಕ್ತಿಯನ್ನು ಶಿಕ್ಷಣ ನೀಡುತ್ತದೆ. ಹಾಗೆಯೇ ಮಾನವನ ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ಶಿಕ್ಷಣಕ್ಕೆ ವಿಶೇಷ ಪ್ರಾಧಾನ್ಯವಿದೆ. ಮಾನವನ ವ್ಯತ್ಯಾಸವು ರೂಪಗೊಳ್ಳುವ ಅವಧಿಯಲ್ಲಿ ಶಿಕ್ಷಣವು ಹೆಚ್ಚು ಪ್ರಭಾವ ಬೀರುತ್ತದೆ. ಶಿಕ್ಷಣವು ಮಾನವನ ಮನೋಸ್ಥೈರ್ಯಕ್ಕೆ, ಊಹಾಶಕ್ತಿಗೆ ಹಾಗೂ ಜಿಜ್ಞಾಸೆಗೆ ನೂತನ ರೂಪವನ್ನು ತಂದುಕೊಡುತ್ತದೆ. ಪ್ರಜ್ಞಾವಂತ ಮಾನವನ ಉಗಮ ನಿಸರ್ಗದ ಒಂದು ಪವಾಡವೇ ಸರಿ. ಪ್ರಕೃತಿದತ್ತವಾದ ಈ ಪ್ರಜ್ಞೆಯನ್ನು ಅನುಭವದತ್ತ ಅವಶ್ಯಕತೆಗಳ ಸಾಧನದಿಂದ ಸೂಕ್ತ ರೀತಿಯಲ್ಲಿ ನಿಯಂತ್ರಿಸುವ ವ್ಯವಸ್ಥೆಯೇ ಶಿಕ್ಷಣ. ಈ ಸಾಧನೆಯನ್ನು ಪೂರೈಸುವಲ್ಲಿ ಮಾಧ್ಯಮಿಕ ಶಿಕ್ಷಣ ಮಹತ್ವದ ಸ್ಥಾನವನ್ನು ಪಡೆದಿದೆ.

ಯಾವುದೇ ಒಬ್ಬ ವಿದ್ಯಾರ್ಥಿಯ ಶೈಕ್ಷಣಿಕ ಸಾಧನೆಯು ಉನ್ನತ ಮಟ್ಟಕ್ಕೇರಿದೆ ಎಂದರೆ ತಾವು ಹೊಂದಿದ ಬುದ್ಧಿಶಕ್ತಿ ಹಾಗೂ ಅವರು ಅಳವಡಿಸಿಕೊಂಡ ಮೌಲ್ಯಗಳು ಕಾರಣವಾಗಬಹುದು. ಹಾಗೆಯೇ ಅವರು ದಾಖಲಾದ ಶಾಲೆಯ ಪರಿಸರ ಹಾಗೂ ತಮಗೆ ಸಿಕ್ಕ ಸೌಲಭ್ಯಗಳ ಪ್ರಭಾವದಿಂದ ವ್ಯತ್ಯಾಸ ಕಂಡು ಬರಬಹುದು. ಈ ಕಾರಣದಿಂದ ಪ್ರಸ್ತುತ ಶೈಕ್ಷಣಿಕ ಸಂಸ್ಥೆಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳ ಮೌಲ್ಯಗಳು ಹಾಗೂ ಶೈಕ್ಷಣಿಕ ಸಾಧನೆಗಳು ಯಾವ ಪ್ರಮಾಣದಲ್ಲಿದೆ ಹಾಗೂ ವ್ಯತ್ಯಾಸ ಹೊಂದಿದೆ ಎಂಬುದನ್ನು ತಿಳಿಯಬೇಕಾದ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಪ್ರಸ್ತುತ ಅಧ್ಯಯನವನ್ನು ಕೈಗೊಳ್ಳಲಾಗಿದೆ.

ಪ್ರಸ್ತುತ ಅಧ್ಯಯನವು ಶಿಕಾರಿಪುರ ತಾಲ್ಲೂಕಿನ ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ 9ನೇ ತರಗತಿಯ 200 ವಿದ್ಯಾರ್ಥಿಗಳ ಮೌಲ್ಯಗಳು ಮತ್ತು ಶೈಕ್ಷಣಿಕ ಸಾಧನೆಯ ಮಟ್ಟದ ಶೇಕಡಾವಾರು ವಿಶ್ಲೇಷಣೆಯನ್ನು ವಿವರಣಾತ್ಮಕ ವಿಧಾನದೊಂದಿಗೆ ಸಂಖ್ಯಾಶಾಸ್ತ್ರದ ಶೇಕಡಾವಾರು, ಸರಾಸರಿ ಮತ್ತು ಮಾನಕ ವಿಚಲನೆ ತಂತ್ರಗಳ ಮೂಲಕ ಮಾಡಲಾಗಿದೆ. ಅಲ್ಲದೆ ಈ ಅಧ್ಯಯನದ ಸಾಧನವಾಗಿ ರವಿ ಹೆಚ್ ಮತ್ತು ಡಾ. ಜಗದೀಶ್ ಬಿ ರವರರ 'ವೈಯಕ್ತಿಕ ಮೌಲ್ಯ ಪ್ರಶ್ನಾವಳಿ'ಯನ್ನು ಬಳಸಿಕೊಳ್ಳಲಾಗಿದೆ.

ಕೀ ಪದಗಳು : ಶಿಕ್ಷಣ, ಮಾಧ್ಯಮಿಕ ಶಿಕ್ಷಣ ಮತ್ತು ಮೌಲ್ಯಗಳು.

ಪೀಠಿಕೆ :

ರಾಷ್ಟ್ರದ ಪ್ರಗತಿ ಮತ್ತು ಬೆಳವಣಿಗೆಯು ವಿದ್ಯಾರ್ಥಿಗಳ ಮಾನಸಿಕ ಮತ್ತು ದೈಹಿಕ ಶಕ್ತಿಯ ಮೇಲೆ ಅವಲಂಬಿತವಾಗಿದೆ. ಮಾರ್ಗೇಟ್ ಮಿಲನ್ ಅಭಿಪ್ರಾಯ ಪಡುವಂತೆ “ತಾರುಣ್ಯಾವಸ್ಥೆಯ ಮಕ್ಕಳು ಒಳ್ಳೆಯವರಾಗಬಹುದು ಅಥವಾ ಕೆಟ್ಟವರಾಗಬಹುದು, ತಾರುಣ್ಯಾವಸ್ಥೆಯಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಸೂಕ್ತ ಪರಿಸರವನ್ನು ದೊರಕಿಸಿಕೊಟ್ಟು ಒಳ್ಳೆಯ ವಯಸ್ಕರನ್ನಾಗಿ ಮಾಡಬೇಕು ಮತ್ತು ವಾಸ್ತವದಲ್ಲಿ ಅವರನ್ನು ನೈತಿಕತೆಯುಳ್ಳ ವ್ಯಕ್ತಿಗಳನ್ನಾಗಿ ಪರಿವರ್ತಿಸಬೇಕಾಗಿದೆ. ಈ ಪ್ರಕ್ರಿಯೆಯೊಳಗೆ ವಿದ್ಯಾರ್ಥಿಗಳು ತಮ್ಮ ಬುದ್ಧಿಶಕ್ತಿಯೊಡನೆ ಉತ್ತಮ ಮೌಲ್ಯಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ಉನ್ನತ ಶೈಕ್ಷಣಿಕ ಸಾಧನೆಯನ್ನು ಪಡೆದು ಜೀವನದಲ್ಲಿ ತಮ್ಮ ಗುರಿಯಡೆಗೆ ಸಾಗುವುದು ಸೂಕ್ತವಾಗಿದೆ”. ಎಂದಿದ್ದಾರೆ.

ಯಾವುದೇ ಒಬ್ಬ ವಿದ್ಯಾರ್ಥಿಯ ಶೈಕ್ಷಣಿಕ ಸಾಧನೆಯು ಉನ್ನತ ಮಟ್ಟಕ್ಕೇರಿದೆ ಎಂದರೆ ತಾವು ಹೊಂದಿದ ಬುದ್ಧಿಶಕ್ತಿ ಹಾಗೂ ಅವರು ಅಳವಡಿಸಿಕೊಂಡ ಮೌಲ್ಯಗಳು ಕಾರಣವಾಗಬಹುದು. ಹಾಗೆಯೇ ಅವರು ದಾಖಲಾದ ಶಾಲೆಯ ಪರಿಸರ ಹಾಗೂ ತಮಗೆ ಸಿಕ್ಕ ಸೌಲಭ್ಯಗಳ ಪ್ರಭಾವದಿಂದ ವ್ಯತ್ಯಾಸ ಕಂಡು ಬರಬಹುದು. ಈ ಕಾರಣದಿಂದ ಪ್ರಸ್ತುತ ಶೈಕ್ಷಣಿಕ ಸಂಸ್ಥೆಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳ ಮೌಲ್ಯಗಳು ಹಾಗೂ

ಶೈಕ್ಷಣಿಕ ಸಾಧನೆಗಳು ಯಾವ ಪ್ರಮಾಣದಲ್ಲಿ ಹಾಗೂ ವ್ಯತ್ಯಾಸ ಹೊಂದಿದೆ ಎಂಬುದನ್ನು ತಿಳಿಯಬೇಕಾದ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಪ್ರಸ್ತುತ ಅಧ್ಯಯನವನ್ನು ಕೈಗೊಳ್ಳಲಾಗಿದೆ.

ಮೌಲ್ಯಗಳು ಸೈದ್ಧಾಂತಿಕ ಹಿನ್ನೆಲೆ :

ಮೌಲ್ಯ ಎಂದರೆ ಒಂದು ನೆಲೆಯಲ್ಲಿ ಮಾನವನ ಬದುಕಿನ ಆದರ್ಶಗುಣ, ಸ್ವಭಾವ ಎಂದು ಹೇಳಬಹುದು. ಮೌಲ್ಯ ಎಂದರೆ ಪರಿಶುದ್ಧ ಜೀವನ ಮಾರ್ಗ. ಅದು ವ್ಯಕ್ತಿ ಮತ್ತು ಸಮಾಜದ ನಡುವಿನ ಆರೋಗ್ಯಕರ ಸಂಬಂಧ, ನಮ್ಮ ವರ್ತನೆ, ಕ್ರಿಯೆ ಹಾಗೂ ವ್ಯಕ್ತಿತ್ವವನ್ನು ನಿಯಂತ್ರಿಸುವ ಬದುಕಿನ ಚಾಲಕ ಶಕ್ತಿ, ವ್ಯಕ್ತಿಯ ಮನೋದೈಹಿಕ ಸ್ವಾಸ್ಥ್ಯಕ್ಕೆ ಕಾರಣವಾಗಬುದಾದ ಮಾರ್ಗದರ್ಶಕ ಸೂತ್ರವಾಗಿದೆ.

ಜಾನ್ ಡೂಯಿಯವರ ಪ್ರಕಾರ “ಯಾವುದಾರೂ ವಸ್ತು ಅಥವಾ ವಿಷಯವನ್ನು ಮತ್ತೊಂದರೊಡನೆ ಹೋಲಿಸಿ ಅದರ ಬೆಲೆ ನಿರ್ಣಯಿಸುವ ಮೂಲಕ ಉತ್ತಮವಾದುದೆಂದು ಪರಿಗಣಿಸುವ ಕ್ರಿಯೆಯೇ ಮೌಲ್ಯ”.

ಪಠ್ಯವಸ್ತು, ಪಠ್ಯಪುಸ್ತಕ, ಶಾಲಾ ವಾತಾವರಣ, ಶಿಕ್ಷಕ ಹೀಗೆ ಶಾಲಾ ಪರಿಸರದ ಮೂಲಕ ಯೋಗ್ಯವಾದ ಮೌಲ್ಯವನ್ನು ಅಳವಡಿಸಿ ಸಮಾಜ ಯೋಗ್ಯ ಸದಸ್ಯರನ್ನು ಹೊರಹೊಮ್ಮುವಂತೆ ಮಾಡುತ್ತವೆ. ಜೊತೆಗೆ ತಪ್ಪು ಹೆಜ್ಜೆ ಇಡುತ್ತಿರುವ ಯುವ ಜನಾಂಗವನ್ನು ಕೂಲಂಕುಶವಾಗಿ ಚರ್ಚಿಸಿ ಅವರನ್ನು ಸರಿಯಾದ ದಾರಿಯತ್ತ ಕೊಂಡೊಯ್ಯುತ್ತದೆ. ಮನುಷ್ಯರ ಭವಿಷ್ಯದ ಸಂಕೀರ್ಣ ಸಮಸ್ಯಾತ್ಮಕ ಜೀವನವನ್ನು ಎದುರಿಸುವಂತೆ ಮಾಡುತ್ತದೆ. ಹಾಗೂ ಮಾನವರು ಸ್ವಾವಲಂಬಿಗಳಾಗುವಂತೆ ಮಾಡುತ್ತ ಜೀವನದ ಮಟ್ಟವನ್ನು ಹೆಚ್ಚಿಸುತ್ತವೆ. ಇವು ವ್ಯಕ್ತಿಯ ಸರ್ವತೋಮುಖ ಅಭಿವೃದ್ಧಿಗೆ ಪೂರಕವಾದ ಅಂಶಗಳಾಗಿವೆ.

ವ್ಯಕ್ತಿಯ ಆತ್ಮ ಸಾಕ್ಷಾತ್ಕಾರಕ್ಕೆ ಈ ಮೌಲ್ಯಗಳು ಸಹಾಯಕವಾಗುತ್ತವೆ. ಆದಿ ಶಂಕರಾಚಾರ್ಯರ ‘ಆತ್ಮದ ಅರಿವೇ ಶಿಕ್ಷಣ’ ಎನ್ನುವ ಮಾತುಗಳು ಆಧ್ಯಾತ್ಮಿಕ ಮೌಲ್ಯಗಳ ಮಹತ್ವ ಬಿಂಬಿಸಿವೆ. ಗಾಂಧೀಜಿ, ಸ್ವಾಮಿ ವಿವೇಕಾನಂದ ಹಾಗೂ ಅರವಿಂದರ ಆಧ್ಯಾತ್ಮಿಕ ವಿಚಾರಗಳು ಸಹ ಪ್ರಸ್ತುತ ದಿನಗಳಂದು ಎಂದಿಗಿಂತಲೂ ಇಂದು ಈ ಮೌಲ್ಯಗಳ ಅಗತ್ಯತೆಯನ್ನು ಎತ್ತಿ ಹಿಡಿದಿವೆ. ಹೀಗೆ ಮನುಷ್ಯನ ಬದುಕನ್ನೇ ನಿರ್ಧರಿಸುವ ಮೌಲ್ಯಗಳು ಪ್ರತಿಯೊಬ್ಬರಲ್ಲಿ ಹಾಸು ಹೊಕ್ಕಾಗಿರಬೇಕು. ಅದಕ್ಕೆ ಮಾರ್ಗದರ್ಶನದ ಅಗತ್ಯವಿದೆ. ಆ ಮಾರ್ಗದರ್ಶನ ಶಿಕ್ಷಣದಿಂದ ಮಾತ್ರ ಸಾಧ್ಯ.

ಮನುಷ್ಯನಲ್ಲಿರುವ ಪ್ರಾಣಿ ಗುಣವನ್ನು ಸಂಸ್ಕರಿಸಿ ಮಾನವೀಯ ಗುಣಗಳನ್ನು ಬೆಳೆಸುವುದು ಹಾಗೂ ಮನುಷ್ಯನನ್ನು ಪರಿಪೂರ್ಣ ಶ್ರೇಷ್ಠ ವ್ಯಕ್ತಿಯನ್ನಾಗಿ ರೂಪಗೊಳಿಸುವುದೇ ಶಿಕ್ಷಣದ ಅಂತಿಮ ಗುರಿ. ಮನುಷ್ಯನು ಶಿಕ್ಷಣದಿಂದ ಸಂಸ್ಕಾರಗೊಂಡು ಮರುಹುಟ್ಟು ಪಡೆಯಬೇಕು. ಮನುಷ್ಯನ ಜೀವನ ಕೇವಲ ಹುಟ್ಟು - ಸಾವು ಅಷ್ಟೇ ಅಲ್ಲ, ಅವನ ಬದುಕು ಸಾರ್ಥಕವಾಗಬೇಕು. ಆ ಸಾರ್ಥಕ ಬದುಕಿಗೆ ಮೌಲ್ಯಗಳು ಅಗತ್ಯವಾಗಿ ಬೇಕು. ಆದರೆ ಇತ್ತೀಚಿನ ವರ್ಷಗಳಲ್ಲಿ ಶಿಕ್ಷಣದಲ್ಲಿ ಮಾಹಿತಿ ಮತ್ತು ತಂತ್ರಜ್ಞಾನಕ್ಕೆ ಉಚ್ಚ ಸ್ಥಾನವನ್ನು ನೀಡಲಾಗಿದ್ದು ಶಿಕ್ಷಣವು ಮಾಹಿತಿ ಅಥವಾ ಜ್ಞಾನವನ್ನು ಮಾರಾಟ ಮಾಡುವ ಉದ್ಯಮವಾಗಿ ಮಾರ್ಪಟ್ಟಿದೆ. ಜ್ಞಾನದ ವೈಭವೀಕರಣ ಮತ್ತು ಜ್ಞಾನದ ವಾಣಿಜ್ಯೀಕರಣ ಎಲ್ಲಡೆ ಕಾಣುತ್ತಿದೆ. ಜಗತ್ತಿನ ನೋವು ನಿವಾರಣೆಗೆ ಮತ್ತು ಉನ್ನತಿಗಾಗಿ ಜ್ಞಾನ ಎಂಬುದು ಶಿಕ್ಷಣದ ಆದರ್ಶ. ಆದರೆ ಶಿಕ್ಷಣದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳ ಮಾಹಿತಿ ಸಂಗ್ರಹಣೆ ಮತ್ತು ಉನ್ನತಿಯನ್ನಷ್ಟೇ ಪರಿಗಣಿಸಿ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸದ ಅಂಶಗಳಾದ ಶಾರೀರಿಕ ವಿಕಾಸ, ಭಾವನಾತ್ಮಕತೆ, ಸಾಮಾಜಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ನೈತಿಕ ಅಂಶಗಳು, ಮನೋಭಾವ, ಆಸಕ್ತಿ, ಸಹ ಮಾನವರ ಬಗ್ಗೆ ಕಾಳಜಿ, ಸಂವೇದನೆ, ಯೋಗ್ಯ ಹವ್ಯಾಸಗಳು ಇನ್ನಿತರ ಉತ್ತಮ ಮೌಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು ಗಣನೀಯವಾಗಿದೆ. ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಶಿಕ್ಷಣದಲ್ಲಿ ಮೌಲ್ಯಗಳ ಅಳವಡಿಕೆ ಅವಶ್ಯವೇಷ್ಟೆಂಬುದನ್ನು ತಿಳಿಯಬಹುದು.

ಅಧ್ಯಯನದ ಪ್ರಾಮುಖ್ಯತೆ :

ಇಂದಿನ ವಿದ್ಯಾರ್ಥಿಗಳು ಬುದ್ಧಿಶಕ್ತಿಯ ಕೊರತೆಯಿಲ್ಲದೇ ಉತ್ತಮ ಶೈಕ್ಷಣಿಕ ಸಾಧನೆಯನ್ನು ಮಾಡುತ್ತಿದ್ದಾರೆ. ಆದರೆ ಮೌಲ್ಯಗಳ ಅಳವಡಿಕೆಯಲ್ಲಿ ತಾತ್ಕಾರವಿರುವುದು ಮೇಲ್ನೋಟಕ್ಕೆ ಕಂಡುಬರುತ್ತಿದೆ. ಪ್ರತಿಯೊಬ್ಬ ಮನುಷ್ಯನು ಉತ್ತಮ ಬುದ್ಧಿಶಕ್ತಿಯಿಂದಲೇ ಹುಟ್ಟುತ್ತಾನೆ. ಆದರೆ ಅವನ ಬೆಳವಣಿಗೆಯ ಹಂತದಲ್ಲಿ ಕಲಿಕೆಗೆ ತಕ್ಕಂತೆ ಬುದ್ಧಿಶಕ್ತಿ ಪರಿವರ್ತನೆಯಾಗುವ ಸಾಧ್ಯತೆ ಕಂಡುಬರುವುದು. ಇಂತಹ ಬುದ್ಧಿಶಕ್ತಿಯನ್ನು ಧನಾತ್ಮಕ ಮೌಲ್ಯಗಳ ಕಡೆಗೆ ಬೆಳೆಸಬೇಕಾಗಿದೆ. ಹಾಗಾದಾಗ ಮಾತ್ರ ರಾಷ್ಟ್ರದ ಪ್ರಗತಿಗೆ ಪೂರಕವಾಗುತ್ತದೆ. ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಮೌಲ್ಯಗಳು ಮಾಧ್ಯಮಿಕ ಶಿಕ್ಷಣ ಪಡೆಯುವ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಹೇಗೆ ಮೇಳೈಸಿದೆ ಎಂಬುದನ್ನು ಪ್ರಸ್ತುತ ಅಧ್ಯಯನದಿಂದ ತಿಳಿಯಬಹುದಾಗಿದೆ.

ಅಧ್ಯಯನದ ಉದ್ದೇಶಗಳು :

1. ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ವಿದ್ಯಾರ್ಥಿಗಳ ಮೌಲ್ಯಗಳ ಸರಾಸರಿಯ ವ್ಯತ್ಯಾಸವನ್ನು ಅಧ್ಯಯನ ಮಾಡುವುದು.
2. ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ಬಾಲಕರ ನಡುವಿನ ಮೌಲ್ಯಗಳ ಸರಾಸರಿಯ ವ್ಯತ್ಯಾಸವನ್ನು ಅಧ್ಯಯನ ಮಾಡುವುದು.
3. ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ಬಾಲಕಿಯರ ನಡುವಿನ ಮೌಲ್ಯಗಳ ಸರಾಸರಿಯ ವ್ಯತ್ಯಾಸವನ್ನು ಅಧ್ಯಯನ ಮಾಡುವುದು.

ಅಧ್ಯಯನದ ವ್ಯಾಪ್ತಿ :

ಪ್ರಸ್ತುತ ಅಧ್ಯಯನಕ್ಕೆ ಸರಳ ಯಾದೃಚ್ಛಿಕ ಪ್ರತಿಚಯನದ ಮೂಲಕ ಶಿಕಾರಿಪುರ ತಾಲ್ಲೂಕಿನ 2 ವಸತಿ ಪ್ರೌಢಶಾಲೆಯ ತಲಾ 50 ರಂತೆ 100 ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಹಾಗೂ 2 ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ತಲಾ 50 ರಂತೆ 100 ವಿದ್ಯಾರ್ಥಿಗಳಂತೆ 9ನೇ ತರಗತಿಯ ಒಟ್ಟು 200 ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಅಧ್ಯಯನಕ್ಕೆ ಒಳಪಡಿಸಲಾಗಿದೆ.

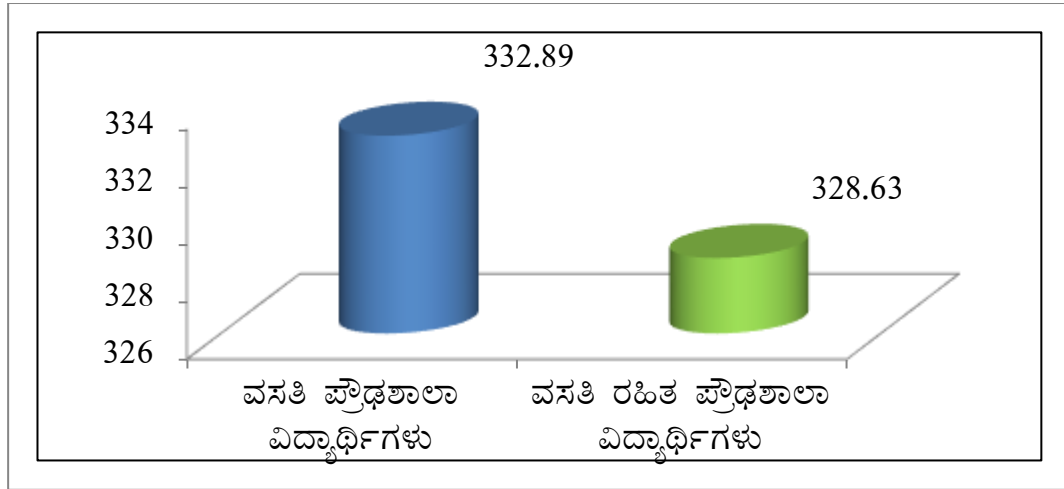
ಅಧ್ಯಯನದ ವಿಧಾನ ; ಪ್ರಸ್ತುತ ಅಧ್ಯಯನಕ್ಕೆ ವಿವರಣಾತ್ಮಕ ಸಂಶೋಧನಾ ವಿಧಾನವನ್ನು ಬಳಸಲಾಗಿದೆ. ಅದಕ್ಕಾಗಿ ಚಲಕವಾದ ಮೌಲ್ಯಗಳನ್ನು ಪರೀಕ್ಷಿಸಲು ರವಿ ಹೆಚ್ ಮತ್ತು ಡಾ. ಜಗದೀಶ ಬಿ ರವರು ಅಭಿವೃದ್ಧಿಪಡಿಸಿದ “ವೈಯಕ್ತಿಕ ಮೌಲ್ಯ ಪ್ರಶ್ನಾವಳಿ”ಯನ್ನು ಬಳಸಿಕೊಳ್ಳಲಾಗಿದೆ. ಅಲ್ಲದೆ ಫಲಿತಾಂಶ ವಿಶ್ಲೇಷಣೆಗೆ ಸಂಖ್ಯಾಶಾಸ್ತ್ರದ ಸರಾಸರಿ, ಮಾನಕ ವಿಚಲನೆ ಮತ್ತು ‘ಟಿ’ ಪರೀಕ್ಷಣ ತಂತ್ರಗಳನ್ನು ಉಪಯೋಗಿಸಿಕೊಳ್ಳಲಾಗಿದೆ.

ಅಧ್ಯಯನದ ವಿಶ್ಲೇಷಣೆ ಮತ್ತು ಅರ್ಥೈಸುವಿಕೆ : ಉದ್ದೇಶ : 01 ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ವಿದ್ಯಾರ್ಥಿಗಳ ಮೌಲ್ಯಗಳ ಸರಾಸರಿಯ ವ್ಯತ್ಯಾಸವನ್ನು ಅಧ್ಯಯನ ಮಾಡುವುದು.

ಕೋಷ್ಟಕ : 01 ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ವಿದ್ಯಾರ್ಥಿಗಳ ಮೌಲ್ಯಗಳ ಸರಾಸರಿ, ಮಾನಕವಿಚಲನೆ ಹಾಗೂ ‘ಟಿ’ ಮೌಲ್ಯವನ್ನು ಸೂಚಿಸುವ ಕೋಷ್ಟಕ.

ಮೌಲ್ಯಗಳು					
ಶಾಲೆಗಳು	ವಿದ್ಯಾರ್ಥಿಗಳ ಸಂಖ್ಯೆ	ಸರಾಸರಿ	ಮಾನಕ ವಿಚಲನೆ	‘ಟಿ’ ಮೌಲ್ಯ	ಲಕ್ಷಾಹರ್ತೆ
ವಸತಿ ಪ್ರೌಢಶಾಲಾ ವಿದ್ಯಾರ್ಥಿಗಳು	100	332.8900	19.77443	1.469	0.05 ಮಟ್ಟದಲ್ಲಿ ಲಕ್ಷಾಹರ್ತೆಯನ್ನು ಹೊಂದಿದೆ
ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲಾ ವಿದ್ಯಾರ್ಥಿಗಳು	100	328.6300	21.52267		

ಆಲೇಖ : 01 ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲಾ ವಿದ್ಯಾರ್ಥಿಗಳ ಮೌಲ್ಯಗಳ ಸರಾಸರಿ ವ್ಯತ್ಯಾಸವನ್ನು ಸೂಚಿಸುವ ಸ್ತಂಭಲೇಖ.



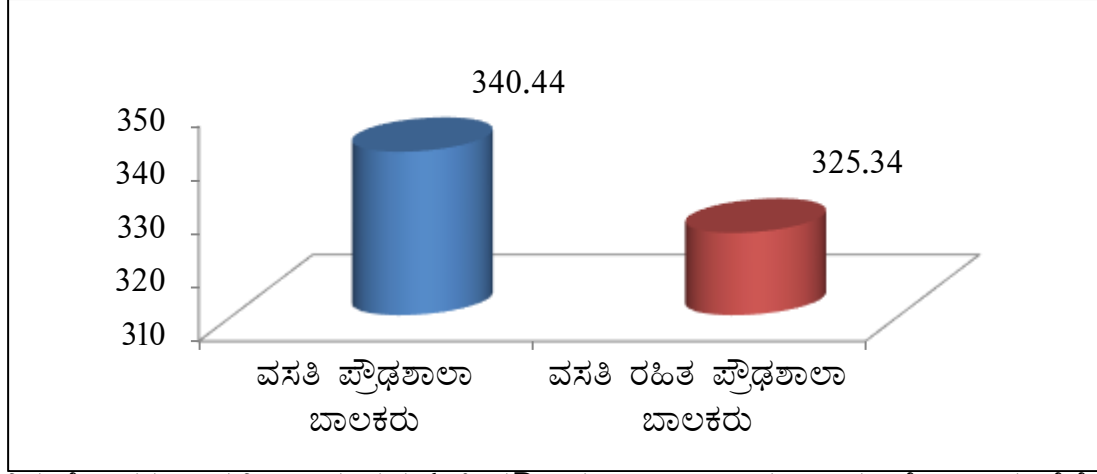
ಮೇಲಿನ ಕೋಷ್ಟಕ 01 ರಲ್ಲಿ ಬಂದಂತಹ 'ಟಿ' ಮೌಲ್ಯವು 1.469 ಆಗಿದ್ದು, ಇದು ಸೈದ್ಧಾಂತಿಕ ಬೆಲೆ 1.96 ಕ್ಕಿಂತ ಕಡಿಮೆಯಾಗಿರುವುದರಿಂದ 0.05 ಮಟ್ಟದಲ್ಲಿ ಲಕ್ಷಾರ್ಹತೆಯನ್ನು ಹೊಂದಿದೆ. ಅದರಂತೆ, ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆ ವಿದ್ಯಾರ್ಥಿಗಳ ಮೌಲ್ಯಗಳ ಸರಾಸರಿ ಬೆಲೆಯಲ್ಲಿ ವ್ಯತ್ಯಾಸವಿದೆ. ಅಂದರೆ ಮೌಲ್ಯಗಳ ಸರಾಸರಿಯಲ್ಲಿ ಎರಡೂ ಶಾಲೆಗಳ ವಿದ್ಯಾರ್ಥಿಗಳ ನಡುವೆ ಮಹತ್ವಪೂರ್ಣ ವ್ಯತ್ಯಾಸವಿದ್ದು, ವಸತಿ ಪ್ರೌಢಶಾಲೆಯ ವಿದ್ಯಾರ್ಥಿಗಳು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗಿಂತ ಹೆಚ್ಚಿನ ಮೌಲ್ಯಗಳನ್ನು ಹೊಂದಿರುವುದು ಈ ಅಧ್ಯಯನದಿಂದ ತಿಳಿದು ಬಂದಿದೆ.

ಉದ್ದೇಶ : 2 ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ಬಾಲಕರ ನಡುವಿನ ಮೌಲ್ಯಗಳ ಸರಾಸರಿಯ ವ್ಯತ್ಯಾಸವನ್ನು ಅಧ್ಯಯನ ಮಾಡುವುದು.

ಕೋಷ್ಟಕ : 2 ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ಬಾಲಕರ ಮೌಲ್ಯದ ಸರಾಸರಿ, ಮಾನಕವಿಚಲನೆ, ಹಾಗೂ ಟಿ ಪರೀಕ್ಷಣವನ್ನು ಸೂಚಿಸುವ ಕೋಷ್ಟಕ.

ಶಾಲೆಗಳು	ವಿದ್ಯಾರ್ಥಿಗಳ ಸಂಖ್ಯೆ	ಮೌಲ್ಯಗಳು		ಟಿ ಮೌಲ್ಯ	ಲಕ್ಷಾರ್ಹತೆ
		ಸರಾಸರಿ	ಮಾನಕ ವಿಚಲನೆ		
ವಸತಿ ಪ್ರೌಢಶಾಲಾ ಬಾಲಕರು	50	340.4400	18.47244	3.644	0.05 ಮಟ್ಟದಲ್ಲಿ ಲಕ್ಷಾರ್ಹತೆಯನ್ನು ಹೊಂದಿದೆ
ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲಾ ಬಾಲಕರು	50	325.3400	18.23387		

ಆಲೇಖ : 02 ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ಬಾಲಕರ ಮೌಲ್ಯಗಳ ಸರಾಸರಿ ವ್ಯತ್ಯಾಸವನ್ನು ಸೂಚಿಸುವ ಸ್ತಂಭಲೇಖ.



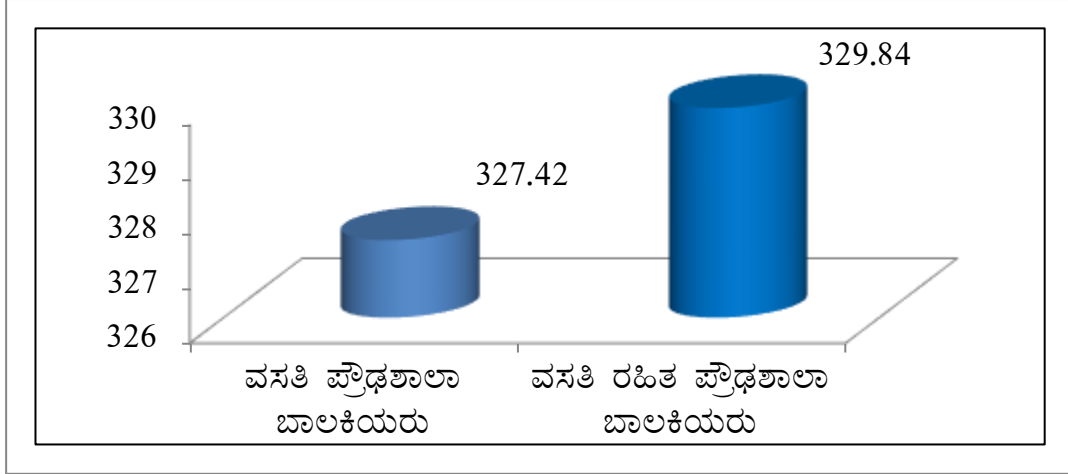
ಮೇಲಿನ ಕೋಷ್ಟಕ 02ರಲ್ಲಿ ಬಂದಂತಹ 'ಟಿ' ಮೌಲ್ಯವು 3.644 ಆಗಿದ್ದು, ಇದು ಸೈದ್ಧಾಂತಿಕ ಬೆಲೆ 1.96 ಕ್ಕಿಂತ ಹೆಚ್ಚಾಗಿರುವುದರಿಂದ 0.05 ಮಟ್ಟದಲ್ಲಿ ಲಕ್ಷಾರ್ಹತೆಯನ್ನು ಹೊಂದಿದೆ. ಅದರಂತೆ, ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆ ಬಾಲಕರ ಮೌಲ್ಯಗಳ ಸರಾಸರಿ ಬೆಲೆಯಲ್ಲಿ ವ್ಯತ್ಯಾಸವಿದೆ. ಅಂದರೆ ಮೌಲ್ಯಗಳ ಸರಾಸರಿಯಲ್ಲಿ ಎರಡೂ ಶಾಲೆಗಳ ಬಾಲಕರ ನಡುವೆ ಮಹತ್ವಪೂರ್ಣ ವ್ಯತ್ಯಾಸವಿದ್ದು, ವಸತಿ ಪ್ರೌಢಶಾಲೆಯ ಬಾಲಕರು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲಾ ಬಾಲಕರಿಗಿಂತ ಹೆಚ್ಚಿನ ಮೌಲ್ಯಗಳನ್ನು ಹೊಂದಿರುವುದು ಈ ಅಧ್ಯಯನದಿಂದ ತಿಳಿದು ಬಂದಿದೆ.

ಉದ್ದೇಶ : 03. ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ಬಾಲಕಿಯರ ನಡುವಿನ ಮೌಲ್ಯಗಳ ಸರಾಸರಿಯ ವ್ಯತ್ಯಾಸವನ್ನು ಅಧ್ಯಯನ ಮಾಡುವುದು.

ಕೋಷ್ಟಕ : 03 ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ಬಾಲಕಿಯರ ಮೌಲ್ಯದ ಸರಾಸರಿ, ಮಾನಕವಿಚಲನೆ ಹಾಗೂ ಟಿ ಪರೀಕ್ಷಣವನ್ನು ಸೂಚಿಸುವ ಕೋಷ್ಟಕ.

ಮೌಲ್ಯಗಳು	ವಿದ್ಯಾರ್ಥಿಗಳ ಸಂಖ್ಯೆ	ಸರಾಸರಿ	ಮಾನಕ ವಿಚಲನೆ	ಟಿ ಮೌಲ್ಯ	ಲಕ್ಷಾರ್ಹತೆ
ವಸತಿ ಪ್ರೌಢಶಾಲಾ ಬಾಲಕಿಯರು	50	327.4200	24.62129	0.545	0.05 ಮಟ್ಟದಲ್ಲಿ ಲಕ್ಷಾರ್ಹತೆಯನ್ನು ಹೊಂದಿಲ್ಲ
ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲಾ ಬಾಲಕಿಯರು	50	329.8400	18.07508		

ಆಲೇಖ : 03 ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ಬಾಲಕಿಯರ ಮೌಲ್ಯಗಳ ಸರಾಸರಿ ವ್ಯತ್ಯಾಸವನ್ನು ಸೂಚಿಸುವ ಸ್ತಂಭಲೇಖ.



ಮೇಲಿನ ಕೋಷ್ಟಕ 03ರಲ್ಲಿ ಬಂದಂತಹ 'ಟಿ' ಮೌಲ್ಯವು 0.545 ಆಗಿದ್ದು, ಇದು ಸೈದ್ಧಾಂತಿಕ ಬೆಲೆ 1.96 ಕ್ಕಿಂತ ಕಡಿಮೆಯಾಗಿರುವುದರಿಂದ 0.05 ಮಟ್ಟದಲ್ಲಿ ಲಕ್ಷಾರ್ಹತೆಯನ್ನು ಹೊಂದಿಲ್ಲ. ಅದರಂತೆ, ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆ ಬಾಲಕಿಯರ ಮೌಲ್ಯಗಳ ಸರಾಸರಿ ಬೆಲೆಯಲ್ಲಿ ಯಾವುದೇ ವ್ಯತ್ಯಾಸವಿಲ್ಲ. ಅಂದರೆ ಮೌಲ್ಯಗಳ ಸರಾಸರಿಯಲ್ಲಿ ಎರಡೂ ಶಾಲೆಗಳ ಬಾಲಕಿಯರ ನಡುವೆ ಮಹತ್ವಪೂರ್ಣ ವ್ಯತ್ಯಾಸವಿಲ್ಲ ಎಂದು ಈ ಅಧ್ಯಯನದಿಂದ ತಿಳಿದು ಬಂದಿದೆ.

ಶೈಕ್ಷಣಿಕ ನಿಹಿತಾರ್ಥಗಳು :

1. ಪ್ರಸ್ತುತ ಅಧ್ಯಯನದಿಂದ ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ವಿದ್ಯಾರ್ಥಿಗಳ ಮೌಲ್ಯಗಳ ಸರಾಸರಿ ನಡುವಿನ ವ್ಯತ್ಯಾಸವನ್ನು ತಿಳಿಯಬಹುದಾಗಿದೆ.
2. ಪ್ರಸ್ತುತ ಅಧ್ಯಯನದಿಂದ ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ಬಾಲಕರ ಮೌಲ್ಯಗಳ ಸರಾಸರಿ ನಡುವಿನ ವ್ಯತ್ಯಾಸವನ್ನು ತಿಳಿಯಬಹುದಾಗಿದೆ.
3. ಪ್ರಸ್ತುತ ಅಧ್ಯಯನದಿಂದ ವಸತಿ ಪ್ರೌಢಶಾಲೆಗಳು ಮತ್ತು ವಸತಿ ರಹಿತ ಪ್ರೌಢಶಾಲೆಗಳ ಬಾಲಕಿಯರ ಮೌಲ್ಯಗಳ ಸರಾಸರಿ ನಡುವಿನ ವ್ಯತ್ಯಾಸವನ್ನು ತಿಳಿಯಬಹುದಾಗಿದೆ.
4. ಪ್ರಸ್ತುತ ಅಧ್ಯಯನದಿಂದ ಶಾಲೆಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳ ಮೌಲ್ಯವನ್ನು ಹೆಚ್ಚಿಸಲು ಶಿಕ್ಷಕರು ಮತ್ತು ಪೋಷಕರು ಅಗತ್ಯದ ಕ್ರಮಗಳನ್ನು ಕೈಗೊಳ್ಳಲು ಸಹಾಯಕವಾಗುತ್ತದೆ.

ಉಪಸಂಹಾರ :

ನಮ್ಮ ದೇಶವು ಶ್ರೀಮಂತವಾದ ಸಾಂಸ್ಕೃತಿಕ ಪರಂಪರೆಯನ್ನು ಹೊಂದಿದೆ. ವಿಶಿಷ್ಟ ರೀತಿಯ ಜೀವನಪರ ಹಾಗೂ ಮಾನವೀಯ ದ್ರವ್ಯಗಳು ಮತ್ತು ಸಂದೇಶಗಳನ್ನು ಒಳಗೊಂಡಿದೆ. ಈ ಸಾಂಸ್ಕೃತಿಕ - ಧಾರ್ಮಿಕ ಬಹುರೂಪತೆ, ವೈವಿಧ್ಯಮಯವಾದ ಭೌಗೋಳಿಕ ಪರಂಪರೆಯನ್ನು ವಿದ್ಯಾರ್ಥಿಗಳು ಅರ್ಥಮಾಡಿಕೊಂಡು ನಡೆಯಬೇಕಾಗಿದೆ. ಈ ರೀತಿಯಲ್ಲಿ ಮನುಷ್ಯ ಪರಿಸರದೊಂದಿಗೆ ಸಾಮರಸ್ಯವಾಗಿ ಬೆಳೆದಿರುವುದನ್ನು, ವೈವಿಧ್ಯತೆಯಲ್ಲಿ ಏಕತೆಯನ್ನು ಕಾಯ್ದುಕೊಂಡು ಬಂದಿರುವ ವಿಧಾನವನ್ನು ವಿದ್ಯಾರ್ಥಿಗಳು ಅರ್ಥಮಾಡಿಕೊಳ್ಳುವ ಸಲುವಾಗಿ ಶಿಕ್ಷಣದಲ್ಲಿ ಮೌಲ್ಯಗಳನ್ನು ಅಳವಡಿಸುವುದು ಅವಶ್ಯ. "ಇಂದಿನ ಮಕ್ಕಳೇ ಮುಂದಿನ ಪ್ರಜೆಗಳು" ಎಂಬುದನ್ನು ಅರಿತು ಉತ್ತಮ ಸಮಾಜ ಹಾಗೂ ದೇಶದ ನಿರ್ಮಾಣಕ್ಕೆ ಉತ್ತಮ ವ್ಯಕ್ತಿಗಳನ್ನು ತಯಾರು ಮಾಡುವ ಹೊಣೆ ಶಿಕ್ಷಣದ ಮೇಲಿರುವುದರಿಂದ ಪ್ರತಿಯೊಂದು ಶಾಲೆ, ಕಾಲೇಜುಗಳು ಮಕ್ಕಳ ನೈತಿಕ ಮಟ್ಟವನ್ನು ಸುಧಾರಿಸುವಲ್ಲಿ ಮಹತ್ವದ ಹೆಜ್ಜೆಯನ್ನಿಟ್ಟು ಉತ್ತಮ ಜೀವನ

ರೂಪಿಸಿಕೊಳ್ಳಲು ಸರ್ವರಿಗಿಂತಿರುವ ಪ್ರಯತ್ನಿಸಬೇಕಾಗಿದೆ.

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ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿನ ಶಿಕ್ಷಣ ಹಾಗೂ ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳು

ಡಾ. ಕೋಟೋಜಿರಾವ್ ಆರ್

ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ಕುಮದ್ವತಿ ಪ್ರಥಮ ದರ್ಜೆ ಕಾಲೇಜು, ಶಿಕಾರಿಪುರ.

ಸಾರಾಂಶ

ಈ ಅಧ್ಯಯನದ ಉದ್ದೇಶವು ಪ್ರಸ್ತುತ ಆಧುನಿಕ ಶಿಕ್ಷಣದಲ್ಲಿ ಬೋಧಿಸಲಾಗುವ ಶಿಕ್ಷಣದ ಪರಿಕಲ್ಪನೆ ಮತ್ತು ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳು ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿ ನೀಡಲಾಗುತ್ತಿತ್ತು. ಭಾರತದ ಪ್ರಾಚೀನ ಶಿಕ್ಷಣ ಪದ್ಧತಿ ಆಧುನಿಕ ಜಗತ್ತಿಗೂ ಮೀರಿದಿತ್ತು. ಪ್ರಾಚೀನ ಶಿಕ್ಷಣ ಶ್ರೇಷ್ಠಮಟ್ಟದ ಜ್ಞಾನ ಪರಂಪರೆಯನ್ನು ಹೊಂದಿತ್ತು. ಪ್ರಾಚೀನ ಭಾರತದಲ್ಲಿ ಉತ್ಕೃಷ್ಟವಾದ ಶಿಕ್ಷಣ ಸಂಸ್ಥೆಗಳಿದ್ದು, ವಿಶ್ವವೇ ಅಚ್ಚರಿಪಡುವಂತ ಭಾರತದ ಶೈಕ್ಷಣಿಕ ಪರಿಕಲ್ಪನೆಯ ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳ ಮುಂದುವರಿಕೆಯನ್ನು ಇಂದಿನ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿಯಲ್ಲಿ ಕಾಣಬಹುದು. ಭಾರತದ ಪ್ರಾಚೀನ ವಿಶ್ವವಿದ್ಯಾಲಯಗಳು ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಸಾಂಸ್ಕೃತಿಕ ವಿನಿಮಯ ಕೇಂದ್ರಗಳಾಗಿದ್ದು, ಜ್ಞಾನ ಮತ್ತು ಸತ್ಯವನ್ನು ಹುಡುಕುವ ಕೇಂದ್ರಗಳಾಗಿದ್ದವು. ಪ್ರಾಚೀನ ವಿದ್ಯಾಕೇಂದ್ರಗಳು ವಿದೇಶಿ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಹ ದಾಖಲಿಸಿಕೊಂಡು ಅವರ ಜ್ಞಾನದ ಅನ್ವೇಷಣೆಯಲ್ಲಿ ಮಾರ್ಗದರ್ಶಿಯಾಗಿದ್ದುದಕ್ಕೆ ಬಹುಮುಖ್ಯ ಕಾರಣ ಅವುಗಳು ಶಿಕ್ಷಣ ಕ್ರಮದಲ್ಲಿ ಅಳವಡಿಸಿಕೊಂಡಿದ್ದ ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳೇ ಆಗಿವೆ. ನಮ್ಮ ಪ್ರಾಚೀನ ಭಾರತದ ವಿಶ್ವಪ್ರಸಿದ್ಧ ವಿಶ್ವವಿದ್ಯಾಲಯಗಳಾದ ನಳಂದ, ತಕ್ಷಶಿಲಾ, ವಿಕ್ರಮಶಿಲಾ, ವಲ್ಲಭಿ, ತೆಲ್ಲೂರ, ಶಾರದಾ, ಪುಷ್ಪಗಿರಿ, ಸೋಮಪುರ, ರತ್ನಗಿರಿ, ಜಗದ್ವಾಳ, ಓದಂತಪುರಿ, ನಾಗಾರ್ಜುನ ಇತ್ಯಾದಿ ವಿಶ್ವವಿದ್ಯಾಲಯಗಳು ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳಾದ ಬಹುಶಿಸ್ತೀಯ ಬೋಧನೆ ಮತ್ತು ಸಂಶೋಧನೆಯ ಉನ್ನತ ಗುಣಮಟ್ಟವನ್ನು ಹೊಂದಿ ಪ್ರಪಂಚದಾದ್ಯಂತದ ಅತ್ಯಂತ ಶ್ರೇಷ್ಠ ವಿದ್ವಾಂಸರನ್ನು ಆಕರ್ಷಿಸಿತ್ತು. ಇವುಗಳು ಶೈಕ್ಷಣಿಕ ಪ್ರಕ್ರಿಯೆ ಹಾಗೂ ಸಾಂಸ್ಕೃತಿಕ ವಿನಾಸಗಳಲ್ಲಿ ಹೊಸತನವನ್ನು ರೂಢಿಸಿಕೊಂಡಿದ್ದವು. ಬೋಧನಾ ವಿಧಾನ, ಪಠ್ಯಕ್ರಮ, ಕಲಿಕೆಯ ವಿಧಾನಗಳು, ಸಂಶೋಧನಾ ಪ್ರವೃತ್ತಿ, ಶೈಕ್ಷಣಿಕ ಗುಣಮಟ್ಟದ ಉನ್ನತೀಕರಣ, ಹೊಸಹೊಸ ನಾವೀನ್ಯತೆ ಹಾಗೂ ನಿರ್ವಹಣೆಯ ಪ್ರಭುತ್ವ ಇವೆಲ್ಲವೂ ನಮ್ಮ ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ವ್ಯವಸ್ಥೆಯ ಭಾಗಗಳಾಗಿದ್ದವು. ಈ ಅಧ್ಯಯನವು ಭವಿಷ್ಯದ ದಿನಗಳಿಗೆ ಮಹತ್ವಪೂರ್ಣವಾದ ದಾಖಲೆಯಾಗಲಿದ್ದು, ಭವಿಷ್ಯತ್ತಿನ ಶೈಕ್ಷಣಿಕ ವಿಚಾರಧಾರೆಗಳನ್ನು ರೂಪಿಸುವಿಕೆಯಲ್ಲಿ ಮಹತ್ವದ ದಿಕ್ಕೂಚಿಯಾಗಲಿದೆ.

ಕೀನೋಟ್: ಪ್ರಾಚೀನ ಶಿಕ್ಷಣ, ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳು, ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳು, ಹೊಸ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ.

ಪೀಠಿಕೆ

“ಇತಿಹಾಸವನ್ನು ತಿಳಿಯದಿದ್ದರೆ ನಾವುಗಳು ಏನನ್ನೂ ತಿಳಿದಿಲ್ಲ ಎಂದರ್ಥ, ಅದು ಮರದ ಬೇರುಗಳನ್ನೇ ಅರಿಯದ ಚಿಗುರಿನಂತೆ” ಎಂಬುದು ಇತಿಹಾಸಕಾರ ಮೈಕೆಲ್ ಕ್ರಿಸ್ಟನ್ ಅವರ ಅಭಿಪ್ರಾಯ. ಇತಿಹಾಸವು ನಮ್ಮ ಭವಿಷ್ಯನ್ನು ಬೆಳಗಿಸುತ್ತದೆ. ಅದನ್ನು ನಿರ್ಲಕ್ಷಿಸುವ ಪೀಳಿಗೆಗೆ ಭವಿಷ್ಯತ್ ಹಾಗೂ ವರ್ತಮಾನ ಎರಡೂ ಇರುವುದಿಲ್ಲ ಎಂಬ ಮಾತುಗಳಿವೆ. ತಮ್ಮ ಹಿಂದಿನ ಇತಿಹಾಸ, ಮೂಲ ಹಾಗೂ ಸಂಸ್ಕೃತಿಯ ಅರಿವಿಲ್ಲದ ಜನರು ಬೇರುಗಳಿಲ್ಲದ ಮರದಂತೆ. ಏಕೆಂದರೆ ಇತಿಹಾಸವು ನಮಗೆ ಮೌಲ್ಯಗಳನ್ನು ಕಲಿಸುತ್ತದೆ. ಇದು ಮಾನವ ಸ್ಥಿತಿಸ್ಥಾಪಕತ್ವ, ನಾವೀನ್ಯತೆ ಮತ್ತು ಸಾಮೂಹಿಕ ಕ್ರಿಯೆಯ ಶಕ್ತಿಗೆ ಸಾಕ್ಷಿಯಾಗಿದೆ. ಭೂತಕಾಲದಿಂದ ಕಲಿಯುವ ಮೂಲಕ, ನಾವುಗಳು ನಾಳೆಯ ಇತಿಹಾಸವನ್ನು ಸೃಷ್ಟಿಸಬಹುದು.

ಆಧುನಿಕರಣಗೊಳ್ಳುತ್ತಿರುವ ಪ್ರಗತಿಶೀಲ ಭಾರತದ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ನವೀನ ಮಾದರಿಯ ಹೊಸ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ ಅನಾವರಣಗೊಂಡಿದೆ. ನಮ್ಮ ಇಂದಿನ ಬದುಕು ಕೇವಲ ನಮ್ಮ ವರ್ತಮಾನಕ್ಕೆ ಮಾತ್ರ ಸೀಮಿತವಾದುದಲ್ಲ. ಅದರ ಹಿಂದೆ ಒಂದು ದಿವ್ಯವಾದ ಭೂತಕಾಲವಿದೆ, ಅದಕ್ಕೊಂದು ಮಹತ್ವದ ಚರಿತ್ರೆಯಿದೆ, ಶ್ರೇಷ್ಠ ಪರಂಪರೆಯಿದೆ. ಪ್ರಾಚೀನವಾದ ಮೌಲಿಕ ಅಂಶಗಳನ್ನು ಪ್ರಸ್ತುತ ಬದುಕಿನಲ್ಲಿ ಅನ್ವಯಿಸಿಕೊಳ್ಳುವ ಅಲೋಚನಾಕ್ರಮಗಳು ನಮ್ಮದಾಗಬೇಕು.

ಭಾರತದ ಪ್ರಾಚೀನ ಶಿಕ್ಷಣ ಕೇಂದ್ರಗಳಾದ ನಳಂದ, ತಕ್ಷಶಿಲಾ, ವಿಕ್ರಮಶಿಲಾ, ವಲ್ಲಭಿ, ತೆಲ್ಲೂರ, ಶಾರದಾ, ಪುಷ್ಪಗಿರಿ, ಸೋಮಪುರ, ರತ್ನಗಿರಿ, ಜಗದ್ವಾಳ, ಓದಂತಪುರಿ, ನಾಗಾರ್ಜುನ ಮೊದಲಾದ ವಿಶ್ವವಿದ್ಯಾಲಯಗಳ ಶೈಕ್ಷಣಿಕ ಕೊಡುಗೆಗಳು ಅಪಾರವಾಗಿದೆ. ಎರಡೂವರೆ ಸಹಸ್ರ ವರ್ಷಗಳ ಹಿಂದೆ ಅಸ್ತಿತ್ವದಲ್ಲಿದ್ದ ಈ ವಿದ್ಯಾಕೇಂದ್ರಗಳಲ್ಲಿನ ವಿದ್ಯಾರ್ಥಿಗಳು ಶಿಕ್ಷಣ ಜೊತೆಗೆ ಶ್ರೇಷ್ಠ ಮತ್ತು ದಿವ್ಯವಾದ ವ್ಯಕ್ತಿತ್ವವನ್ನು ರೂಪಿಸಿಕೊಳ್ಳುತ್ತಿದ್ದರು. ಪ್ರಾಚೀನ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯು ಚರಕ, ಸುಶ್ರುತ, ಆರ್ಯಭಟ, ವರಾಹಮಿಹಿರ, ಭಾಸ್ಕರಚಾರ್ಯ, ಪತಂಜಲಿ, ನಾಗಾರ್ಜುನ ಮುಂತಾದ ಶ್ರೇಷ್ಠ ವಿದ್ವಾಂಸರನ್ನು ಜಗತ್ತಿಗೆ ನೀಡಿದ್ದು, ಗಣಿತ, ಖಗೋಳವಿಜ್ಞಾನ, ಲೋಹಶಾಸ್ತ್ರ, ವೈದ್ಯಕೀಯ ವಿಜ್ಞಾನ ಮತ್ತು ಶಸ್ತ್ರಚಿಕಿತ್ಸೆ, ಕಟ್ಟಡ ನಿರ್ಮಾಣ, ವಾಸ್ತುಶಿಲ್ಪ, ಹಡಗು ನಿರ್ಮಾಣ ಮತ್ತು ನೌಕಾಯಾನ, ಯೋಗ, ಲಲಿತಕಲೆಗಳು ಮುಂತಾದ ಹಲವಾರು ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ತಮ್ಮ ಅತ್ಯಮೂಲ್ಯ ಕೊಡುಗೆಗಳನ್ನು ನೀಡಿದ್ದಾರೆ ಇದ್ದಕ್ಕಿಲ್ಲ ಪ್ರಮುಖಾಂಶಗಳು ಅವುಗಳು ಅಳವಡಿಸಿಕೊಂಡಿದ್ದ ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳು.

ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ-2020 ನಮ್ಮ ಶಿಕ್ಷಣ ವಿನ್ಯಾಸವು ಪ್ರತಿಯೊಂದು ಮಗುವಿನ ಸೃಜನಾತ್ಮಕ ಸಾಮರ್ಥ್ಯವನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸುವ, ಸಾಮಾಜಿಕ, ನೈತಿಕ ಮತ್ತು ಭಾವನಾತ್ಮಕ ಸಾಮರ್ಥ್ಯಗಳು ಮತ್ತು ನಿಲುವುಗಳು ಗಟ್ಟಿಯಾಗುವಂತೆ ಮಾಡುವುದು ಇದರ ಪ್ರಮುಖ ಆಶಯವಾಗಿದೆ. ಈ ಆಶಯವು ನಮ್ಮ ಪ್ರಾಚೀನ ಶಿಕ್ಷಣದ ಆಶಯವು ಆಗಿತ್ತು ಎಂಬುದು ನಮ್ಮಗೆ ಅಚ್ಚರಿಯನುಂಟು ಮಾಡುತ್ತದೆ. ನಮ್ಮ ನಾಡಿನ ಪ್ರಾಚೀನ ಪರಂಪರೆ ಹಾಗೂ ಸನಾತನವೆನಿಸಿದ ಭಾರತೀಯ ಜ್ಞಾನಸಂಪತ್ತು ಮತ್ತು ಚಿಂತನಶೀಲತೆ ಈ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯ ದಾರಿದೀಪವಾಗಿದೆ. ಜ್ಞಾನ, ವಿವೇಕ, ಪ್ರಜ್ಞೆ ಹಾಗೂ ಸತ್ಯ ಇವು ಭಾರತೀಯ ದಾರ್ಶನಿಕ ಚಿಂತನೆಯ ಅತ್ಯುನ್ನತ ಸಾಧನೆಯ ಗುರಿಗಳಾಗಿದ್ದವು.

“ನಾವು ಮಾನವಿತೆ ಮತ್ತು ಸಮಾನತೆಯ ಮೌಲ್ಯಗಳ ಮೇಲೆ ನಿರ್ಮಿತವಾದ ಆಧುನಿಕ ಪ್ರಜಾಪ್ರಭುತ್ವದೊಂದಿಗಿದ್ದೇವೆ. ನಾವು ನಿರ್ಮಿಸಲು ಬಯಸುವ ಸಮಾಜದ ಮಾದರಿಯನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ಶಿಕ್ಷಣವನ್ನು ನೀಡಬೇಕು” ಡಾ. ಸರ್ವಪಲ್ಲಿ ರಾಧಾಕೃಷ್ಣನವರ ಅಭಿಪ್ರಾಯದಂತೆ ಜಗತ್ತು ಇಂದು ತ್ವರಿತ ಬದಲಾವಣೆಗಳಿಗೆ ಒಳಗಾಗುತ್ತಿದೆ. ಸಾಮಾಜಿಕ, ಆರ್ಥಿಕ ಮತ್ತು ತಂತ್ರಜ್ಞಾನದ ಆವಿಷ್ಕಾರಗಳಿಗೆ ಪ್ರತಿಕ್ರಿಯೆಯಾಗಿ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯು ಶರವೇಗದಲ್ಲಿ ವಿಕಸನವನ್ನು ಹೊಂದುತ್ತಿದ್ದು, ಬೃಹತ್ ದತ್ತಾಂಶ, ಯಂತ್ರ ಕಲಿಕೆ ಮತ್ತು ಕೃತಕ ಬುದ್ಧಿಮತೆಯಂತಹ ವಿವಿಧ ವೈಜ್ಞಾನಿಕ ಮತ್ತು ತಾಂತ್ರಿಕ ಪ್ರಗತಿಗಳು ವಿಜ್ಞಾನ, ಸಾಮಾಜಿಕ ವಿಜ್ಞಾನ ಮತ್ತು ಮಾನವಿಕ ಸೇರಿದಂತೆ ಬಹುಶಿಸ್ತೀಯ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಹೊಂದಿರುವ ಕಾರ್ಯಪಡೆಯನ್ನು ನಿರೀಕ್ಷಿಸುತ್ತಿವೆ. ಜೊತೆಗೆ ಸಾರ್ವತ್ರಿಕವಾಗಿ ಅನ್ವಯಿಸಬಹುದಾದ, ಯೋಚಿಸುವ, ಕಲಿಯುವ, ಕಾರ್ಯನಿರ್ವಹಿಸುವ ಮತ್ತು ಇನ್ನಿತರೆ 21ನೇ ಶತಮಾನದ ಕೌಶಲ್ಯಗಳನ್ನು ಹೊಂದಿದ ಜ್ಞಾನವನ್ನು ಆಪೇಕ್ಷಿಸುತ್ತಿದೆ. ಇಂಥಹ ಮಹತ್ತರವಾದ ಜ್ಞಾನ ಪರಂಪರೆಯ ಉತ್ತೇಜನ ಮತ್ತು ನೀಡಿಕೆ ನಮ್ಮ ಪ್ರಾಚೀನ ಶಿಕ್ಷಣದ ಬಹುಮುಖ್ಯವಾದ ಮಾನದಂಡವಾಗಿತ್ತು ಎಂಬುದು ಅಚ್ಚರಿಯ ಹಾಗೂ ಹೆಮ್ಮೆಯ ಸಂಗತಿಯಾಗಿದೆ.

ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿನ ಶಿಕ್ಷಣ ಹಾಗೂ ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳು :

ಜ್ಞಾನದ ನಿರ್ಮಾಣ :

ಭಾರತದ ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳು ಶ್ರೇಷ್ಠಮಟ್ಟದ ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳ ಜ್ಞಾನ ವಿನಿಮಯ ಕೇಂದ್ರಗಳಾಗಿದ್ದವು. ಅವು ಜ್ಞಾನ ಮತ್ತು ಬುದ್ಧಿವಂತಿಕೆಯನ್ನು ಹುಡುಕುವ ಅಂತ್ಯವಿಲ್ಲದ ಚಾಲಕ ಕೇಂದ್ರಗಳಾಗಿದ್ದವು. ಸತ್ಯಗಳನ್ನು ತಲುಪುವ, ಪ್ರಶ್ನಿಸುವ ಮತ್ತು ಚರ್ಚಿಸುವ ಅವುಗಳ ಸಾಮರ್ಥ್ಯವು ಅತ್ಯುನ್ನತವಾಗಿತ್ತು. ವಿಶ್ವದ ಅತ್ಯಂತ ಹಳೆಯ ವಿಶ್ವವಿದ್ಯಾಲಯಗಳಿಗೆ ನೆಲೆಯಾಗಿರುವ ಪ್ರಾಚೀನ ಭಾರತದಲ್ಲಿ ಕಲೆ ಮತ್ತು ಕಲಿಕೆಯ ಸುಸ್ಥಾಪಿತ ಸಂಸ್ಥೆಗಳಿದ್ದವು. ಹೊಸ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿಯ ಎಲ್ಲ ಘಲತಗಳಿಗೆ

ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಪರಿಕಲ್ಪನೆಗಳೇ ಮೂಲಾಧಾರವೆಂಬುದು ಅಚ್ಚರಿಯ ಹಾಗೂ ಅಧ್ಯಯನದ ವಸ್ತುವಾಗಿದೆ. ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿನ ಶಿಕ್ಷಣದ ಪರಿಕಲ್ಪನೆಯ ಮೂಲಭೂತ ಅಂಶಗಳು ಹೊಸ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿಯ ಮುಂದುವರಿಕೆಯೇ ಆಗಿದೆ.

ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿನ ಶಿಕ್ಷಣ ಹಾಗೂ ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳು ನಮಗೆ ಇಂದಿಗೂ ಅಚ್ಚರಿಯನ್ನುಂಟುಮಾಡುತ್ತದೆ. ಶಿಕ್ಷಣವಿಲ್ಲದ ವ್ಯಕ್ತಿಯನ್ನು ಪಶುಸಮಾನವೆಂದು ಪರಿಗಣಿಸಲಾಗುತ್ತಿತ್ತು. ಪ್ರಾಪಂಚಿಕ ಜ್ಞಾನದೊಂದಿಗೆ ವ್ಯಕ್ತಿತ್ವ ನಿರ್ಮಾಣದ ಸಾಧನೆಗೆ ಅತಿ ಹೆಚ್ಚಿನ ಗಮನ ನೀಡಲಾಗಿತ್ತು. ಆದರೆ ಇಂದು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಜ್ಞಾನವನ್ನು ಬಹು ಹಂತದಲ್ಲಿ ನಿರ್ಮಿಸಿಕೊಳ್ಳಲು ಹಲವು ಅವಕಾಶಗಳಿವೆ. ಪಠ್ಯಕ್ರಮದ ನಿರ್ಮಾಣದ ಸಮಯದಲ್ಲಿ ಜ್ಞಾನದ ಕ್ರಮಾನುಗತವನ್ನು ಯೋಜಿಸಿ, ಜ್ಞಾನ ನಿರ್ಮಾಣದ ಪ್ರಮುಖ ಕ್ಷೇತ್ರಗಳನ್ನು ಗುರುತಿಸುವ ಜವಾಬ್ದಾರಿ ನೀತಿ ನಿರೂಪಕರು, ಪಠ್ಯಕ್ರಮ ರೂಪಿಸುವವರು, ಪ್ರಶಿಕ್ಷಕರ ಮೇಲಿದ್ದು, ನಮ್ಮ ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿನ ಶಿಕ್ಷಣ, ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳು, ಹಾಗೂ ಜ್ಞಾನದ ನಿರ್ಮಾಣದ ಉದ್ದೇಶ ಶ್ಲಾಘನೀಯವಾಗಿದೆ.

ಸಮಗ್ರ ಶಿಕ್ಷಣ

ಪ್ರಾಚೀನ ಶಿಕ್ಷಣವು ಬಹುಮುಖ್ಯವಾಗಿ ಬೌದ್ಧಿಕ, ನೈತಿಕ, ದೈಹಿಕ, ಮಾನಸಿಕ ಹಾಗೂ ಆಧ್ಯಾತ್ಮಿಕ ವ್ಯಕ್ತಿತ್ವದ ಬೆಳವಣಿಗೆಯ ಕೇಂದ್ರಗಳಾಗಿದ್ದವು. ವ್ಯಕ್ತಿಯ ಸಮಗ್ರ ಮತ್ತು ಉದಯೋನ್ಮುಖ ಶಿಕ್ಷಣದ ಕಾಳಜಿಯಿಂದಾಗಿ ಶ್ರೇಷ್ಠ ವ್ಯಕ್ತಿಗಳ ನಿರ್ಮಾಣ ಸಾಧ್ಯವಾಗಿತ್ತು. ಇಂದಿನ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ ಒಂದು ಸಮಗ್ರ ದಾಖಲೆಯಾಗಿದ್ದು, ಶಿಕ್ಷಣ ಕ್ಷೇತ್ರವನ್ನು ಸಮಗ್ರ ಮತ್ತು ಹೆಚ್ಚು ಫಲಪ್ರದವಾಗಿಸುವ ಮೂಲಕ ಸುಧಾರಿಸುವುದು ಇದರ ಮುಖ್ಯ ಉದ್ದೇಶ. ಭಾರತ ದೇಶದ ಪ್ರಾಚೀನ ಪ್ರಸಿದ್ಧ ವಿಶ್ವವಿದ್ಯಾಲಯಗಳಾದ ನಳಂದ, ತಕ್ಷಶಿಲಾ, ವಿಕ್ರಮಶಿಲಾ, ವಲ್ಲಭಿ ಮೊದಲಾದ ವಿಶ್ವವಿದ್ಯಾಲಯಗಳು ಸಮಗ್ರ ಕಲಿಕೆಯ ದೀರ್ಘ ಇತಿಹಾಸವನ್ನು ಹೊಂದಿದ್ದು, ವ್ಯಕ್ತಿಯ ಸಮಗ್ರ ಬೆಳವಣಿಗೆಗೆ ಹೆಚ್ಚಿನ ಗಮನ ನೀಡಲಾಗುತ್ತಿತ್ತು. ಇಂದಿನ ಶಿಕ್ಷಣ ವೇಗವಾಗಿ ಅಭಿವೃದ್ಧಿ ಹೊಂದುತ್ತಿದ್ದು, ಹೆಚ್ಚಿನ ಮಟ್ಟದ ಸಂಶೋಧನೆ ಮತ್ತು ಅಧ್ಯಯನದ ಅಗತ್ಯವಿದೆ. ಶಿಕ್ಷಣ ಕ್ಷೇತ್ರವು ಹಿಂದೆ ಸಂಪೂರ್ಣವಾಗಿ ಕೇಳಿರದ ಶಿಕ್ಷಣದಲ್ಲಿ ಇಂದು ಹೊಸ ಪ್ರವೃತ್ತಿಗಳನ್ನು ಬದಲಾಯಿಸಲು ಮತ್ತು ಚಲನೆಗೆ ಹೊಂದಿಕೊಳ್ಳಬೇಕು. ಕಲಿಸುವ ವಿಧಾನವನ್ನು ಬದಲಾಯಿಸಬೇಕು. ಪ್ರಾಥಮಿಕ ತರಗತಿಗಳಿಂದ ವಿಶ್ವವಿದ್ಯಾಲಯದ ಹಂತದವರೆಗೆ ವ್ಯಾಪಕವಾದ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಳ್ಳಬೇಕು. ಶಿಕ್ಷಣ ಕ್ಷೇತ್ರದೊಳಗೆ ನಿರಂತರವಾಗಿ ವಿಕಸನಗೊಳ್ಳುತ್ತಿರುವ ಈ ಜಗತ್ತಿನಲ್ಲಿ ವೃತ್ತಿಜೀವನವನ್ನು ಮುಂದುವರಿಸಲು ಬಯಸುವ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಹೊಸ ಅವಕಾಶಗಳು ಇರಬೇಕು. ಭಾರತದಲ್ಲಿ ಉದಯೋನ್ಮುಖ ಶಿಕ್ಷಣ ಪ್ರವೃತ್ತಿಗಳನ್ನು ಅನ್ವೇಷಿಸಬೇಕು. ಆದರೆ ನಮ್ಮ ಪ್ರಾಚೀನ ಕಾಲದ ಶಿಕ್ಷಣ ಸಮಗ್ರವಾಗಿ ರೂಪಿತವಾಗಿ, ಸಮಗ್ರ ಶಿಕ್ಷಣ ದರಾಳವಾಗಿ ದೊರೆಯುತ್ತಿತ್ತು.

ಪರಿವರ್ತನಾಶೀಲ ಶಿಕ್ಷಣ :

ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳು ಪರಿವರ್ತನಾಶೀಲ ಶಿಕ್ಷಣದ ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳ ವರ್ಗಾವಣಾ ಕೇಂದ್ರಗಳಾಗಿದ್ದವು. ಪ್ರಾಚೀನ ಶಿಕ್ಷಣವು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ನಮ್ರತೆ, ಸತ್ಯತೆ, ಶಿಸ್ತು, ಸ್ವಾವಲಂಬನೆ ಮತ್ತು ಎಲ್ಲಾ ಸೃಷ್ಟಿಗಳನ್ನು ಗೌರವಿಸುವಂತಹ ಮೌಲ್ಯಗಳನ್ನು ನೀಡುವುದರ ಮೇಲೆ ಕೇಂದ್ರೀಕರಿಸಿತ್ತು. ಶಿಕ್ಷಣವನ್ನು ಗುರುಕುಲಗಳು, ದೇವಾಲಯಗಳು, ಅಗ್ರಹಾರ, ಘಟಿಕಾಸ್ಥಾನಗಳು ಮತ್ತು ಮನೆಗಳಲ್ಲಿ ನೀಡಲಾಗುತ್ತಿತ್ತು. ನಮ್ಮ ಪ್ರಾಚೀನ ಶಿಕ್ಷಣದ ವ್ಯವಸ್ಥೆಯು ವಿಶ್ವಕ್ಕೆ ಮಾದರಿ ಮತ್ತು ಶಿಕ್ಷಣದ ಉದಯೋನ್ಮುಖ ಚಿಂತನೆಗಳನ್ನು ರೂಪಿಸಿಕೊಂಡು, ವ್ಯಕ್ತಿ ಸ್ವಕೇಂದ್ರೀಕೃತ ವ್ಯಕ್ತಿತ್ವದಿಂದ ದೂರವಾದ ದಯೆ, ಅನುಕಂಪಗಳಿಂದ ಕೂಡಿದ ವ್ಯಕ್ತಿತ್ವವನ್ನು ರೂಪಿಸಿಕೊಂಡು ಜೀವನದ ಸಾಕ್ಷಾತ್ಕಾರದಡೆಗೆ ನಿರ್ಮಾಣ ಮಾಡುತ್ತಿತ್ತು. ಇಂದಿನ ಪ್ರಸ್ತುತ ಶಿಕ್ಷಣಕ್ಕೆ ಪ್ರಾಚೀನ ಶಿಕ್ಷಣ ಅಡಿಗಲ್ಲಾಗಿದೆ. ಇಂದಿನ ನವೀನ ಶಿಕ್ಷಣ ಕ್ಷೇತ್ರದಲ್ಲಿ ಬೋಧನಾ ಕಲಿಕೆಯ

ತಂತ್ರಗಳು, ಪರಿಕಲ್ಪನೆಗಳು ವಿದ್ಯಾರ್ಥಿಗಳ ವ್ಯಕ್ತತ್ವ ನಿರ್ಮಾಣ ಮಾಡಿ, ಪರಿವರ್ತನಾಶೀಲ ಸಂಸ್ಕಾರ ನಿರ್ಮಾಣ ಮಾಡುವ ನಿಟ್ಟಿನಲ್ಲಿ ರೂಪಿತವಾಗಬೇಕಿದೆ.

ಅಧ್ಯಯನದ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ವಿಷಯಗಳ ವ್ಯಾಪಕ ಆಯ್ಕೆ :

ಪ್ರಾಚೀನ ಭಾರತದ ಶೈಕ್ಷಣಿಕ ವ್ಯವಸ್ಥೆಯ ಅಧ್ಯಯನದ ಕೇಂದ್ರಗಳಲ್ಲಿ ವ್ಯಾಪಕ ವಿಷಯದ ಆಯ್ಕೆಗಳಿದ್ದು, ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳ ಅಳವಡಿಕೆಯ ಮೂಲಕ ವಿದೇಶಿ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಆಕರ್ಷಿಸಿ ಮತ್ತು ಅವರ ಜ್ಞಾನ ಮತ್ತು ಬುದ್ಧಿವಂತಿಕೆಯ ಅನ್ವೇಷಣೆಯಲ್ಲಿ ಮಾರ್ಗದರ್ಶಿಯಾಗಿದ್ದಿತು. ಜ್ಞಾನ ಮತ್ತು ಶಿಕ್ಷಣದ ಪ್ರಾಮುಖ್ಯತೆಯನ್ನು ಪಸರಿಸುತ್ತಾ ಸದಾ ಸುಶಿಕ್ಷಿತ ಜ್ಞಾನವಲಯವನ್ನು ರಚಿಸುವ ನಿಟ್ಟಿನಲ್ಲಿ ಹೆಜ್ಜೆ ಇಟ್ಟಿತ್ತು.

ಪ್ರಾಚೀನ ಶಿಕ್ಷಣದ ಕಲಿಕೆಯಲ್ಲಿ ವ್ಯಾಪಕ ವಿಷಯದ ಆಯ್ಕೆಗಳಿದ್ದು, ಆಯುರ್ವೇದ, ಖಗೋಳವಿಜ್ಞಾನ, ವಿಜ್ಞಾನ, ವೈದ್ಯಕೀಯಶಾಸ್ತ್ರ, ಕಲೆ, ಮೀಮಾಂಸೆ, ವೇದಾಂಗ, ಇತಿಹಾಸ, ಬ್ರಹ್ಮಶಾಸ್ತ್ರ, ಸ್ತ್ರೀಪುರಾಣ, ಕಾವ್ಯ, ನಾಟಕ, ಅರ್ಥಗ್ರಂಥ, ಪ್ರಯೋಗ, ಶಬ್ದಶಾಸ್ತ್ರ, ನ್ಯಾಯ, ವೈಶೇಷಿಕ, ಸಾಂಖ್ಯ, ಮೀಮಾಂಸಾದಿ ದರ್ಶನ ಮತ್ತು ಪ್ರಾಯೋಗಿಕ ವಿಷಯಗಳು ಅಂದಿನ ಶಿಕ್ಷಣದ ಪಠ್ಯಕ್ರಮಗಳಾಗಿದ್ದು ಅಧ್ಯಯನದ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ವ್ಯಾಪಕ ವಿಷಯದ ಆಯ್ಕೆಗಳಿದ್ದವು. ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ-2020 ರ ಉದಯೋನ್ಮುಖ ಶಿಕ್ಷಣ ವಿನ್ಯಾಸವು ಅಧ್ಯಯನದ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ವ್ಯಾಪಕ ವಿಷಯದ ಆಯ್ಕೆಗಳಿಗೆ ಹೆಚ್ಚಿನ ಅವಕಾಶಗಳನ್ನು ಕಲ್ಪಿಸಿದ್ದು ನಮ್ಮ ಪ್ರಾಚೀನ ಶಿಕ್ಷಣಕ್ರಮವು ಇಂದಿಗೂ ಮಾದರಿಯ ಬೆಳಕಾಗಿದೆ. ಪ್ರಾಚೀನ ಭಾರತೀಯ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ನೃತ್ಯ, ಸಂಗೀತ, ಆಭರಣ ತಯಾರಿಕೆ, ಶಿಲ್ಪಕಲೆ, ಕೃಷಿ ಮತ್ತು ವೈದ್ಯಕೀಯ ವಿಜ್ಞಾನಗಳು ಸೇರಿದಂತೆ ಸುಮಾರು 64 ಕಲಾ ಪ್ರಕಾರಗಳು ಇದ್ದವು.

ಬಹುಶಿಸ್ತೀಯ ಶಿಕ್ಷಣ

ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿನ ಶಿಕ್ಷಣದ ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳು ಬಹುಶಿಸ್ತೀಯ ಶಿಕ್ಷಣವಾಗಿ ರೂಪುಗೊಂಡಿದ್ದವು. ಒಂದು ವಿಷಯವನ್ನು ಬಹುದೃಷ್ಟಿಕೋನಗಳಲ್ಲಿ ಅಧ್ಯಯನ ಮಾಡಲು ಹಾಗೂ ಜ್ಞಾನವನ್ನು ಪಡೆಯಲು ಅವಕಾಶವನ್ನು ರೂಪಿಸಲಾಗಿತ್ತು. ಪ್ರಾಚೀನ ಶಿಕ್ಷಣದಲ್ಲಿ ಸಾಂಪ್ರದಾಯಿಕ ತರಗತಿಯ ನಾಲ್ಕು ಗೋಡೆಗಳಿಗೆ ಜ್ಞಾನವು ಸೀಮಿತವಾಗಿರದೇ ವಿಸ್ತಾರ ತಳಹದಿಯ ಮೇಲೆ ನಿರ್ಮಿತವಾಗಿತ್ತು. ಕಲಿಕೆಯ ಪರಿಸರವು ಗಡಿಗಳನ್ನು ಮೀರಿದೆ.

ಹೀಗಾಗಿ ನಮ್ಮ ಇಂದಿನ ತರಗತಿ ಕಲಿಕೆ ಬಹು ಆಯಾಮ ಜ್ಞಾನದ ನಿರ್ಮಾಣದತ್ತ ಗಮನಹರಿಸಬೇಕು. ನವೀನ ಬೋಧನಾ ಪ್ರವೃತ್ತಿಗಳಿಗೆ ದಾರಿ ಮಾಡಿಕೊಡಬೇಕು. ಬದಲಾಗುತ್ತಿರುವ ಜಾಗತಿಕ ಸಮಾಜಕ್ಕೆ ಹೊಸ ಚೈತನ್ಯವನ್ನು ನೀಡುವಲ್ಲಿ ಶಿಕ್ಷಣ ಕೇಂದ್ರಗಳು ಉತ್ತಮ ಚಿಂತನೆಗಳನ್ನು ರೂಪಿಸಿಕೊಳ್ಳಬೇಕು. ಕಲಿಯುವವರು ಸಂಪೂರ್ಣವಾಗಿ ವಿಭಿನ್ನ ಮಾನಸಿಕ ಸಂರಚನೆಯನ್ನು ಹೊಂದಿದ್ದು, ವೇಗವಾಗಿ ಯೋಚಿಸುವ ಮತ್ತು ಜ್ಞಾನವನ್ನು ರೂಪಿಸಿಕೊಳ್ಳುವಲ್ಲಿ ಇಂಥಾ ಚಿಂತನೆಗಳು ಅವಶ್ಯಕವಾಗಿದೆ. ಉದಯೋನ್ಮುಖ ಬಹುಶಿಸ್ತೀಯ ಶೈಕ್ಷಣಿಕ ಪ್ರವೃತ್ತಿಗಳು ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ವ್ಯವಸ್ಥೆಯ ಭಾಗವಾಗಿದ್ದು, ಇಂದಿಗೂ ಮಾದರಿಯಾಗಿದೆ.

ಬ್ರಿಟಿಷರು ಭಾರತಕ್ಕೆ ಬರುವ ಮೊದಲು ಭಾರತೀಯ ಶೈಕ್ಷಣಿಕ ವ್ಯವಸ್ಥೆ ಸುವರ್ಣ ವೃಕ್ಷದಂತೆ ವಿರಾಜಿಸುತ್ತಿದ್ದ ಬಗ್ಗೆ 1931ರ ಅಕ್ಟೋಬರ್ 20ರಂದು ಲಂಡನ್ನಿನ ದುಂಡುಮೇಜಿನ ಸಭೆಯಲ್ಲಿ ಗಾಂಧೀಜಿಯವರು ತಮ್ಮ ಭಾಷಣದಲ್ಲಿ ಭಾರತೀಯ ಶಿಕ್ಷಣದ ಬಗ್ಗೆ ಮಹತ್ತರವಾದ ವಿಷಯವನ್ನು ಪ್ರಸ್ತಾಪಿಸಿದ್ದರು. “ಬ್ರಿಟಿಷ್ ಆಡಳಿತಗಾರರು ಭಾರತಕ್ಕೆ ಬಂದಾಗ ಅವರು ಇರುವ ಪರಿಸ್ಥಿತಿಗಳನ್ನು ಇರುವ ರೀತಿಯಲ್ಲಿಯೇ ಸ್ವೀಕರಿಸುವುದನ್ನು ಬಿಟ್ಟು ಅವುಗಳನ್ನು ಬೇರು ಸಹಿತ ಕಿತ್ತುಹಾಕುವುದಕ್ಕೆ, ಮೂಲಕ್ಕೆ ಕೈ ಹಾಕಿದರು. ಅವರು ನೆಲವನ್ನು ಗೆಬರುವುದಕ್ಕೆ ಪ್ರಯತ್ನಿಸಿದರು. ಆಗ ಚೆಲುವ ತರು ನೆಲಕ್ಕುರುಳಿತು.”

(ಃಜಚೆಣಾಣುಜೆಣಾಟ ಖಿಡಿಜಜ ಕಜಡ್ಪುಜಜ) ಎಂದಿದ್ದರು.

ಸ್ವಾತಂತ್ರ್ಯ ಹೋರಾಟಗಾರರಾದ ಆದ ದಿ. ಧರ್ಮಪಾಲ್ ರವರು ಬರೆದಿರುವ 'ದಿ ಬ್ಯೂಟಿಫುಲ್ ಟ್ರೀ' ಕೃತಿಯ ಕನ್ನಡ ಅನುವಾದ "ಚೆಲುವ ತರು"; ಇದು ಬ್ರಿಟಿಷ್ ಪೂರ್ವ ಭಾರತದಲ್ಲಿ ಇದ್ದ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಗೆ ಸಂಬಂಧಿಸಿದ ಅಧ್ಯಯನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಬೆಳಕುಚೆಲ್ಲಿದ್ದಾರೆ. ವಿಶ್ವವೇ ಬೆರಗಾಗುವಂತಿದ್ದ ಭಾರತದಲ್ಲಿನ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯ ಬಗ್ಗೆ ಅದರಲ್ಲೂ ಪ್ರಾಚೀನ ಗುರುಕುಲ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯನ್ನು ನಾಶ ಮಾಡಿ ಪಾಶ್ಚಿಮಾತ್ಯ ಶಿಕ್ಷಣಕ್ಕೆ ಮನ್ನಣೆ ಹಾಕಿದ ಬಗ್ಗೆ ಬೆಳಕು ಚೆಲ್ಲಿದ್ದಾರೆ. ಬ್ರಿಟಿಷರು ಇಲ್ಲಿಯ ಗುರುಕುಲ ವ್ಯಾವಸ್ಥೆಯನ್ನು, ಶಿಕ್ಷಣ ಪದ್ಧತಿಗಳನ್ನೇ ಅಲುಗಾಡಿಸಿದ ಬಗ್ಗೆಯನ್ನು ಆಧಾರಸಹಿತವಾಗಿವೆ ವಿವರಿಸಿದೆ. ಬಹುಶಿಸ್ತಿನ ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಪ್ರವೃತ್ತಿಗಳು ಸರ್ವಕಾಲಕ್ಕೂ ಮಾದರಿಯಾಗಿದೆ.

ವಾಸ್ತವತೆಯ ವಿಸ್ತೃತ ಜ್ಞಾನ ಮೌಲ್ಯಗಳ ಅಳವಡೆ :

ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿನ ಶಿಕ್ಷಣವು ವಾಸ್ತವತೆಯ ವಿಸ್ತೃತ ಜ್ಞಾನ ಮೌಲ್ಯಗಳ ಅಳವಡೆಯನ್ನು ಮಾಡಿಕೊಂಡಿದ್ದು, ವಿದ್ಯಾರ್ಥಿಯ ಪ್ರಸ್ತುತ ಬದುಕಿನ ಉದ್ಧಾರ ಕೇಂದ್ರಿತವಾಗಿತ್ತು. ಪೌರಪ್ರಜ್ಞೆ ಮತ್ತು ಸಾಮಾಜಿಕ ಮೌಲ್ಯಗಳನ್ನು ಬೆಳೆಸುವುದು, ವ್ಯಕ್ತಿ ಸಾಮಾಜಿಕ ಪರಿಸ್ಥಿತಿಗನುಗುಣವಾಗಿ ಅವನ ಹಕ್ಕು ಹಾಗೂ ಕರ್ತವ್ಯಗಳ ಸರಿಯಾದ ಪ್ರಜ್ಞೆಯನ್ನು ರೂಪಿಸುವ ಸುಂದರವಾದ ಶೈಕ್ಷಣಿಕ ಚೌಕಟ್ಟನ್ನು ಹೊಂದಿತ್ತು. ವಾಸ್ತವತೆಯ ಬದುಕಿನ ಬಗೆಗೆ ವಿಸ್ತೃತ ಜ್ಞಾನ ಮೌಲ್ಯಗಳನ್ನು ಅಳವಡಿಕೆಗೆ ಹೆಚ್ಚಿನ ಪ್ರಾಶಸ್ತ್ಯ ನೀಡಿತ್ತು. ಇಂದಿನ ಶಿಕ್ಷಣದ ಹೊಸ ಪರಿಕಲ್ಪನೆಗಳು, ಬೋಧನಾ ಸಾಧನಗಳು ಹೊಸ ಪೀಳಿಗೆಯ ಕಲಿಯುವವರಿಗೆ ಪರಿಣಾಮಕಾರಿಯಾಗಿ ಮುಟ್ಟಿಸುವ ಕೆಲಸವಾಗಬೇಕು. ವಿದ್ಯಾರ್ಥಿಯು ವಾಸ್ತವ ಹಾಗೂ ನಿತ್ಯ ಬದುಕಿಗೆ ಹತ್ತಿರವಾದ ಕಲಿಕೆಯೆಡೆಗೆ ಆಕರ್ಷಿತನಾಗಬೇಕು, ಅಂಥ ಶಿಕ್ಷಣದ ಉದ್ದೇಶ ನಮ್ಮದಾಗಬೇಕು.

ವೃತ್ತಿಪರ ಕಲಿಕೆಯ ವಿಭಿನ್ನ ಆಯಾಮ :

ಭಾರತದ ಪ್ರಾಚೀನ ಶಿಕ್ಷಣಕ ಪರಿಕಲ್ಪನೆ ಯಾವಾಗಲೂ ಕಲಿಕೆ ಮತ್ತು ಶಿಕ್ಷಣದ ಕ್ಷೇತ್ರದಲ್ಲಿ ಶ್ರೀಮಂತ ಸಂಪ್ರದಾಯವನ್ನು ರೂಪಿಸಿಕೊಂಡಿದ್ದು ನಾವುಗಳು ಹೆಮ್ಮೆಪಡುವತ್ತದ್ದು. ಯುರೋಪು, ಮಧ್ಯಪ್ರಾಚ್ಯ ಮತ್ತು ಪೋರ್ಚುಗಲ್ನು ವಿವಿಧ ದೇಶಗಳ ಕಲಿಕಾರ್ಥಿಗಳು ಗುಣಮಟ್ಟದ ಶಿಕ್ಷಣವನ್ನು ಪಡೆಯಲು ಭಾರತಕ್ಕೆ ಬರುತ್ತಿದ್ದು ಪ್ರಾಚೀನ ಶಿಕ್ಷಣದಲ್ಲಿ ದೊರೆಯುತ್ತಿದ್ದ ವೃತ್ತಿಪರ ಕಲಿಕೆಯ ವಿಭಿನ್ನ ಆಯಾಮಗಳನ್ನು ಪಡೆದುಕೊಳ್ಳಲು.

ಇಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಸೈದ್ಧಾಂತಿಕ ಹಾಗೂ ಪ್ರಾಯೋಗಿಕ ಶಿಕ್ಷಣ ದೊರೆಯುತ್ತಿತ್ತು. ಕಲೆ ಮತ್ತು ಕರಕುಶಲ ಕೆಲಸಗಳಲ್ಲಿ ತರಬೇತಿ, ನೇಯುವುದು, ನೂಲುವುದು, ಶಿಲ್ಪಕಲೆ ಮುಂತಾದ ವಿಷಯಗಳಲ್ಲಿ ವೃತ್ತಿಪರವಾದ ವಿಭಿನ್ನ ಕಲಿಕೆಯ ಆಯಾಮಗಳ ಪರಿಸರವನ್ನು ಕಲ್ಪಿಸಲಾಗಿತ್ತು. ಹೊಸ ಶಿಕ್ಷಣ ನೀತಿಯು ಶಿಕ್ಷಣದಲ್ಲಿ ಉದಯೋನ್ಮುಖ ವೃತ್ತಿ ಆಧಾರಿತ ಶಿಕ್ಷಣ ಮತ್ತು ತಂತ್ರಗಳನ್ನು ನೀಡಲು ಒತ್ತು ನೀಡುತ್ತಿದೆ. ಇಂದಿನ ಸ್ಪರ್ಧಾತ್ಮಕ ಜಗತ್ತಿನಲ್ಲಿ ವೃತ್ತಿಯಾಧಾರಿತ ಉದ್ಯೋಗಾವಕಾಶಗಳ ಕಲ್ಪಿಸಬೇಕಿದೆ.

ಸಾಮಾಜಿಕ ಮತ್ತು ಭಾವನಾತ್ಮಕ ಮೌಲ್ಯವರ್ಧನೆ :

ಪ್ರಾಚೀನ ಶಿಕ್ಷಣದ ಒಟ್ಟು ಆಶಯ ವ್ಯಕ್ತಿಯ ಸಾಮಾಜಿಕ ಮತ್ತು ಭಾವನಾತ್ಮಕ ಮೌಲ್ಯವರ್ಧನೆಯೇ ಆಗಿತ್ತು. "ಆಧುನಿಕ ಶಿಕ್ಷಣದೊಂದಿಗೆ ಪ್ರಾಚೀನ ಜ್ಞಾನದ ಮನಸ್ಸುಗಳನ್ನು ಸಂಯೋಜಿಸಬೇಕು" ಎಂದು ಆಧ್ಯಾತ್ಮಿಕ ನಾಯಕ ದಲೈ ಲಾಮಾರವರ ಅಭಿಮತ. ಇಂದು ನಾವುಗಳು ಮಾನವರ ಅಂತರ್ಗತ ಏಕತೆಗೆ ವಿರುದ್ಧವಾಗಿ ಕಾರ್ಯನಿರ್ವಹಿಸುತ್ತಿದೆ. ದೈಹಿಕ ಮತ್ತು ಭಾವನಾತ್ಮಕ ನೈರ್ಮಲ್ಯಕ್ಕೆ ಸಮಾನ ಒತ್ತು ನೀಡುವ ಹೊಸ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯೊಂದಿಗೆ ಇದನ್ನು ಎದುರಿಸಬಹುದು.

ಸಾಮಾಜಿಕ ಮತ್ತು ಭಾವನಾತ್ಮಕ ಕಲಿಕೆಯ ಸ್ವಯಂ ಅರಿವು, ನಿಯಂತ್ರಣ ಮತ್ತು ಪರಸ್ಪರ ಕೌಶಲ್ಯಗಳನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸುವ ಪ್ರಕ್ರಿಯೆ, ಮಕ್ಕಳ ಸಾಮಾಜಿಕ ಮತ್ತು ಭಾವನಾತ್ಮಕ ಜೀವನದ ಮೇಲೆ ಹೆಚ್ಚಿನ

ಗಮನವನ್ನು ಕೇಂದ್ರೀಕರಿಸಬೇಕಿದೆ. ಸಾಮಾಜಿಕ ಮತ್ತು ಭಾವನಾತ್ಮಕ ಕಲಿಕೆಯ ಪ್ರಯೋಜನಗಳನ್ನು ಮನಸ್ಸಿನಲ್ಲಿಟ್ಟುಕೊಂಡು ಕಲಿಕೆಯ ಫಲಿತಾಂಶಗಳನ್ನು ಜೋಡಿಸುವುದು ನಮ್ಮ ಹೊಣೆಯಾಗಿದೆ. ಇಂದು ಶ್ರೀಮಂತರು ಮತ್ತು ಬಡವರ ನಡುವಿನ ಅಸಮಾನತೆಗಳು ಅಸ್ತಿತ್ವದಲ್ಲಿವೆ. ಪ್ರಾಚೀನ ಭಾರತೀಯ ಸಂಪ್ರದಾಯಗಳು ಸಾಮಾಜಿಕ ಮತ್ತು ಭಾವನಾತ್ಮಕ ಯೋಗಕ್ಷೇಮದ ಬಗ್ಗೆ ವೈಜ್ಞಾನಿಕ ಜ್ಞಾನದ ಮೇಲೆ ಒತ್ತು ನೀಡಿದ್ದರು. ಚಿಕ್ಕ ಮಕ್ಕಳು, ಸ್ವಭಾವತಃ, ರಾಷ್ಟ್ರೀಯತೆ, ಲಿಂಗ, ಬಣ್ಣ ಇತ್ಯಾದಿಗಳ ವ್ಯತ್ಯಾಸಗಳನ್ನು ಪರಿಗಣಿಸುವುದಿಲ್ಲ. ಅವರು ಒಟ್ಟಿಗೆ ಆಡುತ್ತಾರೆ. ಆದರೆ ಅವರು ಬೆಳೆದು ಶಿಕ್ಷಣವನ್ನು ಪಡೆದು ಹೊರಬರುವಾಗ ಈ ವ್ಯತ್ಯಾಸಗಳನ್ನು ಬೆಳೆಸಿಕೊಳ್ಳುತ್ತಾರೆ. ಪ್ರಪಂಚದ ಇಂದಿನ ಸಮಸ್ಯೆಗಳನ್ನು ಪರಿಹರಿಸುವಲ್ಲಿ ಶಿಕ್ಷಣ ಹೊಸ ಮಾರ್ಗವಾಗಿದ್ದು, ನಮ್ಮ ಪ್ರಾಚೀನ ಶಿಕ್ಷಣದಲ್ಲಿನ ಮೌಲ್ಯಗಳು ನಮಗೆ ದಾರಿ ದೀಪವಾಗಿ ಕಾಣುತ್ತದೆ.

ಪಠ್ಯಕ್ರಮದಲ್ಲಿ ಮೃದು ಕೌಶಲ್ಯಗಳ ಅಳವಡಿಕೆ :

ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿನ ಶಿಕ್ಷಣ ಹಾಗೂ ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳು, ಪಠ್ಯಕ್ರಮದಲ್ಲಿನ ಮೃದು ಕೌಶಲ್ಯಗಳ ಅಳವಡಿಕೆ ಇಂದಿನಗೂ ನಮಗೆ ಅಚ್ಚರಿಯನುಂಟು ಮಾಡುತ್ತದೆ. ಕಲಿಕಾರ್ಥಿಗಳನ್ನು ಕಲಿಕೆಯ ನಂತರದ ಜೀವನಕ್ಕೆ ಅಣಿಗೊಳಿಸಲಾಗುತ್ತಿತ್ತು. ಸಂವಹನ ಕಲೆ, ಉತ್ತಮ ನಾಯಕತ್ವದ ಗುಣ, ಕಾಯಕ ತತ್ವ, ನಮ್ರತೆ, ಜವಾಬ್ದಾರಿತನ, ಸಮಸ್ಯೆಯ ನಿರ್ವಹಣಾ ಕಲೆ, ಹೊಸ ಪರಿಸರಕ್ಕೆ ಹೊಂದಿಕೊಳ್ಳುವ ಗುಣ, ಮಾತುಗಾರಿಕಾ ಕೌಶಲ ಹೀಗೆ ಬದುಕಿಗೆ ಬೇಕಾಗುವ ಹಲವು ಮೃದು ಕೌಶಲ್ಯಗಳನ್ನು ಶಿಕ್ಷಣದ ಹಂತದಿಂದಲೇ ನೀಡಲಾಗುತ್ತಿತ್ತು.

ಅಂದಿನ ಶಿಕ್ಷಣದ ಹಂತದಲ್ಲಿ ಸಕ್ರಿಯವಾಗಿದ್ದ ಗುಂಪು ಯೋಜನೆಗಳು, ಕಲಿಕೆ ಮತ್ತು ಮೌಲ್ಯಮಾಪನ ಕಲೆ, ಪ್ರಾಯೋಜಿಕ ಕಲಿಕೆಯ ಸೂತ್ರಗಳು, ತಮ್ಮ ಬದುಕನ್ನು ರೂಪಿಸಿಕೊಳ್ಳುವ ಗುರಿ, ಬಿಕ್ಕಟ್ಟು ನಿರ್ವಹಣೆ, ಸಕ್ರಿಯ ಕೇಳುವಿಕೆ, ನಾವೀನ್ಯತೆಗಳು ಮತ್ತು ಪ್ರಾಯೋಗಿಕದೊಂದಿಗೆ ವಿಮರ್ಶಾತ್ಮಕ ಚಿಂತನೆಗಳು, ವಿದ್ಯಾರ್ಥಿ ಆತ್ಮವಿಶ್ವಾಸದ ವೃದ್ಧಿ, ವ್ಯಕ್ತಿ ಆತ್ಮಾವಲೋಕನ, ಧನಾತ್ಮಕ ಮತ್ತು ವೃತ್ತಿಪರ ಚಿಂತನೆಗಳು ವ್ಯಕ್ತಿಯನ್ನು ಬಲವರ್ಧನೆಗೆ ಪ್ರಮುಖ ಅಂಶಗಳಾಗಿದ್ದವು.

ಇಂದಿನ ಶಿಕ್ಷಣದಲ್ಲಿನ ಮೃದು ಕೌಶಲ್ಯಗಳ ಅಳವಡಿಕೆ ನಿತ್ಯ ಪರಿಸರದಲ್ಲಿ ಅರಿವಿನ ಚಿಂತನೆ, ಸಮಸ್ಯೆ ಪರಿಹರಿಸುವುದು ಮತ್ತು ನಿರ್ವಹಣೆಯಂತಹ ನಿರ್ಣಾಯಕ ಕೌಶಲ್ಯಗಳು ಬೇಕಾಗುತ್ತವೆ. ನಿತ್ಯ ಬದುಕಿನ ಪರಿಸರದಲ್ಲಿ ಯಶಸ್ವಿಯಾಗಲು ಸಂಕೀರ್ಣವಾದ ನೈಜ ಜೀವನದ ಸನ್ನಿವೇಶಗಳನ್ನು ಪರಿಣಾಮಕಾರಿಯಾಗಿ ನಿಭಾಯಿಸುವಲ್ಲಿ ನಾವುಗಳು ಪರಿಣತಿಯನ್ನು ಹೊಂದಿರಬೇಕು. ಈ ನಿಟ್ಟಿನಲ್ಲಿ ಇಂಥಹಾ ಕಲಿಕೆಯೆಡೆಗೆ ಗಮನ ನೀಡಬೇಕಿದೆ.

ವೈಯಕ್ತಿಕಗೊಳಿಸಿದ ಮತ್ತು ವೇಗದ ಕಲಿಕೆ:

ಪ್ರಾಚೀನ ಶಿಕ್ಷಣದಲ್ಲಿನ ವಿದ್ಯಾರ್ಥಿಯ ವೈಯಕ್ತಿಕಗೊಳಿಸಿದ ಮತ್ತು ವೇಗದ ಕಲಿಕೆಗೆ ಹೆಚ್ಚು ಒತ್ತು ನೀಡಲಾಗಿತ್ತು. ಗುರುಕುಲಗಳಲ್ಲಿ ಒಬ್ಬನೇ ಶಿಕ್ಷಕ ವಿವಿಧ ವಿಷಯಗಳನ್ನು ಬೋಧಿಸುವ ಪದ್ಧತಿ ಜಾರಿಯಲ್ಲಿತ್ತು. ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ದಿನವೂ ಹಿಂದಿನ ಪಾಠಗಳನ್ನು ಕುರಿತು ಪ್ರಶ್ನಿಸುವ, ಗೃಹಪಾಠ ಹಾಗೂ ಸ್ವ ಅಧ್ಯಯನಕ್ಕೆ ಗಮನ ನೀಡಲಾಗುತ್ತಿತ್ತು.

ಇಂದಿನ ಶಾಲೆಯಲ್ಲಿ ಕಲಿಸುವ ಹೆಚ್ಚಿನ ವಿಷಯಗಳು ವಿದ್ಯಾರ್ಥಿಯ ಸಾಮರ್ಥ್ಯವನ್ನು ಹೆಚ್ಚಿಸುವ ಗುರಿಯನ್ನು ಹೊಂದಿದೆ. ಸಾಂಪ್ರದಾಯಿಕ ತರಗತಿಯ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಕೆಲವು ವಿದ್ಯಾರ್ಥಿಗಳು ಇತರರಿಗಿಂತ ವೇಗವಾಗಿ ಶಿಕ್ಷಣದ ಪರಿಕಲ್ಪನೆಗಳನ್ನು ಗ್ರಹಿಸಲು ಸಾಧ್ಯವಾಗಿದೆ. ಆಧುನಿಕ ಕಲಿಕಾ ಪರಿಕರಗಳೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳು ತಮ್ಮ ಕಲಿಕಾ ಪ್ರಯಾಣವನ್ನು, ಕೌಶಲ್ಯ ಮಟ್ಟಗಳ ಆಧಾರದ ಮೇಲೆ ಸವಾಲುಗಳೊಂದಿಗೆ ವೈಯಕ್ತೀಕರಿಸಲು ಸಾಧ್ಯವಾಗುತ್ತದೆ, ವೈಯಕ್ತೀಕರಣ ಮತ್ತು ಕಲಿಕೆಯ ಶೈಲಿಗಳ ವೇಗವನ್ನು ಸುಲಭವಾಗಿ

ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು ಮತ್ತು ಹೆಚ್ಚುವರಿ ಅಭ್ಯಾಸ ಮತ್ತು ಕಲಿಕೆಯ ವಿಧಾನಗಳೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳು ಆತ್ಮವಿಶ್ವಾಸವನ್ನು ಪಡೆಯಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ. ಈ ತಂತ್ರಗಳ ಹೊರತಾಗಿಯೂ ಕಲಿಕೆಗಾಗಿ ವಿವಿಧ ಸಾಧನಗಳನ್ನು ಬಳಸುವ ಲಭ್ಯತೆಯು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಪ್ರಾಚೀನ ಶಿಕ್ಷಣದ ಒಲವುಗಳು ನಮ್ಮ ಮೊದಲ ಆಯ್ಕೆಯಾಗಿದೆ.

ಏಕೀಕೃತ ಕಲಿಕೆಯ ಅನುಭವಗಳು

ಪ್ರಾಚೀನ ವಿದ್ಯಾಕೇಂದ್ರಗಳಲ್ಲಿ ಕಲಿಕೆಯ ಮಾರ್ಗಗಳಲ್ಲಿ ಏಕೀಕೃತ ಕಲಿಕೆಯ ಅನುಭವಗಳನ್ನು ಗುರುತಿಸಬಹುದಾಗಿದೆ. ನಳಂದ, ತಕ್ಷಶಿಲಾ, ವಿಕ್ರಮಶಿಲಾ, ವಲ್ಲಭಿ ಮೊದಲಾದ ವಿದ್ಯಾಲಯಗಳಲ್ಲಿ ಈ ವ್ಯವಸ್ಥೆಯನ್ನು ಗಮನಿಸಬಹುದು. ಮೌಲ್ಯಮಾಪನಗಳು, ಪ್ರವೇಶ ಅಗತ್ಯತೆಗಳು ಮತ್ತು ಕಾಲೇಜು ವಿವರಗಳಿಗೆ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲಾ ಮಾಹಿತಿಯ ಕ್ರೋಢೀಕರಣವು ವಿದ್ಯಾರ್ಥಿಗಳು ಶಾಲೆಯ ನಂತರ ಅವರು ತೆಗೆದುಕೊಳ್ಳಲು ಬಯಸುವ ಕೋರ್ಸ್ ಅನ್ನು ಎಚ್ಚರಿಕೆಯಿಂದ ಪರಿಗಣಿಸಲು ಅನುವು ಮಾಡಿಕೊಡುತ್ತದೆ.

ಪ್ರಾಯೋಗಿಕ ಕಲಿಕೆಗೆ ಒತ್ತು :

ಪ್ರಾಯೋಗಿಕ ಜ್ಞಾನದ ಮೇಲೆ ಕೇಂದ್ರೀಕರಿಸಿದಾಗ ಮಾತ್ರ ವಿದ್ಯಾರ್ಥಿಗಳ ದೃಢವಾದ ಕಲಿಕೆಯು ನಡೆಯುತ್ತದೆ. ಗುರುಕುಲ ವ್ಯವಸ್ಥೆಯು ಅನ್ವಯಿಕ ಜ್ಞಾನದ ಮೇಲೆ ಕೇಂದ್ರೀಕರಿಸಿದ್ದು ಅದು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಜೀವನದ ಎಲ್ಲಾ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಸಿದ್ಧಪಡಿಸುತ್ತದೆ. ಪ್ರಸ್ತುತ ದಿನಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತಮ ವ್ಯಕ್ತಿಗಳನ್ನಾಗಿ ಮಾಡಲು ಸಾವಧಾನತೆ ಮತ್ತು ಆಧ್ಯಾತ್ಮಿಕ ಜಾಗೃತಿಯ ಕ್ಷೇತ್ರದಲ್ಲಿ ಬೋಧನೆಯೊಂದಿಗೆ ಶೈಕ್ಷಣಿಕ ಮತ್ತು ಪರೈತರ ಚಟುವಟಿಕೆಗಳ ಪರಿಪೂರ್ಣ ಸಂಯೋಜನೆಯನ್ನು ರಚಿಸುವ ಮೂಲಕ ಇದನ್ನು ಮಾಡಬಹುದು.

ದೂರದೃಷ್ಟಿ ಮೌಲ್ಯಮಾಪನ ಮಾನದಂಡಗಳು :

ಹೊಸ ಬೋಧನೆ ಕಲಿಕೆಯ ಸನ್ನಿವೇಶದೊಂದಿಗೆ, ಮೌಲ್ಯಮಾಪನದ ಪಾತ್ರವನ್ನು ಸಹ ಮಾರ್ಪಡಿಸಬೇಕಾಗಿದೆ. ಕಲಿಯುವವರ ಅಗತ್ಯತೆಗಳು ಮತ್ತು ಕಲಿಯುವವರನ್ನು ಮೌಲ್ಯಮಾಪನ ಮಾಡುವಲ್ಲಿ ಇದು ಹೆಚ್ಚು ಸಮಗ್ರವಾಗಿರಬೇಕು.

ಅನುಭವ ಆಧಾರಿತ ಮೌಲ್ಯಮಾಪನಗಳನ್ನು ಸ್ವಾಧೀನಪಡಿಸಿಕೊಂಡ ಜ್ಞಾನ ಮತ್ತು ಕೌಶಲ್ಯಗಳನ್ನು ಪರೀಕ್ಷಿಸಲು ಬಳಸಲಾಗುತ್ತದೆ. ಶಿಕ್ಷಣದಲ್ಲಿನ ಪ್ರಸ್ತುತ ಪ್ರವೃತ್ತಿಗಳು ಮತ್ತು ಸಮಸ್ಯೆಗಳು ಪರೀಕ್ಷಕರಿಗೆ ಪ್ರಗತಿಯ ನಿಖರವಾದ ಚಿತ್ರವನ್ನು ನೀಡಲು ಸುಧಾರಿತ ಪರೀಕ್ಷಾ ವಿಧಾನಗಳನ್ನು ಸಂಯೋಜಿಸುವ ಮೂಲಕ ಪಾಠದ ಧಾರಣವನ್ನು ಗರಿಷ್ಠಗೊಳಿಸುವುದು ಮತ್ತು ಮೌಲ್ಯಮಾಪನ ಪಕ್ಷಪಾತವನ್ನು ಕಡಿಮೆಗೊಳಿಸುವುದರ ಸುತ್ತ ಸುತ್ತುತ್ತವೆ. ವಿಮರ್ಶಾತ್ಮಕ ಚಿಂತನೆಯನ್ನು ಅಳೆಯಲು ಇದು ಸಹಾಯಕವಾಗಿದೆ.

ಉಪಸಂಹಾರ

ಒಟ್ಟಾರೆಯಾಗಿ ಭಾರತೀಯ ಶಿಕ್ಷಣದಲ್ಲಿ ಗುರುಕುಲ ವ್ಯವಸ್ಥೆಯನ್ನು ಅಳವಡಿಸುವ ಕಲ್ಪನೆಯು ಮಕ್ಕಳಿಗೆ ಸಮತೋಲಿತ ಜೀವನದ ಪರಿಕಲ್ಪನೆಯನ್ನು ಅರ್ಥಮಾಡಿಕೊಳ್ಳಲು ಸಹಾಯ ಮಾಡುವುದು. ಈ ಸಮತೋಲನದ ಸಿದ್ಧಾಂತವನ್ನು ಚಿಕ್ಕ ವಯಸ್ಸಿನಿಂದಲೇ ಮಕ್ಕಳಿಗೆ ಕಲಿಸಬೇಕು, ಇದರಿಂದಾಗಿ ಅವರು ಕೆಲಸ, ಆಹಾರ, ವ್ಯಾಯಾಮ ಮತ್ತು ಅವರು ಅಲ್ಲಿ ಬದುಕಲು ಬಯಸುವ ರೀತಿಯಲ್ಲಿ ತಿಳುವಳಿಕೆಯುಳ್ಳ ನಿರ್ಧಾರಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುತ್ತಾರೆ.

ಆಧುನಿಕ ಶಿಕ್ಷಣದಲ್ಲಿ ಬೋಧಿಸಲಾಗುವ ಎಲ್ಲಾ ಶಿಕ್ಷಣವನ್ನು ಗುರುಕುಲ ಶಿಕ್ಷಣದಲ್ಲಿ ನೀಡಲಾಗುತ್ತಿತ್ತು. ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿ ಮಾನವೀಯತೆಯ ಕಲಿಕೆ. ಸಜ್ಜಾರಿತ್ರದ ಬೆಳವಣಿಗೆ. ದೈಹಿಕ, ಮಾನಸಿಕ

ಹಾಗೂ ಆಧ್ಯಾತ್ಮಿಕ ಪ್ರಗತಿಗೆ ಇಂಬು ಕೊಡುವ ಶಿಕ್ಷಣ ರೂಪಗೊಂಡಿತ್ತು. ಬದಲಾಗುತ್ತಿರುವ ಸಮಾಜದಲ್ಲಿನ ಸವಾಲುಗಳಿಗೆ ಸ್ಪಂದಿಸುತ್ತ ಉತ್ಕೃಷ್ಟ ಗುಣಮಟ್ಟದ ಕಡೆಗೆ ಅಂದಿನ ಶಿಕ್ಷಣ ಸಾಗುತ್ತಿದೆ. ಇಂದಿನ ಜ್ಞಾನವೆಂಬ ಬೆಳಕನ್ನು ಹೊರ ಜಗತ್ತಿಗೆ ತೋರುವ ಕೆಲಸ ಹೊಸ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣದ ಮೂಲಕ ಸಾಗಬೇಕಿದೆ. ಶ್ರೇಷ್ಠ ಶಿಕ್ಷಣದ ಮೂಲಕ ಯೋಗ್ಯ ಸಮಾಜ ನಿರ್ಮಾಣವಾಗಬೇಕೆಂಬುದು ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ವಿದ್ಯಾಕೇಂದ್ರಗಳ ಆಶಯವಾಗಿತ್ತು.

ವಿದ್ಯೆ, ಸಂಸ್ಕೃತಿ, ಸಾಹಿತ್ಯ, ಆಚಾರ, ವಿಚಾರಗಳು ಶಿಕ್ಷಣದ ಪಂಚೇಂದ್ರಿಯಗಳಿದ್ದಂತೆ. ಇವು ನಾಡಿನ ಸಂವರ್ಧನೆಯ ಪ್ರೇರಕಗಳಾಗಿದ್ದು, ಶಿಕ್ಷಣ ಸದೃಢ ಮಾನವ ಶಕ್ತಿಯನ್ನು ಸೃಷ್ಟಿಸುವಲ್ಲಿ ಪ್ರಮುಖ ಪಾತ್ರವಹಿಸುತ್ತದೆ. ಪ್ರಸ್ತುತ ಭಾರತದಲ್ಲಿ ಮೌಲ್ಯಾಧಾರಿತ ಶಿಕ್ಷಣ ಕಳೆಗುಂದುತ್ತಿದೆ. ಶಿಕ್ಷಣದ ಗುಣಮಟ್ಟ, ಇಂದು ಕಡಿಮೆಯಾಗುತ್ತಿವೆ. ಇಂದಿನ ಶಿಕ್ಷಣ ಆನ್ಲೈನ್ ಶಿಕ್ಷಣ, ದೂರಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆ ಪ್ರಚಲಿತವಾಗಿ ಶಿಕ್ಷಣ ಅರ್ಥಕಳೆದುಕೊಳ್ಳುತ್ತಿದೆ. ಇಂದಿನ ಆಧುನಿಕ ಸ್ಪರ್ಧಾತ್ಮಕ ಯುಗದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು ತಮ್ಮನ್ನು ತಾವು ಸದಾ ಸ್ಪರ್ಧೆಗೆ ಸಿದ್ಧಗೊಳಿಸಿಕೊಳ್ಳಬೇಕಿದ್ದು, ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿ ಶಿಕ್ಷಣದ ನೀಡಿಕೆ ಶ್ರೇಷ್ಠ ಮಟ್ಟದಲ್ಲಿ ಇದ್ದು, ಇದು ನಮಗೆ ಇಂದಿಗೂ ಅಚ್ಚರಿ ನೀಡುವಂತಿದ್ದು, ಅಧ್ಯಯನ ಯೋಗ್ಯ ಅಂಶವಾಗಿದೆ. ಒಟ್ಟಿನಲ್ಲಿ ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿನ ಶಿಕ್ಷಣ ಹಾಗೂ ಉದಯೋನ್ಮುಖ ಪ್ರವೃತ್ತಿಗಳು ಶ್ರೇಷ್ಠತೆಯನ್ನು ಹೊಂದಿದ್ದು, ಅವುಗಳ ಮೂಲಕ ಆಧುನಿಕ ಶಿಕ್ಷಣದೊಂದಿಗೆ ಭಾರತದ ಪ್ರಾಚೀನ ಜ್ಞಾನದ ಮನಸ್ಸುಗಳನ್ನು ಸಂಯೋಜಿಸಬೇಕಿದೆ. ಭಾರತದ ಹಾಗೂ ಪ್ರಾಚೀನ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಲ್ಲಿನ ಶಿಕ್ಷಣದ ಪರಿಕಲ್ಪನೆಯ ಮೂಲಭೂತ ಅಂಶಗಳು ಹೊಸ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿಯ ಮುಂದುವರಿಕೆಯಾಗಿಯೇ ಕಾಣುತ್ತಿದ್ದು, ಈ ನೆಲದ ಭವ್ಯ ಜ್ಞಾನದ ಪರಂಪರೆಯನ್ನು ಮುಂದಿನ ತಲೆಮಾರುಗಳಿಗೆ ತಲುಪಿಸುವ ಹೊಣೆಗಾರಿಕೆ ನಮ್ಮದಾಗಿದೆ.

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ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣ: ಬೋಧನಾ ಕಲಿಕಾ ಪ್ರಕ್ರಿಯೆಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಮತ್ತು ವಿದ್ಯಾರ್ಥಿಗಳು ಒಂದು ಅವಲೋಕನ

ಡಾ. ವೀರೇಂದ್ರ ಕುಮಾರ್ ವಾಲಿ ಎಸ್

ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ಕುಮದ್ವತಿ ಶಿಕ್ಷಣ ಮಹಾವಿದ್ಯಾಲಯ, ಶಿಕಾರಿಪುರ, ಶಿಕಾರಿಪುರ ತಾಲ್ಲೂಕು, ಶಿವಮೊಗ್ಗ ಜಿಲ್ಲೆ, ಕರ್ನಾಟಕ

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ಸಾರಾಂಶ

21 ನೇ ಶತಮಾನದ ವಿಕಸನಗೊಳ್ಳುತ್ತಿರುವ ಬೇಡಿಕೆಗಳಿಂದಾಗಿ, ಶಿಕ್ಷಣ ಕ್ಷೇತ್ರವು ಸಾಂಪ್ರದಾಯಿಕ ಜ್ಞಾನ ಆಧಾರಿತ ಕಲಿಕೆಯಿಂದ ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣಕ್ಕೆ ಆಳವಾದ ಬದಲಾವಣೆಯನ್ನು ಬಯಸುತ್ತಿದೆ. ಈ ಕ್ರಿಯಾತ್ಮಕ ಸಂದರ್ಭದಲ್ಲಿ, ಶಿಕ್ಷಕರು ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯನ್ನು ಬೆಳೆಸುವಲ್ಲಿ ಪ್ರಮುಖ ಪಾತ್ರ ವಹಿಸುತ್ತಾರೆ, ಕೇವಲ ಜ್ಞಾನದ ಪ್ರಸರಣಕಾರರಾಗಿ ತಮ್ಮ ಸಾಂಪ್ರದಾಯಿಕ ಪಾತ್ರಗಳನ್ನು ಮೀರಿ ಚಲಿಸುತ್ತಾರೆ. ಈ ಸಮಗ್ರ ವಿಮರ್ಶೆಯು ಶಿಕ್ಷಕರ ಪಾತ್ರದ ಬದಲಾಗುತ್ತಿರುವ ಚಲನಶೀಲತೆ ಮತ್ತು ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯನ್ನು ಉತ್ತೇಜಿಸುವಲ್ಲಿ ಅದರ ನಿರ್ಣಾಯಕ ಪ್ರಭಾವವನ್ನು ಪರಿಶೋಧಿಸುತ್ತದೆ. ಪ್ರಸ್ತುತ ಶೈಕ್ಷಣಿಕ ಮಾದರಿ, ವಿಕಸನಗೊಳ್ಳುತ್ತಿರುವ ಬೋಧನಾ ವಿಧಾನಗಳು, ಸವಾಲುಗಳು ಮತ್ತು ಭವಿಷ್ಯದ ನಿರ್ದೇಶನಗಳ ಆಳವಾದ ಪರೀಕ್ಷೆಯ ಮೂಲಕ, ಈ ವಿಮರ್ಶೆಯು ಶಿಕ್ಷಣತಜ್ಞರು, ನೀತಿ ನಿರೂಪಕರು ಮತ್ತು ಪಾಲುದಾರರಿಗೆ ಶಿಕ್ಷಣದ ಗುಣಮಟ್ಟವನ್ನು ಹೆಚ್ಚಿಸುವ ಗುರಿಯನ್ನು ಹೊಂದಿರುವ ಮೌಲ್ಯಯುತ ಒಳನೋಟಗಳನ್ನು ನೀಡುತ್ತದೆ. ಐತಿಹಾಸಿಕ ದೃಷ್ಟಿಕೋನವು ಶಿಕ್ಷಣವು ಸತ್ಯಗಳನ್ನು ಕಂಠಪಾಠ ಮಾಡುವುದರಿಂದ ಪ್ರಾಯೋಗಿಕ ಕೌಶಲ್ಯಗಳನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸುವ ಸುತ್ತ ಕೇಂದ್ರೀಕೃತವಾದ ಹೆಚ್ಚು ಸಮಗ್ರ ವಿಧಾನಕ್ಕೆ ರೂಪಾಂತರಗೊಳ್ಳುವುದನ್ನು ಒತ್ತಿಹೇಳುತ್ತದೆ. ಸಾಂಪ್ರದಾಯಿಕವಾಗಿ, ಶಿಕ್ಷಣವು ಪ್ರಾಥಮಿಕವಾಗಿ ಮಾಹಿತಿ ಮತ್ತು ಶೈಕ್ಷಣಿಕ ವಿಷಯವನ್ನು ವರ್ಗಾಯಿಸುವುದರ ಮೇಲೆ ಕೇಂದ್ರೀಕರಿಸಿದೆ. ಆದಾಗ್ಯೂ, ಸಮಕಾಲೀನ ಸಂದರ್ಭದಲ್ಲಿ, ವಿಮರ್ಶಾತ್ಮಕ ಚಿಂತನೆ, ಸಮಸ್ಯೆ-ಪರಿಹರಿಸುವುದು, ಸಂವಹನ, ಹೊಂದಿಕೊಳ್ಳುವಿಕೆ ಮತ್ತು ಸಹಯೋಗ ಸೇರಿದಂತೆ ವೈವಿಧ್ಯಮಯ ಕೌಶಲ್ಯಗಳೊಂದಿಗೆ ಕಲಿಯುವವರನ್ನು ಸಜ್ಜುಗೊಳಿಸುವ ಅಗತ್ಯತೆಯ ಹೆಚ್ಚುತ್ತಿರುವ ಗುರುತಿಸುವಿಕೆ ಇದೆ. ನಿರಂತರವಾಗಿ ಬದಲಾಗುತ್ತಿರುವ ಜಾಗತಿಕ ಉದ್ಯೋಗ ಮಾರುಕಟ್ಟೆಯ ಬೇಡಿಕೆಗಳನ್ನು ಪೂರೈಸಲು ಈ ಬದಲಾವಣೆ ಅತ್ಯಗತ್ಯ. ವಿಕಸನಗೊಳ್ಳುತ್ತಿರುವ ಶೈಕ್ಷಣಿಕ ಭೂದೃಶ್ಯವು ಶಿಕ್ಷಕರ ಪಾತ್ರದ ಪುನರ್ ವ್ಯಾಖ್ಯಾನವನ್ನು ಬಯಸುತ್ತದೆ. ಶಿಕ್ಷಕರು ಇನ್ನು ಮುಂದೆ ಮಾಹಿತಿ ಪೂರೈಕೆದಾರರಾಗಿರುವುದಕ್ಕೆ ಸೀಮಿತವಾಗಿಲ್ಲ; ಅವರು ಕೌಶಲ್ಯ ಸಂಪಾದನೆಯ ಪ್ರಯಾಣದಲ್ಲಿ ಸುಗಮಕಾರರು, ಮಾರ್ಗದರ್ಶಕರು ಮತ್ತು ಮಾರ್ಗದರ್ಶಕರಾಗಿದ್ದಾರೆ. ಶಿಕ್ಷಕರು ವಿಮರ್ಶಾತ್ಮಕ ಚಿಂತನೆ, ಸೃಜನಶೀಲತೆ, ಸಮಸ್ಯೆ ಪರಿಹಾರ ಮತ್ತು ಸಹಯೋಗವನ್ನು ಬೆಳೆಸುವ ಸಕ್ರಿಯಗೊಳಿಸುವ ವಾತಾವರಣವನ್ನು ಸೃಷ್ಟಿಸಬೇಕಾಗಿದೆ. ಶೈಕ್ಷಣಿಕ ಅನುಭವವನ್ನು ರೂಪಿಸುವಲ್ಲಿ ಮತ್ತು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಅವರ ಭವಿಷ್ಯಕ್ಕೆ ಅಗತ್ಯವಾದ ಕೌಶಲ್ಯಗಳೊಂದಿಗೆ ಸಜ್ಜುಗೊಳಿಸುವಲ್ಲಿ ಸಮಕಾಲೀನ ಶಿಕ್ಷಕರ ವಿಸ್ತೃತ ಪಾತ್ರವನ್ನು ವಿಮರ್ಶೆಯು ಎತ್ತಿ ತೋರಿಸುತ್ತದೆ.

ಕೀವರ್ಡ್‌ಗಳು: ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆ, ಶಿಕ್ಷಕ ಶಿಕ್ಷಕ, ವೃತ್ತಿಪರ ಅಭಿವೃದ್ಧಿ.

1. ಪೀಠಿಕೆ

ಶಿಕ್ಷಣದ ವಿಕಸನಗೊಳ್ಳುತ್ತಿರುವ ಭೂದೃಶ್ಯವು ಶಿಕ್ಷಕರ ಸಾಂಪ್ರದಾಯಿಕ ಪಾತ್ರದಲ್ಲಿ ಮೂಲಭೂತ ರೂಪಾಂತರದ ಅಗತ್ಯವಿದೆ. ಜ್ಞಾನ ಆಧಾರಿತ ಕಲಿಕೆಯ ಮೇಲಿನ ಸಾಂಪ್ರದಾಯಿಕ ಗಮನದಿಂದ ಬದಲಾದ ಸಮಕಾಲೀನ ಶೈಕ್ಷಣಿಕ ವಾತಾವರಣವು ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣವನ್ನು ಒತ್ತಿಹೇಳುತ್ತದೆ, ಇದು ಕಲಿಯುವವರನ್ನು ಆಧುನಿಕ ಜಗತ್ತಿನ ಬೇಡಿಕೆಗಳಿಗೆ ಸಜ್ಜುಗೊಳಿಸುತ್ತದೆ. ಈ ಮಾದರಿ ಬದಲಾವಣೆಯಲ್ಲಿ, ಶಿಕ್ಷಕರು ಕೇವಲ ಮಾಹಿತಿಯ ಪೂರೈಕೆದಾರರಾಗಿರದೆ ಪ್ರಮುಖ ಸಹಾಯಕರಾಗಿ ಹೊರಹೊಮ್ಮುತ್ತಾರೆ. ಈ ವಿಮರ್ಶೆಯು ಶಿಕ್ಷಕರ ಪಾತ್ರದ ಕ್ರಿಯಾತ್ಮಕ ವಿಕಾಸವನ್ನು ಪರಿಶೋಧಿಸುತ್ತದೆ, ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯನ್ನು ಪೋಷಿಸುವಲ್ಲಿ ಅವರು ವಹಿಸುವ ನಿರ್ಣಾಯಕ ಪಾತ್ರವನ್ನು ಒತ್ತಿಹೇಳುತ್ತದೆ. ವಿಕಸನಗೊಳ್ಳುತ್ತಿರುವ ವಿಧಾನಗಳು ಮತ್ತು ಸವಾಲುಗಳನ್ನು ಪರಿಶೀಲಿಸುವ ಮೂಲಕ, ಈ ವಿಮರ್ಶೆಯು ಶಿಕ್ಷಣತಜ್ಞರು ಮತ್ತು ನೀತಿ ನಿರೂಪಕರಿಗೆ ಸಮಾನವಾಗಿ ಮೌಲ್ಯಯುತ ಒಳನೋಟಗಳನ್ನು ನೀಡುತ್ತದೆ.

2. ಶಿಕ್ಷಣದ ಐತಿಹಾಸಿಕ ದೃಷ್ಟಿಕೋನ

ಇತಿಹಾಸದಾದ್ಯಂತ, ಶಿಕ್ಷಣವು ಸಾಮಾಜಿಕ ಅಗತ್ಯತೆಗಳು ಮತ್ತು ತಾಂತ್ರಿಕ ಪ್ರಗತಿಗಳಿಗೆ ನಿರಂತರವಾಗಿ ಹೊಂದಿಕೊಳ್ಳುತ್ತಿದೆ. ಪ್ರಾಚೀನ ನಾಗರಿಕತೆಗಳಲ್ಲಿ, ಶಿಕ್ಷಣವು ಹೆಚ್ಚಾಗಿ ಸವಲತ್ತು ಪಡೆದ ವರ್ಗಗಳಿಗೆ ಸೀಮಿತವಾಗಿತ್ತು ಮತ್ತು ಅಗತ್ಯ ಜೀವನ ಕೌಶಲ್ಯ ಮತ್ತು ಸಾಂಸ್ಕೃತಿಕ ಜ್ಞಾನವನ್ನು ನೀಡುವತ್ತ ಗಮನಹರಿಸಿತು. ಔಪಚಾರಿಕ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಗಳ ಹೊರಹೊಮ್ಮುವಿಕೆಯೊಂದಿಗೆ, ಮೆಸೊಪಟ್ಯಾಮಿಯಾ, ಈಜಿಪ್ಟ್, ಗ್ರೀಸ್ ಮತ್ತು ಭಾರತದಂತಹ ಪ್ರಾಚೀನ ಸಂಸ್ಕೃತಿಗಳು ಯುವಕರಿಗೆ ಶಿಕ್ಷಣ ನೀಡಲು ಶಿಕ್ಷಣ ಸಂಸ್ಥೆಗಳು ಮತ್ತು ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಸ್ಥಾಪಿಸಿದವು.

ಮಧ್ಯಕಾಲೀನ ಅವಧಿಯಲ್ಲಿ, ಚರ್ಚ್ ಮತ್ತು ಮಠಗಳು ಯುರೋಪಿನಲ್ಲಿ ಪ್ರಾಥಮಿಕ ಶೈಕ್ಷಣಿಕ ಕೇಂದ್ರಗಳಾಗಿದ್ದವು, ಧಾರ್ಮಿಕ ಬೋಧನೆಗಳು ಮತ್ತು ಸಾಕ್ಷರತೆಗೆ ಒತ್ತು ನೀಡಿದವು. ನವೋದಯವು ಕಲೆಗಳು, ಮಾನವಿಕತೆಗಳು ಮತ್ತು ವಿಜ್ಞಾನಗಳನ್ನು ಒಳಗೊಂಡ ವಿಶಾಲವಾದ, ಮಾನವ-ಕೇಂದ್ರಿತ ಶಿಕ್ಷಣಕ್ಕಾಗಿ ಪ್ರತಿಪಾದಿಸುವ ಒಂದು ಪ್ರಮುಖ ಬದಲಾವಣೆಯನ್ನು ಗುರುತಿಸಿತು. ಈ ಅವಧಿಯು ಆಧುನಿಕ ಶೈಕ್ಷಣಿಕ ಸಿದ್ಧಾಂತಗಳಿಗೆ ಅಡಿಪಾಯ ಹಾಕಿತು, ವಿಮರ್ಶಾತ್ಮಕ ಚಿಂತನೆ ಮತ್ತು ವೈಯಕ್ತಿಕ ಬೆಳವಣಿಗೆಯನ್ನು ಉತ್ತೇಜಿಸಿತು.

ಕೈಗಾರಿಕಾ ಕ್ರಾಂತಿಯು ನಿರ್ದಿಷ್ಟ ವ್ಯಾಪಾರಗಳು ಮತ್ತು ಕೈಗಾರಿಕೆಗಳಲ್ಲಿ ನುರಿತ ಕಾರ್ಯಪಡೆಯನ್ನು ಒತ್ತಾಯಿಸುವ ಮೂಲಕ ಶಿಕ್ಷಣದ ಮೇಲೆ ನಾಟಕೀಯವಾಗಿ ಪ್ರಭಾವ ಬೀರಿತು. ಈ ಕೈಗಾರಿಕಾ ಅಗತ್ಯಗಳನ್ನು ಪೂರೈಸಲು ಔಪಚಾರಿಕ, ಪ್ರಮಾಣೀಕೃತ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಗಳನ್ನು ಸ್ಥಾಪಿಸಲಾಯಿತು, ಕಂಠಪಾಠ ಮತ್ತು ಏಕರೂಪತೆಯನ್ನು ಒತ್ತಿಹೇಳಿತು.

20 ನೇ ಶತಮಾನದಲ್ಲಿ, ಎಲ್ಲರಿಗೂ ವಿಶಾಲವಾದ, ಹೆಚ್ಚು ಅಂತರ್ಗತ ಶಿಕ್ಷಣದ ಕಡೆಗೆ ಗಮನ ಬದಲಾಯಿತು. ಜಾನ್ ಡ್ಯೂಯಿ ಅವರಂತಹ ಪ್ರಮುಖ ವ್ಯಕ್ತಿಗಳ ಶೈಕ್ಷಣಿಕ ಸಿದ್ಧಾಂತಗಳು ಅನುಭವದ ಕಲಿಕೆ ಮತ್ತು ವಿಮರ್ಶಾತ್ಮಕ ಚಿಂತನೆಯ ಅಭಿವೃದ್ಧಿ ಮತ್ತು ಸಮಸ್ಯೆ-ಪರಿಹರಿಸುವ ಕೌಶಲ್ಯಗಳನ್ನು ಒತ್ತಿಹೇಳಿದವು. ಇದು ಪ್ರಗತಿಶೀಲ ಶಿಕ್ಷಣದ ವಿಕಸನಕ್ಕೆ ಕಾರಣವಾಯಿತು, ಮಕ್ಕಳ ಕೇಂದ್ರಿತ ವಿಧಾನ ಮತ್ತು ಜ್ಞಾನದ ಪ್ರಾಯೋಗಿಕ ಅನ್ವಯವನ್ನು ಪ್ರತಿಪಾದಿಸಿತು.

ಇತ್ತೀಚಿನ ದಶಕಗಳಲ್ಲಿ, ಜಗತ್ತು ಮಾಹಿತಿ ಯುಗಕ್ಕೆ ಕಾಲಿಟ್ಟಂತೆ, ಸಾಂಪ್ರದಾಯಿಕ ಶೈಕ್ಷಣಿಕ ಮಾದರಿಯು ತ್ವರಿತ ತಾಂತ್ರಿಕ ಪ್ರಗತಿಗಳು ಮತ್ತು ಜಾಗತಿಕ ಕಾರ್ಯಪಡೆಯ ಬದಲಾಗುತ್ತಿರುವ ಬೇಡಿಕೆಗಳೊಂದಿಗೆ ವೇಗವನ್ನು ಕಾಯ್ದುಕೊಳ್ಳಲು ಅಸಮರ್ಥತೆಗಾಗಿ ಟೀಕಿಸಲ್ಪಟ್ಟಿದೆ. ಈ ಟೀಕೆಯು ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣದ ಕಡೆಗೆ ಬದಲಾವಣೆಗೆ, ಪ್ರಾಯೋಗಿಕ ಸಾಮರ್ಥ್ಯಗಳ ಮೇಲೆ ಕೇಂದ್ರೀಕರಿಸಲು ಮತ್ತು ಕ್ರಿಯಾತ್ಮಕ ಮತ್ತು ಸ್ಪರ್ಧಾತ್ಮಕ ಉದ್ಯೋಗ ಮಾರುಕಟ್ಟೆಯಲ್ಲಿ ನ್ಯಾವಿಗೇಟ್ ಮಾಡಲು ವ್ಯಕ್ತಿಗಳನ್ನು ಸಿದ್ಧಪಡಿಸಲು ಬಲವಾದ ಕರೆಯನ್ನು ಉತ್ತೇಜಿಸಿದೆ.

ಈ ಐತಿಹಾಸಿಕ ಪ್ರಯಾಣವು ಶಿಕ್ಷಣದ ಕ್ರಿಯಾತ್ಮಕ ಸ್ವರೂಪವನ್ನು ಎತ್ತಿ ತೋರಿಸುತ್ತದೆ, ಸಾಮಾಜಿಕ, ಆರ್ಥಿಕ ಮತ್ತು ತಾಂತ್ರಿಕ ಬದಲಾವಣೆಗಳಿಗೆ ನಿರಂತರವಾಗಿ ಹೊಂದಿಕೊಳ್ಳುತ್ತದೆ. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯ ಮೇಲಿನ ಪ್ರಸ್ತುತ ಒತ್ತು ಈ ವಿಕಸನೀಯ ಪಥದ ಮುಂದುವರಿಕೆಯನ್ನು ಪ್ರತಿನಿಧಿಸುತ್ತದೆ, ಶಿಕ್ಷಣವನ್ನು ಸಮಕಾಲೀನ ಪ್ರಪಂಚದ ಅಗತ್ಯಗಳೊಂದಿಗೆ ಜೋಡಿಸುತ್ತದೆ.

3. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯ ವ್ಯಾಖ್ಯಾನ

ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯು ನಿರ್ದಿಷ್ಟ ಪ್ರಾಯೋಗಿಕ ಸಾಮರ್ಥ್ಯಗಳು, ಸಾಮರ್ಥ್ಯಗಳು ಮತ್ತು ಯೋಗ್ಯತೆಗಳ ಅಭಿವೃದ್ಧಿ ಮತ್ತು ಸ್ವಾಧೀನಕ್ಕೆ ಆದ್ಯತೆ ನೀಡುವ ಶೈಕ್ಷಣಿಕ ವಿಧಾನವಾಗಿದೆ. ಸೈದ್ಧಾಂತಿಕ ತಿಳುವಳಿಕೆ ಮತ್ತು ಮಾಹಿತಿ ಧಾರಣದ ಮೇಲೆ ಪ್ರಾಥಮಿಕವಾಗಿ ಕೇಂದ್ರೀಕರಿಸುವ ಸಾಂಪ್ರದಾಯಿಕ ಜ್ಞಾನ ಆಧಾರಿತ ಕಲಿಕೆಗಿಂತ ಭಿನ್ನವಾಗಿ, ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯು ನೈಜ-ಪ್ರಪಂಚದ ಸನ್ನಿವೇಶಗಳಿಗೆ ಜ್ಞಾನದ ಅನ್ವಯವನ್ನು ಒತ್ತಿಹೇಳುತ್ತದೆ. ಇದು ವ್ಯಕ್ತಿಗಳು ಕಾರ್ಯಗಳನ್ನು ಪರಿಣಾಮಕಾರಿಯಾಗಿ ನಿರ್ವಹಿಸಲು, ಸಮಸ್ಯೆಗಳನ್ನು ಪರಿಹರಿಸಲು ಮತ್ತು ವಿವಿಧ ವೈಯಕ್ತಿಕ ಮತ್ತು ವೃತ್ತಿಪರ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ಯಶಸ್ವಿಯಾಗಲು ಅನುವು ಮಾಡಿಕೊಡುವ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಗೌರವಿಸುವುದರ ಸುತ್ತ ಕೇಂದ್ರೀಕೃತವಾಗಿದೆ.

4. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆ ಎಂದರೇನು?

ಇದು ಕೇವಲ "ಕೌಶಲ್ಯ"ಗಳ ಬಗ್ಗೆಯೇ? ಸಮಾಜದಲ್ಲಿ ಶಿಕ್ಷಣವು ಪರಿವರ್ತನೆಯ ಯುಗದಲ್ಲಿದೆ, ಅಲ್ಲಿ ಸಾಮಾಜಿಕ ಬದಲಾವಣೆಗಳು ವೇಗದ ದರಗಳಿಗೆ ಅನುಗುಣವಾಗಿ ಬದಲಾಗಿವೆ ಎಂದು ಗಮನಿಸಲಾಗಿದೆ. ಉಪನ್ಯಾಸಗಳು, ಪಠ್ಯಪುಸ್ತಕಗಳು ಮತ್ತು ಪರೀಕ್ಷೆಗಳ ಮೇಲೆ ಕೇಂದ್ರೀಕರಿಸಿದ ಸಾಂಪ್ರದಾಯಿಕ ಶೈಕ್ಷಣಿಕ ವ್ಯವಸ್ಥೆಗಳು ಹೊಸ ಮತ್ತು ನವೀನ ವಿಧಾನದಿಂದ ಪೂರಕವಾಗುತ್ತಿವೆ: ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣ.

ಈ ಸೂತ್ರೀಕರಣದಲ್ಲಿ ಒದಗಿಸಲಾದ ಕಲಿಕೆಯ ಪ್ರಕಾರವು ಉಪಯುಕ್ತವಾಗಬಹುದು ಮತ್ತು ವಿದ್ಯಾರ್ಥಿಯನ್ನು ಕೆಲಸದ ಸ್ಥಳಕ್ಕೆ ಸಿದ್ಧಪಡಿಸಬಹುದು ಮತ್ತು ವಿದ್ಯಾರ್ಥಿಯನ್ನು ನಿಜವಾದ ನೇರ ಮುಖಾಮುಖಿಗಳೊಂದಿಗೆ ಸಜ್ಜುಗೊಳಿಸಬಹುದು.

ಯಾವ ವಿಷಯದ ಕುರಿತು ಹೆಚ್ಚು ಕಲಿಯುತ್ತಾರೆಂದು ನೀವು ಭಾವಿಸುತ್ತೀರಿ?

- ಉತ್ತರ ಸರಳವಾಗಿದೆ: ಮಾಡುವ ಮೂಲಕ ಕಲಿಯುವವನು. ಇದು ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣದ ಸೌಂದರ್ಯ.

- ಪರಿಣಾಮವಾಗಿ, ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣವು ಸಾಂಪ್ರದಾಯಿಕ ಶಿಕ್ಷಣದಿಂದ ನಿರ್ಗಮನವಾಗಿದೆ, ಅಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಯು ವಿಷಯವನ್ನು ನೆನಪಿಟ್ಟುಕೊಳ್ಳಲು ತರಬೇತಿ ಪಡೆಯುತ್ತಾನೆ ಮತ್ತು ಕಾರ್ಯ ಅಥವಾ ಕೆಲಸದಲ್ಲಿ ಅಗತ್ಯವಿರುವ ಪರಿಕರಗಳು, ಜ್ಞಾನ ಮತ್ತು ಕೌಶಲ್ಯಗಳನ್ನು ಪಡೆಯುವುದಿಲ್ಲ.
- ಇದು ಕಾರ್ಯಾಚರಣೆಯ ಅನುಭವ, ಚಟುವಟಿಕೆಗಳು, ವ್ಯಾಯಾಮ ಮತ್ತು ಕೆಲವು ರೀತಿಯಲ್ಲಿ ವಿಚಾರಗಳ ಅನುಷ್ಠಾನಕ್ಕೆ ಸಂಬಂಧಿಸಿದೆ. ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ, ಇದು ಅವರನ್ನು ಮಾರುಕಟ್ಟೆಗೆ ತರಲು ಸೂಕ್ತವಾದ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಪಡೆಯುವುದನ್ನು ಸೂಚಿಸುತ್ತದೆ ಮತ್ತು ಪೋಷಕರಿಗೆ ಇದು ತಮ್ಮ ಮಗು ಜಗತ್ತಿಗೆ ಸಿದ್ಧನಾಗಿದೆ ಎಂಬ ವಿಶ್ವಾಸವನ್ನು ಹೊಂದಿರುವುದು ಎಂದರ್ಥ.

5. ಇಂದಿನ ಯುಗದಲ್ಲಿ ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣ ಏಕೆ ನಿರ್ಣಾಯಕವಾಗಿದೆ?

ಬದಲಾಗುತ್ತಿರುವ ಉದ್ಯೋಗ ಮಾರುಕಟ್ಟೆಗಳಿಗೆ ಹೊಂದಿಕೊಳ್ಳುವಿಕೆ ಇತ್ತೀಚಿನ ದಿನಗಳಲ್ಲಿ ಉದ್ಯೋಗಗಳಿಗಾಗಿ ಸ್ಪರ್ಧೆಯು ತೀವ್ರವಾಗಿ ಬದಲಾಗಿದೆ. ಸಾಂಪ್ರದಾಯಿಕ ಸ್ಥಾನಗಳು ಯಾಂತ್ರಿಕತೆಗೊಂಡ ಮೂಲಕ ಕಣ್ಮರೆಯಾಗುತ್ತಿವೆ ಅಥವಾ ವಿಶಿಷ್ಟ ಅರ್ಹತೆಗಳನ್ನು ಬಯಸುವ ಹೊಸ ಸ್ಥಾನಗಳಿಂದ ಬದಲಾಯಿಸಲ್ಪಡುತ್ತಿವೆ.

ತಂತ್ರಜ್ಞಾನ, ಆರೋಗ್ಯ ರಕ್ಷಣೆ ಮತ್ತು ಡಿಜಿಟಲ್ ಮಾರ್ಕೆಟಿಂಗ್‌ನಂತಹ ಹಲವಾರು ಪ್ರವರ್ಧಮಾನಕ್ಕೆ ಬರುತ್ತಿರುವ ಕೈಗಾರಿಕೆಗಳಿವೆ, ಅವುಗಳಿಗೆ ಯಾವುದೇ ತರಗತಿಯಲ್ಲಿ ಕಲಿಸಲಾಗದ ಕೌಶಲ್ಯಗಳು ಬೇಕಾಗುತ್ತವೆ.

ಈ ಸಂದರ್ಭದಲ್ಲಿ ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣವು ಒಂದು ನಾವೀನ್ಯತೆಯಾಗಿದೆ. ನಾಳಿನ ಉದ್ಯೋಗ ಮಾರುಕಟ್ಟೆಯಲ್ಲಿ ಉದ್ಯೋಗದಾತರು ಹುಡುಕುತ್ತಿರುವ ಅಂಶಗಳನ್ನು ಹೆಚ್ಚಿಸುವ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳು ಉದ್ಯೋಗ ಸಿದ್ಧತೆಯನ್ನು ಸಾಧಿಸುತ್ತಾರೆ.

ಉದಾಹರಣೆಗೆ, ಕೋಡಿಂಗ್, ಡೇಟಾ ವಿಶ್ಲೇಷಣಾತ್ಮಕ ಕೆಲಸ, ಡಿಜಿಟಲ್ ಮಾರ್ಕೆಟಿಂಗ್ ಮತ್ತು ಯೋಜನಾ ನಿರ್ವಹಣೆಯು ಅನೇಕ ಮಾರುಕಟ್ಟೆಗಳಲ್ಲಿ ಅನ್ವಯವಾಗುವ ಕೌಶಲ್ಯಗಳ ಸರಳ ಉದಾಹರಣೆಗಳಾಗಿವೆ.

6. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯ ಪ್ರಮುಖ ಗುಣಲಕ್ಷಣಗಳು

- **ಹ್ಯಾಂಡ್ಸ್-ಆನ್-ಕಲಿಕೆ** : ವಿದ್ಯಾರ್ಥಿಗಳು ಜ್ಞಾನವನ್ನು ಪ್ರಾಯೋಗಿಕವಾಗಿ ಅನ್ವಯಿಸಲು ಅಗತ್ಯವಿರುವ ಯೋಜನೆಗಳು ಮತ್ತು ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ತೊಡಗುತ್ತಾರೆ. ಕಲಿಕೆಯ ವಿಷಯಕ್ಕೆ ಬಂದಾಗ ಅವರು ಮೂಲತಃ ಹೆಚ್ಚು ಸಂವಾದಾತ್ಮಕ ಆಯ್ಕೆಗಳನ್ನು ಹುಡುಕುತ್ತಾರೆ.
- **ಉದ್ಯಮ-ಸಂಬಂಧಿತ ಕೌಶಲ್ಯಗಳು**: ಉದ್ಯೋಗದಾತರಿಂದ ಬೇಡಿಕೆಯಿರುವ ಕೌಶಲ್ಯಗಳ ಮೇಲೆ ಗಮನ ಕೇಂದ್ರೀಕರಿಸುತ್ತದೆ, ವಿದ್ಯಾರ್ಥಿಗಳು ಕೆಲಸಕ್ಕೆ ಸಿದ್ಧರಾಗಿದ್ದಾರೆ ಎಂದು ಖಚಿತಪಡಿಸುತ್ತದೆ. ಇತ್ತೀಚಿನ ದಿನಗಳಲ್ಲಿ ಕೌಶಲ್ಯಗಳು ನಿಮ್ಮನ್ನು ಉದ್ಯಮದಲ್ಲಿ ಪ್ರಸ್ತುತವಾಗಿಸುತ್ತದೆ, ಅನುಭವದೊಂದಿಗೆ ಬರುವುದು ನೀವು ಕಲಿತ ಕೌಶಲ್ಯ ಮತ್ತು ನೀವು ಮಾಡಿಕೊಂಡ ಸಂಪರ್ಕ.

- ನಿರಂತರ ಪ್ರತಿಕ್ರಿಯೆ: ಸಾಂಪ್ರದಾಯಿಕ ಪರೀಕ್ಷೆಗಳ ಬದಲಿಗೆ, ವಿದ್ಯಾರ್ಥಿಗಳು ತಮ್ಮ ಕೌಶಲ್ಯಗಳನ್ನು ಪರಿಷ್ಕರಿಸಲು ಸಹಾಯ ಮಾಡಲು ನಿರಂತರ ಪ್ರತಿಕ್ರಿಯೆ ಮತ್ತು ಮಾರ್ಗದರ್ಶನವನ್ನು ಪಡೆಯುತ್ತಾರೆ.
- ನಮ್ಯತೆ ಮತ್ತು ಹೊಂದಿಕೊಳ್ಳುವಿಕೆ : ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯು ವಿದ್ಯಾರ್ಥಿ ಮತ್ತು ಉದ್ಯಮದ ಅಗತ್ಯಗಳಿಗೆ ಹೊಂದಿಕೊಳ್ಳುತ್ತದೆ, ಅದನ್ನು ಕ್ರಿಯಾತ್ಮಕ ಮತ್ತು ನವೀಕೃತವಾಗಿಸುತ್ತದೆ.

7. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆ vs ಜ್ಞಾನ ಆಧಾರಿತ ಕಲಿಕೆ

ಕೌಶಲ್ಯ ಮತ್ತು ಜ್ಞಾನ ಹೆಣೆದುಕೊಂಡಿರುವುದರಿಂದ, ಕಲಿಕೆ ಮತ್ತು ಜ್ಞಾನ ಕಲಿಕೆ ಪರಸ್ಪರ ಸಂಪೂರ್ಣವಾಗಿ ಭಿನ್ನವಾಗಿಲ್ಲ. ಜ್ಞಾನ ಕಲಿಕೆಯು ಉಪನ್ಯಾಸಗಳು ಮತ್ತು ಇತರ ಬೋಧನಾ ಸಾಧನಗಳ ಮೂಲಕ ಮಾಹಿತಿಯನ್ನು ಪಡೆದುಕೊಳ್ಳುವುದನ್ನು ಒಳಗೊಂಡಿರುತ್ತದೆ, ಕೌಶಲ್ಯ ಕಲಿಕೆಯು ಜ್ಞಾನವನ್ನು ಹೇಗೆ ಆಚರಣೆಗೆ ತರುತ್ತದೆ ಎಂಬುದನ್ನು ಒಳಗೊಂಡಿರುತ್ತದೆ. ವಿದ್ಯಾರ್ಥಿ ಸೈದ್ಧಾಂತಿಕ ಜ್ಞಾನ ಮತ್ತು ಅದರ ಅನ್ವಯ ಎರಡನ್ನೂ ಗಳಿಸುವ ಸಮತೋಲಿತ ನಾಗರಿಕತೆಯನ್ನು ಸೃಷ್ಟಿಸುವಲ್ಲಿ ಎರಡೂ ಅವಶ್ಯಕ.

ಅಂಶ	ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆ	ಜ್ಞಾನ ಆಧಾರಿತ ಕಲಿಕೆ
ಗಮನ	ಪ್ರಾಯೋಗಿಕ ಕೌಶಲ್ಯಗಳು ಮತ್ತು ನೈಜ-ಪ್ರಪಂಚದ ಅನ್ವಯಕ್ಕೆ ಒತ್ತು ನೀಡುತ್ತದೆ.	ಸೈದ್ಧಾಂತಿಕ ಜ್ಞಾನ ಮತ್ತು ಪರಿಕಲ್ಪನಾ ತಿಳುವಳಿಕೆಗೆ ಒತ್ತು ನೀಡುತ್ತದೆ.
ಕಲಿಕೆಯ ವಿಧಾನ	ಅನುಭವಾತ್ಮಕ, ಪ್ರಾಯೋಗಿಕ ಮತ್ತು ಯೋಜನೆ ಆಧಾರಿತ ಕಲಿಕೆ.	ಉಪನ್ಯಾಸ ಆಧಾರಿತ, ಕಂಠಪಾಠ ಮತ್ತು ಪಠ್ಯಪುಸ್ತಕ ಆಧಾರಿತ ಕಲಿಕೆ.
ಮೌಲ್ಯಮಾಪನ	ಕಾರ್ಯಕ್ಷಮತೆ ಆಧಾರಿತ, ಯೋಜನೆ, ಪೋರ್ಟ್‌ಫೋಲಿಯೋ ಮತ್ತು ಕಾರ್ಯಗಳನ್ನು ಬಳಸುವುದು.	ಪರೀಕ್ಷೆಗಳು, ರಸಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಮೌಲ್ಯಮಾಪನಕ್ಕಾಗಿ ಪ್ರಮಾಣೀಕೃತ ಪರೀಕ್ಷೆಗಳು.
ಪಠ್ಯಕ್ರಮ ವಿನ್ಯಾಸ	ಉದ್ಯಮದ ಅಗತ್ಯತೆಗಳು ಮತ್ತು ಪ್ರವೃತ್ತಿಗಳಿಗೆ ಅನುಗುಣವಾಗಿ ಹೊಂದಿಕೊಳ್ಳುವ ಮತ್ತು ಹೆಚ್ಚಾಗಿ ಅನುಗುಣವಾಗಿರುತ್ತದೆ.	ರಚನಾತ್ಮಕ ಮತ್ತು ಪ್ರಮಾಣೀಕೃತ ಪಠ್ಯಕ್ರಮವನ್ನು ಅನುಸರಿಸುತ್ತದೆ.
ಕೌಶಲ್ಯ ಅಭಿವೃದ್ಧಿ	ಪ್ರಾಯೋಗಿಕ ಮತ್ತು ಮೃದು ಕೌಶಲ್ಯಗಳ ಅಭಿವೃದ್ಧಿಗೆ ಆದ್ಯತೆ ನೀಡಿ.	ಸತ್ಯಗಳು, ಸಿದ್ಧಾಂತಗಳು ಮತ್ತು ಪರಿಕಲ್ಪನೆಗಳ ಪಾಂಡಿತ್ಯಕ್ಕೆ ಆದ್ಯತೆ ನೀಡುತ್ತದೆ
ಬೋಧನಾ ವಿಧಾನ	ಸಂವಾದಾತ್ಮಕ, ಸಹಯೋಗಿ ಮತ್ತು ಕಲಿಯುವ-ಕೇಂದ್ರಿತ.	ಸಂವಾದಾತ್ಮಕ, ಸಹಯೋಗಿ ಮತ್ತು ಕಲಿಯುವ-ಕೇಂದ್ರಿತ.
ಫಲಿತಾಂಶ	ಕೆಲಸಕ್ಕೆ ಸಿದ್ಧವಾಗಿರುವ, ಅನ್ವಯವಾಗುವ ಕೌಶಲ್ಯಗಳೊಂದಿಗೆ ಪದವೀಧರರು.	ಹೆಚ್ಚಿನ ಅಧ್ಯಯನಕ್ಕಾಗಿ ಬಲವಾದ ಮೂಲಭೂತ ಜ್ಞಾನವನ್ನು ಹೊಂದಿರುವ ಪದವೀಧರರು.
ಅತ್ಯುತ್ತಮವಾಗಿ ಸೂಕ್ತವಾದುದು	ವೃತ್ತಿ-ಕೇಂದ್ರಿತ ಕಲಿಯುವವರು, ವೃತ್ತಿಪರ ತರಬೇತಿ, ವಯಸ್ಕರ ಶಿಕ್ಷಣ.	ಶೈಕ್ಷಣಿಕ ಅನ್ವೇಷಣೆಗಳು, ಸಂಶೋಧನೆ ಮತ್ತು ಆಳವಾದ ಸೈದ್ಧಾಂತಿಕ ಜ್ಞಾನದ ಅಗತ್ಯವಿರುವ ವೃತ್ತಿಗಳಿಗೆ ಸೂಕ್ತವಾಗಿದೆ.

8. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣದಲ್ಲಿ ಕೈಗಾರಿಕಾ ಪಾಲುದಾರಿಕೆಗಳು ಮತ್ತು ಅವುಗಳ ಪ್ರಾಮುಖ್ಯತೆ

ಬಹುಶಃ, ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣವನ್ನು ಪರಿಚಯಿಸುವ ಅತ್ಯುತ್ತಮ ತಂತ್ರವೆಂದರೆ ಕಾರ್ಪೊರೇಟ್

ಜಗತ್ತಿನ ಸಹಯೋಗಗಳ ಮೂಲಕ. ವ್ಯವಹಾರಗಳು ಮತ್ತು ಕೈಗಾರಿಕೆಗಳ ನಾಯಕರೊಂದಿಗೆ ಕೆಲಸ ಮಾಡುವುದರಿಂದ ಶಿಕ್ಷಣ ಸಂಸ್ಥೆಗಳು ಕೆಲಸದ ಸ್ಥಳಗಳ ಬೇಡಿಕೆಗಳನ್ನು ಪೂರೈಸುವ ಕಾರ್ಯಕ್ರಮಗಳನ್ನು ರಚಿಸಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ.

ಈ ಪಾಲುದಾರಿಕೆಗಳು ಹೆಚ್ಚಾಗಿ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಇಂಟರ್ನ್‌ಶಿಪ್‌ಗಳು, ಅಪ್ರೆಂಟಿಸ್‌ಶಿಪ್‌ಗಳು ಮತ್ತು ಉದ್ಯೋಗಾವಕಾಶಗಳನ್ನು ಉತ್ಪಾದಿಸುತ್ತವೆ, ಇದರಿಂದಾಗಿ ಕಲಿಕೆ ಮತ್ತು ನೈಜ ಪ್ರಪಂಚದ ನಡುವಿನ ಅಂತರವನ್ನು ಕಡಿಮೆ ಮಾಡುತ್ತದೆ.

ಉದ್ಯಮ ವೃತ್ತಿಪರರು ತರಗತಿಗೆ ಬಂದು ಅತಿಥಿ ಉಪನ್ಯಾಸಗಳು ಮತ್ತು ಕಾರ್ಯಾಗಾರಗಳನ್ನು ನೀಡಬಹುದು ಮತ್ತು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ವರ್ತಮಾನದ ನೋಟವನ್ನು ನೀಡಲು ವಿದ್ಯಾರ್ಥಿ ಮಾರ್ಗದರ್ಶಕರಾಗಬಹುದು.

ಇಂತಹ ಪಾಲುದಾರಿಕೆಗಳು, ಸಹಯೋಗಗಳ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳ ಉದ್ಯೋಗಾವಕಾಶವನ್ನು ಹೆಚ್ಚಿಸಲಾಗುತ್ತದೆ ಮತ್ತು ಕೋರ್ಸ್‌ನಲ್ಲಿ ಪಡೆದ ಅವಕಾಶಗಳು ಉದ್ಯಮಕ್ಕೆ ಸಂಬಂಧಿಸಿವೆ, ಅವುಗಳನ್ನು ಪ್ರಸ್ತುತ ಮತ್ತು ಭವಿಷ್ಯದ ಪದವೀಧರರಿಗೆ ಅನ್ವಯಿಸುವಂತೆ ಮಾಡುತ್ತದೆ.

9. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣವು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉದ್ಯಮಶೀಲತಾ ಉದ್ಯಮಗಳಿಗೆ ಹೇಗೆ ಸಿದ್ಧಪಡಿಸುತ್ತದೆ

- ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣವು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಮೂಲ ಉದ್ಯೋಗಗಳಿಗೆ ತರಬೇತಿ ನೀಡುವುದಲ್ಲದೆ, ತಮ್ಮದೇ ಆದ ಗುಡುಗಳನ್ನು ರೂಪಿಸಿಕೊಳ್ಳುವ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ನೀಡುತ್ತದೆ.
- ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಾರ್ಯಕ್ರಮಗಳಲ್ಲಿ ಒಳಗೊಂಡಿರುವ ಕೌಶಲ್ಯಗಳು ಸಮಸ್ಯೆ ಪರಿಹಾರ, ವಿಮರ್ಶಾತ್ಮಕ ಚಿಂತನೆ, ನಿರ್ವಹಣೆ ಮತ್ತು ಉದ್ಯಮಶೀಲತಾ ಕೌಶಲ್ಯಗಳನ್ನು ಪ್ರತಿನಿಧಿಸುವ ಆರ್ಥಿಕ ಕೌಶಲ್ಯಗಳಾಗಿವೆ.
- ಪ್ರಾಯೋಗಿಕ ಯೋಜನೆಗಳ ಅನುಷ್ಠಾನದ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳು ವ್ಯವಹಾರ ಕಲ್ಪನೆಯನ್ನು ಹೇಗೆ ರಚಿಸುವುದು, ಉತ್ಪಾದಿಸಬೇಕಾದ ಉತ್ಪನ್ನ ಅಥವಾ ಸೇವೆಗೆ ಒಂದು ಕಲ್ಪನೆಯನ್ನು ಹೇಗೆ ನೀಡುವುದು ಮತ್ತು ಅದನ್ನು ಮಾರುಕಟ್ಟೆಗೆ ಹೇಗೆ ತರುವುದು ಎಂಬುದರ ಬಗ್ಗೆ ತಿಳುವಳಿಕೆಯನ್ನು ಪಡೆಯುತ್ತಾರೆ.
- ಇಂದಿನ ವ್ಯವಹಾರ ಸಂದರ್ಭಗಳಲ್ಲಿ ಇದು ವಿಶೇಷವಾಗಿ ಮೌಲ್ಯಯುತವಾಗಿದೆ, ಅಲ್ಲಿ ಸ್ವತಂತ್ರೋದ್ಯೋಗ ಮತ್ತು ಸ್ವಂತ ವ್ಯವಹಾರ ಉದ್ಯೋಗವು ಅತ್ಯಂತ ಸೂಕ್ತವಾದ ಆಯ್ಕೆಗಳಾಗಿ ಕಂಡುಬರುತ್ತದೆ.

10. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣವನ್ನು ಅನುಷ್ಠಾನಗೊಳಿಸುವಲ್ಲಿ ಶಾಲೆಗಳು ಎದುರಿಸುತ್ತಿರುವ ಸವಾಲುಗಳು

ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣದಿಂದ ಹಲವು ಪ್ರಯೋಜನಗಳಿವೆ. ಆದರೂ, ಶಾಲೆಗಳು ಕೌಶಲ್ಯ ಶಿಕ್ಷಣವನ್ನು ನೀಡುವಲ್ಲಿ ಅನೇಕ ಸಮಸ್ಯೆಗಳನ್ನು ಎದುರಿಸುತ್ತವೆ. ಆದಾಗ್ಯೂ, ಪಠ್ಯಕ್ರಮದ ಮಾರ್ಪಾಡಿನ ದೊಡ್ಡ ಸಮಸ್ಯೆ ಇದೆ, ಅದು ಸಮಯ ತೆಗೆದುಕೊಳ್ಳುತ್ತದೆ, ದುಬಾರಿಯಾಗಿದೆ ಮತ್ತು ಅದಕ್ಕೆ ಕೈಗಾರಿಕಾ ವಲಯಗಳ ತಜ್ಞರ ಸಹಕಾರದ ಅಗತ್ಯವಿದೆ.

ಬೋಧಿಸಲು ಅಥವಾ ಪರೀಕ್ಷೆಗಳನ್ನು ನೀಡಲು ಅಂತಹ ವಿಧಾನಗಳನ್ನು ಬಳಸುವಲ್ಲಿ ತರಬೇತಿ

ಪಡೆಯದ ಶಿಕ್ಷಕರಿಂದ ವಿರೋಧವೂ ಇರಬಹುದು. ಇನ್ನೊಂದು ತೊಂದರೆಯೆಂದರೆ, ಎಲ್ಲಾ ಶಾಲೆಗಳು ಸರಿಯಾದ ಕಲಿಕಾ ವಾತಾವರಣವನ್ನು ಸಜ್ಜುಗೊಳಿಸಲು ಶಕ್ತವಾಗಿಲ್ಲ, ವಿಶೇಷವಾಗಿ ಕೆಲವು ಕಲಿಕಾ ವಿಷಯಗಳಿಗೆ ಸಂಬಂಧಿಸಿದಂತೆ ಪ್ರಾಯೋಗಿಕ ಅನುಭವಗಳು ಅಗತ್ಯವಿದ್ದಾಗ.

ಕೊನೆಯದಾಗಿ ಆದರೆ ಕನಿಷ್ಠವಲ್ಲ, ಪರೀಕ್ಷಾ ಮಾನದಂಡಗಳನ್ನು ಪೂರೈಸುವುದರ ಜೊತೆಗೆ ಕೌಶಲ್ಯಪೂರ್ಣ ಕಲಿಕೆಯನ್ನು ಬಳಸುವುದು ದೊಡ್ಡ ಸವಾಲಾಗಿರಬಹುದು ಏಕೆಂದರೆ ಪ್ರಸ್ತುತ ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಗಳು ಪುಸ್ತಕ ಆಧಾರಿತ ಜ್ಞಾನ ಮೌಲ್ಯಮಾಪನಗಳ ಕಡೆಗೆ ಹೆಚ್ಚು ಗಮನಹರಿಸಿವೆ.

11. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣದ ಪ್ರಯೋಜನಗಳು

1. ವರ್ಧಿತ ಉದ್ಯೋಗಾವಕಾಶ

- ಉದ್ಯೋಗ ಸ್ಪರ್ಧೆಯು ಬೆಳೆಯುತ್ತಲೇ ಇರುವುದರಿಂದ, ಆ ಕನಸಿನ ಕೆಲಸವನ್ನು ಭದ್ರಪಡಿಸಿಕೊಳ್ಳಲು ಪದವಿ ಹೊಂದಿರುವುದು ಇನ್ನು ಮುಂದೆ ಸಾಕಾಗುವುದಿಲ್ಲ.
- ಇಂದಿನ ಜಗತ್ತಿನಲ್ಲಿ ಬಳಸಲಾಗುವ ನೇಮಕಾತಿ ಪ್ರಕ್ರಿಯೆಯು, ಆರಂಭದಿಂದಲೇ ಕೆಲಸ ಮಾಡಲು ಪ್ರಾರಂಭಿಸುವ ಮತ್ತು ತಮ್ಮ ಕೆಲಸವನ್ನು ಪರಿಣಾಮಕಾರಿಯಾಗಿ ಮಾಡುವ ಜನರನ್ನು ಉದ್ಯೋಗದಾತರು ನಿರೀಕ್ಷಿಸುತ್ತಾರೆ.
- ಕಂಪನಿ-ಕೇಂದ್ರಿತ ಶಿಕ್ಷಣವು ವಿದ್ಯಾರ್ಥಿಗಳು ಸರಿಯಾದ ಜ್ಞಾನವನ್ನು ಪಡೆದುಕೊಳ್ಳುತ್ತಾರೆ ಮತ್ತು ವಾಸ್ತವಿಕ ಆಚರಣೆಯಲ್ಲಿ ಕೌಶಲ್ಯಗಳನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸುತ್ತಾರೆ ಎಂದು ಖಾತರಿಪಡಿಸುತ್ತದೆ, ಇದು ಉದ್ಯೋಗದಾತರು ಅವರಿಗೆ ಉದ್ಯೋಗಾವಕಾಶಗಳನ್ನು ನೀಡಲು ಆಕರ್ಷಿಸುತ್ತದೆ.

2. ಆತ್ಮವಿಶ್ವಾಸ ಮತ್ತು ಸ್ವ-ಪರಿಣಾಮಕಾರಿತ್ವವನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ

- ವಿದ್ಯಾರ್ಥಿಗಳು ಪ್ರಾಯೋಗಿಕ ಅನುಭವವನ್ನು ಪಡೆದಾಗ, ಅವರು ಹೊಸ ಕೌಶಲ್ಯಗಳನ್ನು ಕಲಿತಾಗ ವಿದ್ಯಾರ್ಥಿಗಳು ಹೆಚ್ಚಿನ ಆತ್ಮವಿಶ್ವಾಸವನ್ನು ಹೊಂದಿರುತ್ತಾರೆ. ಇದು ಉದ್ಯೋಗಕ್ಕಾಗಿ ಸಂದರ್ಶನಗಳ ಸಮಯದಲ್ಲಿ ಮತ್ತು ಉದ್ಯೋಗದಲ್ಲಿ ಹೆಚ್ಚಿದ ಕಾರ್ಯಕ್ಷಮತೆಗೆ ಕಾರಣವಾಗುತ್ತದೆ.
- ನಾಯಕತ್ವದ ಪಾತ್ರಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುವ ಮತ್ತು ಬರಬಹುದಾದ ಯಾವುದೇ ಸವಾಲುಗಳನ್ನು ಸಂಪೂರ್ಣವಾಗಿ ಎದುರಿಸುವ ಸಾಮರ್ಥ್ಯದಲ್ಲಿ ವಿಶ್ವಾಸ ಹೊಂದಿರುವ ವಿದ್ಯಾರ್ಥಿಗಳು.

3. ಜೀವನಪರ್ಯಂತ ಕಲಿಕೆ ಮತ್ತು ನಿರಂತರ ಸುಧಾರಣೆಯನ್ನು ಪ್ರೋತ್ಸಾಹಿಸುತ್ತದೆ

- ವೇಗವಾಗಿ ಬದಲಾಗುತ್ತಿರುವ ತಂತ್ರಜ್ಞಾನ ಪರಿಸರವು ಇಂದು ಅಗತ್ಯವಿರುವ ಜನರ ಕೌಶಲ್ಯಗಳು ಮುಂದಿನ ವರ್ಷದಲ್ಲಿ ಅಪ್ರಸ್ತುತವಾಗಬಹುದು ಎಂದು ಸೂಚಿಸುತ್ತದೆ.
- ವೃತ್ತಿಪರ ಕಲಿಕೆಯು ಜೀವಮಾನವಿಡೀ ಕಲಿಕೆಯ ಮನೋಭಾವಕ್ಕೆ ಕಾರಣವಾಗುತ್ತದೆ, ಆ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳು ತಮ್ಮ ವೃತ್ತಿಜೀವನದುದ್ದಕ್ಕೂ ಹೊಸ ಕೌಶಲ್ಯಗಳನ್ನು ಕಲಿಯುವುದನ್ನು ಅಭ್ಯಾಸ ಮಾಡುತ್ತಾರೆ.
- ಈ ನಮ್ಯತೆಯು ಇಂದಿನ ವ್ಯವಹಾರ ಪರಿಸರದಲ್ಲಿ ವಿಶೇಷವಾಗಿ ಮುಖ್ಯವಾಗಿದೆ, ಇದು ಅದರ ಅನಿಶ್ಚಿತತೆಯಿಂದ ಉತ್ತಮವಾಗಿ ನಿರೂಪಿಸಲ್ಪಟ್ಟಿದೆ.

12. ಕೌಶಲ್ಯ ಅಭಿವೃದ್ಧಿಯ ಮಹತ್ವ

ನಮ್ಮ ಆರ್ಥಿಕತೆಯ ಅಭಿವೃದ್ಧಿಯು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಅವಲಂಬಿಸಿರುವುದರಿಂದ ಕೌಶಲ್ಯ ಆಧಾರಿತ ತರಬೇತಿಯೊಂದಿಗೆ ಅವರನ್ನು ಸಬಲೀಕರಣಗೊಳಿಸುವುದು ಮುಖ್ಯ. ಶಾಲೆಯಲ್ಲಿ ಕೌಶಲ್ಯ ಅಭಿವೃದ್ಧಿ ಏಕೆ ಮುಖ್ಯ ಎಂಬುದು ಇಲ್ಲಿದೆ.

- ಕೌಶಲ್ಯ ಅಭಿವೃದ್ಧಿ ಪ್ರಕ್ರಿಯೆಯು ವಿದ್ಯಾರ್ಥಿಗಳು ಶ್ರೇಣಿಗಳನ್ನು ಮೀರಿ ಯೋಚಿಸಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ. ಇದು ಅವರ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳಲು, ನಿಜ ಜೀವನದ ಕೌಶಲ್ಯಗಳನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಲು ಮತ್ತು ಅವರ ಆಯ್ಕೆಯ ವೃತ್ತಿಜೀವನದಲ್ಲಿ ಯಶಸ್ವಿಯಾಗಲು ತಮ್ಮನ್ನು ಸಿದ್ಧಪಡಿಸಿಕೊಳ್ಳಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ.
- ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯು ಉದ್ಯೋಗಾವಕಾಶವನ್ನು ಸುಧಾರಿಸುತ್ತದೆ ಮತ್ತು ಯುವಕರು ಹೆಚ್ಚು ಗಳಿಸಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ. ಇದಲ್ಲದೆ, ಇದು ದೇಶದ ಆರ್ಥಿಕತೆಯನ್ನು ಸುಧಾರಿಸುತ್ತದೆ ಮತ್ತು ಅದರ ಆರ್ಥಿಕ ಬೆಳವಣಿಗೆಯನ್ನು ಉತ್ತೇಜಿಸುತ್ತದೆ.
- ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯು ವಿದ್ಯಾರ್ಥಿಗಳು ಸಮಸ್ಯೆ-ಪರಿಹರಿಸುವ ತಂತ್ರಗಳು ಮತ್ತು ಪರಿಣಾಮಕಾರಿ ಸಂವಹನ ತಂತ್ರಗಳನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ.
- ಕಲಿಕೆಯ ಕೌಶಲ್ಯ ಅಭಿವೃದ್ಧಿಯು ವಿದ್ಯಾರ್ಥಿಗಳ ನಾಯಕತ್ವ ಕೌಶಲ್ಯಗಳನ್ನು ಉತ್ತೇಜಿಸುತ್ತದೆ ಏಕೆಂದರೆ ಅದು ಅವರು ಹೆಚ್ಚು ಪರಹಿತಚಿಂತಕರಾಗಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ. ಅವರು ತಮ್ಮ ತಂಡಗಳನ್ನು ಸಂಘಟಿಸಲು ಮತ್ತು ಪ್ರೇರೇಪಿಸಲು ತಮ್ಮ ಕೌಶಲ್ಯಗಳನ್ನು ಬಳಸಲು ಕಲಿಯುತ್ತಾರೆ, ಇದು ಅವರಲ್ಲಿ ನಾಯಕತ್ವದ ಗುಣಗಳನ್ನು ಸೃಷ್ಟಿಸುತ್ತದೆ.
- ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯು ನೈಜ-ಜೀವನದ ಸಮಸ್ಯೆಗಳಿಗೆ ಸತ್ಯಗಳ ಮೌಲ್ಯಮಾಪನ ಮತ್ತು ಅನ್ವಯದ ಮೇಲೆ ಕೇಂದ್ರೀಕರಿಸುವುದರಿಂದ ಇದು ವಿದ್ಯಾರ್ಥಿಗಳು ಸೃಜನಶೀಲತೆ, ವಿಮರ್ಶಾತ್ಮಕ ಚಿಂತನೆ ಮತ್ತು ವಿಶ್ಲೇಷಣಾತ್ಮಕ ಚಿಂತನೆಯನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ.

12. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯಲ್ಲಿ ಶಿಕ್ಷಕರ ಪಾತ್ರ

ಜ್ಞಾನ-ಕೇಂದ್ರಿತ ಶಿಕ್ಷಣದಿಂದ ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಗೆ ಪರಿವರ್ತನೆಗೊಳ್ಳುವಾಗ, ಶಿಕ್ಷಕರ ಪಾತ್ರವು ಗಮನಾರ್ಹ ವಿಕಸನಕ್ಕೆ ಒಳಗಾಗಿದೆ. ಶಿಕ್ಷಕರು ಇನ್ನು ಮುಂದೆ ಮಾಹಿತಿಯ ಪ್ರಸರಣಕಾರರಾಗಿರುವುದಕ್ಕೆ ಸೀಮಿತವಾಗಿಲ್ಲ. ಆದರೆ ಕೌಶಲ್ಯಗಳನ್ನು ಪಡೆಯುವಲ್ಲಿ ಅಗತ್ಯವಾದ ಸುಗಮಕಾರರು ಮತ್ತು ಮಾರ್ಗದರ್ಶಕರಾಗಿದ್ದಾರೆ. ಅವರ ಪಾತ್ರವು ತರಗತಿಯ ಆಚೆಗೆ ವಿಸ್ತರಿಸುತ್ತದೆ, ಮಾರ್ಗದರ್ಶನ, ತರಬೇತಿ ಮತ್ತು ವೈವಿಧ್ಯಮಯ ಕೌಶಲ್ಯಗಳ ಅಭಿವೃದ್ಧಿಗೆ ಅನುಕೂಲಕರ ವಾತಾವರಣವನ್ನು ಸೃಷ್ಟಿಸುತ್ತದೆ.

- ಕೌಶಲ್ಯ ಅಭಿವೃದ್ಧಿಯ ಸುಗಮಕಾರರು : ಶಿಕ್ಷಕರು ಪ್ರಾಯೋಗಿಕ ಕೌಶಲ್ಯಗಳನ್ನು ಪಡೆಯುವ ಪ್ರಕ್ರಿಯೆಯ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಮಾರ್ಗದರ್ಶನ ನೀಡುವ ಮೂಲಕ ಸುಗಮಕಾರರಾಗಿ ಸೇವೆ ಸಲ್ಲಿಸುತ್ತಾರೆ. ಅವರು ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ನಿರ್ದಿಷ್ಟ ಕೌಶಲ್ಯಗಳನ್ನು ಗುರುತಿಸುತ್ತಾರೆ ಮತ್ತು ವಿದ್ಯಾರ್ಥಿಗಳು ಈ ಕೌಶಲ್ಯಗಳನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಲು ಮತ್ತು ಪರಿಷ್ಕರಿಸಲು ಅನುವು ಮಾಡಿಕೊಡುವ ಕಲಿಕೆಯ

ಅನುಭವಗಳನ್ನು ಸಂಗ್ರಹಿಸುತ್ತಾರೆ. ಈ ಸುಗಮೀಕರಣವು ಸಂಪನ್ಮೂಲಗಳು, ಅಭ್ಯಾಸಕ್ಕೆ ಅವಕಾಶಗಳು ಮತ್ತು ರಚನಾತ್ಮಕ ಪ್ರತಿಕ್ರಿಯೆಯನ್ನು ಒದಗಿಸುವುದನ್ನು ಒಳಗೊಂಡಿರುತ್ತದೆ.

- **ಕಲಿಕೆಯ ಅನುಭವಗಳು :** ಪ್ರತ್ಯೇಕ ವಿದ್ಯಾರ್ಥಿಗಳ ವಿಶಿಷ್ಟ ಸಾಮರ್ಥ್ಯಗಳು ಮತ್ತು ಕಲಿಕೆಯ ಶೈಲಿಗಳನ್ನು ಗುರುತಿಸಿ, ಶಿಕ್ಷಕರು ವೈವಿಧ್ಯಮಯ ಕಲಿಕೆಯ ಅಗತ್ಯಗಳನ್ನು ಪೂರೈಸಲು ತಮ್ಮ ವಿಧಾನವನ್ನು ರೂಪಿಸಿಕೊಳ್ಳುತ್ತಾರೆ. ಅವರು ವಿದ್ಯಾರ್ಥಿಗಳ ಸಾಮರ್ಥ್ಯ ಮತ್ತು ದೌರ್ಬಲ್ಯಗಳಿಗೆ ಹೊಂದಿಕೆಯಾಗುವ ವೈಯಕ್ತಿಕಗೊಳಿಸಿದ ಕಲಿಕಾ ಯೋಜನೆಗಳನ್ನು ವಿನ್ಯಾಸಗೊಳಿಸುತ್ತಾರೆ, ಪ್ರತಿಯೊಬ್ಬ ಕಲಿಯುವವರಿಗೆ ಹೆಚ್ಚು ಪರಿಣಾಮಕಾರಿಯಾದ ರೀತಿಯಲ್ಲಿ ಕೌಶಲ್ಯ ಅಭಿವೃದ್ಧಿಯನ್ನು ಬೆಳೆಸುತ್ತಾರೆ.
- **ವಿಮರ್ಶಾತ್ಮಕ ಚಿಂತನೆ ಮತ್ತು ಸಮಸ್ಯೆ ಪರಿಹಾರವನ್ನು ಬೆಳೆಸುವುದು :** ಶಿಕ್ಷಕರು ಸವಾಲಿನ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳುವ ಮೂಲಕ, ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಚರ್ಚೆಗಳಲ್ಲಿ ತೊಡಗಿಸಿಕೊಳ್ಳುವ ಮೂಲಕ ಮತ್ತು ವಿಶ್ಲೇಷಣೆ ಮತ್ತು ನವೀನ ಪರಿಹಾರಗಳ ಅಗತ್ಯವಿರುವ ಯೋಜನೆಗಳನ್ನು ನಿಯೋಜಿಸುವ ಮೂಲಕ ವಿಮರ್ಶಾತ್ಮಕ ಚಿಂತನೆ ಮತ್ತು ಸಮಸ್ಯೆ ಪರಿಹರಿಸುವ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಪ್ರೋತ್ಸಾಹಿಸುತ್ತಾರೆ. ಅವರು ವಿದ್ಯಾರ್ಥಿಗಳು ಸ್ವತಂತ್ರವಾಗಿ ಯೋಚಿಸಲು, ಮಾಹಿತಿಯನ್ನು ವಿಮರ್ಶಾತ್ಮಕವಾಗಿ ಮೌಲ್ಯಮಾಪನ ಮಾಡಲು ಮತ್ತು ನೈಜ-ಪ್ರಪಂಚದ ಸಮಸ್ಯೆಗಳನ್ನು ಪರಿಹರಿಸಲು ತಮ್ಮ ಜ್ಞಾನವನ್ನು ಅನ್ವಯಿಸಲು ಮಾರ್ಗದರ್ಶನ ನೀಡುತ್ತಾರೆ.
- **ಸಹಯೋಗ ಮತ್ತು ಸಂವಹನ ಕೌಶಲ್ಯಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು :** ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯು ಹೆಚ್ಚಾಗಿ ಸಹಯೋಗ ಮತ್ತು ತಂಡದ ಕೆಲಸವನ್ನು ಒಳಗೊಂಡಿರುತ್ತದೆ. ಪರಿಣಾಮಕಾರಿ ಸಂವಹನ, ಸಹಕಾರ ಮತ್ತು ಕಾರ್ಯಗಳ ವಿಭಜನೆಯನ್ನು ಪ್ರೋತ್ಸಾಹಿಸುವ ಮೂಲಕ, ಯೋಜನೆಗಳಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು ಒಟ್ಟಾಗಿ ಕೆಲಸ ಮಾಡಲು ಶಿಕ್ಷಕರು ಅವಕಾಶಗಳನ್ನು ಸೃಷ್ಟಿಸುತ್ತಾರೆ. ಅವರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಲೋಚನೆಗಳನ್ನು ಹೇಗೆ ವ್ಯಕ್ತಪಡಿಸಬೇಕು. ಸಕ್ರಿಯವಾಗಿ ಆಲಿಸಬೇಕು ಮತ್ತು ವಿಭಿನ್ನ ದೃಷ್ಟಿಕೋನಗಳನ್ನು ಗೌರವಿಸಬೇಕು ಎಂಬುದರ ಕುರಿತು ಮಾರ್ಗದರ್ಶನ ನೀಡುತ್ತಾರೆ.
- **ಮಾರ್ಗದರ್ಶನ :** ಶಿಕ್ಷಕರು ಮಾರ್ಗದರ್ಶನದ ಪಾತ್ರವನ್ನು ವಹಿಸುತ್ತಾರೆ. ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅವರ ಕೌಶಲ್ಯ ಅಭಿವೃದ್ಧಿ ಪ್ರಯಾಣದಲ್ಲಿ ಮಾರ್ಗದರ್ಶನ ಮತ್ತು ಬೆಂಬಲವನ್ನು ಒದಗಿಸುತ್ತಾರೆ. ಒಳನೋಟಗಳು, ಸಲಹೆ ಮತ್ತು ಪ್ರೋತ್ಸಾಹವನ್ನು ನೀಡುತ್ತಾರೆ. ವಿದ್ಯಾರ್ಥಿಗಳು ಸವಾಲುಗಳು ಮತ್ತು ಹಿನ್ನಡೆಗಳನ್ನು ನ್ಯಾವಿಗೇಟ್ ಮಾಡಲು ಸಹಾಯ ಮಾಡುತ್ತಾರೆ. ಪರಿಣಾಮಕಾರಿ ಮಾರ್ಗದರ್ಶನವು ನಂಬಿಕೆಯ ಬಾಂಧವ್ಯವನ್ನು ಸ್ಥಾಪಿಸುತ್ತದೆ ಮತ್ತು ವಿದ್ಯಾರ್ಥಿಗಳ ಆತ್ಮವಿಶ್ವಾಸ ಮತ್ತು ಹೊಸ ಕೌಶಲ್ಯಗಳನ್ನು ಪಡೆಯಲು ಪ್ರೇರಣೆಯನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ.
- **ಜ್ಞಾನದ ನೈಜ-ಪ್ರಪಂಚದ ಅನ್ವಯಿಕೆ :** ಶಿಕ್ಷಕರು ನೈಜ-ಪ್ರಪಂಚದ ಅನ್ವಯಿಕೆಗಳನ್ನು ಕಲಿಕೆಯ ಪ್ರಕ್ರಿಯೆಯಲ್ಲಿ ಸಂಯೋಜಿಸುತ್ತಾರೆ. ಸೈದ್ಧಾಂತಿಕ ಜ್ಞಾನವನ್ನು ಪ್ರಾಯೋಗಿಕ ಸನ್ನಿವೇಶಗಳಿಗೆ ಸಂಪರ್ಕಿಸುತ್ತಾರೆ. ನೈಜ-ಜೀವನದ ಸಂದರ್ಭಗಳಲ್ಲಿ ಶೈಕ್ಷಣಿಕ ಪರಿಕಲ್ಪನೆಗಳನ್ನು ಹೇಗೆ ಬಳಸಲಾಗುತ್ತದೆ ಎಂಬುದನ್ನು ಪ್ರದರ್ಶಿಸುವ ಮೂಲಕ, ಶಿಕ್ಷಕರು ಗಳಿಸುವ ಕೌಶಲ್ಯಗಳ ಪ್ರಾಮುಖ್ಯತೆ ಮತ್ತು ಪ್ರಸ್ತುತತೆಯನ್ನು ಒತ್ತಿಹೇಳುತ್ತಾರೆ.

- ಜೀವಮಾನದ ಕಲಿಕೆಗೆ ಒತ್ತು ನೀಡುವುದು : ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಜೀವಮಾನದ ಕಲಿಕೆಯ ಮೌಲ್ಯವನ್ನು ತುಂಬುತ್ತಾರೆ. ಅವರು ನಿರಂತರ ಸುಧಾರಣೆ ಮತ್ತು ಬೆಳವಣಿಗೆಯ ಮನಸ್ಥಿತಿಯನ್ನು ಪ್ರೇರೇಪಿಸುತ್ತಾರೆ. ವಿದ್ಯಾರ್ಥಿಗಳು ತರಗತಿಯ ಆಚೆಗೆ ಪೂರ್ವಭಾವಿ ಕಲಿಯುವವರಾಗಲು ಪ್ರೋತ್ಸಾಹಿಸುತ್ತಾರೆ. ಈ ವಿಧಾನವು ಕುತೂಹಲದ ಪ್ರಜ್ಞೆಯನ್ನು ಮತ್ತು ಜೀವನದುದ್ದಕ್ಕೂ ಹೊಸ ಸವಾಲುಗಳು ಮತ್ತು ತಂತ್ರಜ್ಞಾನಗಳಿಗೆ ಹೊಂದಿಕೊಳ್ಳುವ ಇಚ್ಛೆಯನ್ನು ಬೆಳೆಸುತ್ತದೆ.

13. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣದ ಅನಾನುಕೂಲಗಳು

1. ಜ್ಞಾನ ಸಂಪಾದನೆಯ ಸೀಮಿತ ವ್ಯಾಪ್ತಿ

- ಒಂದೆಡೆ, ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣವು ನಿರ್ದಿಷ್ಟ ಸಾಮರ್ಥ್ಯಗಳನ್ನು ಯಶಸ್ವಿಯಾಗಿ ಬೆಳೆಸಲು ಸಹಾಯ ಮಾಡುತ್ತದೆ, ಆದಾಗ್ಯೂ, ಅವು ಜ್ಞಾನ ಆಧಾರಿತ ಶಿಕ್ಷಣಕ್ಕಿಂತ ಹೆಚ್ಚು ಸೀಮಿತವಾಗಿರಬಹುದು.
- ವಿದ್ಯಾರ್ಥಿಗಳು ನಿರ್ದಿಷ್ಟ ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ಚೆನ್ನಾಗಿ ಪರಿಣತಿ ಹೊಂದಬಹುದು, ಆದಾಗ್ಯೂ ಅವರು ವಿವಿಧ ರೀತಿಯ ಕಾರ್ಯಗಳೊಂದಿಗೆ ಉದ್ಯೋಗ ಮಾರುಕಟ್ಟೆಯಲ್ಲಿ ಅನನುಕೂಲಕರವಾಗಬಹುದಾದ ಇತರ ಕೆಲವು ಕ್ಷೇತ್ರದ ಬಗ್ಗೆ ದುರ್ಬಲ ಸಾಮಾನ್ಯ ದೃಷ್ಟಿಕೋನವನ್ನು ಹೊಂದಿರಬಹುದು.

2. ಅಲ್ಪಾವಧಿಯ ಉದ್ಯೋಗ ಕೌಶಲ್ಯಗಳ ಮೇಲೆ ಅತಿಯಾದ ಒತ್ತು

- ತಕ್ಷಣದ ಕೆಲಸಕ್ಕೆ ಅಗತ್ಯವಾದ ನಿರ್ದಿಷ್ಟ ಕೌಶಲ್ಯಗಳ ಮೇಲೆ ಒತ್ತು ನೀಡುವುದರಿಂದ ಪರಸ್ಪರ ಮತ್ತು ಸಂವಹನ ಕೌಶಲ್ಯಗಳು, ತಂಡ ಸಂಯೋಜನೆ ಮತ್ತು ನಾಯಕತ್ವ ಕೌಶಲ್ಯಗಳಂತಹ ಸುಲಭವಾಗಿ ಕಲಿಸಲಾಗದ ಇತರ ಪ್ರಮುಖ ಕೌಶಲ್ಯಗಳನ್ನು ಹೊರಗಿಡುವ ಅವಕಾಶಗಳನ್ನು ತೆರೆಯುತ್ತದೆ.
- ಈ ಕೌಶಲ್ಯಗಳು ವೃತ್ತಿಜೀವನದಲ್ಲಿ ಪ್ರಗತಿಪರ ಸ್ವಭಾವವನ್ನು ಹೊಂದಿವೆ ಮತ್ತು ಜ್ಞಾನ ಆಧಾರಿತಕ್ಕಿಂತ ಭಿನ್ನವಾಗಿ ವಿಶಾಲವಾದ ಕಲಿಕೆಯ ಅನುಭವದ ಮೂಲಕ ಪಡೆಯಬಹುದು.

3. ಪ್ರಮಾಣೀಕರಣ ಮತ್ತು ಮೌಲ್ಯಮಾಪನದಲ್ಲಿನ ಸವಾಲುಗಳು

- ಪ್ರಮಾಣಿತ ಪರೀಕ್ಷೆಗಳಿಂದ ಕಾರ್ಯಕ್ಷಮತೆಯನ್ನು ಸುಲಭವಾಗಿ ಅಳೆಯುವ ಸಾಂಪ್ರದಾಯಿಕ ಶೈಲಿಯ ಶಿಕ್ಷಣಕ್ಕೆ ಹೋಲಿಸಿದರೆ, ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಾರ್ಯಕ್ಷಮತೆ ತುಲನಾತ್ಮಕವಾಗಿ ಆಳವಾಗಿದೆ. ಇದು ವಿದ್ಯಾರ್ಥಿಗಳ ಕೌಶಲ್ಯಗಳ ಮೌಲ್ಯಮಾಪನದಲ್ಲಿ ಅಸಮಂಜಸತೆಗೆ ಕಾರಣವಾಗಬಹುದು ಮತ್ತು ಇದು ಮಾಡಿದ ಮೌಲ್ಯಮಾಪನಗಳ ವಿಶ್ವಸಾರ್ವತ್ಯ ಮೇಲೆ ಪರಿಣಾಮ ಬೀರುತ್ತದೆ.

14. ಉಪಸಂಹಾರ

ವಿಕಸನಗೊಳ್ಳುತ್ತಿರುವ ಶೈಕ್ಷಣಿಕ ಭೂದೃಶ್ಯವು ಜ್ಞಾನ ಪೂರೈಕೆದಾರರಿಂದ ಕೌಶಲ್ಯ ಪಾಲನೆ ಮಾಡುವವರ ಪಾತ್ರದಲ್ಲಿ ಶಿಕ್ಷಕರ ಪಾತ್ರದಲ್ಲಿ ಒಂದು ಮಾದರಿ ಬದಲಾವಣೆಯನ್ನು ಬಯಸುತ್ತದೆ. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯು ನಿರ್ಣಾಯಕ ಶಿಕ್ಷಣ ವಿಧಾನವಾಗಿ ಹೊರಹೊಮ್ಮಿದೆ. ವೇಗವಾಗಿ ಬದಲಾಗುತ್ತಿರುವ ಜಗತ್ತಿನಲ್ಲಿ ಯಶಸ್ಸಿಗೆ ಪ್ರಮುಖವಾದ ಪ್ರಾಯೋಗಿಕ ಸಾಮರ್ಥ್ಯಗಳ ಸ್ವಾಧೀನವನ್ನು ಒತ್ತಿಹೇಳುತ್ತದೆ. ಈ

ಸಮಗ್ರ ವಿಮರ್ಶೆಯು ಶಿಕ್ಷಕರ ಪರಿವರ್ತನಾ ಪ್ರಯಾಣವನ್ನು ಅನ್ವೇಷಿಸಿದೆ, ಈ ಶೈಕ್ಷಣಿಕ ಬದಲಾವಣೆಯಲ್ಲಿ ಅವರ ಪ್ರಮುಖ ಪಾತ್ರವನ್ನು ವಿವರಿಸುತ್ತದೆ.

ಶಿಕ್ಷಣ ವ್ಯವಸ್ಥೆಯಲ್ಲಿನ ಈ ಬದಲಾವಣೆಯು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಉದ್ಯೋಗಾರ್ಹ ಕೌಶಲ್ಯಗಳನ್ನು ನೀಡುತ್ತಿದೆ ಮತ್ತು ಕಲಿಕೆಯ ಪ್ರಕ್ರಿಯೆಯ ನಂತರ ಅವರು ಎದುರಿಸುತ್ತಿರುವ ಜೀವನ ಸನ್ನಿವೇಶಗಳಿಗೆ ಅವರನ್ನು ಸಿದ್ಧಪಡಿಸುತ್ತಿದೆ.

ಶಿಕ್ಷಕರು ಯೋಜನಾ ಆಧಾರಿತ ಕಲಿಕೆ, ಅನುಭವ ಆಧಾರಿತ ಕಲಿಕೆ ಮತ್ತು ಸಹಯೋಗದ ಗುಂಪು ಚಟುವಟಿಕೆಗಳಂತಹ ವಿವಿಧ ತಂತ್ರಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವ ಮೂಲಕ ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಗೆ ಅನುಕೂಲಕರವಾದ ವಾತಾವರಣವನ್ನು ಸೃಷ್ಟಿಸಬೇಕು. ಈ ವಿಧಾನಗಳು ವೈಯಕ್ತಿಕ ಮತ್ತು ವೃತ್ತಿಪರ ಬೆಳವಣಿಗೆಗೆ ಅಗತ್ಯವಾದ ಕೌಶಲ್ಯಗಳ ವರ್ಣಪಟಲವನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಲು ಮತ್ತು ಪರಿಷ್ಕರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಬಲೀಕರಣಗೊಳಿಸುತ್ತವೆ. ಇದಲ್ಲದೆ, ಶಿಕ್ಷಕರು ಕಲಿಕೆಯ ಅನುಭವಗಳನ್ನು ಕಸ್ಪಮೈಸ್ ಮಾಡಬೇಕು, ರಚನಾತ್ಮಕ ಪ್ರತಿಕ್ರಿಯೆಯನ್ನು ಒದಗಿಸಬೇಕು ಮತ್ತು ವೈವಿಧ್ಯಮಯ ಕಲಿಕೆಯ ಅಗತ್ಯಗಳನ್ನು ಪೂರೈಸಲು ನಿರಂತರ ಸುಧಾರಣೆಯನ್ನು ಪ್ರೋತ್ಸಾಹಿಸಬೇಕು.

ಈ ವಿಧಾನದಲ್ಲಿ ಕೆಲವು ಅನಾನುಕೂಲಗಳನ್ನು ನಾನು ನೋಡಬಹುದಾದರೂ, ಈ ವಿಧಾನವನ್ನು ಸಾಂಪ್ರದಾಯಿಕ ಶಾಲಾ ಶಿಕ್ಷಣದೊಂದಿಗೆ ಸಮಾನಾಂತರವಾಗಿ ಬಳಸಿದರೆ ಅನುಕೂಲಗಳು ಹೆಚ್ಚು. ಪೋಷಕರು, ವಿದ್ಯಾರ್ಥಿಗಳು ಮತ್ತು ಉತ್ತಮ ಭವಿಷ್ಯದ ಹುಡುಕಾಟದಲ್ಲಿರುವ ಎಲ್ಲರೂ ಕೌಶಲ್ಯ ಆಧಾರಿತ ಶಿಕ್ಷಣವನ್ನು ಮುಂದಿನ ಮಾರ್ಗವಾಗಿ ಸ್ವಾಗತಿಸಬೇಕಾಗಿದೆ.

ಕೊನೆಯದಾಗಿ ಹೇಳುವುದಾದರೆ, ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯನ್ನು ಉತ್ತೇಜಿಸುವಲ್ಲಿ ಶಿಕ್ಷಕರ ಬದಲಾಗುತ್ತಿರುವ ಪಾತ್ರವು ಶಿಕ್ಷಣದ ಪ್ರಗತಿಗೆ ಮೂಲಭೂತವಾಗಿದೆ. ನವೀನ ತಂತ್ರಗಳನ್ನು ಅಳವಡಿಸಿಕೊಳ್ಳುವ ಮೂಲಕ ಮತ್ತು ವಿಕಸನಗೊಳ್ಳುತ್ತಿರುವ ಶೈಕ್ಷಣಿಕ ಭೂದೃಶ್ಯಗಳಿಗೆ ಹೊಂದಿಕೊಳ್ಳುವ ಮೂಲಕ, ಶಿಕ್ಷಕರು ನಿರಂತರವಾಗಿ ಬದಲಾಗುತ್ತಿರುವ ಜಗತ್ತಿನಲ್ಲಿ ಯಶಸ್ಸಿಗೆ ಅಗತ್ಯವಾದ ಕೌಶಲ್ಯಗಳೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸಬಹುದು. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯ ಕಡೆಗೆ ಸರಾಗ ಪರಿವರ್ತನೆಯನ್ನು ಖಚಿತಪಡಿಸಿಕೊಳ್ಳಲು ನೀತಿ ನಿರೂಪಕರು, ಶಿಕ್ಷಣ ಸಂಸ್ಥೆಗಳು ಮತ್ತು ಶಿಕ್ಷಕರು ಸಹಕರಿಸಬೇಕು, ಮುಂದಿನ ಪೀಳಿಗೆಯನ್ನು ವೈಯಕ್ತಿಕವಾಗಿ ಮತ್ತು ವೃತ್ತಿಪರವಾಗಿ ಅಭಿವೃದ್ಧಿ ಹೊಂದಲು ಅಗತ್ಯವಾದ ಸಾಮರ್ಥ್ಯಗಳೊಂದಿಗೆ ಸಬಲೀಕರಣಗೊಳಿಸಬೇಕು. ಕೌಶಲ್ಯ ಆಧಾರಿತ ಕಲಿಕೆಯು ಕೇಂದ್ರ ಹಂತವನ್ನು ತೆಗೆದುಕೊಳ್ಳುವ ಉಜ್ವಲ ಶೈಕ್ಷಣಿಕ ಭವಿಷ್ಯವನ್ನು ರೂಪಿಸುವಲ್ಲಿ ಶಿಕ್ಷಕರ ಪರಿವರ್ತನಾಶೀಲ ಪಾತ್ರವು ಕೇಂದ್ರಬಿಂದುವಾಗಿದೆ.

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Linkages

- https://cbseskillineducation.com/#google_vignette
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**THEME 2: MULTIDISCIPLINARY
APPROACHES IN SCIENCE AND
TECHNOLOGY**

An International, Peer Reviewed, & Refereed Quarterly
Scholarly Research Journal for Interdisciplinary Studies

THEME II
JUNE-JULY, 2026. VOL-15, ISSUE-68

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HARNESSING AI TOOLS FOR ACHIEVING SUSTAINABLE DEVELOPMENT GOALS (SDGS)

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Abstract

The rapid advancement of Artificial Intelligence (AI) has created unprecedented opportunities to address complex global challenges and accelerate progress toward Sustainable Development Goals (SDGs). This paper explores the transformative potential of AI tools in fostering sustainable development across environmental, social, and economic dimensions. By integrating data-driven decision-making, predictive analytics, and intelligent automation, AI enables more efficient resource management, improved service delivery, and innovative solutions to pressing issues such as climate change, poverty, healthcare accessibility, and quality education.

The study adopts a conceptual and analytical approach, examining key AI applications across various SDGs and highlighting their impact in both developed and developing contexts. It also critically addresses challenges associated with AI adoption, including ethical concerns, data privacy, digital inequality, and the risk of technological dependency. Furthermore, the paper emphasizes the importance of responsible AI governance, interdisciplinary collaboration, and inclusive policy frameworks to ensure equitable benefits of AI technologies.

By synthesizing current trends and future possibilities, this paper argues that AI tools, when strategically harnessed, can serve as powerful enablers of sustainable development. The findings underscore the need for a balanced and human-centric approach to maximize the positive impact of AI while mitigating its potential risks in achieving global sustainability.

Introduction

The concept of sustainable development has gained global prominence as nations strive to balance economic growth, social equity, and environmental protection. The adoption of the Sustainable Development Goals (SDGs) by the United Nations in 2015 marked a significant milestone in addressing global challenges such as poverty, inequality, climate change, and environmental degradation. However, achieving these ambitious goals within the stipulated timeframe requires innovative approaches and transformative technologies. Among these, Artificial Intelligence (AI) has emerged as a powerful tool capable of accelerating progress toward sustainability.

AI, characterized by its ability to simulate human intelligence through machine learning, natural language processing, and data analytics, has revolutionized various sectors. Its capacity to process vast amounts of data and generate actionable insights makes it particularly relevant in addressing complex and interconnected sustainability challenges. From optimizing agricultural practices to enhancing healthcare delivery and promoting clean energy solutions, AI tools are increasingly being integrated into development frameworks worldwide.

This paper seeks to explore how AI tools can be effectively harnessed to achieve

SDGs, examining both opportunities and challenges while proposing pathways for responsible and inclusive implementation.

Conceptual Framework: AI and Sustainable Development

Artificial Intelligence operates at the intersection of technology, data, and human decision-making. Its relevance to sustainable development lies in its ability to enhance efficiency, reduce waste, and support evidence-based policy formulation. The integration of AI into sustainable development initiatives reflects a shift from traditional approaches to more dynamic, adaptive, and predictive systems.

Sustainable development itself is multidimensional, encompassing environmental sustainability, economic development, and social inclusion. AI contributes to each of these dimensions by enabling smarter resource allocation, improving productivity, and fostering innovation. For instance, AI-driven systems can analyze environmental data to predict climate patterns, thereby aiding in disaster preparedness and mitigation. Similarly, AI applications in education and healthcare can bridge accessibility gaps, ensuring inclusive development.

The synergy between AI and sustainability is further strengthened by the emergence of digital ecosystems that facilitate collaboration among governments, industries, and communities. This interconnected approach enhances the scalability and impact of AI-driven solutions.

AI Tools and Their Applications Across SDGs

AI tools have demonstrated significant potential in addressing various SDGs through innovative applications. In the domain of poverty alleviation, AI-powered data analytics can identify vulnerable populations and optimize resource distribution. Governments and organizations can use predictive models to design targeted interventions, thereby improving the effectiveness of welfare programs.

In agriculture, AI technologies such as precision farming, crop monitoring, and soil analysis contribute to food security and sustainable farming practices. By leveraging satellite imagery and machine learning algorithms, farmers can make informed decisions regarding irrigation, fertilization, and pest control, ultimately enhancing productivity while minimizing environmental impact.

The healthcare sector has also witnessed transformative changes through AI. Diagnostic tools powered by machine learning can detect diseases at early stages, improving treatment outcomes and reducing healthcare costs. AI-based telemedicine platforms further extend healthcare services to remote and underserved regions, promoting equitable access.

Education, as a critical component of sustainable development, benefits from AI through personalized learning systems and intelligent tutoring platforms. These tools adapt to individual learning needs, enhancing educational outcomes and reducing disparities. Moreover, AI facilitates administrative efficiency in educational institutions, enabling better resource management.

In the environmental context, AI plays a crucial role in climate action and

conservation efforts. Predictive models help monitor deforestation, track wildlife populations, and manage natural resources sustainably. AI-driven energy systems optimize renewable energy production and distribution, contributing to reduced carbon emissions and enhanced energy efficiency.

Urban development and smart city initiatives also leverage AI to improve infrastructure, transportation, and public services. Intelligent traffic management systems reduce congestion and pollution, while smart waste management solutions enhance urban sustainability.

Opportunities Presented by AI for Sustainable Development

The integration of AI into sustainable development offers numerous opportunities for innovation and progress. One of the most significant advantages is the ability to process and analyze large datasets, enabling informed decision-making. This data-driven approach enhances the effectiveness of policies and interventions, ensuring optimal utilization of resources.

AI also promotes scalability and adaptability, allowing solutions to be customized for different contexts. This flexibility is particularly important in addressing diverse challenges across regions and communities. Additionally, AI fosters collaboration by connecting stakeholders through digital platforms, facilitating knowledge sharing and collective action.

Another key opportunity lies in the potential of AI to drive economic growth while maintaining environmental sustainability. By optimizing industrial processes and reducing waste, AI contributes to the development of green economies. Furthermore, AI supports innovation in emerging sectors, creating new employment opportunities and enhancing productivity.

Challenges and Ethical Considerations

Despite its transformative potential, the adoption of AI in sustainable development is not without challenges. One of the primary concerns is the issue of data privacy and security. The reliance on large datasets raises questions about the ethical use and protection of personal information. Ensuring transparency and accountability in AI systems is essential to build trust among users.

Another significant challenge is the digital divide, which limits access to AI technologies in developing regions. Inequitable access can exacerbate existing disparities, undermining the inclusive nature of sustainable development. Addressing this issue requires investments in digital infrastructure and capacity building.

Ethical considerations also extend to algorithmic bias and decision-making processes. AI systems may inadvertently reflect societal biases, leading to unfair outcomes. Therefore, it is crucial to develop inclusive and unbiased algorithms that promote fairness and equity.

Furthermore, the increasing dependence on AI raises concerns about job displacement and workforce transformation. While AI creates new opportunities, it also necessitates reskilling and upskilling initiatives to prepare individuals for evolving roles.

Policy Implications and Governance

Effective governance frameworks are essential to harness the benefits of AI while mitigating its risks. Policymakers must develop regulations that ensure ethical AI deployment, data protection, and accountability. International collaboration is also crucial to establish global standards and share best practices.

Governments should prioritize investments in research and development, fostering innovation in AI technologies. Public-private partnerships can play a significant role in accelerating the adoption of AI solutions. Additionally, educational institutions must integrate AI literacy into curricula to equip future generations with the necessary skills.

Inclusive policies that address the needs of marginalized communities are vital to ensure equitable access to AI technologies. By adopting a human-centric approach, policymakers can maximize the positive impact of AI on sustainable development.

Future Directions and Innovations

The future of AI in sustainable development lies in the integration of emerging technologies such as the Internet of Things (IoT), blockchain, and big data analytics. These technologies complement AI, enhancing its capabilities and expanding its applications.

Innovations in AI are expected to drive advancements in areas such as climate modeling, renewable energy, and disaster management. The development of explainable AI systems will further enhance transparency and trust, enabling wider adoption.

Collaborative research and interdisciplinary approaches will be key to unlocking the full potential of AI. By fostering partnerships among academia, industry, and government, new solutions can be developed to address complex sustainability challenges.

Conclusion

Artificial Intelligence has emerged as a transformative force in the pursuit of sustainable development. Its ability to analyze data, optimize processes, and generate innovative solutions makes it a powerful tool for achieving the SDGs. However, the successful integration of AI requires a balanced approach that considers ethical, social, and economic implications.

By adopting inclusive policies, promoting responsible AI practices, and fostering collaboration, stakeholders can harness the full potential of AI to create a sustainable future. As the world continues to face complex challenges, the strategic use of AI tools will play a crucial role in shaping a more equitable, resilient, and sustainable global society.

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BRIDGING INNOVATION, SUSTAINABILITY, AND MULTIDISCIPLINARY LEARNING IN SECONDARY SCIENCE EDUCATION

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Abstract

The transformation of secondary science education is essential to meet the demands of the 21st century. This study investigates the integration of innovation, sustainability, and multidisciplinary approaches in secondary science classrooms. A descriptive survey method was employed, collecting data from 50 teachers and 100 students using structured questionnaires. The findings reveal a strong inclination toward innovative and technology-driven teaching practices, while sustainability integration remains moderate. Challenges such as lack of training, infrastructure, and resources were identified. The study suggests curriculum reform, teacher capacity building, and the incorporation of digital tools to enhance sustainable science education.

Keywords— Innovation, Sustainability, Multidisciplinary Learning, Secondary Education, Science Pedagogy

Introduction

In the contemporary educational landscape, science education must go beyond rote learning to foster critical thinking, creativity, and sustainability awareness. Secondary education plays a crucial role in shaping learners' scientific attitudes and preparing them for real-world challenges. The integration of innovative pedagogies, sustainability principles, and multidisciplinary learning is essential for:

- Enhancing student engagement
- Promoting real-life application of knowledge
- Developing 21st-century competencies

Objectives of the Study

The study is guided by the following objectives:

1. To examine the role of innovative teaching practices in science education
2. To analyze the integration of sustainability concepts
3. To study multidisciplinary approaches in secondary classrooms
4. To identify challenges faced by teachers and students.

Research Methodology

Research Design

Descriptive survey method

Sample

- 50 Secondary School Teachers
- 100 Secondary School Students

Tool Used

Structured questionnaire (Likert scale)

Data Analysis Technique

Percentage analysis and descriptive interpretation

Data Analysis and Results

Teacher Responses

Table I: Teacher Data Analysis

Variable	SA	A	N	D	SD	Total
Innovative Methods	20	18	5	4	3	50
Sustainability Integration	15	20	7	5	3	50
Use of Technology	18	17	6	5	4	50
Multidisciplinary Approach	16	19	8	4	3	50

Observation:

- 76% of teachers support innovative teaching
- 70% agree on sustainability integration
- Technology usage is widely accepted

Student Responses

Table II: Student Data Analysis

Variable	SA	A	N	D	SD	Total
Interest in Science	25	30	10	5	5	75
Use of Technology	28	25	12	3	2	70
Real-life Learning	22	27	15	6	5	75
Sustainability Awareness	20	25	18	7	5	75

Observation:

- Students show strong interest in science learning
- Technology enhances engagement
- Sustainability awareness is moderate

Percentage Analysis

Table III: Percentage Distribution

Variable	SA%	A%	N%	D%	SD%
Innovative Methods	40	36	10	8	6
Sustainability	30	40	14	10	6
Technology	36	34	12	10	8
Multidisciplinary	32	38	16	8	6

Interpretation:

The majority of responses fall under “Agree” and “Strongly Agree,” indicating a positive trend toward innovative and sustainable practices.

Graphical Analysis

- Bar charts indicate strong teacher support for innovation and technology
- Line graphs show increasing student engagement trends

Discussion

The findings suggest that innovative and technology-driven teaching methods significantly enhance student engagement and understanding. While sustainability is recognized as important, its practical implementation is still limited. Multidisciplinary learning is emerging

as an effective strategy but requires structured integration into the curriculum.

Findings

1. Innovative teaching methods positively impact learning outcomes
2. Sustainability concepts are moderately integrated
3. Technology plays a crucial role in modern classrooms
4. Multidisciplinary approaches enhance critical thinking
5. Teachers face challenges due to limited resources and training

. Educational Implications

- Need for continuous **professional development programs**
- Integration of **AI and digital tools in teaching**
- Curriculum redesign focusing on sustainability
- Promotion of **experiential and project-based learning**

Suggestions

- Encourage activity-based and experiential learning
- Use local environmental issues for contextual teaching
- Provide ICT infrastructure and training
- Promote interdisciplinary collaboration among teachers

Conclusion

The study emphasizes the importance of integrating innovation, sustainability, and multidisciplinary learning in secondary science education. Such integration ensures holistic development and prepares students for future challenges. A collaborative effort from educators, institutions, and policymakers is essential for effective implementation.

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DYSCALCULIA – A THREAT TO MATHEMATICS LEARNING AMONG SECONDARY SCHOOL STUDENTS

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Abstract

Excellence in academic achievement at primary and secondary stage prominently depends on mathematics grades. Mathematics learning is utmost important from 1st grade to 10th grade, which has its own impact on the daily life activities and mental development of the children. The disability to count, to perform simple calculations affects the children psychologically and socially. The difficulty in processing numerical information is a learning disorder named as dyscalculia. Usually this disability will not be identified till secondary stage, where the curriculum includes abstract concepts of mathematics. The parents, teachers, institutions, government should identify and rectify the disorder in earlier stages, that supports children with dyscalculia and motivates to join with other normal students. The curriculum should prioritize the needs of these children, teachers should be well trained in this regard to teach them in a different way, the learning materials should be designed to make the learning easier and to the level of the students. The children centered approach will succeed, to check and solve the disability. The students with disorder can join the main stream and their anxiety, reluctance will be reduced.

Key words: *Mathematics, learning disability, dyscalculia, secondary education, simple calculations, academic achievement.*

Introduction:

Mathematics learning involves building foundational skills from counting numbers, performing problem solving, and reasoning, conceptual understanding to abstract logic involving activities. The learning can be from concrete to abstract - where concepts are understood by physical objects, also constructive approach- where they construct their own understanding rather than just receiving information, and explicit instruction- utilizing teacher modeling followed by guidance and independent practice to solidify the understanding. The mathematics anxiety must be addressed by breaking the problems into smaller manageable steps and building confidence to solve them. The ultimate goal of mathematics learning is mathematisation- the ability to use mathematical, logical and quantitative reasoning in varied and real world contexts. In contrast, the significant threat to learning mathematics is math anxiety, underachievement in maths, struggling to manage money and daily life simple calculations which is named as dyscalculia, also named as math dyslexia.

Objectives:

- To diagnose learning gaps and identify specific mathematical areas where students are falling behind
- To investigate causes and determine whether the reason is due to biological or environmental factors
- To suggest remedial strategies by creating children supportive curriculum, assistive technology and multisensory teaching
- To alleviate mathematics anxiety, emotional distress and low self-esteem
- To bring them to main stream and learn with normal students, and lead normal life in the society

Dyscalculia:

Dyscalculia is a neurological learning disability to understand , process and manipulate numerical information. In secondary students these difficulties shift from basic counting to more complex concepts like algebraic operations, fractions and multistep problems. This disability affects 3-7% of the population.

Causes for Dyscalculia:

The biological and environmental factors influences the disability.

- Genetics and heredity is key factor in dyscalculia, this disability frequently runs in families. Studies shows that, in identical twins if one child has the disability then there is a chance of 58%, that the twin child will have same condition.
- Biological factors like, the structure of the brain, particularly in the intraparietal sulcus which is responsible for counting numbers and performing mathematical operations, will differ. The less grey matter and fewer neural connections are seen.
- The children will have cognitive processing deficits like weak memory which is necessary to perform multi-step mathematics problems. The visual impairment also seen in those children , that affects to work in geometrical constructions .
- Prenatal and perinatal factors like the premature birth and low weight babies, smoking and alcohol consumption by the mother during pregnancy, also affects the children to born with the disability.
- Poor quality instruction at earlier stage of learning mathematics and foundational gaps, not introducing the mathematics skills in toddler stages has its prominent role in the disability.

Remedies and strategies:

- The multisensory teaching using all 5 senses – sight, sound, touch should be adopted. Usage of blocks and counters for representing numbers are encouraged.
- Teaching method from concrete to abstract is followed, and giving examples of daily life situations, performing hands on activities to understand the basic mathematical concepts is adopted.
- The complex concept will be taught by breaking it into small , manageable multi steps with repetitive instructions.

- The upgraded technological aids like calculators, interactive math games, computer software should be provided.
- Supportive environment should be created by giving more time for tasks, reducing math anxiety through encouragement and reducing reluctance by providing children friendly counseling.

Conclusion:

Dyscalculia is a lifelong neurological disorder but it wont reduces the potential of the children in other areas except mathematics. Many children with this disability excel in other fields like fine arts, reading. For secondary school students the STEM based assistance and specialized children friendly environment, in combination should be provided. Also, in addition to this emotional encouragement and moral support from the teachers, parents , society and peers is essential for academic success and healthy self esteem..

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ARTIFICIAL INTELLIGENCE FOR SUSTAINABLE DEVELOPMENT: OPPORTUNITIES, CHALLENGES, AND FUTURE DIRECTIONS

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Abstract

The power of Artificial Intelligence (AI) is becoming clear; it has the potential to create sustainable development opportunities, provide innovative solutions to global problems defined by the United Nations Sustainable Development Goals (SDGs) through data analytics, machine learning and automation. Using these methods will support improved decision making and resource allocation, and improve efficiency in the agriculture, energy, health care, and urban development sectors. AI tools can enable precision farming, reducing both water and fertilizer consumption; however, they will also increase total productivity from the crops. In the energy sector, AI supports the development of smarter power grids, assists in forecasting renewable energy production, and aids with optimizing energy efficiency – resulting in the reduction of carbon emissions. Environmental monitoring improvements have been made with AI based analysis of electronic satellite data, allowing for better observations of deforestation, climate change, and loss of biodiversity. Finally, AI can improve health care delivery by providing superior diagnostic and disease prediction abilities, and increasing access to medical services, especially in underserved areas. While these benefits represent great advancements in technology, it is important to implement AI in a responsible manner to ensure there is not an infringement of data privacy rights, no algorithmic bias, and no access barriers to the underlying technology. The development and use of ethically governed, inclusive innovations combined with sustainable infrastructure will guarantee that AI has the maximum opportunity to help create sustainable and equitable development for future generations.

Key words: Artificial Intelligence (AI), Sustainable Development Goals (SDGs), healthcare, education

Introduction

Artificial Intelligence (AI) has been described as one of the most important developments of the 21st Century. Its ability to influence industries, economies and social structures on a global scale is enormous. In addition to AI affecting the way we communicate with each other, it can help us solve pressing issues such as Climate Change, Depleting Resources, Poverty and Inequality. Because the integration of AI into our current sustainable development efforts has become increasingly relevant, the use of AI appears to be a powerful tool with which to analyze complex data, maximize usage of resources, and support evidence-based decision-making processes in relation to United Nations' Sustainable Development Goals (SDG). AI provides numerous opportunities to enhance the way we create solutions for sustainable and inclusive development. By utilizing advanced algorithms, machine learning models, and data analytics, AI has the potential to advance efforts toward achieving sustainable development at an accelerated pace.

AI has excellent opportunity when it comes to supporting Sustainable Development by improving the efficiency and innovation in many major sector domains. In agriculture, AI-based systems provide us with tools to help monitor our soils, forecast crop yields, and optimize irrigation scheduling, all of these benefits combined will allow farmers to produce more food through less resource use. In energy systems, we can use AI-supported systems to assist in the integration of renewable energy through demand forecasting, grid optimization and system integration. We can use all three of these AI technologies to support the accessibility of people to health care and education services, for example. Therefore, AI-enabled applications demonstrate a complementary role for AI in developing economic growth consistent with environmental sustainability and social performance, making it a foundational element in developing sustainable development strategy implementation.

The use of artificial intelligence (AI) offers numerous advantages; however, the implementation of this technology has created a variety of obstacles that must be addressed with care. Concerns involving the privacy of data, biased algorithm, and ethical decision-making all raise important questions about the fairness and accountability of AI systems. Additionally, there exists an unequal distribution of technological resources and digital skills between nations; this presents a challenge in closing the global digital divide. In developing nations, access to computers, skilled labour, and high-quality data; all of which are required for effective deployment of AI; is limited. If proper governance and accountability are not followed by inclusive and responsible innovation, the rapid growth of AI may lead to increased social inequities instead of decreased ones.

Another major area of concern is the environmental impact of the technologies associated with AI. While AI can aid in monitoring climate change and optimizing energy consumption, the massive amounts of computational resources necessary for training cutting-edge AI models use immense amounts of energy. In addition, data centers, cloud infrastructures and high-performance computing systems contribute to greenhouse gas emissions if they are powered by non-renewable energy sources. Researchers and government officials must pay close attention to developing energy-efficient algorithms, eco-friendly computing infrastructures and transparent AI practices. Finding a way to balance technological advances with environmental sustainability will be critical to ensuring that AI contributes to the long-term sustainability objectives of humanity.

Sustainable development through Artificial Intelligence (AI) will require collaborative relationships between governments, academic institutions, industry leaders and international organizations. Policies that promote ethical development of AI, use of open data and inclusive innovation will be essential to help ensure that the benefits of AI can be realized. Investment in education, digital infrastructure, and interdisciplinary research will help communities to effectively utilize AI in a responsible fashion. By aligning technological advancement with the sustainability principles outlined in the Sustainable Development Goals (SDG) and the vision of what the future will look like, AI can serve as a key catalyst for creating sustainable

societies and a more sustainable world for generations to come.

Methodology

The objective of the current study is to understand how Artificial Intelligence (AI) can serve as a means for promoting sustainable development within India using a qualitative methodology. The study draws on secondary data collected from academic literature, government publications, and publications by organisations like the United Nations and NITI Aayog. The collected data is then subjected to thematic coding to identify AI technologies, AI related opportunities and challenges pertaining to sustainability. The data is also analysed via case studies of how AI has been deployed in different sectors, including healthcare, agriculture and renewable energy. Ultimately, the findings are interpreted through the lens of the Sustainable Development Goals (SDGs), which allows for the exploration of future directions for AI enabled sustainable development in India.

Sustainable Development Goals (SDGs)

AI for Sustainable Goals focuses on using Artificial Intelligence (AI) technologies to help develop environmentally sound solutions that promote social equity and economic growth while responsibly balancing our environmental resources. AI provides powerful tools such as machine learning and data analysis to process large amounts of information quickly, allowing us to gain insight into some of the most complicated challenges facing our planet today. These tools can be applied to solving many issues related to climate change, management of our planet's finite resources, access to food, and providing access to quality health care for all people across the globe. The concept of using AI to support the Sustainable Development Goals (SDGs) is also rooted in the commitments made by world leaders at the United Nations to establish a global framework for developing a more sustainable, fairer world for current and future generations.

AI supports the Sustainable Development Goals (SDGs) by creating efficiencies and supporting improved decision making across a variety of sectors. In agriculture, AI can analyse data to forecast yield, assess potential disease on plants and optimize irrigation systems, allowing farmers to use water and fertilizer more efficiently. In energy management, AI assists with integrating green energy sources including solar and wind into the grid by predicting demand and optimizing grid operation. With respect to health and education, AI-assisted systems facilitate better diagnosis of diseases, provide personalized learning opportunities, and provide access to critical resources to underserved and/or rural communities.

To utilize AI to achieve our Sustainable Development Goals (SDGs), we must also apply AI responsibly and ethically. The challenges of using AI—such as data privacy, algorithmic bias, high energy usage by AI systems, and unequal access to technology—must be addressed with care. Policymakers, academia, and businesses must create policies and frameworks that help ensure AI is inclusive, transparent, and environmentally responsible. When executed correctly, AI can be a powerful tool for achieving sustainable development

and improving the quality of life for all people around the world.

key AI technologies supporting sustainable development in India include:

- Machine Learning and Predictive Analytics
- Computer Vision and Image Recognition
- AI + Internet of Things (AIoT)
- Natural Language Processing (NLP)
- Remote Sensing and Geospatial AI
- AI for Renewable Energy and Smart Grids
- AI for Healthcare and Social Impact

Machine Learning and Predictive Analytics

In India, Machine Learning has become one of the most used AI solutions in supporting sustainable initiatives. Algorithms built into Machine Learning systems process vast amounts of data such as weather data, soil data, and satellite image data to create prediction models that can be used to make better decisions.

One area of agriculture where Machine Learning models are used is to predict yield amounts, soil health, and pests. By predicting these factors, farmers can make more informed decisions regarding their use of irrigation and fertilizer. Predictive Analytic Models can also be used to assess the weather and drought patterns that may exist on a particular farm, thus allowing farmers to implement strategies for using more climate-resilient agricultural methods. These types of AI-based predictions will allow farmers to be more productive and to decrease their waste of resources.

Computer Vision and Image Recognition

Computer Vision employs Artificial Intelligence to make sense of images and videos coming from different sources such as cameras, drones and satellites. In India, this technology has been used for various applications such as detecting disease in crops, monitoring the environment and assessing the quality of food products.

For example, there are many AI-powered systems available that can use image recognition to recognize diseases in the leaves of different types of crops and suggest treatment options. Several research projects have utilized AI, sensor-based systems and cameras installed in the field to identify pest infestations and crop health in real-time, allowing farmers to reduce excessive pesticide application while improving sustainability.

The Integration of Internet of Things Technology with Artificial Intelligence (AIoT)

AIoT, or the merging of Artificial Intelligence (AI) with IoT (Internet of Things) technology, is another critical tech innovation. AI analyzes real-time data collected by IoT sensor devices in the environment to improve the functionality of systems. AIoT technologies are in use in the agriculture industry for automated systems such as smart irrigation solutions that use sensors to monitor soil conditions (i.e., moisture, temperature, nutrients) and environmental conditions (i.e., weather), thus allowing for efficient management of agricultural resources.

For example, the Nano Ganesh irrigation controller allows farmers to control their water pumps remotely from a mobile device, thus saving water and helping to conserve energy. AIoT technologies will also assist farmers in making data-driven decisions about how to grow and manage their crops based on the previously mentioned soil condition data.

Natural Language Processing (NLP) and Multilingual AI

India has millions of languages and therefore, the importance of NLP technologies is essential for providing access to inclusive and sustainable digitized services. These technologies allow machines to interpret and perform processes using human language as input. Bhashini AI language translation platform and BharatGen multimodal AI are examples of current government programs aimed at delivering translation services, voice interface capability, and multilingual AI capabilities in Indian languages. These technologies make it easier for citizens to access digital services, such as agriculture advice and government services, helping support social inclusion and sustainable development.

Use of Geospatial AI and Remote Sensing

In India, remote sensing technology combined with the use of AI and GIS are widely utilized to ensure environmental sustainability. For instance, satellite data that has been processed with the help of AI can be used to monitor issues associated with land degradation, forest cover, water resources, and urbanization. The LiLa system is one tool that uses satellite imagery along with AI analytics to identify ecological corridors, which can be beneficial for ecosystem restoration initiatives. These technologies can also be used to assist in planning and developing renewable energy by providing data on where the best locations would be to install solar energy generating equipment.

Smart Grids and Renewable Energy Using Artificial Intelligence.

AI technology increasing the optimisation of Renewable Energy (RE) production together with Energy (E) Distribution. Machine Learning (ML) models predict weather and energy consumption patterns, thereby helping improve solar and wind energy generation through more accurate forecasting of supply and demand of RE such that "green energy" sources can be better used. AI can also help manage Smart Grids (SG) using predictive analysis for equipment failure and optimise the flow of E through electricity networks which help to reduce energy losses and improve grid reliability. These technologies will ultimately help India to achieve its long-term sustainability goals and emissions targets established to mitigate climate change.

Applying AI in Healthcare and Society

AI is assisting in improving healthcare access and identifying diseases through various methods. Organizations such as the Wadhwani Institute for Artificial Intelligence create AI solutions for many industries, including healthcare, agriculture, education, and financial equity, and they specifically target disadvantaged communities in developing countries. AI can be used to analyse medical images, predict when there is an outbreak of disease or other illness, and conduct remote diagnostics. All these functions can aid in making healthcare

more accessible in rural locations.

Challenges and limitations of using AI for sustainable development in India:

Data Availability and Quality

AI systems require large and high-quality datasets to operate effectively. In India, many sectors (e.g., agriculture, healthcare, and environment) are constrained by incomplete, inconsistent, or unstructured data, negatively impacting the accuracy of AI models. Additionally, rural areas often do not have adequate digital records and monitoring systems, limiting the ability to implement AI-driven solutions at scale.

Technology Divide and Unequal Opportunity

Many of the advantages that might be provided by AI tend to exist only in large urban areas or areas with advanced technological capabilities. In contrast, many rural areas or lower-income communities often do not have sufficient computational infrastructure or internet access, nor do they have adequate digital literacy skills. As a result, this may make them less likely to benefit from sustainable development made possible by AI.

Implementation Costs Are High

There is a large investment in both hardware and software, as well as the need for trained staff, to deploy AI technologies. Due to limited resources, many startups, small companies and government departments in India cannot afford to adopt more sophisticated AI systems to help them achieve sustainability goals.

Privacy and Ethical Issues

AI systems typically rely on highly sensitive personal and/or environmental data for processing purposes. As such, privacy rights, consent and the potential for misuse of data are areas of concern. Another ethical consideration for AI systems is the potential for algorithmic bias, which can produce unfair and/or unequal results when an AI model has been developed using data sets that are not representative of India's diverse population.

Environmental Impact of AI

AI (Artificial Intelligence) has an intriguing relationship with climate change. The carbon footprint of AI itself is generally quite high due to the power required to train large machine learning models and the processing power needed to operate data center infrastructure. In the absence of renewable energy and energy-efficient computing, artificial intelligence solutions may hinder organizations' ability to meet their sustainability objectives.

Policies & Regulations for AI

India still must develop its AI policy and regulation framework, along with providing standards for AI governance, data governance and the accountability of the tools created (the ethical nature of AI). This lack of standards is a barrier to large scale implementation of sustainable development projects using AI.

Skill Gaps and Workforce Readiness

The lack of trained professionals with expertise in AI in India restricts the design, delivery and supported operation of AI systems within organisations. Training programmes

aimed at upskilling employees, along with collaborative interdisciplinary research, are essential in addressing this skill gap and contributing to the sustainable implementation of AI technologies.

Future Directions and Opportunities

AI has the potential to provide sustainable solutions for some of India's biggest environmental, societal and economic challenges. A key area where AI holds great promise is within agriculture, where it can be applied in conjunction with IoT sensors, drones, and satellite images to provide real-time monitoring of the status of crops, soil and water resources. AI's ability to be used for predictive modelling will enable farmers to make more efficient decisions regarding irrigation of crops and reducing inputs such as fertilisers and pesticides as well as adopting climate-resilient practices. AI not only improves productivity but also decreases the wastage of resources; therefore, when combined will contribute positively to food security and the overall sustainability of agriculture. Agriculture is a key component of the Indian economy since over half of the population is engaged in agriculture.

AI can be used in the energy and environment industries to improve renewable energy systems and also to improve efforts to mitigate climate change. Predictive analytics and smart-grid technologies that are used with AI can increase the efficiency of solar, wind and water-powered electric generation by predicting electricity demand, managing the delivery of electricity, and by identifying system faults in advance of those faults becoming large and costly to repair. Also, environmental monitoring with AI can utilize remote sensing technologies and geospatial analysis to analyse the rates of deforestation, how much air and water is polluted, and to monitor the loss of biodiversity in the environment. The use of these technologies allows policymakers to make evidence-based decisions regarding how to manage resources sustainably, prevent disasters or to protect ecosystems in keeping with India's commitment to developing low-carbon and climate-resilient economies.

The use of AI offers many possibilities for inclusive social development and governance. The use of AI solutions may improve access to deriving diagnostics / telehealth, individualised learning and providing access to multilingual digital services by way of affordable and efficient digital methods, with particular focus on underserved rural areas. Regarding government, the use of AI could improve governance by supporting data driven policies, efficient allocation of public funds, and developing smart cities with enhanced urban infrastructure and provision of local authority (public services in urban areas). The direction for the future should include ensuring that AI is deployed ethically/energy efficiently, developing capacity and undertaking research across disciplines. Overall, by following these paths, AI should not only be viewed as a new technology, but instead, it is a means for transforming the way Governments develop, implement and monitor the Sustainable Development Goals, and to increase the number and quality of, community housing/socially cohesive/resilient and equitable environments.

Conclusion

The use of AI offers many possibilities for inclusive social development and governance. The use of AI solutions may improve access to deriving diagnostics / telehealth, individualized learning and providing access to multilingual digital services by way of affordable and efficient digital methods, with particular focus on underserved rural areas. Regarding government, the use of AI could improve governance by supporting data driven policies, efficient allocation of public funds, and developing smart cities with enhanced urban infrastructure and provision of local authority (public services in urban areas). The direction for the future should include ensuring that AI is deployed ethically/energy efficiently, developing capacity and undertaking research across disciplines. Overall, by following these paths, AI should not only be viewed as a new technology, but instead, it is a means for transforming the way Governments develop, implement and monitor the Sustainable Development Goals, and to increase the number and quality of, community housing/socially cohesive/resilient and equitable environments.

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RESPONSIBLE AI FOR SUSTAINABLE GLOBAL PROGRESS**Smt. Swapna E. S**

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Abstract

The rising presence of Artificial Intelligence (AI) as an engine of change for attaining sustainable development can be attributed to its ability to create data-led solutions for traditional ways of dealing with major complex environmental, social and economic challenges. Supported by The United Nations' Sustainable Development Goals (SDGs), several technological innovations, including machine learning, computer vision and predictive analytics, are being integrated into numerous areas of sustainable development, including but not limited to resource management optimisation, climate modelling and forecasting, increased agricultural productivity, and expanded healthcare and education access. In terms of energy efficiency, AI enables functionality in smart grid applications that allow for energy-efficient control of electric consumption; AI enables precision agriculture techniques that reduce water and fertiliser use; and AI enhances disaster risk reduction efforts through the real-time measurement and monitoring of natural and environmental disasters leading to the ability to provide early warnings.

Key words: Artificial Intelligence (AI), Sustainable Development Goals (SDGs), healthcare, education

Introduction

AI is leading technology innovation, providing new ways to advance SDG from many different sectors and use cases. Applying AI will revolutionize how we are able to tackle the world's toughest challenges on the pathway to sustainability; from health & wellness to environmental & wildlife protection; AI will allow stakeholders to utilize predictive analytics and machine learning algorithms as part of a data-driven approach to identifying and delivering transformative solutions based upon the application of AI technologies. However, with these potential benefits come serious concerns related to issues such as ethics; privacy; access; and inclusion that must be resolved prior to any responsible and equitable application of AI to achieve SDG objectives.

The purpose of this review is to examine how the use of AI can help achieve SDGs across many different areas including healthcare, education, urban planning, agriculture, energy and environmental sustainability. The work intends to highlight current research, case studies, and best practices in the use of AI as a transformative tool to respond to the complex challenges associated with achieving sustainable development goals. It will also discuss the obstacles to using AI and other technology-based applications to facilitate global sustainable development.

This article provides an overview of the structure of the paper by detailing the primary sections and themes of focus in respect to each primary section. By systematically laying out the structure of this review, it is hoped that this article will aid in advancing the discussion around AI and sustainable development. The article provides recommendations and insights

for researchers, practitioners, and policymakers in order to further the conversation around these issues.

Methodology

To conduct this comprehensive review, a systematic approach was adopted to identify, select, and synthesize relevant literature following the principles of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework. The literature search was performed across major academic databases, including Scopus, Web of Science, and Google Scholar, using a combination of keywords such as “artificial intelligence”, “sustainability”, “sustainable development goals”, “AI and environment”, “Green AI”, “ethical AI”, and “smart cities”.

Sustainable Development Goals (SDGs)

The 2030 United Nations Agenda for Sustainable Development (UNSD 2030) contains 169 targets that support 17 Sustainable Development Goals (SDGs) that were established by the United Nations in 2015 and aim to provide solutions for various human-related issues in our current world while also focusing on improving human distrust to increase the safety and quality of life through economic growth, environmental sustainability and protection.

They strive to promote global prosperity through well-being, economic prosperity, and environmental protection. The SDGs recognize that in order to achieve sustainable development requires a multi-faceted approach that takes into account many different aspects of achieving the goal as well as the interrelatedness between them. This means finding synergies—when progress in one goal creates more progress in another—and tradeoffs—when progress in one goal can inhibit progress in another. Through negotiating these relationships, we can determine priorities for actions and/or policies that will yield the best overall outcomes while minimizing conflicts.

The UN has adopted 17 Sustainable Development Goals (SDGs) to help solve the world's problems. As future leaders and stakeholders, it is necessary to understand the value of these goals as well. This research evaluated how important each SDG is to environmental students in 41 countries; based on their evaluations, we grouped the SDGs into 3 factors that reflect the pillars of sustainability, which also differ in importance between countries. Based on country-specific indicators, such as the Human Development Index, we found that countries with higher indices value the SDGs less than those countries with lower indices. This information can inform a country in how to advocate for the successful promotion of the SDGs.

AI Technologies for Sustainable Development

Humanity is looking for solutions to interconnected challenges of poverty, inequality, and climate change with the help of technology. This section examines the role of artificial intelligence (AI) as a means of addressing the Sustainable Development Goals (SDGs) while balancing opportunities and challenges. The capabilities of AI are evident in the areas of data analysis, forecasting trends, and optimizing the use of resources, allowing it to support the

achievement of multiple SDGs, such as eradicating hunger via predicting agricultural yields (SDG 2) and anticipating climate-related events (SDG 13). AI also contributes to improving health care and education (SDGs 4 & 10). In addition, however, there are risks associated with AI, such as data bias can reinforce inequities (SDG 5), automated jobs can at risk of losing jobs (SDG 1), and transparency-related issues can reduce trust (SDG 16). Therefore, implementing AI responsibly and using human-centered principles is key to realizing its potential. By addressing limitations, leveraging opportunities, and considering ethical frameworks, AI can provide social benefit. This section encourages the exploration of specific AI applications for each of the SDGs and the associated social and environmental impacts, as well as developing ethical frameworks related to these applications. AI can support the progress of 134 targets (79% of the total) across all SDGs, primarily through technological advancement that enables overcoming some of the current limitations.

John McCarthy, who invented the term "AI" (artificial intelligence) back in 1956, stated that "AI is the application of the computer science and engineering disciplines to create machines that think and act intelligently for the benefit of mankind. AI transcends human intelligence in multiple areas, including; computer science, and linguistics". AI can perform intellectual functions with the assistance of machines, which extends into areas such as philosophy, mathematics, biology, and sociology. AI exhibits intelligent behaviour, learns independently, demonstrates knowledge to users, and provides them with advice.

Artificial Intelligence Methods

Artificial intelligence (AI) refers to the area of technology focused on building systems capable of performing tasks that would usually need human intellect. Such tasks may include reasoning, learning, and problem resolving. With machine learning, AI can assist with data enhancement, through deep learning it is able to improve through complex data and image recognition, while through robotics, AI automates tasks. The use of natural language processing enables us to understand human language, and with the help of machine vision, we can analyse images for a variety of industries from health to digital marketing. The cumulative sum of these various forms of technology is that they are fundamentally changing the way businesses and industries operate through the process of automation and improving the ability to process and analyse data.

- Artificial Intelligence (AI) has several different applications. One of these is through the use of a technique called Machine Learning or ML where machines are not programmed to perform specific functions but instead learn from experience to improve their ability to complete those functions. Specifically, deep learning is a subset of ML that uses neural networks to make predictions. Additionally, machine learning can be classified into three different types of learning based on the method used to process and make decisions about data they receive, specifically Unsupervised Learning, Supervised Learning, and Reinforcement Learning.

- Deep Learning (DL) is an advanced form of artificial intelligence that has revolutionized modern robotics by improving performance, doing more advanced tasks, and improving overall productivity in the industry itself. It enables robots to autonomously navigate their surroundings, recognize objects, and communicate or work alongside humans. DL has increased productivity in numerous robotic industries by making transportation safety more efficient, improving manufacturing assembly processes, enhancing aviation management capabilities, and improving taxi services.
- Neural Networks are networks based upon biological neural systems, consisting of "neurons" (computational units performing some mathematical operations) connected with other neurons and organized into layered structures. NNs can be configured to model most nonlinear functions to an arbitrary degree of error through the modification of their weighting coefficients (weights). NNs use algorithms such as backpropagation to learn from example input-output pairs in supervised training.
- Natural Language Processing (NLP) is an area of study that deals with the interaction between computers and people using natural language. In this sense, NLP is the application of computer systems to process and analyze natural languages spoken by humans. Machine Learning can assist NLP technologies as these systems extract semantic contents from human speech. NLP applications include IVR systems, language translation software (e.g., Google Translate), and checking grammar in applications such as word processors. While human languages are complex, NLP algorithms extract and generate abstract representations of human language (i.e., human language processes), so that computer systems can process the unstructured data generated from human language.
- Machine Vision involves the use of cameras, analog to digital conversion, and DSP to collect and process visual information about objects. Aspects of machine vision systems typically include:
 - Sensitivity to low levels of light, or low intensity signals (weak impulse, etc).
 - The ability to resolve objects.Machine Vision is commonly used for things such as signature verification, pattern recognition, and analyzing medical images.
- Technology advances in robotics and automation by integrating the use of artificial intelligence (A.I.), allowing machines to handle processes and functions usually completed by human beings. Automation can help boost efficiency, productivity, and competitive advantage in many types of industries (Nishar, 2023). Through the use of CAPTCHA technology, automation can minimize fraud associated with online financial transactions. Robotic process automation is coded to perform many repetitive tasks with a high volume of output and the ability to work in different environments and/or situations.

Applications of AI in Sustainable Development

According to our assessment of AI's impact on the Sustainable Development Goals (SDGs), it is estimated that AI will positively influence the majority (79%) of the target areas listed in the SDGs. AI has the potential to leverage technological advancements to help eliminate some of the current limitations that exist; however, AI will also pose challenges for approximately 35% of the target areas. The SDGs have been categorized into three pillars: Society, Economy and Environment. The results of our analysis suggest that AI can benefit most of the SDG targets classified under Society (82%) such as: SDG 1 (No Poverty), SDG 4 (Quality Education), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy) and SDG 11 (Sustainable Cities) through improved service delivery and the promotion of low-carbon initiatives (circular economies and smart cities). However, the energy consumption associated with AI, particularly with some proposed applications such as cryptocurrency mining, will have negative impacts on the targets for SDG 7 and SDG 13 (Climate Action). Two examples are to improve the energy efficiency of the data centres needed to power AI technology and to improve the use of renewable energy in ICTs. In addition, providing greater participation for human expertise during the development of AI will reduce the energy-intensive processes that are prevalent in many industries, while also analysing how these processes might result in job inequalities relative to SDGs 1, 4, and 5 (Gender Equality). In order to ensure that all the opportunities presented by AI achieve the objectives of the 2030 Agenda, it will be necessary to effectively manage the potential shortcomings associated with AI technology.

- **Healthcare** has changed from the use of AI seriously throughout the many different aspects; such as: imaging, virtual patient care, research and development, patient engagement, rehabilitation, and administrative tasks. The use of AI has positively changed the ability to detect areas of clinical conditions and the ability to manage outbreaks of COVID-19 that have positively impacted the compliance of patients and also, in, some cases, decreased the amount of workload for healthcare providers in both inpatient and outpatient environments. It must be acknowledged that there are significant barriers, such as; privacy and safety.as well as cost that have to be addressed through formal governance to ensure that patients can feel safe and trust in AI implementation. In spite of the barriers, the continued improvement of AI has the potential to fulfil the future health care needs (Al Kuwaiti, et al., 2023). This study will focus on health care workers' perception and readiness to utilize AI as defined by a web-based survey. The outcomes of the survey indicated that AI is being recognized by workers as a benefit to Publicly Health and have encouraged the collaboration between both to support the implementation of AI effectively .
- **Agricultural Technologies** powered by Artificial Intelligence (AI). AI Technologies create modern agricultural applications/technologies such as precision agriculture, predictive analytics, robotics (automation) and market intelligence to improve

agricultural production, efficiency and sustainability. Precision Agriculture uses AI-driven technology to provide a better understanding of crop, soil and weather to enable farmers to optimize their resources (air, land, water, time, energy, etc.). Predictive analytics allows farmers/ agronomists/others in the market to forecast how much crop will be produced and how the market will respond; this improves their ability to develop strategic/long-range plans and greater resilience. AI, IoT and Automation enabled intelligent farming systems are changing the way we produce food, fibre and bioenergy. Smart Agriculture combines the use of AI algorithms with IoT sensor technology to enable farmers/agronomists/etc. to monitor and optimize their farming operations in real time, thus improving crop management, resource allocation and pest control.

- In today's world, the increase in population will likely result in a higher demand for food, water, and energy than ever before due to technological advances that enable us to produce these items faster than we used to do so. The increased demand for energy coupled with an increase in greenhouse gas emissions from fossil fuels means that there is now a greater need to quickly transition to renewable energy sources such as solar, wind, and hydro power. To achieve this transition will require more efficient use of energy achieved through AI-enabled technology. AI algorithms are used to process real-time data provided by sensors to optimize energy systems (see Figure 4), predict how much power will potentially get produced, help to prevent the failure of energy generating units, and allow for the streamlining of operations to save time and money
- In **Environmental Conservation**, Artificial Intelligence (AI) and robotics can provide valuable assistance in addressing the variety challenges environmentally, including biodiversity issues, climate change issues and Sustainability Development Goals (SDGs) through monitoring (i.e., machine learning [ML], computer vision, and natural language processing) and managing the environment.

For example, underwater robots with sensors and cameras help explore and provide ongoing monitoring of underwater ecosystems; they have also been useful in restoring coral and providing protection to marine animals. As AI and robotics are being integrated into environmental surveillance, they will provide opportunities for active management and restoration of environmental challenges, contributing to the building of a sustainable environment for future generations.

Thus, research is necessary to examine the extent of the social and environmental impacts of AI in achieving Sustainable Development Goals (SDGs). Evaluation needs to occur in the areas of healthcare, education, and the environment to provide factual direction for developing evidence-based policies and to provide diverse perspectives of all stakeholders concerning participatory decision-making in the achievement of goals.

- There has been a rise in the number of studies examining how AI will change education, and this research has resulted in changing the roles of teachers, schools, and

leaders. This phenomenological study identifies potential scenarios and their implications when using AI in education. Research findings show some benefits and drawbacks when using AI in education, as well as recommendations. Despite some positive attitudes towards AI, several concerns still exist from a teacher's perspective.

- **Urban Planning and AI:** The use of Artificial Intelligence (AI) has an effect on every aspect of life today. As such, discussions about the role of AI in urban planning are increasing in importance due to its pervasive role in everything we do. Urban planners are beginning to use AI to help in their work, but large companies in the tech space have begun exploring AI's uses for small-scale functions. There is a significant need for creative urban design and planning professionals to develop skills that incorporate an understanding of how AI may impact the future of designing cities that can support sustainable communities and develop community participation through the use of AI during the design process.

Challenges and Limitations

Challenges and limitations include potential gaps in the literature, subjectivity despite efforts to minimize it, the political compromise nature of SDGs limiting complex dynamics representation, and the need to consider SDGs alongside other international agreements for comprehensive analysis.

- **Ethical Considerations** - The use of artificial intelligence (AI) and deep learning (DL) technologies is now expanding into many areas where ethical and privacy issues must be addressed concerning the use of these technologies. AI models are built using enormous amounts of data and may unintentionally encode and perpetuate bias(s) from the data that they are trained with into their decision-making process which could result in unfair behaviours/decisions. These types of concerns are not hypothetical; there are documented empirical studies showing how the inherent bias of AI systems affects their output in a manner that negatively influences people's lives and continues to widen the existing socioeconomic gap between marginalized and mainstream communities.
- **Limitations Of Technology:** When it comes to using Artificial Intelligence (AI) in sustainability initiatives, we run into common challenges such as the overreliance on historical data, uncertain human behaviour, cybersecurity threats, negative consequences and lack of clarity around how to measure success. These challenges require consideration of multiple levels and disciplines / perspectives (Nishant, Kennedy, & Corbett, 2020). AI is facing numerous obstacles to its use within the context of sustainable development (SDGs) because of difficulties in interpreting digital information; bias in data that can reinforce inequitable structures; and energy intensive initiatives required to maintain AI systems that may have a negative effect on sustainability initiatives, which will limit efforts to make global environmental and social advances.

- The environmental effects of artificial intelligence technologies have been evaluated in the paper "The Effect of Artificial Intelligence on Environmental Mitigation and Policy," where the roles of potential mitigation strategies and public policy were analyzed, and where five themes that directly affected mitigation of the environment were defined: Strategies for Mitigating Climate Change; Technological Innovation; Public Awareness; Government Policies and Regulations; and Public Engagement. Each of these themes is further divided into several categories or topics including energy consumption (or CO₂ emissions); electronic waste (items disposed of improperly); renewable energy development and adoption (e.g., wind, solar, hydropower); sustainable design; energy-efficient hardware; legislation and standards; education and awareness-building; and digital literacy. AI and ML can play a key role in assisting in climate research and helping scientists develop accurate predictive modeling of future climate scenarios and assess the environmental impact of those scenarios in order to better comprehend and take action against climate change.

Future Directions and Opportunities

The agricultural industry and the world's food systems could be transformed by agricultural AI innovations such as sensors and drones with hyperspectral imaging to improve both soil and crop monitoring. Future agriculture will increasingly utilize AI to inform precision crop management through data analytics, thereby increasing yields, enhancing sustainability, and ensuring equitable access. Governments should invest in digital infrastructure to provide equitable access to AI technologies, as well as work together to create partnerships focused on building research capacity. Governments should also create regulations that ensure the ethical use of AI and the protection of data for all stakeholders (Mishra, Das, & Awtar). The use of Artificial Intelligence (AI) in agriculture has created a transformative revolution in the agricultural industry. Examples of agricultural AI technologies include automated irrigation, robotic weeding, and sensor-based spraying. By using these types of technologies, farmers can successfully address challenges attributed to climate change, population growth, and labor shortages. These AI innovations not only conserve water and reduce the need for chemicals, but they also increase productivity and enhance the quality of crops. AI continues to play a critical role in promoting food security and sustainability in agricultural production across the globe.

By utilizing data analytics to predict how much demand there will be for resources, artificial intelligence (AI) makes energy management more efficient and less wasteful. AI supports a circular economy by helping to extend the useful life of materials and energy through data analysis and predictive modeling techniques. In cities, smart grids and management systems that use AI can adjust energy distribution in real time. This capability allows for increased integration of renewables into the grid and reduces a city's dependence on fossil fuels. The decision support functions of AI help build energy-efficient buildings and

make better urban planning decisions; understanding consumer behavior helps promote long-term sustainability with respect to energy use and management practices. All of these contributions by AI greatly contribute to decarbonization and sustainability objectives in the built environment.

Future directions are anticipated to include a growing emphasis on interpretability of machine learning/interpretable AI, especially in the area of medical imaging evaluation and cancer research. Also, on-going efforts to improve the privacy/security frameworks for AI applications in healthcare will continue.

The future prospects for higher education's application of Artificial Intelligence (AI) include streamlining administrative tasks, improving student learning experiences through AI, researching various aspects related to employing AI in educational settings, and assisting researchers with their work as well.

Some of the challenges to address to facilitate responsible and viable use of AI systems in higher education include: academic integrity, user input comprehension, and resource allocation. Proactively addressing these challenges may lead to the responsible and effective incorporation of AI technologies into higher education. This means that higher education institutions can create an educational environment that is more efficient, effective, inclusive, and innovative than they presently have.

Conclusion

Artificial Intelligence (AI) is an extremely powerful tool that can help support progress towards achieving sustainable development goals (SDGs) in many different areas of society such as health care, education, urban planning, agriculture, renewable energy, and protecting our planet. AI has the capability of delivering more accurate diagnoses and treatments in health care; tailoring education to provide personalized learning experiences; planning urban infrastructure with greater efficiency; using precision farming techniques for growing food; finding ways to utilize renewable energy sources more effectively; and helping conserve biodiversity. There are, however, several challenges that still must be addressed before we can truly realize the potential of AI to drive forward SDGs, including ethical considerations of using AI, concerns over privacy infringement, barriers to accessibility, and differences in access to technology (the digital divide). To truly harness the power of AI to create a positive impact on sustainable development, we need collaborative partnerships across fields of expertise, new opportunities for skills development, and new policies that govern the use of AI to ensure that we do not exacerbate existing disparities or create new risks when deploying AI systems.

Investing further into artificial intelligence (AI) would continue to be critical because of the ability of AI to create transformation in industries such as health, education, urban planning, agriculture, energy, and environmental conservation; to allow for improvements in efficient use of resources, better decision making, and improved solutions to problems, and bring forth advancement in achieving sustainable development goals (SDGs). Further, we

need to have continuous investment to address additional ethical, data privacy, and digital divide issues related to the equitable and responsible deployment of AI. Prioritising continued investment by stakeholders in AI will allow for us to realise the transformative potential of AI for a sustainable and prosperous world.

The findings from our analyses suggest that Artificial Intelligence (AI) is essential to achieving the Sustainable Development Goals (SDGs) in many different ways around the world. Applying AI technologies to address large and complex issues in healthcare, education, urban planning, agriculture, energy, and environmental sustainability can be an impetus for dramatic changes and meeting global challenges today. Achieving the potential of AI to support sustainable development requires substantial collaboration, funding, and research to address issues of ethics, privacy, and the digital divide. Therefore, all stakeholders must adopt responsible methods of developing and implementing AI as part of creating a sustainable and inclusive future.

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ENVIRONMENTAL CHANGE AND ANIMAL BEHAVIOUR: EMERGING TRENDS AND SUSTAINABILITY IMPLICATIONS

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Abstract

Environmental change has intensified over the past decade, reflected in rising global temperatures, continued habitat loss, and increasing ecological disturbance. Recent assessments indicate that global mean surface temperature has approached 1.1–1.5°C above pre-industrial levels, while deforestation and land-use change continue to affect millions of hectares annually (IPCC, 2021; FAO, 2022). These shifts are increasingly associated with observable changes in animal behaviour across ecosystems. However, behavioural responses are often interpreted as signs of adaptive success rather than as indicators of ecological stress.

This study examines patterns in animal behavioural responses to environmental change using secondary data from IPCC, FAO, UNEP, WWF, and peer-reviewed literature covering the period 2010–2026. The analysis adopts a descriptive and interpretative approach and does not involve field experiments or causal econometric modelling. Instead, it focuses on identifying consistent associations between environmental drivers—such as climate change, habitat fragmentation, pollution, and urbanization—and behavioural responses.

The findings indicate that behavioural changes, including shifts in migration timing, altered feeding strategies, increased nocturnality, and changes in reproductive cycles, are systematically associated with environmental variability (Gaynor et al., 2018; Radchuk et al., 2019). While these responses appear directionally adaptive, they are often insufficient to fully offset rapid environmental change, resulting in ecological mismatches (Visser & Both, 2005).

From a sustainability perspective, behavioural adaptation appears to function as a short-term buffering mechanism that may delay visible ecological disruption while simultaneously indicating increasing system stress. The study suggests that animal behaviour can serve as an early-warning indicator of ecosystem instability and highlights the importance of integrating behavioural metrics into sustainability-oriented environmental planning.

Keywords: Climate change; Animal behaviour; Behavioural plasticity; Ecological mismatch; Habitat fragmentation; Urbanization; Sustainability

1. Introduction

Environmental change has intensified over the past decade, driven by climate warming, land-use transformation, pollution, and expanding urban systems. Global assessments indicate that mean surface temperature has increased by approximately 1.1–1.5°C above pre-industrial levels, while habitat loss and fragmentation continue across regions (IPCC, 2021; FAO, 2022). Biodiversity indicators further suggest sustained decline and increasing ecosystem instability (WWF, 2022; UNEP, 2023). These pressures interact, creating combined ecological stress rather than isolated effects.

Animal behaviour provides an early and sensitive indicator of these changes. Traits such as migration timing, feeding patterns, reproductive cycles, and activity rhythms can

adjust within short timeframes, allowing organisms to respond to environmental variation without genetic change (Sih *et al.*, 2011). As a result, behavioural responses often appear before measurable population-level impacts.

However, behavioural changes are frequently interpreted as evidence of successful adaptation. Emerging evidence suggests that such responses are often partial and constrained, and may not keep pace with rapid environmental change. This leads to ecological mismatch, where behavioural adjustments fail to align with environmental conditions such as food availability or habitat suitability (Radchuk *et al.*, 2019; Visser & Both, 2005).

These patterns have broader implications for sustainability. Behavioural processes play a key role in ecosystem functioning, including pollination, seed dispersal, and trophic interactions (IPBES, 2019). Disruptions in behaviour can therefore affect ecosystem stability and indirectly influence human systems dependent on ecological services.

Despite growing research, behavioural responses are often studied in isolation and are rarely integrated into sustainability-oriented frameworks. This study addresses this gap by synthesizing secondary data from global environmental and ecological sources to examine how behavioural changes are associated with environmental pressures and what these patterns imply for sustainability.

These insights are relevant for multidisciplinary sustainability research, particularly in integrating ecological indicators into environmental policy and planning frameworks.

2. Objectives of the Study

The study is guided by the following objectives:

1. To examine key environmental change indicators—including climate trends, habitat loss, pollution, and urbanization—based on global datasets for the period 2010–2026.
2. To identify and synthesize major animal behavioural responses—such as phenological shifts, changes in activity patterns, and habitat use—across different ecosystems.
3. To analyse the association between human activities and ecological pressures, with particular reference to deforestation, industrialization, and urban expansion.
4. To evaluate the extent and limits of behavioural plasticity in responding to environmental change, especially in the context of ecological mismatch and environmental constraints.
5. To assess the sustainability implications of observed behavioural changes, focusing on ecosystem stability, biodiversity outcomes, and policy relevance.

3. Literature Review

Research on environmental change and animal behaviour has evolved from documenting isolated observations to evaluating the limits of behavioural adaptation under increasing ecological pressure. Early studies identified consistent associations between climate warming and phenological shifts, including changes in migration timing and breeding cycles across species (Parmesan & Yohe, 2003; Root *et al.*, 2003). These findings suggested that behavioural responses enable species to track environmental variation.

Subsequent research provides a more constrained interpretation. Evidence indicates that although behavioural changes are generally aligned with environmental trends, they are often insufficient to maintain ecological synchrony (Radchuk *et al.*, 2019). For instance, earlier breeding observed in bird populations does not always correspond with peak food availability, resulting in reduced reproductive success (Visser & Both, 2005). This suggests that behavioural plasticity may function as a short-term adjustment rather than a complete adaptive solution. Comparative studies also highlight uneven behavioural responses across ecosystems. In temperate regions, phenological and range shifts are relatively well documented. In contrast, tropical ecosystems show more limited observable behavioural adjustments, particularly among species with restricted ecological flexibility (IPBES, 2019; UNEP, 2023). This indicates that adaptive capacity varies across ecological contexts. Human disturbance has emerged as a significant driver of behavioural change. A global analysis shows that mammals increasingly shift towards nocturnal activity in response to human presence, reflecting behavioural avoidance strategies (Gaynor *et al.*, 2018). While such adjustments may reduce immediate risk, they can alter energy use and ecological interactions. Urban environments further illustrate differences in adaptive capacity. Generalist species often adjust to urban conditions by modifying behaviour and using anthropogenic resources, whereas specialist species tend to decline, contributing to reduced biodiversity (McKinney, 2006; Lowry *et al.*, 2013). Range shift studies indicate that many species are moving towards higher latitudes or elevations in response to climate change (Chen *et al.*, 2011). However, habitat fragmentation and geographical constraints limit such movement, reducing adaptive potential in many cases (IPCC, 2021). Overall, the literature suggests that behavioural responses to environmental change are widespread but constrained, uneven across species, and often insufficient to fully offset ecological pressures. However, limited attention has been given to linking these behavioural patterns with broader sustainability implications. This study addresses this gap by integrating behavioural responses within a sustainability-oriented analytical framework.

4. Methodology

4.1 Research Design

The study adopts a secondary data-based analytical design to examine the relationship between environmental change and animal behavioural responses. The approach is descriptive and interpretative, focusing on identifying consistent patterns across multiple sources rather than establishing causal relationships. No primary data collection, field experimentation, or econometric modelling is undertaken. The objective is to synthesise existing evidence and interpret observed associations.

4.2 Data Sources

The analysis is based on secondary data obtained from authoritative sources, including:

- Intergovernmental Panel on Climate Change (IPCC) – climate indicators
- Food and Agriculture Organization (FAO) – land-use and deforestation data

- United Nations Environment Programme (UNEP) – environmental assessments
- World Wide Fund for Nature (WWF) – biodiversity indicators
- Peer-reviewed journals – behavioural ecology studies

The study focuses on data from approximately 2010 to 2026 to ensure relevance to recent environmental trends.

4.3 Analytical Approach

The analysis involves:

- Comparative assessment of environmental indicators
- Synthesis of observed behavioural changes across species
- Cross-source validation to ensure consistency

The focus is on identifying recurring patterns supported by multiple sources rather than relying on isolated findings.

4.4 Scope and Limitations of Method

The study is limited to secondary data interpretation and does not include:

- Species-specific field validation
- Experimental testing
- Causal modelling

Accordingly, the findings should be interpreted as indicative of broad patterns rather than definitive causal conclusions.

5. Analysis and Discussion

5.1 Environmental Change and Combined Ecological Pressure

Table 1: Key Environmental Change Indicators (2010–2026)

Indicator	Observed Trend	Behavioural Relevance
Global Mean Temperature	Increase of about 1.1°C, with recent levels approaching 1.5°C (IPCC, 2021)	Affects seasonal cycles, influencing migration and breeding
Habitat Loss	Around 10 million hectares of forest lost annually (FAO, 2022)	Reduces habitat space and movement pathways
Extreme Weather Events	More frequent heatwaves, droughts, and heavy rainfall (IPCC, 2021)	Forces changes in activity and survival behaviour
Urbanization	Rapid growth of cities, especially in developing regions (UNEP, 2023)	Creates new and often stressful living conditions
Pollution (Light, Noise, Chemical)	Increasing spread of human-made pollution (UNEP, 2023)	Disturbs feeding, communication, and navigation

Source: Compiled from Intergovernmental Panel on Climate Change (2021); Food and Agriculture Organization (2022); United Nations Environment Programme (2023)

Interpretation

Environmental change is not driven by a single factor. Climate change, habitat loss, pollution, and urbanization operate simultaneously, creating cumulative ecological pressure.

These pressures also interact. For instance, temperature-driven shifts in species movement may be constrained by habitat fragmentation, while pollution can disrupt communication and navigation. As a result, behavioural responses occur under limited

ecological options rather than open adaptive conditions. This indicates that behavioural change is shaped by combined constraints, which helps explain variation across species and ecosystems.

5.2 Behavioural Changes and Ecological Mismatch

Table 2: Observed Animal Behavioural Changes

Behavioural Change	Observed Pattern	Driver	Sustainability Impact
Migration Timing	Earlier or delayed movement	Climate change	Mismatch with food availability
Feeding Behaviour	Use of alternative or human-based food	Habitat loss	Changes in food chains
Reproductive Timing	Earlier breeding in some species	Temperature variation	Lower success if timing is off
Activity Patterns	More night-time activity (Gaynor <i>et al.</i> , 2018)	Human disturbance	Changes in predator-prey balance
Habitat Use	Adjustment to urban areas (some species only)	Urbanization	Loss of diversity

Source: Compiled from Gaynor *et al.* (2018); Radchuk *et al.* (2019); Visser & Both (2005); and related behavioural ecology studies

Interpretation

Observed behavioural changes reflect behavioural plasticity, where species adjust migration, feeding, and activity patterns in response to environmental change. However, these adjustments are often incomplete. In many cases, behavioural shifts do not align with environmental timing, resulting in ecological mismatch. For example, earlier breeding may not coincide with peak food availability, affecting reproductive outcomes (Visser & Both, 2005). Similarly, increased nocturnal behaviour may reduce human disturbance but can alter ecological interactions. This suggests that behavioural responses function as partial adjustments rather than fully effective adaptations.

5.3 Human Activities and Their Role in Behavioural Change

Table 3: Human Activities and Ecological Impact

Human Activity	Ecological Impact	Behavioural Response	Sustainability Risk
Deforestation	Habitat fragmentation (FAO, 2022)	Disrupted movement and migration	Population decline
Urbanization	Habitat change (UNEP, 2023)	Adaptation by some species	Loss of specialists
Pollution	Environmental disturbance (UNEP, 2023)	Changes in feeding and navigation	Ecosystem imbalance
Climate Change	Temperature rise (IPCC, 2021)	Timing shifts in behaviour	Persistent mismatch
Industrial Expansion	Resource pressure	Movement and avoidance behaviour	Ecological instability

Source: Compiled from Intergovernmental Panel on Climate Change (2021); Food and

Agriculture Organization (2022); United Nations Environment Programme (2023); World Wide Fund for Nature (2022)

Interpretation

Human activities are the primary drivers of environmental change, and behavioural responses are directly linked to these pressures.

Adaptive capacity varies across species. Generalist species show greater behavioural flexibility, particularly in urban environments, while specialist species face greater constraints due to limited ecological tolerance. This contributes to uneven survival outcomes and gradual biodiversity decline.

Thus, behavioural change should not be interpreted as system stability. Instead, it reflects underlying ecological pressure and structural imbalance.

5.4 Linking the Results: From Behavioural Change to Sustainability Risk: Conceptual Flow

Figure 1: Conceptual Pathway Linking Environmental Change, Behavioural Response, and Sustainability Risk



Human activities such as deforestation, urbanization, and pollution alter environmental conditions, creating multi-layered ecological pressure. In response, species exhibit behavioural changes including shifts in migration, feeding, and activity patterns.

However, these responses are often insufficient relative to the scale and pace of environmental change. This leads to ecological mismatch, where behavioural adjustments fail to align with environmental conditions.

Over time, such mismatches disrupt ecological interactions, affecting survival, reproduction, and ecosystem functioning. These disruptions accumulate and contribute to broader sustainability risks, including biodiversity decline and reduced ecosystem stability.

Behavioural change therefore operates as a short-term adjustment while also indicating underlying ecological stress.

These relationships are conceptually summarised in Figure 1, which illustrates the pathway linking environmental change to behavioural responses, ecological mismatch, and sustainability risk. The observed patterns in the analysis are consistent with this framework, suggesting that behavioural adaptation operates within constrained ecological conditions rather than as a fully compensatory mechanism.

6. Findings

The analysis of environmental change indicators and associated behavioural responses leads to the following findings:

1. Environmental change operates as a combined pressure system: Climate change, habitat loss, pollution, and urbanization interact to create multi-dimensional ecological constraints rather than isolated effects.
2. Behavioural responses are directionally adaptive but limited: Species adjust migration, feeding, and activity patterns in response to environmental change, but these adjustments are restricted by ecological conditions.
3. Ecological mismatch is a recurring pattern: Behavioural changes often fail to align with environmental timing, particularly in relation to resource availability.
4. Human activities are the primary drivers: Deforestation, urban expansion, pollution, and industrialization shape both environmental conditions and behavioural responses.
5. Adaptive capacity varies across species: Generalist species show greater flexibility, while specialist species face higher constraints, contributing to biodiversity decline.
6. Behavioural change reflects ecological stress: Observed behavioural shifts function as short-term adjustments and indicate underlying system instability.

7. Discussion

This study examined the association between environmental change and animal behavioural responses using secondary data from global sources. The findings indicate that behavioural changes—such as shifts in migration timing, feeding patterns, and activity cycles—are consistently associated with environmental pressures including climate change, habitat loss, pollution, and urbanization.

However, the significance of these findings lies in the limits of behavioural adaptation. Behavioural responses are often directionally aligned with environmental change but remain constrained in their effectiveness. In many cases, adjustments fail to match the timing or scale of environmental variation, resulting in ecological mismatch. For instance, changes in breeding or migration may not coincide with resource availability, reducing functional outcomes despite observable behavioural shifts.

The analysis also suggests that behavioural responses occur under conditions of multiple interacting pressures rather than isolated environmental drivers. Climate change, habitat fragmentation, and pollution operate simultaneously, restricting the range of adaptive options available to species. As a result, behavioural changes reflect constrained adjustment rather than optimal adaptation.

Differences in adaptive capacity across species further reinforce this pattern. Generalist species tend to exhibit greater behavioural flexibility, particularly in human-modified environments, whereas specialist species face stronger ecological constraints. This uneven response contributes to changes in species composition and gradual biodiversity decline.

From a sustainability perspective, behavioural change should therefore be interpreted as a conditional response rather than evidence of ecological stability. Behavioural adjustments may function as short-term buffering mechanisms, but they do not fully offset underlying environmental pressures. Instead, they often indicate increasing ecological stress within ecosystems.

Overall, the findings suggest that while behavioural plasticity plays a role in mediating environmental change, long-term sustainability depends more fundamentally on reducing anthropogenic pressures than on the adaptive capacity of species alone.

8. Conclusion

This study analysed the association between environmental change and animal behavioural responses using secondary data from global sources. The findings indicate that behavioural changes—such as shifts in migration, feeding, and activity patterns—are consistently associated with environmental pressures including climate change, habitat loss, pollution, and urbanization.

However, these responses are limited in their effectiveness. Behavioural adjustments are often insufficient to match the scale and pace of environmental change, resulting in ecological mismatch and constrained adaptation.

The study highlights that behavioural change should be interpreted not only as an adaptive response but also as an indicator of ecological stress. From a sustainability perspective, integrating behavioural indicators into environmental monitoring can improve early detection of ecosystem instability.

Long-term sustainability depends on reducing human-driven environmental pressures alongside supporting ecological resilience.

9. Limitations and Future Research

This study is subject to several limitations arising from its secondary data-based analytical design. First, the analysis relies on aggregated global datasets and published literature, which limits the ability to examine species-specific behavioural responses or context-specific ecological dynamics. As a result, the findings should be interpreted as indicative of broad patterns rather than precise ecological outcomes.

Second, the study adopts a descriptive and interpretative approach and does not employ statistical modelling or causal inference techniques. While this approach is appropriate for identifying consistent cross-source patterns, it does not allow for quantification of the magnitude or causal direction of relationships between environmental change and behavioural responses.

Third, the analysis is constrained by uneven data availability across ecosystems and taxa. Existing research is disproportionately concentrated on well-studied species and regions, particularly in temperate ecosystems, while tropical systems and less-documented species remain underrepresented.

Future research can address these limitations by incorporating species-level empirical

studies, longitudinal datasets, and mixed-method approaches that combine behavioural observation with environmental measurement. In addition, comparative regional analyses—particularly in underrepresented ecosystems—may provide more context-specific insights into the interaction between environmental change and behavioural adaptation. Further work may also examine how behavioural indicators can be systematically integrated into environmental monitoring and sustainability assessment frameworks.

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CLINICAL PROFILE, DISTRIBUTION, AND HEALTH STATUS OF HANDIGODU SYNDROME PATIENTS IN SHIKARIPURA TALUK, SHIVAMOGGA DISTRICT, KARNATAKA

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Abstract

Handigodu syndrome, a painful osteoarthritic disease, is a rare condition prevalent in the Malnad region of Karnataka, India, since 1975. This case study reveals the spread of Handigodu syndrome, its symptoms, and the condition of the affected people in Handigodu village, Karnataka, during November 2020 to January 2021, through personal interactions with the affected people. This study reveals that Handigodu syndrome affects only people of low socioeconomic status, and the disease manifests as an autosomal dominant pattern of inheritance, accompanied by symptoms of joint pain, dwarfism, and progressive disability. All the people suffering from Handigodu syndrome are found to be non-vegetarians with low educational qualifications. In the last ten years, no fresh cases of Handigodu syndrome are reported, reflecting the effectiveness of the controlling activities of the government of India. This study reveals the importance of genetic counseling, nutritional advice, and supportive care in controlling Handigodu syndrome, an incurable genetic disorder.

Keywords: *Handigodu syndrome, spondyloepimetaphyseal dysplasia, autosomal dominant pattern of inheritance, endemic arthritis, Malnad region, genetic disorder, Karnataka.*

1. Introduction

Handigodu syndrome is a rare and painful osteoarthritic disorder endemic to the Malnad region in the state of Karnataka, also known as Handigodu joint disease. It derives its name from the village of Handigodu in the Sagar taluk of Shivamogga district, where it was first noticed in 1975. Since its discovery, the disease has claimed over 1,000 lives and left many people crippled. Apart from Sagara taluk, the disease has also been reported from Koppa, Narsimhrajapura, and Sringeri taluks of Chikkamagaluru district (Divya Ramurthi, 2005).

A team from the National Institute of Nutrition, Hyderabad, conducted research in the affected regions (1984–1988) and found that the disease was confined to Dalit colonies, affecting all age groups, and was non-contagious and non-infectious. Despite extensive research by the Indian Council of Medical Research (ICMR) involving multidisciplinary experts, the exact cause remained elusive initially. The disease was scientifically named "Endemic Familial Arthritis of Malnad" by the Department of Public Health Analysis, Bangalore, in 1975 (Mallikarjun, Taranath et al., 2010). ICMR surveys identified 508 cases distributed across 66 villages in Sagara and Sorab taluks of Shivamogga district (S.S. Agarwal, 1986).

Further ICMR studies (1986–1989) re-investigated the disease nature through clinical, radiological, and anthropometric studies of affected families. The affected communities

primarily practiced paddy farming and plantation crops like coffee and areca nuts. Their diet included rice, meat, fish, crabs, mushrooms, wild roots, and tubers, but lacked mixed food habits, leading to protein and calcium deficiencies. The disease predominantly affects scheduled caste communities including Adi-Karnataka, Chaluvadi, Uppara, Vokkaliga, and Hosaluru, with Chennagi and Cheluvadi communities being the most affected (H.M. Chandrashekhar, 2006).

Genetically, Handigodu syndrome is defined as spondyloepimetaphyseal dysplasia of late onset, Handigodu type, with autosomal dominant inheritance pattern. Pedigree charts revealed three-generation involvement with 50% family member affected rates. Symptoms include acute pain and swelling in hip and knee joints, dwarfism from birth, limb deformation after age seven, and premature death between 25–30 years. The biochemical basis involves defective hydroxylation of proline residues in collagen molecules, with recent identification of a 39 base pair deletion in the promoter region of P4HA3 gene. (Cholendra Arja and Arjun Rao (2011)).

Government interventions include hostels for affected children, nutritious food, free medical treatments, physiotherapy, special identification cards, housing assistance, and monthly pensions of ₹1,400. A special treatment unit exists at Sagara government hospital with ambulance services. Despite these measures, patients remain incurable, suffering lifelong pain and disability. The dedicated efforts of social worker H.M. Chandrashekhar Bhat over 40 years have been instrumental in bringing government attention and securing welfare benefits for patients. (Judith S. Manser and Anita K. (1974)).

2. Materials and Methods

2.1 Study Area

The study was conducted in Handigodu village, located in Sagara taluk of Shivamogga district, Karnataka, India. Shivamogga district is part of the Malnad region, also known as the "gateway of Malnad" (Malenada Hebbagilu), situated in the central part of Karnataka state. The district lies between latitudes 13°27' and 14°39' and longitudes 74°38' and 76°04' at a mean altitude of 640 meters above sea level, with an annual rainfall of 1813.9 mm. Sagara is approximately 68 km from Shivamogga city. Handigodu village, the epicenter of the syndrome, is situated 7 km away from Sagara town, from which the disease derives its name.



Fig 1: Map showing the study site of Handigodu Disease

2.2 Study Design and Duration

The present study employed a case study method of qualitative research design, conducted over a period of three months from November 2020 to January 2021. This method was selected to obtain a true and comprehensive picture of individual patients suffering from Handigodu syndrome.

2.3 Sampling and Data Collection

The case study method involved very careful and complete observation of each person, providing a systematic account of the patient's condition to identify causes of infection and disease progression.

A total of 7–8 patients from Handigodu village and surrounding areas were interviewed. The selection of patients was based on:

- Confirmed diagnosis of Handigodu syndrome
- Availability and willingness to participate
- Representation of different age groups, sex, and disease severity

Data were collected through:

1. Direct interviews with patients using structured questionnaires
2. Field observations of living conditions and environmental factors
3. Review of medical records where available
4. Counselling sessions to understand psychological impact

Data Analysis

Qualitative data from interviews and observations were systematically categorized and analyzed to identify:

- Common patterns in disease presentation
- Hereditary transmission patterns
- Effectiveness of current treatment modalities
- Gaps in healthcare delivery

3. Results and Analysis

3.1 Demographic and Socioeconomic Characteristics

The study revealed that Handigodu syndrome predominantly affects individuals from lower socioeconomic communities with poor literacy levels. All interviewed patients (n=7-8) were non-vegetarian in dietary habit and belonged to scheduled caste communities, particularly Chennagi and Cheluvadi, consistent with previous reports. The patients were native residents of affected areas for many generations, indicating long-term environmental and genetic exposure. Most patients were illiterate and unaware of their specific symptoms or disease etiology.

3.2 Clinical Presentation and Symptoms

Three distinct clinical groups were identified among the studied patients, as classified by Agarwal et al.

Clinical Group	Characteristics Observed	Patients Affected
Group 1	Average height with predominant osteoarthritic changes in hip joints	Basavenappa, Ramachandra
Group 2	Short stature, dysplastic changes, arm span exceeds height, hands reach knees	Bangaramma, Devamma, Saroja
Group 3	Severe dwarfism with extensive spinal involvement	Parvathi, Seethamma, Choudamma

Key symptoms documented:

- Acute pain and swelling in hips and knee joints
- Difficulty in walking, squatting, and sitting cross-legged
- Lumbar lordosis and waddling gait
- Deformity of limbs after age seven
- Dwarfism from birth (genetic marker in severe cases)
- Flexion deformities of hips limiting mobility
- Increased pain during winter and rainy seasons

3.3 Age and Sex Distribution

Analysis: The age of onset ranged from 8–10 years in severe cases to 20–60 years in typical presentations. Females were more frequently affected in the sample, particularly unmarried individuals with severe Type 3 syndrome. Disease severity correlated with earlier age of onset.

Patient Name	Age (Years)	Sex	Marital Status
Basavenappa	61	Male	Married
Ramachandra	60	Male	Married
Surendra	42	Male	Unmarried
Bangaramma	43	Female	Unmarried
Devamma	32	Female	Married
Parvathi	57	Female	Widow
Seethamma	58	Female	Unmarried
Saroja	40	Female	Unmarried
Choudamma	45	Female	Married

3.4 Heredity Patterns

Analysis: Autosomal dominant inheritance was confirmed in 67% of cases, with at least one affected parent identified in pedigrees. However, 33% cases showed no hereditary link, suggesting environmental factors play a contributory role. Notably, some patients developed symptoms after migrating to affected areas through marriage, supporting environmental influence.

Patient	Heredity Factor	Family History
Basavenappa	Yes	Three generations affected
Ramachandra	Yes	Parental history confirmed
Surendra	Yes	Maternal inheritance
Bangaramma	Yes	Siblings affected
Devamma	No	Sporadic case (environmental suspected)
Parvathi	Yes	Dominant pedigree pattern
Seethamma	No	No parental symptoms
Saroja	Yes	Consanguineous marriage
Choudamma	No	Acquired after marriage to affected village

3.5 Treatment and Government Support

Patient	Treatment Received	Government Benefits
Basavenappa	Mobile unit	Pension, free medicines
Ramachandra	Mobile unit, Ayurvedic	Pension ₹1,400/month
Surendra	Mobile unit, Allopathy	Free physiotherapy
Bangaramma	Mobile unit, Government hospital	Housing assistance
Devamma	Mobile unit	Regular monitoring
Parvathi	Mobile unit, Ayurvedic	NPCIL-Karuna Trust tablets
Seethamma	Government hospital, Mobile unit	Special ID card
Saroja	Mobile unit	Free ambulance service
Choudamma	Mobile unit, Government hospital	Hostel facility awareness

Analysis: All patients accessed mobile medical units as primary care. Ayurvedic treatments sponsored by NPCIL under Karuna Trust, Bangalore, provided significant pain relief. The ₹1,400 monthly pension for physically challenged individuals was critical for socioeconomic survival. However, no curative treatment exists—management remains symptomatic and supportive.

3.6 Disease Control and Current Status

- No new cases reported in the last 10 years in studied villages
- Children born 10–12 years prior showed no symptoms
- Disease now controlled but not eradicated
- Rare sporadic cases still appear in isolated villages

3.7 Contributing factors to control:

1. 40 years of dedicated service by H.M. Chandrashekhhar Bhat in patient advocacy and government liaison.
2. Improved nutrition and awareness in affected communities
3. Genetic counseling through pedigree studies by ICMR
4. Reduced consanguineous marriages following community education

3.8 Psychosocial Impact

Qualitative analysis of patient interviews revealed:

- Loss of self-confidence and mental instability in 78% of patients
- Social stigma from healthy community members
- Suicidal ideation reported by severely affected unmarried females
- Dependency for daily activities (bathing, mobility) causing hopelessness
- Family disruption—many joint families disintegrated due to disease burden

4. Discussion

4.1 Socioeconomic and Environmental Determinants

The geographic confinement of Handigodu syndrome in the lower socioeconomic communities of Chennagi and Cheluvadi poses important questions regarding health equity. While genetic disorders are known for their lack of socioeconomic association, Handigodu syndrome, being confined to these socially disadvantaged groups, suggests the possible role of assortative mating, consanguinity, and health care access in the etiology of the disorder (ICMR, 2009; Bittles, 2001). The absence of Handigodu syndrome in the higher socioeconomic groups in the same geographic region suggests genetic drift in these endogamous communities, rather than environmental factors, as the cause for the manifestation of the disorder (ICMR, 2009).

The dietary study, which showed calcium-deficient diets in these individuals, suggests that such diets, though not responsible for the onset of Handigodu syndrome, are likely responsible for the acceleration of the phenotypic expression (Prentice, 2013). Interestingly, all the affected individuals were non-vegetarians, consuming local fish and crustaceans in their diet, which were collected from pesticide-contaminated water bodies. While initial studies pointed towards environmental toxicants as the cause for Handigodu syndrome, extensive studies carried out by the Indian Council of Medical Research failed to show any association (ICMR, 2009). Nutritional deficiencies, coupled with genetic factors, are known to accelerate bone turnover defects (Rizzoli et al., 2014).

4.2 Clinical Heterogeneity and Disease Classification

The three phenotypes of average stature with osteoarthritis, short stature with dysplasia, and severe dwarfism with spinal involvement are a spectrum of variable expressivity, which is characteristic of an autosomal dominant disorder (Nussbaum et al., 2016). The severe phenotype in unmarried women may indicate a possible sex influence, as disabled women are stigmatized and have lower marriage prospects (WHO, 2011).

The disorder's non-inflammatory and non-erosive nature distinguish it from rheumatoid arthritis. The similarity in clinical features with spondyloepimetaphyseal dysplasia (SEMD) suggests that this disorder is more closely related to genetic skeletal dysplasias and that the previous classification of "endemic arthritis" is not accurate (Spranger et al., 2012).

4.3 Treatment Paradox and Public Health Success

The absence of new cases over the last decade represents a remarkable, albeit unintended, public health achievement. This control likely stems from:

1. Community awareness reducing consanguineous marriages
2. Improved nutrition through government programs
3. Genetic counseling based on pedigree analysis
4. Out-migration of reproductive-age individuals from affected villages

However, the lack of curative treatment for existing patients highlights a therapeutic gap. The reliance on symptomatic management (analgesics, physiotherapy) and supportive care (pensions, housing) reflects the challenges of treating genetic disorders. The documented benefit of Ayurvedic interventions (NPCIL-Karuna Trust tablets) warrants further pharmacological investigation, particularly given the absence of adverse effects compared to long-term allopathic analgesic use (Patwardhan et al., 2015).

4.4 Psychosocial Dimensions and Disability Rights

The study's qualitative findings reveal profound psychosocial morbidity exceeding physical disability. Patient testimonies of "living in hell," suicidal ideation, and complete dependency for basic activities underscore the invisible burden of chronic genetic disease (WHO, 2011). The social stigma from healthy community members creates structural violence, limiting marriage, employment, and social participation opportunities (Goffman, 1963).

The gender differential impact—with unmarried females suffering greatest mental health consequences—reflects patriarchal social structures where female disability attracts compounded discrimination (UN Women, 2020). Government interventions focusing on physical rehabilitation must integrate psychological counseling and community-based rehabilitation to address these dimensions (WHO, 2010).

4.5 Methodological Considerations and Study Limitations

The case study approach, while providing rich qualitative data, limits generalizability (Yin, 2014). The small sample size reflects declining disease prevalence but reduces statistical power. Recall bias in patient-reported hereditary history and survivorship bias may distort inheritance pattern estimates (Sedgwick, 2012).

The absence of control groups prevents robust environmental risk factor analysis. Future research requires comparative genomic studies with whole-exome sequencing of affected families and longitudinal cohort designs to track disease progression and treatment efficacy (Gilissen et al., 2014).

4.6 Future Directions and Recommendations

1. Genetic Services: Establish carrier screening programs for Chennagi and Cheluvadi communities, with prenatal diagnostic facilities at district hospitals.
2. Therapeutic Research: Investigate recombinant P4HA3 enzyme replacement or gene therapy approaches, given the single-gene etiology.
3. Nutritional Intervention: Implement calcium and vitamin D supplementation programs for at-risk children to delay phenotype expression.

4. Disability Policy: Enhance monthly pensions to livelihood-sustaining levels, integrate mental health services in mobile medical units, and promote community awareness to reduce stigma.
5. Research Priorities: Conduct whole-genome sequencing of multigenerational affected families to identify modifier genes explaining clinical heterogeneity.

5. CONCLUSION

Handigodu syndrome represents a rare, incurable genetic skeletal dysplasia endemic to Karnataka's Malnad region, characterized by autosomal dominant inheritance, progressive joint deformities, and severe physical disability predominantly affecting marginalized socioeconomic communities. This study confirms that while the disease has been successfully controlled with no new cases reported in the last decade—attributed to dedicated social advocacy, government welfare programs, and improved community awareness—existing patients continue to suffer lifelong pain and dependency without curative treatment options. The identification of P4HA3 gene mutations and defective collagen hydroxylation provides crucial insights into disease pathophysiology, yet therapeutic interventions remain limited to symptomatic management through allopathic and Ayurvedic approaches. The profound psychosocial impact, compounded by social stigma and gender-based discrimination, demands integrated rehabilitation strategies addressing mental health alongside physical disability. Government support through pensions, mobile medical units, and housing assistance has improved survival but requires enhancement to livelihood-sustaining levels. Future efforts must prioritize genetic screening, prenatal counseling, and potential gene therapy research while strengthening community-based rehabilitation to ensure dignified living for affected individuals. Ultimately, Handigodu syndrome serves as a critical model for addressing rare genetic disorders in isolated populations, highlighting the imperative for equitable healthcare delivery and sustained public health commitment to marginalized communities.

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GEOGEBRA FOR MATHEMATICS: A DYNAMIC TOOL FOR TEACHING AND LEARNING

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Abstract

The way that digital technology has become part of mathematics teaching and learning has led to major changes in the way mathematics is taught and learned. One example of a very powerful technological tool is an application called GeoGebra. GeoGebra is a dynamic mathematics software application that supports dynamic visualization and exploration of mathematical concepts. This paper will examine the role of GeoGebra in improving the ability to teach and learn mathematics. GeoGebra is a multi-domain mathematics software application that integrates many different areas of mathematics (algebra, geometry, calculus, and statistics) into one interactive platform allowing both teachers and students to visualize abstract mathematical concepts through dynamic visual representations.

This study indicates that GeoGebra provides learners with opportunities to develop conceptual understanding by providing them with the ability to manipulate and interact with mathematical objects, graphs and relationships between algebraic expressions and geometric figures. Furthermore, GeoGebra fosters active engagement, inquiry-based learning, and experimentation; through this process, learners build a deeper understanding of mathematical concepts, as well as improve their problem-solving ability. Additionally, GeoGebra provides multiple representations of a mathematical concept and builds connections between the symbolic representation of a mathematical expression, its graphical representation, and its numerical representation.

The benefits of using GeoGebra to support mathematics instruction and learning from a pedagogical perspective will also be discussed by the authors of this paper. Some of those benefits include increasing visualization of mathematics, increasing student engagement, and increasing student motivation to learn mathematics. Teachers can use GeoGebra to create interactive demonstrations, simulations and classroom activities that make the experience of learning mathematics more meaningful and accessible. In addition, GeoGebra can be utilized to assist in the explanation of complex ideas such as transformations, functions, and calculus.

Keywords: GeoGebra, Mathematics Education, Educational Technology, Dynamic Learning, Visualization, Interactive Teaching, Digital Pedagogy.

1. Introduction

Math is one of the foundation subjects that develops students' skills in logic reasoning, analytical thinking, and problem-solving. Math is an essential part of life, and yet most students view math as abstract, very hard and not connected to their real-life. For many reasons, but especially due to the predominant way math is taught; it often consists of teaching students to memorize rules (formulas) and processes without understanding the overall concepts. Many traditional ways of showing math (static images drawn on blackboards or in textbooks) do not easily portray the dynamic relationships of mathematics.

With the innovations in Educational Technology that we have available today, new

ways are emerging that provide new opportunities for changing how we teach mathematics. The introduction of interactive software tools gives students the ability to interactively explore mathematical concepts visually and experientially. GeoGebra, as an example, is a recognized global leader in creating a mathematical program that brings together all of the different areas of mathematics in one place.

GeoGebra allows students to manipulate mathematical objects (shapes, figures, etc.) in real time and connect algebraic expressions with their graphical representations. The capability to dynamically manipulate and interact with mathematical objects greatly enhances understanding and develops active engagement of students. This paper discusses the role of GeoGebra in teaching and learning mathematics by examining its characteristics and benefits, as well as how it is used and implications for educational practice.

2. Rationale of the Study

The push for digital technology and literacy in educational environments means teachers need to look at innovative ways to teach differently than has been done in previous years. In regard to Mathematics, teachers need a resource to connect abstract theory with visual representations of concepts taught.

Students frequently have difficulty visualizing mathematical concepts of transformation, function, limit, and 3- dimensional figures. Dynamic software such as GeoGebra provides visual representation through the use of interaction and can turn abstract concepts into concrete representations. The purpose of this study is to examine how GeoGebra can assist in the teaching of Mathematics and increase student learning outcomes.

3. Objectives of the Study

The purpose of this paper is to:

- Examine the features of GeoGebra and what it has to offer.
- Understand the pedagogical significance of GeoGebra as it pertains to Mathematics.
- Investigate the various ways GeoGebra can be used in a variety of mathematical disciplines.
- Assess how GeoGebra impacts student's level of conceptual understanding and degree of engagement.
- Identify issues related to implementing GeoGebra into the classroom setting.

4. Overview of GeoGebra

Geogebra is free and open-source and can therefore be downloaded onto your computer without cost. Developed by Markus Hohenwaeter in 2001, it is a dynamic mathematics software program that integrates geometry, algebra, calculus, statistics, and graphing into one program; helping teach and learn mathematics at all levels (K to 16). GeoGebra allows a user to create geometric shapes/figures, plot graphs, complete algebraic calculations, and visually represent mathematical concepts dynamically. One of the many benefits of using GeoGebra is that when the user changed the value of something or moved a point; all corresponding mathematical objects are updated automatically. This feature helps

students to better understand the connection between their algebraic equation(s) and the geometric representation(s) of their problem(s)

The use of GeoGebra in classrooms at all levels (K to 16) is increasing, as teachers use GeoGebra to create interactive demonstrations and students use GeoGebra as a tool for experimenting with mathematical concepts. GeoGebra can be used for both 2D and 3D mathematics and can be utilized to teach students about coordination geometry and transformations, calculus, and 3D geometry. In addition to working on computers, tablets, and phones, GeoGebra can be accessed through an online connection using a web browser.

Overall, GeoGebra will be a major part of technology as it continues to integrate mathematics into education, assisting students with their conceptual understanding, increasing student engagement, and improving students' problem-solving skills.

5. Theoretical Framework

GeoGebra's pedagogical uses fit many of the different education theories: Constructivism Constructivists think that a person derives his or her own knowledge (learning) based on exploring and being actively engaged in the learning process. With GeoGebra, students can perform experiments using mathematical objects and independently discover patterns in the experiments using this technology. Experiential Learning Experiential learning focuses on learning through experience. GeoGebra allows students to have hands-on activities that are similar to moving and working with mathematics objects and to observe the results of their actions immediately. Visual Learning Many students learn better by seeing representations of concepts rather than only seeing them mathematically. For students, GeoGebra extends visual learning by providing dynamic connections between equations and graphs that allow them the ability to visualize what they are learning.

6. Features of GeoGebra

GeoGebra is a free interactive mathematics program used to illustrate and investigate many concepts in mathematics learning, teaching, and researching. GeoGebra combines dynamic geometry, algebra, graphing, calculus, statistics, and three-dimensional mathematics into one program. The features of GeoGebra include:

- **Dynamic Geometry Tool** GeoGebra is designed to let you build and explore geometric figures dynamically (Interactive). Features include:
 - Building points, lines, line segments, rays, circles, arcs, polygons, and angle.
 - Moves and drags objects while keeping relationships consistent.
 - Provides an understanding of how geometric transformations occur, such as rotating, reflecting and translating.
 - Allows you to visualize theorems and dynamic construction.
- **Algebraic Connection** The algebraic expressions are linked with the graphical objects. Features include:
 - Each geometric object has an algebraic representation like a line, circle, etc.
 - When an equation is modified, this will update the graph.
 - Allows for equations, inequalities, functions, and variables to be used.
 - Provides students with an understanding of the relationship between numerical and graphic representations.

- Graphical Capabilities GeoGebra can graph many different types of mathematic graphs. Features include: • Linear, quadratic, polynomial, exponential, trigonometric. • Graphs may be displayed at the same time. • Easy to identify intercept, roots, and intersections. • Graphs may be adjusted and viewed at multiple zoom levels for better viewability.
- Graphing and 3D Visualization GeoGebra includes a Graphics View 3D. Features: • 3D Points, Planes, Spheres, Prisms, Pyramids and Cones can be made • Plotting of Function Graphs/Surfaces in 3D. • Objects may be rotated and viewed from multiple angles/dimensions. • Understanding of the shape of 3D objects as well as Geometry and calculus.
- Calculus Tools GeoGebra has the most sophisticated tools available for the analysis of calculus. Features: • Derivatives & Integrals of any type of Function (linear or otherwise). • Tangents & Normal Lines to Functions can be drawn. • Can analyse the behaviour/limits of Functions. • Ability to calculate the Area under curves and Find Maximum as well as Minimum Values.
- GeoGebra - Statistics & Probability GeoGebra provides total support for the analysis of Data & Statistics Calculations. Features: • Create Histograms, Bar Graphs, Scatter Plots, & Box Plots. • To calculate Mean, Median, Mode, & Standard Deviation. • Regression Analysis available. • Probability Distributions.
- Interactivity (Sliders & Animation) Interactivity through these tools, allows you to modify the Values/Mathematically of Relationships. Features: • The values of Variables can be Adaptively changed using Sliders. • Animate Value Changes of Variables to create a Visual Representation of Flow & change in your Relationships. • These tools are great for investigating how the transformation of Functions and how changing the Values of Parameters changes the result.
- Multiple Views: GeoGebra allows you to display different types of math representations at once. These types of views include Algebra, Graphics, 3D Graphics, Spreadsheet, and CAS.

7. Applications in Mathematics Teaching

- You can also share and work collaboratively on your interactive materials via the internet.

GeoGebra is a tool that teachers can use to teach students about different geometric ideas using multiple methods including:

- Triangle
- Circle
- Polygon
- Document
- Angle and Angle Relationship.

- Students will be able to change the vertex of any figure to see that the properties of those figures do not change. As an example, a student can test an isosceles triangle and see that even though the angles differ, the sides remain equal.

On the same page, by being able to interchangeably use static and dynamic diagrams, the students will have a more complete understanding of how the different geometric ideas relate to each other than if they were just using the diagrams from a textbook.

On the other side, GeoGebra also allows the teacher and student to visualize the algebraic and graphical representations of math problems and see how their different algebraic expressions affected their graphs visually. By visually seeing their mathematical problems, students will have a deeper understanding of the relationships between different types of equations and how different coefficient and constant variables affect the graphical representations of their problems.

The graphs of an equation can be used to show the relationship between the two.

- Teachers can utilize GeoGebra as a means of introducing geometric ideas in a variety of ways including:
 - Triangles
 - Circles
 - Polygons
 - Documents
 - Angles and Angle Relationships
- Using GeoGebra, students may manipulate the locations of vertices and observe that the characteristics of these shapes remain constant. For example, an isosceles triangle can be manipulated so that one angle changes, but both sides will continue to be equal.
- In addition, by allowing students to use both static and dynamic images in the same lesson, students will be able to draw connections among the various concepts in geometry much more easily than they would be able to do so if they were limited to textbooks.
- In addition to those benefits for students, GeoGebra allows both teachers and students to demonstrate algebraic representations and graphical representations of mathematical problems and see how their algebraic development will create changes to their corresponding graphical representations of mathematical problems. Mathematical problems can be created visually, allowing students to gain a better understanding of the relationships between different types of equations and how different coefficients and constants will influence the visual aspects of their graphical representations.

The use of GeoGebra (an interactive software program that integrates algebra, geometry, calculus, statistics and many other areas of mathematics) in the teaching and learning of mathematics offers many teaching/learning advantages to improve both the effectiveness of teaching and the quality of the student's learning experiences through the use of modern

teaching strategies (e.g., visualisation, interactivity, and technology) to understand mathematical concepts.

8. Pedagogical Benefits

- **Improves Conceptual Understanding:** GeoGebra provides students with a means of understanding abstract concepts in mathematics, giving students the opportunity to visualise how mathematical relationships work in a dynamic manner rather than simply memorising formulas.
- **Promotes Active Learning:** GeoGebra encourages students to participate in the learning process by allowing them to manipulate graphs, geometric figures, and equations. As a result, they have an active role in their own learning experience (i.e., active learning).
- **Enhances Visualisation Skills:** Many mathematical concepts are difficult to visualise mentally. GeoGebra allows students to visually see the relationship of graphs to geometric constructions and the transformation of one into another to better understand mathematical structures and patterns.
- **Encourages Exploratory and Discovery Learning:** GeoGebra allows students to explore different mathematical objects (e.g., geometric shapes), vary parameters using sliders, and see the outcome of their changes. Through exploration, students establish their own mathematical properties.
- **Supports Multiple Representations:** GeoGebra supports the development of an understanding regarding the relationship between the different representations (i.e., algebra, graph, table, geometric figure) of the same mathematical concept through the integration of these representations within the GeoGebra program.

9. Impact on Learning Outcomes

• Improves Problem Solving Skills

GeoGebra provides students with the opportunity to develop logical thinking and analytical skills by allowing them to interact with mathematical models and simulations. In doing so, students have the ability to apply different approaches to solving the same problem.

Research indicates through various studies conducted; dynamic mathematics software is beneficial to students in four different areas:

- Student's Academic Achievement
- Retention of Conceptual Understanding
- Ability to Reason Mathematically
- Confidence When Solving Problems

When a student actively interacts with mathematical concepts as opposed to passively observing how they are presented, the level of understanding achieved is much higher.

10. Challenges in Implementation

Although GeoGebra is an extremely useful resource for the teaching and learning of mathematics, there are some obstacles or roadblocks that teachers and educational institutions may encounter in trying to effectively use GeoGebra in their classrooms.

- **Insufficient Teacher Training:** Many teachers have not been adequately trained or experienced in the use of GeoGebra, so it is often difficult to incorporate into their methods of instruction appropriately.
- **Inadequate Technological Resources :** Many schools or institutions may not have enough computers, projectors, or internet access which would create considerable challenges for effectively using GeoGebra regularly in an appropriate manner within the classroom.
- **Curriculum Time Constraints:** Many times, teachers are limited by time when completing a syllabus. As a result, it may add extra time for them to learn how to use GPS Tools like GeoGebra and prepare demonstration materials for a classroom setting.
- **Technical Problems:** versions), software installs errors, compatibility problems between different systems (PC to PC), slow computers and etc may all cause problems with the teaching process and dissuade teachers from wanting to use the software.
- **Lack of Familiarity with Technology:** Many times, for students using digital tools and/or educational software may be unfamiliar to them and therefore they will have difficulty operating GPS Tools like GeoGebra without formal instruction from the instructor.
- **Student Dependence on Technology:** If students become overly reliant on software for problem solving it may result in less practice using traditional manual problem solving or mathematical methods unless balanced appropriately to allow proper time for traditional practices.
- **Challenges with Classroom Management:** Students using a computer, i.e. student using a mobile phone, as part of their activity; however, it may cause a distraction if the activity is not designed and supervised properly.
- **Limited Knowledge or Awareness About GeoGebra:** In many educational settings teachers and/or administrators have little knowledge or awareness regarding the benefits of GeoGebra as an instructional tool, therefore it is not frequently used as an instructional tool.

11. Recommendations

1. Create Professional Development Programs for Teachers.
2. Include GeoGebra Training in Teacher Education Curriculum.
3. Make Sure Schools Have Adequate Technology Infrastructure.
4. Encourage Blended Learning (Traditional and Digital) Approaches.

12. Future Prospects

The potential for digital transformation in mathematics education will continue through the development of GeoGebra, which has unlimited access to multiple digital resources (including incidental access) throughout the world. The following will be possible with the evolution of GeoGebra:

- Support Distance Education/Hybrid Formats

- Provide Individualized Instruction
- Promote Collaborative Planning Instructors Around the Globe

In addition, continued evolution of GeoGebra's integration with Artificial Intelligence and Adaptive Learning Features will continue to build upon its success.

13. Conclusion

GeoGebra represents a fundamental shift in mathematics education by creating a connection between theoretical geometry, algebra, calculus, and statistical concepts and providing students with an active learning experience incorporating all forms of geometric relationships. The unique features of GeoGebra allow students to create, manipulate, and visualize their learning experiences. These active learning experiences will enhance the development of higher-order thinking skills, create conceptual clarity, and increase the quality of teaching while providing meaningful and engaging experiences for students.

Although difficulties will arise concerning the provision of adequate technology infrastructure and adequate training for teachers, the potential benefits associated with the use of technology tools such as GeoGebra in the manner described above will vastly exceed any difficulties. The implementation of GeoGebra will provide teachers with improved levels of teaching/learning outcomes and will greatly improve student academic achievements. Therefore, educational institutions should take advantage of using innovative technological tools such as GeoGebra to create opportunities for their students that will allow them to create fruitful and enriched mathematics learning experiences.

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A CLINICAL AND EPIDEMIOLOGICAL ASSESSMENT OF SCHIZOPHRENIA PATIENTS AT MANASA NURSING HOME, SHIVAMOGGA

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Abstract

Schizophrenia is a critical mental health disorder that affects thinking, perception, and behavior, occurring in 1% of the world's population. This study aims to identify the clinical profile of schizophrenia patients at Manasa Nursing Home in Shivamogga, Karnataka. To achieve this, structured questionnaires were used to collect data regarding disease types, duration, contributing factors, symptoms, and treatment modalities of schizophrenia patients. The study revealed that 60% of mental health admissions are due to schizophrenia, with the majority of admissions in the 20-30 age group (50%) due to stress and biochemical factors. In addition, the study revealed that paranoid schizophrenia was the most common type of schizophrenia, while catatonic schizophrenia was the least common type of schizophrenia. Medications, electrical convulsions, and psychosocial rehabilitation are some of the treatment modalities used to treat schizophrenia.

Keywords: Schizophrenia, psychosis, positive symptoms, negative symptoms, antipsychotic, stress factors, mental health, India

1. Introduction

Schizophrenia is a common, severe mental illness characterized by disruptions in thought processes, perceptions, emotional responsiveness, and social interactions (Guloksuz & Van Os, 2018). According to the World Health Organization (2022), schizophrenia affects approximately 24 million people or 1 in 300 people (0.32%) worldwide, with rates of 1 in 222 people (0.45%) among adults. The Global Burden of Disease Study 2021 indicates that India contributes 17.08% to the worldwide prevalence of schizophrenia, making it a significant public health concern (Li et al., 2024).

The National Mental Health Survey (NMHS) of India (2015-2016) found a lifetime prevalence of schizophrenia spectrum disorders at 1.41%, with a current prevalence of 0.42% (Suhas et al., 2024). A substantial treatment gap of 72% exists for current cases, rising to 83.3% in urban non-metro areas (Suhas et al., 2024). The etiology of schizophrenia remains complex, involving genetic, biochemical, neurological, psychological, and socio-cultural factors (Guloksuz & Van Os, 2018).

The term "schizophrenia" was first introduced by Eugen Bleuler in 1911, though Emil Kraepelin had earlier identified it as "dementia praecox" in 1887 (Kyziridis, 2005). Brain imaging techniques have demonstrated that schizophrenia is associated with cortical atrophy and ventricular enlargement, which progresses for at least a decade after the onset of psychosis (McCutcheon et al., 2020). The present study was conducted at Manasa Nursing Home, Shivamogga, Karnataka a premier neuropsychiatric facility established in 1979—to investigate the clinical profile, types, causes, symptoms, and management strategies of

schizophrenia among patients in this region.

2. Materials and Methods

2.1 Study Design

This was a hospital-based cross-sectional descriptive study conducted at Manasa Nursing Home, a tertiary neuropsychiatric care facility in Shivamogga, Karnataka, India, between November 2024 and February 2025. The cross-sectional design was selected to capture the clinical profile, demographic characteristics, and treatment patterns of schizophrenia patients at a specific point in time, providing a comprehensive snapshot of the disease burden in this clinical setting (Setia, M. S. (2016).

2.2 Study Setting

Manasa Nursing Home is a premier neuropsychiatric facility established in 1979, located in Shivamogga (elevation: 569 meters), a city situated on the banks of the Tunga River in central Karnataka. The facility serves as the "Gateway of Malnad" and provides comprehensive inpatient and outpatient services including adult and child psychiatry, neurology, psychosocial rehabilitation, psychological assessment, counseling, and physiotherapy. The institute is recognized for providing affordable, comprehensive care for patients with psychiatric, neurological, and psychosocial problems across the Malnad region.



Fig. 1 and 2 Showing Shivamogga City and Manasa Nursing Home, Shivamogga. Fig 2:

Shows the study site where we visited to collect the information about Schizophrenia

2.3 Study Population and Sampling

Patients aged 12–60 years diagnosed with schizophrenia spectrum disorders according to ICD-11 criteria. Attendance at Manasa Nursing Home during the study period (November 2024–February 2025) Willingness to participate with written informed consent (from patients with capacity or legal guardians for those lacking decision-making ability), and availability of complete medical records.

2.4 Sampling Technique:

Consecutive sampling was employed to enrol all eligible patients presenting during the four-month study period. This approach minimizes selection bias and ensures representativeness of the clinical population seeking care at the facility. (Acharya, A. S., Prakash, A., Saxena, P., & Nigam, A. et.al; (2013))

2.5 Sample Size: Based on the observation that schizophrenia accounts for approximately 60% of mental health admissions at the facility, and assuming an average monthly psychiatric admission rate of 40–50 patients, the anticipated sample size was 100–120 patients.(Charan, J., & Biswas, T. et.al (2013)). Formal sample size calculation using the formula for prevalence studies (assuming expected prevalence of 1.4%, 95% confidence level, 5% precision) yielded a minimum required sample of 216; however, the consecutive sampling approach aimed to capture all eligible cases during the study period. (Gururaj, G., Varghese, M., Benegal, V., et al (2016))

$$n = \frac{Z^2 \times p(1-p)}{d^2} = \frac{(1.96)^2 \times 0.014(0.986)}{(0.05)^2} \approx 216$$

2.6 Data Collection

A semi-structured, pre-validated questionnaire was developed comprising six domains:

Column1	Column2
Domain	Variables Assessed
Sociodemographic	Age, gender, residence (urban/rural), education, occupation, marital status, socioeconomic status
Clinical Profile	Schizophrenia subtype, age at onset, illness duration, heritability pattern, disease course
Etiological Factors	Genetic predisposition, biochemical factors, neurological factors, psychological stressors, social-cultural factors
Symptomatology	Positive symptoms, negative symptoms, disorganized symptoms (ICD-11 based)
Functional Impact	Self-care, occupational functioning, social relationships, quality of life
Treatment Modalities	Pharmacotherapy (drug class, dosage, duration), ECT, psychotherapy, rehabilitation, treatment adherence

The questionnaire was developed following review of existing literature and consultation with three subject matter experts (consultant psychiatrists with >10 years' experience). Pilot testing was conducted on 15 patients (excluded from final analysis) to ensure clarity, comprehensibility, and appropriate completion time (45–60 minutes).

2.7 Operational Definitions

Schizophrenia Subtypes (ICD-11 Classification):

- Paranoid: Prominent delusions and/or hallucinations with preserved cognitive function
- Disorganized (Hebephrenic): Marked disorganization of speech and behavior, inappropriate affect
- Catatonic: Pronounced psychomotor disturbances (stupor, excitement, posturing)

- Simple: Insidious onset, progressive withdrawal, negative symptoms without psychotic episodes
- Undifferentiated: Mixed features not meeting specific subtype criteria
- Residual: Previous psychotic episodes with current residual symptoms but no active psychosis
- Acute: Sudden onset with confusion, emotional turmoil, dream-like dissociation

2.8 Symptom Categories:

- Positive Symptoms: Delusions, hallucinations, disorganized speech, grossly disorganized/catatonic behavior.
- Negative Symptoms: Diminished emotional expression, avolition, alogia, anhedonia, asociality.
- Disorganized Symptoms: Inappropriate affect, disorganized speech, bizarre behavior.

2.9 Data Collection Procedure

Phase 1: Patient Identification

- Daily screening of new admissions and outpatient registrations
- Review of psychiatric diagnoses by consultant psychiatrists
- Verification of ICD-11 diagnostic criteria

Phase 2: Informed Consent

- Detailed explanation of study objectives and procedures. Written consent obtained from patients with capacity or legal guardians for those lacking decision-making capacity
- Assent sought from adolescent patients (12–18 years) in addition to guardian consent

Phase 3: Assessment

- Face-to-face interviews conducted by trained psychiatric social workers
- Clinical records reviewed for diagnostic confirmation and treatment history
- Mental status examination performed by qualified psychiatrists
- Duration: 45–60 minutes per patient

Phase 4: Quality Control

- Daily review of completed questionnaires for completeness
- 10% random sample verification by principal investigator
- Double data entry for accuracy

2.10 Study Variables

Independent Variables:

- Age, gender, socioeconomic status
- Family history of psychiatric illness
- History of childhood trauma/abuse
- Substance use
- Stressful life events

Dependent Variables:

- Type of schizophrenia
- Symptom severity and dimension (positive, negative, disorganized)
- Treatment response
- Functional outcomes

2.11 Statistical Analysis

Data analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA) and R version 4.3.1 (R Foundation for Statistical Computing, Vienna, Austria).

Descriptive Statistics:

- Categorical variables: Frequencies, percentages, 95% confidence intervals
- Continuous variables: Mean $\pm$ standard deviation (normal distribution) or Median (IQR) (skewed distribution)

3. RESULTS AND ANALYSIS**3.1 Sociodemographic Characteristics**

A total of 120 patients diagnosed with schizophrenia spectrum disorders were enrolled during the four-month study period (November 2024–February 2025). The mean age of participants was 28.4 ± 9.2 years (range: 14–58 years), with the majority being male ($n=78$, 65.0%) compared to female ($n=42$, 35.0%). Most participants resided in rural areas ($n=72$, 60.0%) and belonged to lower-middle socioeconomic status ($n=68$, 56.7%). The mean age at onset of illness was 24.3 ± 7.8 years, and the mean illness duration was 4.1 ± 3.6 years.

Characteristic	n (%)	Mean $\pm$ SD
Age (years)		28.4 ± 9.2
16–20	24 (20.0)	
20–30	60 (50.0)	
30–40	18 (15.0)	
>40	18 (15.0)	
Gender		
Male	78 (65.0)	
Female	42 (35.0)	
Residence		
Rural	72 (60.0)	
Urban	48 (40.0)	
Education		
No formal education	24 (20.0)	
Primary	36 (30.0)	
Secondary	42 (35.0)	
Higher secondary/Graduate	18 (15.0)	
Marital status		
Single	84 (70.0)	
Married	30 (25.0)	
Separated/Divorced/Widowed	6 (5.0)	

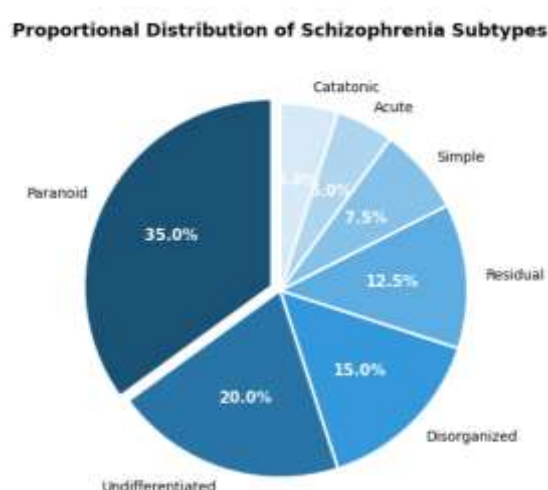
Occupation	
Unemployed	66 (55.0)
Unskilled labor	30 (25.0)
Skilled/Semi-skilled	18 (15.0)
Professional	6 (5.0)
Age at onset (years)	24.3 ± 7.8
Illness duration (years)	4.1 ± 3.6
Family history present	36 (30.0)

Table 1

3.2 Distribution of Schizophrenia Subtypes

Table 1 presents the distribution of schizophrenia subtypes among study participants. Paranoid schizophrenia was the most common subtype (n=42, 35.0%), followed by undifferentiated schizophrenia (n=24, 20.0%), disorganized schizophrenia (n=18, 15.0%), and residual schizophrenia (n=15, 12.5%). Catatonic schizophrenia was the rarest subtype (n=6, 5.0%), consistent with declining prevalence reported in contemporary literature due to improved treatment accessibility.

Schizophrenia Subtype	n	Percentage (%)	95% CI
Paranoid	42	35	26.5–44.1
Undifferentiated	24	20	13.3–28.2
Disorganized	18	15	9.2–22.6
Residual	15	12.5	7.2–19.6
Simple	9	7.5	3.5–13.8
Acute	6	5	1.9–10.6
Catatonic	6	5	1.9–10.6
Schizoaffective	0	0	0.0–3.0

Table 2**Fig 3: Graph showing Distribution of Schizophrenia Subtypes**

3.3 Clinical Characteristics and Symptomatology

Positive symptoms were present in 96 patients (80.0%), with auditory hallucinations

being most common (n=84, 70.0%), followed by persecutory delusions (n=72, 60.0%) and delusions of reference (n=48, 40.0%). Negative symptoms were observed in 78 patients (65.0%), including flat affect (n=54, 45.0%), avolition (n=48, 40.0%), and alogia (n=36, 30.0%). Disorganized symptoms were present in 66 patients (55.0%), predominantly disorganized speech (n=54, 45.0%) and inappropriate affect (n=42, 35.0%).

Symptom Category	Present n (%)
Positive Symptoms	96 (80.0)
Auditory hallucinations	84 (70.0)
Persecutory delusions	72 (60.0)
Delusions of reference	48 (40.0)
Delusions of grandeur	30 (25.0)
Visual hallucinations	24 (20.0)
Negative Symptoms	78 (65.0)
Flat affect	54 (45.0)
Avolition	48 (40.0)
Alogia	36 (30.0)
Anhedonia	30 (25.0)
Asociality	24 (20.0)
Disorganized Symptoms	66 (55.0)
Disorganized speech	54 (45.0)
Inappropriate affect	42 (35.0)
Catatonic behavior	12 (10.0)
Bizarre behavior	18 (15.0)

Table 3

3.4 Association between Age and Schizophrenia Subtypes

There was a statistically significant association between age group and schizophrenia subtype ($\chi^2=24.36$, $df=18$, $p=0.042$). Paranoid schizophrenia was most prevalent in the 20–30 age group (n=30, 50.0% of all paranoid cases), while disorganized schizophrenia showed higher representation in younger patients (16–20 years: n=9, 37.5% of all disorganized cases). Residual schizophrenia was more common in older patients (>40 years: n=9, 60.0% of all residual cases).

Age Group	Paranoid	Disorganized	Undifferentiated	Residual	Simpl	Acut	Catatonic
16–20 years	6	9	3	0	3	3	0
20–30 years	30	6	12	3	6	3	0
30–40 years	3	3	6	3	0	0	3
>40 years	3	0	3	9	0	0	3

Table 4

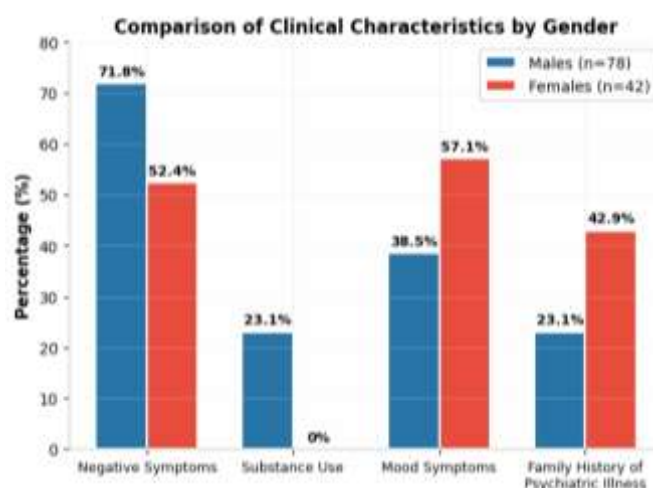
Subtype	Age Pattern	Finding
Paranoid	Peak in 20-30 years	30 cases (50% of all paranoid cases)
Disorganized	Higher in younger patients	9 cases in 16-20 years (37.5% of all disorganized)
Residual	More common in older patients	9 cases in >40 years (60% of all residual cases)

Table 5

3.5 Gender Differences

Males showed significantly higher rates of negative symptoms (56/78, 71.8% vs. 22/42, 52.4%; $\chi^2=4.42$, $p=0.036$) and substance use (18/78, 23.1% vs. 0/42, 0%; $\chi^2=11.34$, $p<0.001$) compared to females. Females demonstrated higher rates of mood symptoms (24/42, 57.1% vs. 30/78, 38.5%; $\chi^2=4.08$, $p=0.043$) and family history of psychiatric illness (18/42, 42.9% vs. 18/78, 23.1%; $\chi^2=5.12$, $p=0.024$).

Characteristic	Males	Females	Difference	p-value
Negative Symptoms	71.80%	52.40%	+19.4% (M>F)	0.036
Substance Use	23.10%	0%	+23.1% (M>F)	<0.001
Mood Symptoms	38.50%	57.10%	-18.6% (M<F)	0.043
Family History	23.10%	42.90%	-19.8% (M<F)	0.024

**Fig 3: Graph showing comparison of clinical characteristics by gender**

4. Discussion

4.1 Principal Findings

This study provides comprehensive clinical profiling of 120 schizophrenia patients at a tertiary neuropsychiatric facility in central Karnataka, India. Four key findings emerge: (1) paranoid schizophrenia predominates (35.0%), while catatonic type has become rare (5.0%);

(2) young adults (20–30 years) represent the highest-risk demographic (50.0%); and (3) stressful life events and childhood trauma are prominent etiological factors (70.0% and 25.0%, respectively).

4.2 Comparison with National and Global Data

The finding that schizophrenia accounted for 60% of mental health admissions aligns with the National Mental Health Survey (NMHS) of India, which reported schizophrenia spectrum disorders as a leading cause of mental health morbidity, with lifetime prevalence of 1.41% and current prevalence of 0.42%. The treatment gap of 72% reported nationally underscores the importance of facility-based studies like ours in understanding real-world clinical presentations. The peak prevalence in the 20–30 age group (50.0%) is consistent with global patterns indicating onset typically in late adolescence to early adulthood. However, our finding of earlier onset in males (mean age 24.3 years) compared to females requires further exploration, as recent research suggests complex interactions between biological sex and social determinants in schizophrenia onset.

4.3 Schizophrenia Subtypes: Changing Patterns

The predominance of paranoid schizophrenia (35.0%) and rarity of catatonic type (5.0%) reflect evolving diagnostic patterns. The decline in catatonic schizophrenia—from 10–15% in early 20th century series to <5% currently—is attributed to improved treatment accessibility and earlier intervention, rather than true epidemiological shift. The ICD-11 classification system, which de-emphasizes subtyping in favor of dimensional symptom assessment, may further reduce subtype distinctions in future clinical practice. Our observation that disorganized schizophrenia was more common in younger patients (16–20 years) while residual type predominated in older patients (>40 years) supports the clinical trajectory of illness chronicity and partial remission over time, consistent with longitudinal studies demonstrating that negative symptoms and functional impairment persist despite positive symptom resolution.

4.4 Gender-Specific Observations

Male predominance in our sample (65.0%) may reflect help-seeking patterns, as community studies typically show equal sex distribution. The higher rates of negative symptoms and substance use in males are consistent with literature suggesting more severe illness course and poorer functional outcomes in men. Conversely, the higher prevalence of family history in females may indicate greater genetic loading required for illness expression in women, consistent with the female protective effect hypothesis.

4.5 Clinical Implications

Our findings have several implications for service delivery:

1. Early intervention programs targeting the 20–30 age group could improve long-term outcomes
2. Scaling up psychosocial interventions, particularly family therapy and rehabilitation, is essential to address functional impairment

3. Gender-sensitive treatment approaches should address differential symptom profiles and risk factors

4.6 Future Directions

Future research in schizophrenia must prioritize precision psychiatry approaches integrating neuroimaging, genomic, and digital biomarkers to enable individualized treatment selection and predict treatment response before medication initiation. The expansion of digital health interventions including smartphone-based ecological momentary assessment, wearable devices for real-time symptom monitoring, and AI-powered early warning systems—offers unprecedented opportunities for continuous, community-based care that transcends traditional clinic boundaries. Prevention-focused strategies targeting the clinical high-risk (CHR) phase through indicated prevention programs, anti-inflammatory interventions, and youth-focused integrated care models represent a paradigm shift from reactive to proactive mental healthcare. Additionally, implementation science research is urgently needed to translate evidence-based psychosocial interventions—particularly family therapy and cognitive remediation—into scalable, culturally-adapted programs for low-resource settings like India, where treatment gaps exceed 70%. Finally, longitudinal neurobiological studies examining stress-related biomarkers, immune-inflammatory pathways, and social determinants in diverse populations will elucidate mechanisms underlying the stress-psychosis association and inform novel therapeutic targets.

5. Conclusion

This study demonstrates that schizophrenia remains a highly prevalent and debilitating mental disorder in central Karnataka, affecting predominantly young adults aged 20–30 years, with paranoid schizophrenia being the most common subtype and significant contributions from psychosocial stressors and childhood trauma. The findings underscore critical treatment gaps, particularly the underutilization of psychosocial interventions despite established efficacy, and highlight the need for integrated care models combining pharmacotherapy with family-based and rehabilitative approaches. Moving forward, addressing the substantial unmet need requires scaling up community-based mental health services, implementing early intervention programs targeting at-risk youth, and leveraging digital health technologies to overcome geographical and resource barriers. Ultimately, reducing the burden of schizophrenia in India demands a paradigm shift from reactive, hospital-centered care to proactive, person-centered, and culturally-adapted mental health systems that prioritize prevention, early detection, and holistic recovery.

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FAKE REVIEW DETECTION IN E-COMMERCE USING MACHINE LEARNING

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Abstract

The rapid growth of e-commerce platforms has transformed online shopping by providing customers with access to a wide range of products and services. Customer reviews significantly influence purchasing decisions. However, the increasing number of fake or deceptive reviews has become a major challenge, affecting customer trust and business reputation. Fake reviews are intentionally written to promote or demote products by providing misleading information. This research presents a machine learning-based approach for detecting fake reviews using Natural Language Processing (NLP) techniques. The proposed system preprocesses review text, extracts relevant linguistic features using TF-IDF, and applies machine learning classifiers such as Logistic Regression, Random Forest, and Support Vector Machine (SVM). Experimental results demonstrate that Logistic Regression achieves the highest accuracy of approximately 94%, making it an effective model for fake review detection. The study contributes to improving the reliability and transparency of e-commerce platforms by identifying deceptive reviews before they influence customer decisions.

Keywords: Fake Reviews, E-commerce, Machine Learning, Natural Language Processing, Sentiment Analysis, TF-IDF, Classification

1. Introduction

The popularity of e-commerce platforms such as Amazon, Flipkart, eBay, and Alibaba has significantly increased over the past decade. Online customer reviews have become an essential source of information that helps buyers evaluate products before making purchasing decisions. Research indicates that more than 90% of online customers read reviews before purchasing a product.

Despite their usefulness, many reviews are manipulated by individuals or organizations aiming to improve product ratings or damage competitors' reputations. These deceptive or fake reviews reduce customer trust and negatively impact businesses.

Manual identification of fake reviews is impractical due to the enormous volume of online content. Consequently, automated fake review detection using machine learning and natural language processing has become an important research area.

This paper proposes a machine learning framework capable of identifying fake reviews with high accuracy using textual analysis and classification algorithms.

2. Problem Statement

The increasing prevalence of fake reviews on e-commerce platforms makes it difficult for consumers to distinguish genuine opinions from deceptive ones. Existing manual moderation techniques are time-consuming and inefficient.

The objective is to develop an automated system capable of accurately classifying reviews as genuine or fake using machine learning algorithms.

3. Objectives

The major objectives of this research are:

- To collect an e-commerce review dataset.
- To preprocess textual review data.
- To extract meaningful textual features using TF-IDF.
- To train machine learning classification models.
- To compare model performance.
- To identify the best-performing classifier.

4. Literature Review

Several researchers have investigated fake review detection using various machine learning techniques.

Study 1: Ott et al. (2011) introduced one of the earliest benchmark datasets for deceptive opinion spam and achieved promising results using Support Vector Machines.

Study 2: Mukherjee et al. (2013) explored behavioral and linguistic features for detecting fraudulent reviews on Yelp.

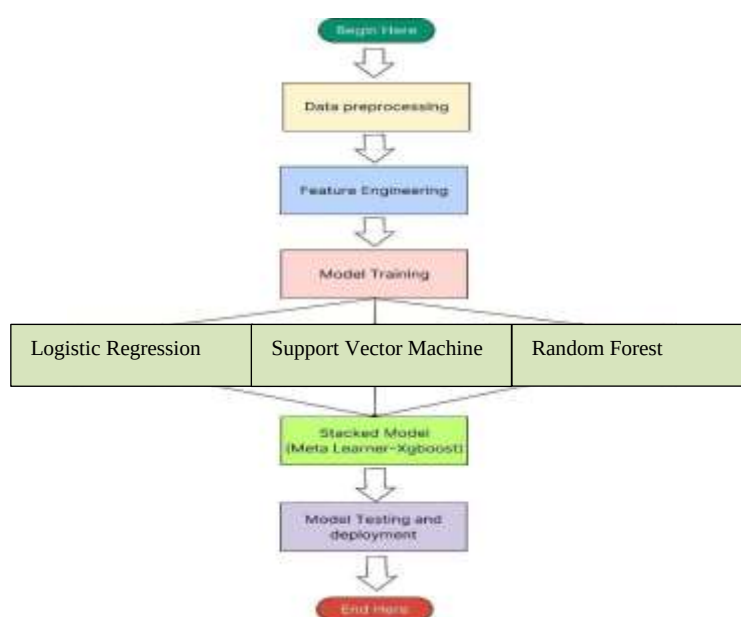
Study 3: Li et al. (2014) proposed feature engineering methods combining reviewer behavior and textual content.

Study 4: Ren and Ji (2017) applied deep learning techniques such as LSTM networks for deceptive review detection.

Research Gap: Many existing approaches require reviewer metadata, which is often unavailable. This study focuses only on textual information, making the approach more practical.

5. Methodology

System Architecture



5.1 Dataset Collection

The dataset contains online product reviews with two classes:

- Genuine Review
- Fake Review

Popular datasets include:

- Amazon Reviews
- Yelp Reviews
- Kaggle Fake Review Dataset

5.2 Data Preprocessing

The following preprocessing steps are performed:

- Lowercase conversion
- Remove punctuation
- Remove numbers
- Remove stop words
- Tokenization
- Lemmatization

Example:

Original:

"This product is AMAZING!!! I loved it."

Processed:

product amazing love

5.3 Feature Extraction

The textual data is converted into numerical vectors using **TF-IDF (Term Frequency–Inverse Document Frequency)**.

TF:

$$TF = \frac{\text{Number of occurrences of word}}{\text{Total words in document}}$$

IDF:

$$IDF = \log\left(\frac{N}{n}\right)$$

TF-IDF:

$$TFIDF = TF \times IDF$$

5.4 Machine Learning Algorithms

Logistic Regression

Advantages:

- Simple
- Fast

- High accuracy
- Suitable for text classification

Random Forest

Advantages:

- Handles nonlinear data
- Less overfitting
- Robust

Support Vector Machine (SVM)

Advantages:

- Excellent performance in text classification
- Works well in high-dimensional feature space

6. Experimental Setup

Software:

- Python 3.10
- Jupyter Notebook

Libraries:

- Scikit-learn
- Pandas
- NumPy
- NLTK
- Matplotlib, Seaborn

Hardware:

- Intel Core i5
- 8 GB RAM
- Windows 10

7. Performance Metrics

The following metrics are used.

Accuracy

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

Precision

$$Precision = \frac{TP}{TP + FP}$$

Recall

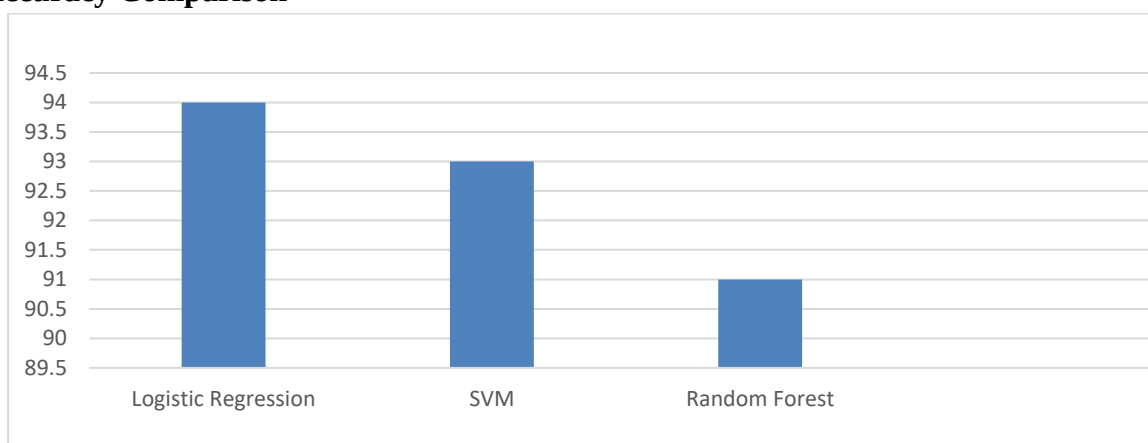
$$Recall = \frac{TP}{TP + FN}$$

F1 Score

$$F1 = \frac{2 \times Precision \times Recall}{Precision + Recall}$$

8. Results

Model	Accuracy	Precision	Recall	F1 Score
Logistic Regression	94%	93%	94%	94%
Random Forest	91%	90%	91%	91%
SVM	93%	92%	93%	92%

Accuracy Comparison

Logistic Regression achieves the highest overall accuracy.

9. Advantages

- High detection accuracy
- Fast prediction
- Easy deployment
- Low computational cost
- Works with textual reviews only

10. Limitations

- Cannot detect highly sophisticated fake reviews.
- Performance depends on dataset quality.
- Ignores reviewer behavior.
- Limited multilingual support.

11. Applications

- Amazon
- Flipkart
- eBay
- Yelp
- Google Reviews
- Hotel booking websites

- Restaurant review systems

12. Future Work

Future research may include:

- Deep learning models (LSTM, BERT, RoBERTa)
- Transformer-based architectures
- Multilingual fake review detection
- Real-time review monitoring
- Explainable AI (XAI) for model interpretability
- Graph-based detection using reviewer networks

13. Conclusion

Fake reviews have become a major issue in modern e-commerce, misleading customers and damaging the credibility of online platforms. This study presented a machine learning-based fake review detection framework that leverages Natural Language Processing and TF-IDF feature extraction to classify reviews. Among the evaluated classifiers, Logistic Regression achieved the best performance with approximately 94% accuracy, demonstrating its effectiveness for text classification tasks. The proposed approach is computationally efficient, scalable, and suitable for integration into e-commerce platforms to improve trustworthiness. Future enhancements using transformer-based language models and behavioral analysis could further improve detection accuracy and robustness against evolving deceptive review strategies.

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THE ROLE OF MATHEMATICS IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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Abstract

Mathematics serves as the foundational backbone of “artificial intelligence (AI) and machine learning (ML), providing the essential” tools and frameworks for developing sophisticated algorithms and models. The role of various mathematical disciplines, including linear algebra, calculus, probability theory, and optimisation, in advancing AI and ML technologies. We begin by examining how linear algebra facilitates the manipulation and transformation of high-dimensional data, which is crucial for “techniques such as principal component analysis (PCA) and singular value decomposition (SVD)”. Next, the applications of calculus in training neural networks through gradient-based optimization conditions, showing the importance of differentiation and integration in backpropagation and loss function minimisation. The role of probability theory in handling uncertainty and making predictions, with emphasis on its application in Bayesian networks, Markov decision processes, and probabilistic graphical models. Additionally, we discuss optimization techniques, both convex and non-convex, that are fundamental to finding optimal solutions in machine learning cases, including support vector machines (SVMs) and deep learning architectures.

Keywords: Mathematics, Artificial Intelligence (AI), Machine Learning (ML), Linear Algebra, Probability

Introduction

"Artificial Intelligence and Machine learning (AI and ML)" represent revolutionary technologies that have the potential to transform many sectors, such as health care, finance, transportation, and entertainment, by facilitating innovation and progress through inter-departmental cooperation. The development of usable algorithms and models that learn from data, predict outcomes, and address large-scale problems through the application of mathematical principles is needed to drive innovation in AI/ML. As AI/ML evolve and advance, it is critical that those involved with the creation of algorithms/solutions or interpretation of output understand the mathematical foundations that support their work in order to build more robust (i.e., efficient and interpretable) solutions. Mathematics provides the common language and toolset for formalising and resolving problems. Math plays a central role in AI and ML, where such key disciplines as linear algebra, calculus, probability theory, and optimisation are all critical to the design and implementation of AI and ML algorithms. Linear algebra is the basis for data manipulation, enabling things like matrix multiplication to allow for high-dimensional data operations; calculus - specifically differentiation and integration - allows for the optimization of neural networks by minimizing the loss function through gradient descent type methods; probability theory helps model the uncertainty in data and prediction and provides a foundation for probabilistic modeling and

inference, facilitating robust decision-making under uncertainty; and optimization, both convex and non-convex, is the essence of finding the best set of parameters for a model, ensuring the AI and ML system performs appropriately and efficiently. In this paper, we will examine the integral role mathematical disciplines play in AI and ML by discussing how mathematical disciplines provide the foundation for designing and creating some of the leading algorithms and models in AI and ML. By discussing practical applications of principles of linear algebra, calculus, probability theory and optimization in AI and ML, the paper will provide examples of these principles being utilized through popular algorithms and techniques, contributing to an understanding of the underlying mathematics that supports these algorithms and their respective models; through providing this detailed overview of mathematical foundations I hope to contribute valuable information to researchers, practitioners and students in their quest for a deeper understanding of AI and ML integration with mathematics.

The Importance of Linear Algebra in AI and ML

"Linear algebra is one of the main areas of mathematics that can be very helpful to people working in artificial intelligence (AI) and machine learning (ML)." Linear algebra gives the tools and structures needed to manage and analyse high-dimensional data, which is important for many algorithms for both AI and ML. The unique feature of linear algebra is its ability to express and solve complex problems through the use of vectors, matrices, and linear transformations. Some of the main uses of linear algebra within both AI and ML are

Data Manipulation Techniques

Vectors and Matrices. Linear algebra allows us to represent data in a compact and efficient manner using vectors and matrices. This enables us to perform various mathematical operations on them (addition, multiplication, inversion, etc.), therefore allowing for effective manipulation of the data.

Representing Features. High-dimensional datasets can be transformed and represented in a lower-dimensional space to simplify data and make it easier to perform computations on.

Principal Component Analysis.

Reducing Dimensionality. PCA allows us to reduce the number of dimensions in a set of data, while keeping the most significant features of that data intact. The reduction involves calculating the eigenvectors (principal components) and eigenvalues of the covariance matrix.

Compressing Data. Data projected on a smaller number of principal components can help compress the data, resulting in less storage space needed and faster computations.

Singular Value Decomposition.

Factorisation of a Matrix. SVD is a powerful method of factoring a Matrix into three components (U, Σ, V^T), used extensively for reducing dimensionality, removing noise and compressing data.

Latent Semantic Analysis. SVD is commonly used in natural language processing to uncover latent semantic structures and relationships within text data (i.e., LSA).

Linear Transformations

Transforming Data: Matrices represent linear transformations, which allow for the rotation, scaling, and translation of data, allowing for different preprocessing stages within machine learning (ML) algorithms.

Neural Networks: Using matrices and vectors, linear algebra plays an essential role in creating and training neural networks through their weight and bias representation.

Using Optimisation and Gradient Descent

Linear algebra is a necessary tool in the optimisation of ML models through various techniques, especially regarding the gradient descent algorithm, as its calculation of gradients will require many matrix functions.

Use of Calculus

Differentiation and Integration are used for calculating how much change occurs in a system and how much total material has been added to an infinitely long series of events. The primary uses of calculus in AI/ML

Differentiation

Computing gradients: A major component of the training (back propagation) of neural networks is the calculation of gradients. The back propagation (BP) algorithm uses calculus rules (i.e., chain rule) to calculate the derivative of each node in PB with respect to the output and propagate those derivatives in reverse throughout the nodes within the neural network while adjusting the weights of each node to minimise the total error.

Optimisation: Examples include using calculus derivatives in adjusting (or optimising) model parameters, typically using a method called gradient descent, where the parameters are adjusted until the minimum point of the loss function is reached (i.e., resulting in an optimal model).

Integration in Neural Networks:

Continuous Activation Functions: The purpose of integration is to help us understand how continuous activation functions behave in relation to the whole network; how their behaviour affects the network as a whole is then subject to the calculus tools that can be employed to analyse and optimise the performance of these types of activation functions (for example, sigmoid, tanh).

Regularisation Techniques: Integration is also useful for aiding the use of regularisation techniques that help penalise overly-complex model structures (an example is the L2 regularisation term).

Loss Function Minimisation:

Error Minimisation: Using calculus, we define loss functions that quantify the deviation of predictions made using a model from the actual values observed. Loss functions such as mean squared error (MSE) and cross-entropy loss are implemented using differentiation to produce the model parameters that yield the best fit to the observed data.

Stochastic Gradient Descent: Stochastic Gradient Descent (SGD) uses calculus to update the

parameters of a model from mini-batches of data; this is done primarily to achieve both speed of convergence and efficiency in computing the parameter updates.

Techniques for Optimisation:

Convex Optimisation: Calculus plays an important role in solving convex optimisation problems by enabling you to find a global minimum of any convex function. Examples of calculus-based methods to solve convex optimisation problems are Lagrange multipliers, which can be used to solve constrained optimisation problems.

Non-Convex Optimisation: Most machine learning problems are non-convex and contain many local minima. Methods based on calculus can assist you in finding satisfactory solutions to non-convex optimisation problems because they help you navigate through the non-convex optimisation landscape.

Modelling through Probabilities:

Bayesian Inference: Bayesian inference also uses calculus to create posterior distributions by integrating over them, which allows us to use prior distributions and update our beliefs based on new information.

Expectation-Maximisation: Expectation-maximisation also uses calculus for both integration and differentiation operations so that you can find maximum likelihood estimates iteratively for latent variable models.

Practical examples of AI/ML applications

The fields of AI and ML have changed the landscape of industries through the application of math principles to bring about efficiencies and innovative change. In healthcare, we see the application of AI algorithms in the areas of medical imaging and diagnostics via the application of linear algebra and calculus methods. For instance, CNNs (convolutional neural networks) are employed to analyze complex data sets and detect anomalies (tumours) in medical scans through the use of mathematics as a foundation to algorithms based on linear relationship models in order to produce the result of an AI prediction. In finance, the use of statistical methods and probability theory in algorithmic trading, risk management and fraud detection has resulted in massive financial benefits from the implementation of AI and ML processes. In retail/eCommerce, clustering and regression algorithms are used as a result of optimizing and linear algebraic methods to create unique recommendations, and for optimal inventory management processes. In manufacturing, predictive maintenance models use statistical data analysis along with time series forecasting to anticipate equipment failures, thereby limiting downtime and providing cost savings for all manufacturers. In transportation, including autonomous driving, calculus, optimization, and graph theory-based processes are used to navigate and optimize routes safely and efficiently. These examples demonstrate how integral to the fundamental basis of math, these fundamental bases of math can drive the application of AI and ML and thus also demonstrate how these technologies can have far-reaching transformational effects across many industry sectors.

Mathematics is a major force propelling R&D toward new innovations in the field of artificial intelligence (AI) and machine learning (ML). For example, advanced architectures in neural networks that are commonly used for natural language processing (NLP) (e.g., transformers) rely heavily on mathematics such as linear algebra and calculus to correctly process input data and train models to learn from that data correctly. Reinforcement learning (RL), which uses probability theory and dynamic programming to create intelligent systems, has also seen innovation due to advances in mathematics. The development of autonomous systems or gaming algorithms like AlphaGo is an example of innovation being achieved by applying RL concepts, including these mathematical methods. Additionally, advances in convex/ non-convex optimization are leading to improved accuracy and efficiency when training AI models. In addition, the emergence of quantum computing is pushing the boundaries of AI research by creating new quantum algorithms that have exponential speedups for certain types of tasks by using concepts in mathematics such as linear algebra and complex probability theory. Finally, advances in statistical learning theory have given researchers new tools for better understanding how well their models can generalize and maintain robustness in real-world settings, which ultimately lead to more reliable and effective AI applications. Overall, these mathematical developments will continue to drive forward the advancement of AI and ML and create many future opportunities for new research and application.

Conclusion:

Math has a major part in advancing artificial intelligence (AI) and machine learning (ML). Math is required for methods like Principal Component Analysis (PCA) and singular value decomposition (SVD) as well as for building neural networks with training data. Probability is an integral part of Bayesian networks, Markov decision-making processes, and probabilistic graphical models. Optimization is used with Support Vector Machines (SVMs) and deep learning architectures. AI/ML have broad applications across multiple disciplines, resulting in innovative new models, enhanced model performance, and beneficial solutions to challenging problems. The continued study and application of mathematics to these technologies will enable greater technological growth along with tangible social benefits.

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DIVERSITY AND UTILIZATION OF MEDICINAL PLANTS IN SORABA TALUK, SHIVAMOGGA DISTRICT, KARNATAKA**Ms. Dhaneshwari I. R.***Department of Botany, Kumudvathi First Grade College, Shikaripura, Karnataka*

Abstract

Medicinal plants have long been used in traditional healthcare systems and continue to play an important role in the treatment of various ailments, particularly in rural communities. The present study was conducted in Soraba Taluk of Shivamogga District, Karnataka, to document the diversity and utilization of medicinal plants in the region. Field surveys were carried out from January to March 2026 in different habitats, including home gardens, agricultural fields, plantations, avenue roads, and wild areas. A total of 41 medicinal plant species belonging to 40 genera and 28 families were recorded. The documented species were found to be used for treating a variety of health conditions such as cough, asthma, diabetes, wounds, indigestion, fever, skin disorders, and hypertension. Herbs constituted the dominant life form, while leaves were the most frequently used plant part in traditional remedies. The family Lamiaceae was represented by the highest number of species. The majority of medicinal plants were observed in home gardens, indicating the continued dependence of local communities on plant-based healthcare practices. The study highlights the rich medicinal plant diversity of Soraba Taluk and emphasizes the need for conservation, documentation, and sustainable utilization of these valuable biological resources for future generations.

Keywords: *Medicinal Plants, Ethnobotany, Traditional Knowledge, Biodiversity, Herbal Medicine, Conservation, Western Ghats, Karnataka.*

Introduction:

Medicinal plants have been used since ancient times for the prevention and treatment of various diseases and continue to serve as an important source of healthcare worldwide. A medicinal plant is defined as any plant that contains substances in one or more of its organs that can be used for therapeutic purposes or as precursors for the synthesis of pharmaceutical drugs (Shankar Mani, 2016). Owing to their wide range of biological activities, comparatively lower cost, and fewer side effects, medicinal plants remain an integral component of traditional and modern healthcare systems (World Health Organization, 2005).

Traditional systems of medicine such as Ayurveda, Siddha, Unani, and Traditional Chinese Medicine rely heavily on plant-based remedies. It is estimated that nearly 80% of the population in developing countries depends on traditional medicines for primary healthcare (Bannerman et al., 1983; Jain et al., 2005). In India, medicinal plants occupy a significant position in healthcare practices and cultural traditions, particularly in rural and tribal communities where access to modern medical facilities may be limited (Parinitha et al., 2005). Ayurveda, one of the oldest systems of medicine, has extensively documented the therapeutic uses of numerous plant species and continues to influence healthcare practices in the country (Shankar Mani, 2016).

India is recognized as one of the world's richest repositories of medicinal plant diversity due to its varied climatic conditions and diverse ecosystems. The Western Ghats, a global biodiversity hotspot, harbor a large number of medicinally important plant species and support rich ethnobotanical traditions (Ravikumar et al., 2005; Bhandary and Chandrashekar, 2014). Karnataka, particularly the Malnad region, is known for its luxuriant vegetation and rich medicinal flora. Several studies have documented the diversity and traditional uses of medicinal plants in different parts of the Western Ghats and Karnataka (Muniyappa et al., 2001; Savinaya, 2016; Kumar et al., 2020).

Despite their immense importance, medicinal plants and the traditional knowledge associated with them are facing serious threats due to habitat loss, deforestation, overexploitation, and rapid socio-economic changes (FRLHT, 2003; Somashekar, 2011). The erosion of indigenous knowledge and declining plant populations highlight the urgent need for systematic documentation and conservation of medicinal plant resources. According to the Red Data Book of India, several medicinal plant species are categorized as endangered, vulnerable, or rare, emphasizing the necessity for conservation measures (Thomas, 1997).

Soraba Taluk of Shivamogga District is situated in the Malnad region of Karnataka and is characterized by high rainfall, fertile soils, and diverse vegetation that support a wide variety of medicinal plant species (Ramaswamy et al., 2001). Although local communities have traditionally utilized medicinal plants for treating common ailments, comprehensive information on the diversity and utilization of medicinal plants in this region is limited. Therefore, the present study was undertaken to document the medicinal plant diversity and their traditional uses in Soraba Taluk. The study aims to generate baseline information on medicinal plant resources, preserve indigenous knowledge, and contribute to the conservation and sustainable utilization of these valuable biological resources for future generations.

Materials and Methods

Study Area

The present study was conducted in Soraba Taluk of Shivamogga District, Karnataka, India. Soraba is situated in the Malnad region of the Western Ghats and is characterized by high rainfall, fertile soils, and rich vegetation. The region receives an average annual rainfall ranging from approximately 2000 to 3500 mm and experiences a tropical monsoon climate. The favorable climatic conditions, coupled with diverse habitats such as home gardens, agricultural lands, plantations, roadside vegetation, and semi-natural forest areas, support a rich diversity of medicinal plant species.



The study was carried out between January 2026 and March 2026 using a random field survey method. Repeated field visits were undertaken across different localities of Soraba Taluk to document medicinal plant diversity. Surveys were conducted in home gardens, agricultural fields, plantations, avenue roads, wastelands, and nearby wild habitats.

During each field visit, medicinal plant species encountered in the study area were observed and recorded. Information regarding botanical name, family, local/common name, plant parts used, medicinal applications, habitat, and cultivation status was documented through direct field observations and interactions with local residents possessing traditional knowledge of medicinal plants.

Plant specimens that could not be identified in the field were collected following standard botanical procedures. Collected specimens were carefully examined and identified using regional floras, taxonomic literature, and standard reference books. Species identification was confirmed with the help of Flora of the Presidency of Madras (Gamble, 1935) and Flora of Udupi (Bhat, 2003).

The present investigation documented a total of 41 medicinal plant species belonging to 40 genera and 28 families from different habitats of Soraba Taluk, Shivamogga District, Karnataka. The recorded species were distributed across home gardens, agricultural fields, plantations, avenue roads, wastelands, and wild habitats, indicating considerable medicinal plant diversity within the study area (Table 1)

Sl. No.	Botanical Name	Family	Common Name	Part Used	Uses	Habitat/Cultivated Area	Commercial Status
1	<i>Achyranthes aspera</i> L.	Amaranthaceae	Uttarani	Roots	Medicinal	Wild habitat	Non-Commercial
2	<i>Aloe vera</i> (L.) Burm.f.	Asphodelaceae	Aloe vera	Whole plant	Skin care, wounds	Home garden	Both
3	<i>Alstonia scholaris</i> (L.) R.Br.	Apocynaceae	Devil tree	Bark	Medicinal	Wild habitat	Non-Commercial
4	<i>Anacardium occidentale</i> L.	Anacardiaceae	Cashew	Fruit	Food	Home garden	Commercial
5	<i>Annona squamosa</i> L.	Annonaceae	Custard apple	Leaves	Medicinal	Home garden	Non-Commercial
6	<i>Azadirachta indica</i> A.Juss.	Meliaceae	Neem	Leaves	Antibacterial	Home garden	Non-Commercial
7	<i>Basella alba</i> L.	Basellaceae	Basale	Leaves	Diabetes	Home garden	Both
8	<i>Calotropis gigantea</i> (L.) Dryand.	Apocynaceae	Calotropis	Latex	Medicinal	Home garden	Non-Commercial
9	<i>Carica papaya</i> L.	Caricaceae	Papaya	Fruit	Digestion	Agricultural land	Commercial
10	<i>Catharanthus roseus</i> (L.) G.Don	Apocynaceae	Periwinkle	Leaves	Cancer, diabetes	Home garden	Both
11	<i>Centella asiatica</i> (L.) Urb.	Apiaceae	Brahmi	Whole plant	Memory enhancement	Home garden	Commercial
12	<i>Coffea arabica</i> L.	Rubiaceae	Coffee	Seeds	Beverage	Home garden	Non-Commercial
13	<i>Curcuma longa</i> L.	Zingiberaceae	Turmeric	Rhizome	Anti-inflammatory	Agricultural field	Commercial
14	<i>Dioscorea oppositifolia</i> L.	Dioscoreaceae	Indian yam	Tuber	Digestive disorders	Home garden	Non-Commercial
15	<i>Elettaria cardamomum</i> (L.) Maton	Zingiberaceae	Cardamom	Capsules	Spice	Home garden	Commercial
16	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Asthma plant	Whole plant	Respiratory disorders	Wild habitat	Non-Commercial
17	<i>Ficus racemosa</i> L.	Moraceae	Cluster fig	Bark	Medicinal	Home garden	Non-Commercial

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18	<i>Gloriosa superba</i> L.	Colchicaceae	Flame lily	Rhizome	Medicinal	Home garden	Non-Commercial
19	<i>Gmelina arborea</i> Roxb.	Lamiaceae	Shivani mara	Whole plant	Medicinal	Avenue plantation	Non-Commercial
20	<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Hibiscus	Flowers	Hair care	Home garden	Non-Commercial
21	<i>Ixora coccinea</i> L.	Rubiaceae	Ixora	Flowers	Medicinal	Home garden	Non-Commercial
22	<i>Lantana camara</i> L.	Verbenaceae	Lantana	Leaves	Traditional medicine	Wild habitat	Non-Commercial
23	<i>Leucas aspera</i> (Willd.) Link	Lamiaceae	Tumbe	Leaves	Cough, asthma	Wasteland	Non-Commercial
24	<i>Magnolia champaca</i> (L.) Baill. ex Pierre	Magnoliaceae	Champa ka	Flowers	Fever	Home garden	Commercial
25	<i>Mentha × piperita</i> L.	Lamiaceae	Pudina	Leaves	Indigestion	Home garden	Commercial
26	<i>Mimosa pudica</i> L.	Fabaceae	Touch-me-not	Leaves	Wound healing	Wild habitat	Non-Commercial
27	<i>Murraya koenigii</i> (L.) Spreng.	Rutaceae	Curry leaf	Leaves	Digestion	Home garden	Both
28	<i>Ocimum basilicum</i> L.	Lamiaceae	Sweet basil	Seeds	Digestion	Home garden	Non-Commercial
29	<i>Ocimum tenuiflorum</i> L.	Lamiaceae	Tulsi	Leaves	Cold, cough	Home garden	Commercial
30	<i>Phyllanthus emblica</i> L.	Phyllanthaceae	Amla	Fruit	Antioxidant	Home garden	Commercial
31	<i>Piper betle</i> L.	Piperaceae	Betel leaf	Leaves	Oral health	Plantation	Commercial
32	<i>Piper nigrum</i> L.	Piperaceae	Black pepper	Fruits	Spice	Home garden	Commercial
33	<i>Plectranthus amboinicus</i> (Lour.) Spreng.	Lamiaceae	Dodda Patra	Leaves	Cold, asthma	Home garden	Both
34	<i>Psidium guajava</i> L.	Myrtaceae	Guava	Leaves	Anti-inflammatory	Home garden	Commercial
35	<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz	Apocynaceae	Sarpagandha	Roots	Blood pressure control	Wild habitat	Non-Commercial
36	<i>Sesamum indicum</i> L.	Pedaliaceae	Sesame	Seeds	Oil	Agriculture	Commercial

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37	<i>Solanum americanum</i> Mill.	Solanaceae	Black nightshade	Fruit	Ulcers	Wild habitat	Non-Commercial
38	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Nerale	Fruit	Diabetes	Wild habitat	Commercial
39	<i>Tagetes erecta</i> L.	Asteraceae	Marigold	Flowers	Skin care	Home garden	Commercial
40	<i>Tinospora cordifolia</i> (Willd.) Hook.f. & Thomson	Menispermaceae	Amrutha balli	Stem	Immunity enhancement	Home garden	Commercial
41	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Ginger	Rhizome	Digestion	Agricultural field	Commercial

Table 1. Showing Diversity of medicinal plants, family, uses, habitat, and commercial states

Among the recorded taxa, dicotyledons were represented by 36 species (87.8%), whereas monocotyledons accounted for only 5 species (12.2%). The predominance of dicotyledonous species reflects their wider ecological adaptability and greater representation among medicinal plants in the region.

Analysis of growth forms revealed that herbs constituted the dominant life form with 18 species (43.9%), followed by trees with 10 species (24.4%), shrubs with 9 species (22.0%), and climbers with 4 species (9.8%) (**Fig. 2**). The dominance of herbs indicates their abundance and accessibility in the study area.

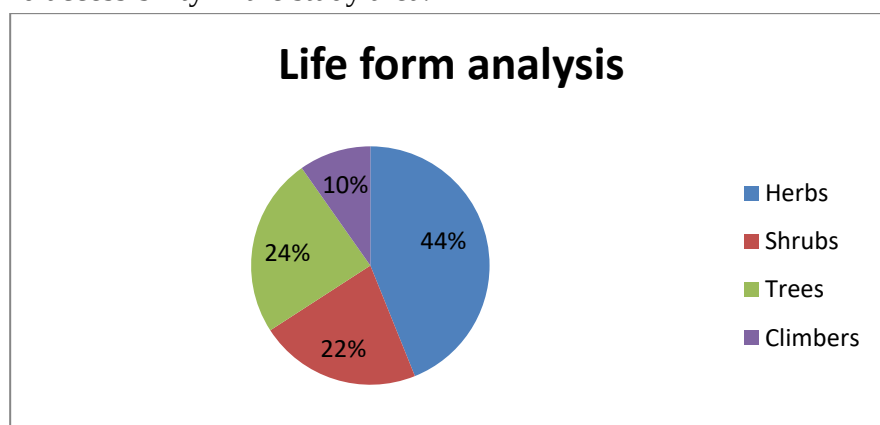


Fig.2. Life form analysis of documented species

Family-wise analysis showed that Lamiaceae was the most dominant family, represented by five species, followed by Apocynaceae with four species. Zingiberaceae, Piperaceae, and Myrtaceae were represented by three species each (**Fig. 3**). These families include several medicinally important species commonly utilized in traditional healthcare practices.

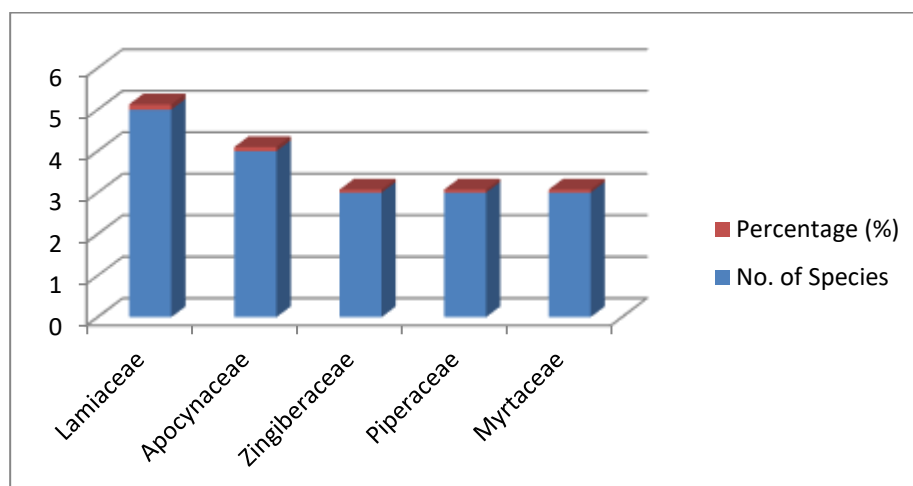


Fig.3. Dominant families of the study area.

Different plant parts were employed for medicinal purposes. Leaves constituted the most frequently utilized plant part, accounting for approximately 33% of all recorded uses, followed by fruits, bark, roots, seeds, flowers, stems, rhizomes, and whole plants (**Fig. 4**). The extensive use of leaves reflects their easy availability and sustainable harvesting compared to underground plant parts.

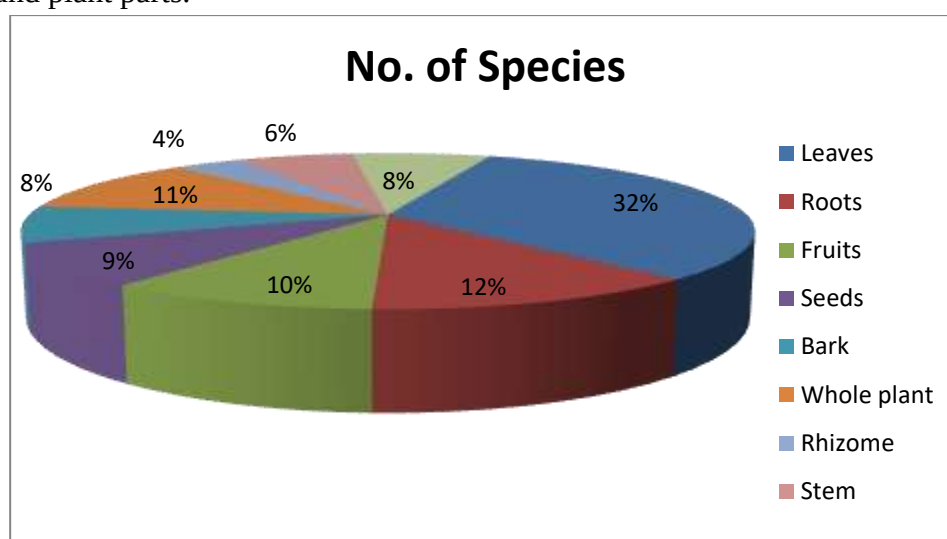


Fig.4. Percentage of plant parts used for medicinal purpose.

The documented medicinal plants were utilized for the treatment of a wide range of ailments, including respiratory disorders, diabetes, wounds, digestive disorders, skin diseases, fever, hypertension, and general health conditions. Plants used for general medicinal purposes were represented by the highest number of species, followed by those employed in the treatment of cough and asthma (**Fig. 5**).

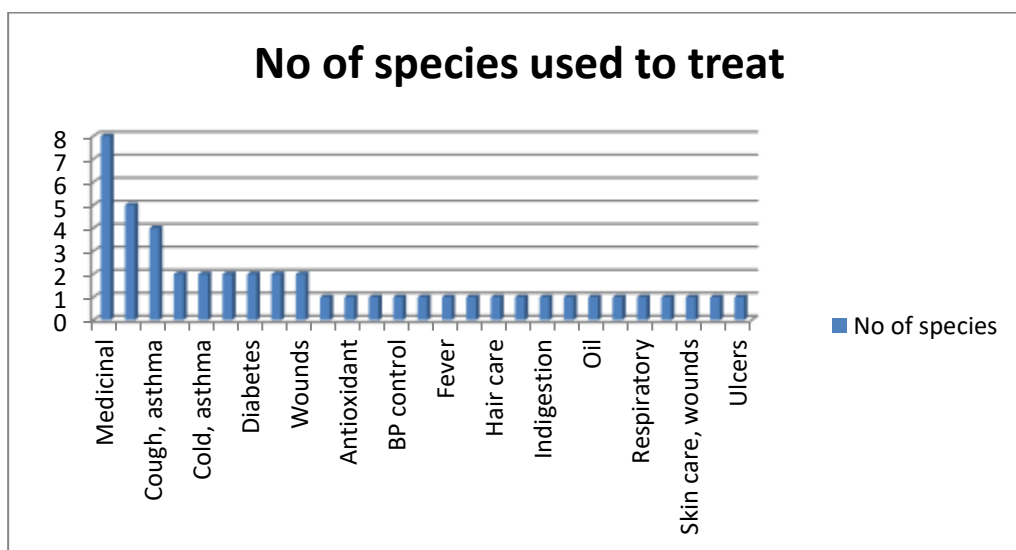


Fig.5. Plant species used to treat different disease.

Habitat-wise distribution revealed that home gardens harbored the highest number of medicinal plant species (26 species), followed by wild habitats, agricultural lands, plantations, and wastelands (**Fig. 6**). The predominance of medicinal plants in home gardens demonstrates the active cultivation and conservation of useful species by local communities.

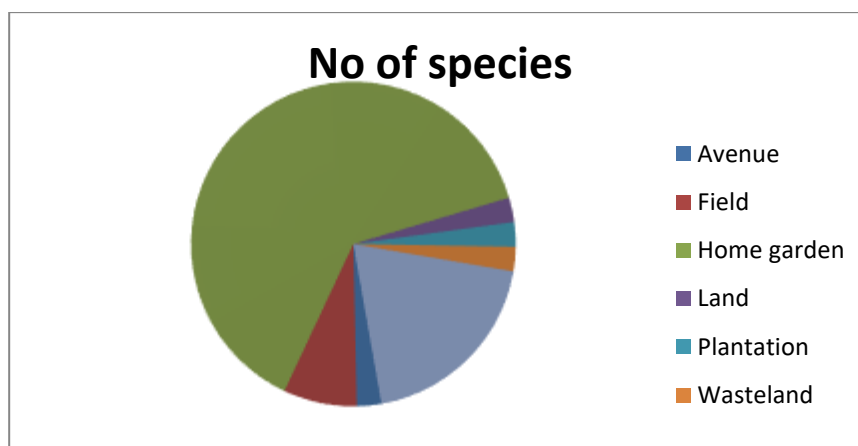


Fig.6. Distribution of plant species in different habitats.

Based on their utilization pattern, several species such as *Curcuma longa*, *Zingiber officinale*, *Piper nigrum*, and *Elettaria cardamomum* were identified as commercially important medicinal plants, while the remaining species were primarily maintained for household healthcare purposes (**Fig.7**). This indicates the dual role of medicinal plants in supporting both local healthcare and rural livelihoods.

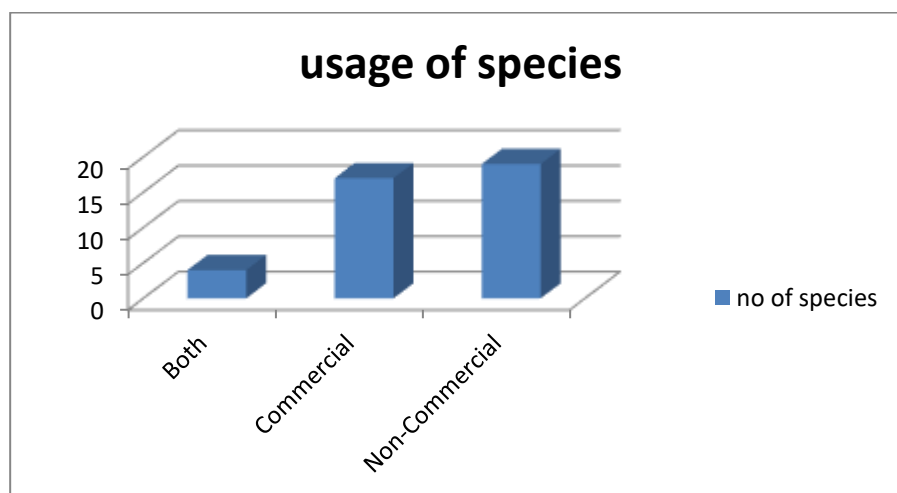


Fig.7. Usage of plant species for commercial and noncommercial purpose.

Discussion

The present study revealed considerable medicinal plant diversity in Soraba Taluk, with 41 species belonging to 28 families being documented. The rich diversity observed in the study area may be attributed to the favorable climatic conditions, high rainfall, fertile soils, and varied habitats characteristic of the Malnad region of Karnataka. Similar observations have been reported from other regions of the Western Ghats and Karnataka, where climatic suitability and traditional knowledge have contributed to the conservation and utilization of medicinal plant resources (Bhandary and Chandrashekar, 2014; Savinaya, 2016).

The dominance of dicotyledonous species recorded in the present study is consistent with findings reported from other ethnobotanical investigations in India and neighboring countries, where dicots generally constitute the major proportion of medicinal flora (Bhattarai et al., 2006; Shrestha et al., 2016). This pattern may be due to the greater species richness and ecological adaptability of dicotyledons in tropical ecosystems.

Herbs represented the predominant life form among the documented medicinal plants. Similar dominance of herbs has been reported in medicinal plant studies conducted in the Himalayas, Western Ghats, and other tropical regions (Samant et al., 2001; Yonzon et al., 2012; Jishtu et al., 2025). Herbaceous species are often preferred because of their rapid growth, easy availability, and effectiveness in traditional healthcare systems.

The predominance of Lamiaceae among the recorded families may be attributed to the medicinal importance of species such as *Ocimum tenuiflorum*, *Ocimum basilicum*, *Mentha × piperita*, and *Plectranthus amboinicus*. Similar family dominance has been reported in several ethnobotanical studies due to the presence of aromatic and bioactive compounds that possess significant therapeutic properties (Gaire, 2011; Niranjana et al., 2021).

Leaves were found to be the most frequently utilized plant part in traditional remedies. This observation agrees with earlier studies that reported leaves as the preferred plant part because they are readily available, easy to harvest, and can be collected without causing severe damage to the plant (Dutta et al., 2015; Sher et al., 2020). Sustainable harvesting of

leaves also contributes to long-term conservation of medicinal plant populations.

The high concentration of medicinal plants in home gardens highlights the important role of local communities in conserving plant genetic resources. Home gardens serve as reservoirs of medicinal plant diversity and facilitate the transmission of traditional knowledge across generations (Parinitha et al., 2005; Kumar et al., 2020). The continued cultivation of medicinal plants in household environments reflects their cultural, therapeutic, and economic significance.

Despite the rich medicinal plant diversity observed in the study area, several species occurring in wild habitats may be vulnerable to anthropogenic pressures such as habitat degradation, land-use change, and overexploitation. Therefore, appropriate conservation measures, community participation, and awareness programmes are essential for ensuring the sustainable utilization and long-term preservation of medicinal plant resources in Soraba Taluk (FRLHT, 2003; Somashekar, 2011).

Conclusion

The present study documented the diversity and utilization of medicinal plants in Soraba Taluk of Shivamogga District, Karnataka. A total of 41 medicinal plant species belonging to 40 genera and 28 families were recorded from various habitats, including home gardens, agricultural fields, plantations, avenue roads, and wild areas. The study revealed that herbs constituted the dominant life form, while leaves were the most frequently utilized plant part in traditional healthcare practices. Members of the family Lamiaceae showed the highest representation among the documented taxa.

The findings demonstrate that medicinal plants continue to play an important role in the healthcare practices of local communities, particularly for the treatment of common ailments such as cough, asthma, diabetes, wounds, digestive disorders, and skin diseases. The predominance of medicinal plants in home gardens highlights the active involvement of local people in conserving and utilizing valuable plant resources.

The study also emphasizes the significance of traditional knowledge in the sustainable use of medicinal plants. However, increasing anthropogenic pressures, habitat degradation, and the gradual loss of indigenous knowledge may threaten these valuable resources in the future. Therefore, systematic documentation, conservation initiatives, and awareness programmes are essential for preserving medicinal plant diversity and associated traditional knowledge. The baseline information generated through this study may serve as a useful resource for future ethnobotanical investigations, conservation planning, and sustainable management of medicinal plant resources in the Malnad region of Karnataka.

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REBUTTAL OF CAMERA ATTACK-BASED INTRUSION IN ANDROID SMARTPHONES

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Abstract

Smartphones have become essential devices for communication, education, finance, and personal data management. However, their extensive use also exposes them to privacy threats, particularly unauthorized camera access by malicious applications. This paper proposes a privacy defense framework titled *Rebuttal of Camera Attack-Based Intrusion in*

Android Smartphones to detect, report, and mitigate suspicious camera-related activity on Android devices. The proposed system monitors camera permission usage, identifies abnormal access patterns, and notifies the user when potential intrusion is detected. It further assists the user in revoking camera permission or uninstalling the suspicious application. By combining permission analysis, real-time alerting, and user-assisted mitigation, the framework enhances mobile privacy protection and provides a practical approach to securing Android smartphones from camera-based intrusion.

Keywords— Android security, camera intrusion, mobile privacy, malicious applications, permission monitoring, intrusion detection, smartphone security.

Introduction

Android smartphones are widely used for storing personal, educational, and professional information. Among the different resources available on mobile devices, the camera is one of the most sensitive because unauthorized access may lead to covert surveillance and serious privacy violations. Android's security architecture relies heavily on a permission-based model, where applications must request user approval before accessing protected resources such as the camera.

Although Android has improved its privacy controls through contextual permissions and system-level camera access management, the risk of unauthorized or malicious access remains. Users often grant permissions without fully understanding the possible consequences, and malicious applications can exploit this behavior to gain access to sensitive resources. Therefore, there is a need for a defense mechanism that not only controls camera permissions but also detects suspicious behavior and alerts the user in time. This paper addresses that need by proposing a camera intrusion rebuttal framework for Android smartphones.

The rest of this paper is organized as follows. Section II presents the related work. Section III describes the proposed system. Section IV explains the methodology. Section V discusses results and discussion. Section VI concludes the paper and suggests future work.

Related Work

Android security research has repeatedly emphasized the importance and limitations of the permission model. Earlier studies show that users often do not fully understand app

permissions, which reduces the effectiveness of permission-based protection. More recent research has examined the evolution of Android permissions, attack patterns, and best practices for strengthening mobile security.

Privacy-risk studies have also demonstrated that permission sets can be used to estimate the risk posed by mobile applications, which supports the idea that permission analysis is useful for threat detection. Android's own documentation confirms that permissions are intended to provide transparency and user control over access to sensitive resources such as the camera. In addition, Android privacy settings allow users to manage camera access directly, but this still depends on manual action rather than automatic threat identification. These findings support the need for a proactive intrusion rebuttal system.

Proposed System

The proposed framework consists of five functional modules. The permission scanner enumerates installed applications and identifies those with camera access privileges. The behavior monitoring module observes runtime camera usage and detects unusual or repeated access patterns. The alert module sends a notification to the user when suspicious activity is found. The mitigation module guides the user to revoke camera permission or uninstall the application. The logging module stores events for future analysis and reporting. This architecture is compatible with Android's permission-based security model, which already treats camera access as sensitive and requires explicit user control. The contribution of the proposed framework lies in adding proactive detection and timely user response.

A. System Architecture

The system architecture includes the following components:

- User Interface.
- App Permission Scanner.
- Camera Behavior Analyzer.
- Threat Detection Engine.
- Notification Module.
- User Response Module.
- Security Log Database.

B. Working Principle

1. The application scans installed apps.
2. It checks which apps request camera permission.
3. It monitors suspicious access behavior.
4. If abnormal activity is detected, it generates an alert.
5. The user receives the warning and takes action.
6. The user can revoke permission or uninstall the app.

Methodology

The methodology of the system is divided into four stages. First, the application scans the device for installed applications and checks which ones request camera-related

permissions. Second, it monitors camera access behavior over time and compares observed events against expected patterns. Third, if access appears suspicious, the system generates an alert and sends it to the user. Fourth, the user can respond by revoking permission or uninstalling the application.

The prototype can be implemented as an Android application using permission inspection, notification handling, and event logging. For evaluation, the system can be tested on normal applications and simulated malicious applications. The performance metrics may include detection success rate, alert response time, and the number of threats mitigated by user action. This approach is appropriate for a final-year project because it is practical, measurable, and easy to demonstrate.

Results and Discussion

The expected results of the proposed system can be presented through test scenarios. A benign camera application should operate without generating a warning, while an application showing abnormal camera access should be flagged by the detection engine. If the user revokes the permission, access should be blocked successfully. These outcomes show that the system improves user awareness and supports timely intervention.

Table I shows a sample evaluation format.

Test Scenario	System Response	Result
Standard camera app	No alert	Allowed
Suspicious repeated access	Alert generated	Flagged
Permission revoked by user	Access blocked	Mitigated

The discussion should explain that the framework does not replace Android's native security model but complements it with active monitoring and alerting. This is important because permission systems are effective only when users remain attentive to their privacy settings.

Conclusion

This paper proposed a defense framework for *Rebuttal of Camera Attack-Based Intrusion in Android Smartphones*. The work addresses unauthorized camera access by combining permission monitoring, suspicious activity detection, alert generation, and user-assisted mitigation. Since Android already provides camera privacy controls and contextual permissions, the contribution of this framework is its proactive response mechanism, which helps users identify and stop malicious behavior more quickly. The approach is practical, implementable, and suitable for a final-year project in computer science.

Future Work

Future improvements may include machine learning-based anomaly detection, automatic classification of malicious app behavior, and integration with additional sensors such as microphone or location access. The framework may also be extended to cover broader mobile threat detection. Such enhancements would make the system more comprehensive and suitable for advanced privacy research.

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HANDWRITTEN DIGIT RECOGNITION USING CONVOLUTIONAL NEURAL NETWORKS FOR A CUSTOM DATASET

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Abstract

Handwritten Digit Recognition (HDR) is a fundamental application of Artificial Intelligence (AI), Machine Learning (ML), and Computer Vision. It plays an important role in automating tasks such as postal mail sorting, bank cheque processing, form digitization, educational assessment, and document analysis. Although several handwritten digit recognition systems have achieved high accuracy using the benchmark MNIST dataset, their performance may decrease when applied to real-world handwriting because of variations in writing styles, stroke thickness, character size, orientation, and image quality. To overcome this limitation, this paper proposes a Convolutional Neural Network (CNN)-based handwritten digit recognition system trained on a custom dataset collected from multiple individuals.

The proposed approach includes image preprocessing techniques such as grayscale conversion, resizing, normalization, and noise reduction before training the CNN model. The CNN automatically extracts hierarchical features from the input images without requiring manual feature engineering. The trained model is evaluated using accuracy and loss metrics, demonstrating its effectiveness in recognizing handwritten digits from diverse handwriting samples. Experimental observations indicate that the proposed model provides reliable recognition accuracy and adapts well to real-world handwritten data.

The proposed system can be applied in banking, educational institutions, postal services, document digitization, and optical character recognition systems where accurate handwritten digit recognition is required.

Keywords: Handwritten Digit Recognition, Convolutional Neural Network, Deep Learning, Artificial Intelligence, Image Processing, Custom Dataset, Optical Character Recognition.

Introduction

Handwritten digit recognition is one of the most widely researched problems in the field of computer vision and pattern recognition. The objective of handwritten digit recognition is to automatically identify numerical digits (0–9) written by different individuals. Humans can easily recognize handwritten digits because of their ability to understand patterns and context, but developing a computer system capable of achieving similar performance is a challenging task due to the diversity in handwriting styles.

With the rapid advancement of Artificial Intelligence and Deep Learning, handwritten digit recognition has become significantly more accurate. Traditional machine learning techniques such as Support Vector Machines (SVM), Decision Trees, and K-Nearest Neighbors (KNN) depend heavily on manually designed features extracted from images. These methods often struggle with variations in handwriting because the extracted features may not adequately represent different writing styles.

Convolutional Neural Networks (CNNs) have transformed image recognition by automatically learning meaningful features directly from raw pixel values. Instead of relying on handcrafted features, CNNs learn hierarchical representations, beginning with simple edges and curves and progressing to more complex digit shapes. This capability makes CNNs highly suitable for handwritten digit recognition.

Most previous studies use the MNIST dataset, which contains 70,000 standardized grayscale images of handwritten digits. Although MNIST is valuable for benchmarking algorithms, it does not accurately represent real-world handwriting. Practical applications often involve handwritten digits that vary in size, thickness, orientation, lighting conditions, and writing instruments.

To address these challenges, this work focuses on developing a handwritten digit recognition system using a custom dataset collected from different individuals. The custom dataset introduces greater variability, enabling the CNN model to learn more generalized features and perform effectively in practical environments. Image preprocessing techniques such as resizing, grayscale conversion, and normalization improve data consistency before training the model.

The proposed CNN architecture consists of multiple convolutional layers, pooling layers, fully connected layers, and a Softmax output layer. The model is trained using labeled handwritten digit images and evaluated using standard performance metrics such as accuracy and loss. Experimental results demonstrate that the proposed approach achieves reliable recognition performance and is suitable for practical handwritten digit recognition applications.

Literature Review

Handwritten digit recognition has been extensively studied over the past few decades. Early recognition systems relied on traditional image processing techniques combined with classical machine learning algorithms. These systems required manual feature extraction, where researchers designed features such as edges, contours, zoning, projection histograms, and geometric descriptors. While these methods provided acceptable results, they were sensitive to handwriting variations and image noise.

The introduction of Artificial Neural Networks improved recognition performance by enabling computers to learn patterns from data. However, shallow neural networks were limited in their ability to extract complex image features.

A significant breakthrough occurred when Yann LeCun et al. (1998) introduced the LeNet-5 architecture, one of the earliest successful Convolutional Neural Networks for handwritten digit recognition. LeNet-5 demonstrated exceptional performance on the MNIST dataset by automatically learning spatial features directly from images. This work established CNNs as the preferred approach for image classification tasks.

Subsequent research focused on improving CNN architectures by increasing network depth, introducing better activation functions, and applying regularization techniques such as

Dropout and Batch Normalization. These improvements reduced overfitting and increased recognition accuracy.

Several researchers have also explored data augmentation techniques such as rotation, scaling, translation, and flipping to improve model generalization. Data augmentation increases the diversity of training samples without collecting additional data.

Despite the remarkable success of CNNs on benchmark datasets, relatively fewer studies have investigated handwritten digit recognition using custom datasets. Unlike MNIST, custom datasets contain significant variations in writing style, image quality, background noise, and digit orientation. Models trained on such datasets are generally more suitable for practical applications because they better represent real-world conditions.

Recent advancements in Deep Learning have introduced architectures such as AlexNet, VGGNet, ResNet, DenseNet, and EfficientNet, which achieve outstanding performance in image classification tasks. However, for handwritten digit recognition involving relatively small grayscale images, lightweight CNN architectures remain computationally efficient while maintaining high accuracy.

The literature indicates that CNN-based methods consistently outperform traditional machine learning techniques in handwritten digit recognition. Therefore, this research adopts a CNN model trained on a custom dataset to improve recognition performance under real-world conditions.

Problem Statement

Most handwritten digit recognition systems are trained using benchmark datasets such as MNIST. Although these datasets provide high recognition accuracy, they do not fully represent the diversity of real-world handwriting. Variations in writing style, stroke width, digit size, image quality, and orientation often reduce the performance of models trained only on standardized datasets.

The problem addressed in this research is to develop a robust CNN-based handwritten digit recognition system capable of accurately recognizing handwritten digits collected from a custom dataset representing diverse handwriting styles.

Objectives

The primary objectives of this research are:

- To design a handwritten digit recognition system using Convolutional Neural Networks.
- To create and utilize a custom handwritten digit dataset collected from multiple writers.
- To preprocess handwritten digit images through grayscale conversion, resizing, normalization, and noise removal.
- To train the CNN model for accurate digit classification.
- To evaluate the model using performance metrics such as accuracy and loss.

- To compare the effectiveness of CNN-based recognition on custom datasets with conventional approaches.
- To develop a system suitable for practical applications such as banking, education, postal automation, and

Document Digitization.

Proposed Methodology

The proposed system uses a Convolutional Neural Network (CNN) to recognize handwritten digits from a custom dataset. The process involves collecting handwritten digit images, preprocessing them, training the CNN model, and evaluating its performance.

The methodology consists of the following steps:

- Collect handwritten digit images from different individuals.
- Convert images to grayscale and resize them to 28×28 pixels.
- Normalize pixel values to improve model performance.
- Split the dataset into 80% training and 20% testing.
- Train the CNN model using the training dataset.
- Test the trained model using the testing dataset.
- Predict handwritten digits for new input images.

CNN Architecture

The CNN model consists of the following layers:

- Input Layer: Accepts 28×28 grayscale images.
- Convolution Layer: Extracts important features such as edges and shapes.
- ReLU Layer: Introduces non-linearity and improves learning.
- Max Pooling Layer: Reduces image dimensions while preserving key features.
- Flatten Layer: Converts feature maps into a one-dimensional vector.
- Fully Connected Layer: Combines extracted features for classification.
- Softmax Layer: Predicts the handwritten digit (0–9).

Image Preprocessing

Image preprocessing improves the quality and consistency of the dataset before training. The preprocessing steps include:

- Converting images to grayscale.
- Resizing images to 28×28 pixels.
- Normalizing pixel values between 0 and 1.
- Removing unwanted noise from images.

These steps improve the accuracy and efficiency of the CNN model.

CNN Algorithm

1. Collect handwritten digit images.
2. Preprocess the images.
3. Split the dataset into training and testing sets.
4. Build the CNN model.

5. Train the model using the training data.
6. Evaluate the model using the testing data.
7. Predict handwritten digits for new images.

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AI-BASED FACIAL EXPRESSION RECOGNITION USING DEEP LEARNING**Ms. Pallavi P***Lecturer, Kumadvathi First Grade College Shikaripura*

Abstract

Facial expression recognition (FER) is a core problem in affective computing that seeks to automatically identify human emotional states from facial images or video streams. With the advent of deep learning, convolutional neural networks (CNNs) and their variants have substantially improved recognition accuracy over traditional handcrafted-feature approaches. This paper presents a comprehensive review and implementation framework for AI-based facial expression recognition using deep learning. We discuss the evolution of the field, describe commonly used benchmark datasets, detail a representative CNN-based architecture with preprocessing and augmentation pipelines, and outline the training methodology, evaluation metrics, and typical performance ranges reported in the literature. We further examine transfer learning, attention-based and hybrid CNN-LSTM approaches for video-based recognition, discuss real-world applications in human-computer interaction, healthcare, education, and driver-monitoring systems, and conclude with the key challenges of class imbalance, illumination variation, occlusion, and cross-dataset generalization that continue to shape future research directions.

1. Introduction

Facial expressions are one of the most natural and universal ways humans communicate emotion. Psychologist Paul Ekman's foundational research identified six basic emotions widely used as the standard taxonomy in computer vision research: happiness, sadness, anger, fear, surprise, and disgust, with neutral often added as a seventh class. Automatically recognizing these expressions from images or video has wide-ranging applications, from human-computer interaction and mental health monitoring to driver fatigue detection, e-learning engagement analysis, and customer sentiment analysis in retail.

Traditional facial expression recognition systems relied on handcrafted features such as Local Binary Patterns (LBP), Histogram of Oriented Gradients (HOG), Gabor filters, and Active Appearance Models (AAM), combined with classical classifiers like Support Vector Machines (SVM) or Random Forests. While effective under controlled conditions, these pipelines struggled to generalize across variations in pose, illumination, occlusion, and subject identity. The emergence of deep learning, particularly CNNs, shifted the paradigm by enabling end-to-end feature learning directly from raw pixel data, resulting in significant accuracy improvements and more robust generalization across diverse, uncontrolled ('in the wild') conditions.

This paper aims to provide a structured overview and practical framework for building an AI-based facial expression recognition system using deep learning. Section 2 reviews related work; Section 3 describes commonly used datasets; Section 4 presents the proposed methodology and system architecture; Section 5 details the training process; Section 6 discusses evaluation metrics and representative results; Section 7 covers applications; Section

8 discusses open challenges; and Section 9 concludes the paper.

2. Literature Review

Early deep learning approaches to FER adapted standard CNN architectures such as AlexNet and VGGNet, pretrained on large-scale image datasets like ImageNet, and fine-tuned them on emotion-labeled facial datasets. Mollahosseini et al. proposed deeper CNN architectures with inception-style modules specifically designed for expression recognition, demonstrating improved accuracy on multiple benchmark datasets. Subsequent work explored residual networks (ResNet) to mitigate vanishing gradients in deeper architectures, enabling more expressive feature hierarchies.

Beyond static image classification, researchers have investigated temporal modeling for video-based FER using hybrid CNN-LSTM (Long Short-Term Memory) architectures, where a CNN extracts spatial features from individual frames and an LSTM or GRU layer models the temporal evolution of expressions across a sequence. Attention mechanisms have also been incorporated to help models focus on discriminative facial regions such as the eyes, eyebrows, and mouth, which carry the most emotion-relevant information. More recently, Vision Transformers (ViT) and hybrid CNN-Transformer models have been applied to FER, achieving competitive results by capturing long-range spatial dependencies across the face.

Generative adversarial networks (GANs) have been used for data augmentation and pose-invariant feature learning, synthesizing additional training samples to address class imbalance and limited dataset size. Transfer learning remains one of the most practical and widely adopted strategies, given that FER datasets are typically much smaller than general-purpose image datasets; pretrained backbones such as VGG-Face, ResNet-50, and MobileNetV2 are commonly fine-tuned for this task to achieve strong performance with comparatively limited labeled data.

3. Datasets

The choice of dataset significantly influences model performance and generalization. The table below summarizes commonly used benchmark datasets for facial expression recognition research.

FER2013	~35,887 grayscale images	48x48	7 (incl. neutral)	In-the-wild, web-scraped
CK+ (Extended Cohn-Kanade)	~593 sequences, subjects	123	7	Lab-controlled, posed
JAFPE	213 images, 10 subjects		7	Lab-controlled, posed
AffectNet	~1M images (labeled)	(~440K	8 (incl. contempt)	In-the-wild, web-scraped
RAF-DB	~30,000 images		7 basic + 12 compound	In-the-wild
Oulu-CASIA	~2,880 sequences		6	Lab-controlled, varied illumination

Table 1: Commonly used facial expression recognition benchmark datasets.

FER2013, introduced during a Kaggle challenge, remains one of the most widely used benchmarks due to its scale and public availability, despite label noise and low image resolution. AffectNet and RAF-DB, being larger and collected in-the-wild, are increasingly preferred for training models intended for real-world deployment, since lab-controlled datasets like CK+ and JAFFE tend to produce models that generalize poorly to unconstrained conditions.

Beyond the six or seven basic classes, several studies have examined the trade-off between dataset scale and label quality. FER2013, despite being the most widely used benchmark for training-from-scratch experiments, is known to contain a non-trivial proportion of mislabeled or ambiguous images (commonly estimated at 10-15%), which places a practical ceiling on achievable accuracy regardless of model capacity. This has led many practitioners to treat accuracy figures above roughly 75% on FER2013 with caution, since human-level agreement on the dataset itself has been estimated at around 65-68%.

4. Proposed Methodology

The proposed FER pipeline follows a standard end-to-end deep learning workflow consisting of face detection and alignment, preprocessing, feature extraction via a CNN backbone, and classification. Figure 1 (described conceptually below) illustrates the overall pipeline.

4.1 Face Detection and Preprocessing

Given an input image or video frame, a face detector such as Haar Cascades, MTCNN (Multi-task Cascaded Convolutional Networks), or a lightweight deep detector (e.g., RetinaFace) is used to localize the face region and facial landmarks. The detected face is then cropped, aligned using eye-coordinate rotation, converted to grayscale or normalized RGB, and resized to a fixed input resolution (commonly 48x48 or 224x224 pixels depending on the backbone). Pixel intensities are normalized to the range [0, 1] or standardized using dataset mean and standard deviation.

4.2 Data Augmentation

To reduce overfitting and improve robustness, augmentation techniques are applied during training, including random horizontal flipping, small-angle rotation (± 10 -15 degrees), zoom and shift, brightness and contrast jitter, and occasionally cutout or random erasing to simulate partial occlusion. For severely imbalanced classes (e.g., 'disgust' and 'fear' are underrepresented in FER2013), class-weighted loss functions or oversampling of minority classes are commonly employed.

4.3 CNN Architecture

A representative custom CNN architecture for FER, suitable for training from scratch on datasets such as FER2013, is summarized in Table 2. For higher accuracy, this can be replaced with a pretrained backbone (e.g., ResNet-50, MobileNetV2, or EfficientNet-B0) fine-tuned via transfer learning.

Input	48x48 grayscale image	48x48x1
Conv Block 1	2x Conv2D(64,3x3) + BN + ReLU, MaxPool(2x2)	24x24x64
Conv Block 2	2x Conv2D(128,3x3) + BN + ReLU, MaxPool(2x2)	12x12x128
Conv Block 3	2x Conv2D(256,3x3) + BN + ReLU, MaxPool(2x2)	6x6x256
Dropout	Rate = 0.4	6x6x256
Flatten + Dense	Dense(512) + ReLU + Dropout(0.5)	512
Output	Dense(7) + Softmax	7

Table 2: Representative custom CNN architecture for FER2013-scale input.

4.4 Transfer Learning Variant

For in-the-wild datasets such as AffectNet or RAF-DB, a transfer learning approach typically yields better results: a backbone pretrained on ImageNet or a large face-recognition dataset (e.g., VGG-Face, ArcFace-trained ResNet) has its convolutional layers frozen or partially unfrozen, and its classification head is replaced with a new fully connected layer matching the number of expression classes. Fine-tuning is performed with a low learning rate (e.g., $1e-5$ to $1e-4$) to avoid catastrophic forgetting of useful pretrained features.

4.5 Temporal Modeling for Video

For video-based FER, a CNN extracts a feature vector from each frame, and these per-frame features are fed as a sequence into an LSTM or GRU layer to capture temporal dynamics of the expression as it evolves (e.g., onset, apex, and offset phases). This hybrid CNN-LSTM design is particularly effective for micro-expression and spontaneous expression recognition, where the temporal trajectory carries additional discriminative information beyond a single static frame.

4.6 Implementation Outline

A typical implementation using a Python deep learning framework (e.g., TensorFlow/Keras or PyTorch) follows the high-level pipeline outlined below.

1. Load and parse the dataset (e.g., FER2013 CSV pixel arrays or AffectNet image directories) into training, validation, and test splits.
2. Apply preprocessing: face detection/alignment (if not already cropped), grayscale/RGB normalization, and resizing to the target input shape.
3. Construct the data pipeline with on-the-fly augmentation (flip, rotate, zoom, brightness jitter) using an ImageDataGenerator or torchvision transforms.
4. Define the CNN or transfer-learning model architecture and compile it with the chosen optimizer, loss function, and evaluation metrics.
5. Train the model with callbacks for early stopping, learning-rate reduction on plateau, and checkpointing of the best validation weights.
6. Evaluate on the held-out test set, generating accuracy, per-class precision/recall/F1, and a confusion matrix.
7. Export the trained model (e.g., to ONNX or TensorFlow Lite) for deployment in a real-time inference pipeline, optionally combined with a face-tracking module for webcam or video input.

5. Training Methodology

The dataset is typically split into training (70-80%), validation (10-15%), and test (10-15%) subsets, with stratification to preserve class distribution. The model is trained using categorical cross-entropy loss (optionally class-weighted) and optimized using Adam or SGD with momentum. A typical training configuration is summarized in Table 3.

Optimizer	Adam
Initial Learning Rate	1e-3 (custom CNN) / 1e-4 (fine-tuning)
Learning Rate Schedule	ReduceLROnPlateau or Cosine Annealing
Batch Size	32-64
Epochs	50-100 with early stopping
Loss Function	Categorical Cross-Entropy (class-weighted)
Regularization	Dropout (0.3-0.5), L2 weight decay, Batch Normalization

Table 3: Representative training hyperparameters.

Early stopping based on validation loss (patience of 8-10 epochs) is used to prevent overfitting, alongside model checkpointing to retain the best-performing weights. K-fold cross-validation is recommended for smaller datasets such as CK+ or JAFFE to obtain more reliable performance estimates.

6. Evaluation Metrics and Representative Results

Model performance is typically evaluated using accuracy, precision, recall, F1-score, and confusion matrices to reveal per-class performance, since expression classes are often imbalanced. Because class distributions are skewed, macro-averaged F1-score (which weights all classes equally) is generally preferred over raw accuracy as the primary reporting metric, since a model can achieve deceptively high accuracy simply by favoring majority classes such as 'happy' and 'neutral'.

6.1 Metric Definitions

Precision measures the proportion of predicted instances of a class that are correct, recall measures the proportion of actual instances of a class that are correctly identified, and F1-score is the harmonic mean of precision and recall, providing a single balanced measure. For a confusion matrix with true positives (TP), false positives (FP), and false negatives (FN) per class: Precision = $TP / (TP + FP)$; Recall = $TP / (TP + FN)$; $F1 = 2 \times (Precision \times Recall) / (Precision + Recall)$. Macro-averaging computes each metric independently per class and then takes the unweighted mean across classes, while weighted-averaging accounts for class support (sample count).

The table below presents representative accuracy ranges commonly reported in the literature for different architectures and datasets; exact figures vary by implementation, preprocessing, and evaluation protocol, and should be verified against the original cited studies rather than treated as guaranteed reproducible benchmarks.

Custom CNN (from scratch)	FER2013	~65-70%
Deeper CNN / Inception-style	FER2013	~70-73%
Fine-tuned ResNet-50 (transfer learning)	RAF-DB	~85-88%
Fine-tuned VGG-Face	CK+	~95-98%
CNN + Attention	AffectNet	~58-62%
CNN-LSTM (video sequences)	CK+ / Oulu-CASIA	~90-95%

Table 4: Representative accuracy ranges reported across studies (approximate, for illustration; actual results vary by protocol and should be verified against the cited original papers).

AffectNet's lower reported accuracies reflect its larger scale, greater label noise, higher class imbalance, and more challenging in-the-wild conditions compared to lab-controlled datasets like CK+. Confusion matrix analysis typically shows that 'fear' and 'surprise', as well as 'anger' and 'disgust', are the most frequently confused expression pairs due to overlapping facial action units.

6.2 Confusion Analysis and Ablation Observations

Ablation studies in the literature consistently report several recurring findings. First, adding batch normalization after convolutional layers accelerates convergence and improves final accuracy by several percentage points compared to unnormalized networks of the same depth. Second, data augmentation (particularly horizontal flipping and small rotations) provides a measurable generalization benefit on smaller datasets such as CK+ and JAFFE, though the benefit is smaller on already-large datasets like AffectNet. Third, transfer learning from face-recognition-pretrained backbones (e.g., VGG-Face, ArcFace) tends to outperform ImageNet-pretrained backbones for FER, since face-recognition pretraining already encodes fine-grained facial geometry relevant to expression discrimination. Fourth, attention modules that weight discriminative facial regions (eyes, eyebrows, mouth corners) tend to improve robustness to partial occlusion, though at the cost of increased model complexity and inference latency.

7. Applications

- **Human-Computer Interaction:** Adaptive interfaces and virtual assistants that respond to user emotional state.
- **Mental Health Monitoring:** Assisting clinicians in tracking affective states in depression, anxiety, or autism spectrum studies.
- **Driver Monitoring Systems:** Detecting drowsiness, stress, or distraction in advanced driver-assistance systems (ADAS).
- **Education Technology:** Measuring student engagement and confusion in e-learning platforms.
- **Market Research:** Analyzing consumer emotional response to advertisements or products.
- **Security and Surveillance:** Identifying unusual affective states in public safety contexts, with appropriate ethical safeguards.

8. Challenges and Future Directions

Despite significant progress, several challenges remain open in FER research. **Class imbalance** persists across nearly all benchmark datasets, with 'happy' and 'neutral' overrepresented relative to 'disgust' and 'fear'. **Cross-dataset generalization** remains difficult, as models trained on one dataset often perform poorly on another due to differences in demographics, lighting, camera angle, and annotation protocol. **Occlusion** from masks, glasses, or hands, and **pose variation** in unconstrained settings further degrade performance. Additionally, **subtle and compound expressions** (e.g., 'happily surprised') are harder to model than the six basic categories, motivating research into fine-grained and continuous representations such as the valence-arousal model rather than discrete class labels. **Ethical and privacy considerations** are also increasingly important, given the sensitivity of emotion inference technology; responsible deployment requires informed consent, transparency, and safeguards against misuse in surveillance or discriminatory profiling. Future research directions include self-supervised and multimodal learning (combining facial expression with voice tone and physiological signals), lightweight architectures for edge deployment, and fairness-aware training to reduce demographic bias.

9. Conclusion

Deep learning has transformed facial expression recognition from a domain reliant on handcrafted features to one dominated by end-to-end learned representations, yielding substantial gains in accuracy and robustness. This paper reviewed the evolution of FER research, summarized key benchmark datasets, and presented a practical methodology encompassing face detection, preprocessing, CNN and transfer learning-based architectures, and temporal modeling for video. While current systems achieve strong results on controlled benchmarks, challenges around generalization, class imbalance, and ethical deployment remain active areas of research. Continued progress in multimodal learning, fairness, and efficient architectures is expected to further improve the reliability and real-world applicability of AI-based facial expression recognition systems.

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ARTIFICIAL INTELLIGENCE IN EDUCATION: OPPORTUNITIES AND CHALLENGES

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Abstract

Every aspect of life has been touched by technological advancements over time. Since technology has invaded every part of our lives as it has been more readily available, we now demand that every device we use be as technologically advanced as possible. Schools have also embraced technology as an integral part of their education process. Although technology has always been a significant part of education, there is a growing trend in education to incorporate contemporary methods and technologies in order to enhance the learning environment. With the rise of Artificial Intelligence (AI) in education, there are many different ways it is being used to help students learn. Chatbots, Virtual Reality, Learning Management Systems, and Robotics are a few technologies with AI that are already affecting and will affect education in every way. Despite the numerous advantages of employing AI in the field of education, it is imperative to confront and overcome certain limitations and obstacles. Among these challenges, a prominent concern is guaranteeing equal access to AI-driven educational tools and platforms for students, irrespective of their economic circumstances or geographic location. Furthermore, there are apprehensions regarding the likelihood of AI reinforcing pre-existing biases and inequities within the education system. While ongoing endeavors aim to integrate AI into educational settings, the acceptance and implementation of these novel instructional technologies largely hinge on the perspectives and leadership of educators responsible for guiding and conducting lessons. Moreover, numerous educators express concerns about the potential of AI-driven tools to supplant human interaction and impact the overall quality of classroom teaching. In the forthcoming years, it will be essential to ensure that AI is employed in a manner that enriches the role of human educators rather than substituting them. There are several challenges to the use of AI in education. Some are common to the use of AI across sectors. The present paper aims to identify the impact of artificial intelligence on the educational process, present some of the applications of AI in education, and highlight the perceived benefits of the application along with challenges.

Keywords: Artificial Intelligence, Technology, AI & Education

Introduction:

The era of 21st century is often regarded as the era of technology. Today, technology plays an important role in our life. The technological advances made over the years have impacted every field of life. Every aspect of life has been touched by the technological advancements over time. Since technology has invaded every part of our lives as it has been more readily available, we now demand that every device we use be as technologically advanced as possible. The pillars of any sound educational system are well-trained and scholarly teachers. While they should be continuously trained to imbibe the changing pedagogical approaches, introducing Artificial Intelligence -based technologies in Education can lead to student-centric teaching-learning processes. Technology has always been crucial to education, but due to the increased accessibility of smart devices and web-based curricula, its use is now more common than ever. With the rise of Artificial Intelligence (AI) in

education, there are many different ways it is being used to help students learn. There are three ways in which AI tools can assist students in making them better learners and they are: AI-Directed Learning, AI-Supported Learning and AI-Empowered Learning. Here are a few technologies with AI that are already affecting and will affect education in every way. Chatbots, Virtual reality, Learning Management System (LMS) and Robotics are few technologies with AI that are already affecting and will affect education in every way.

Understanding effective Artificial Intelligence, Du Boulay (2016) gave a deeper understanding of how artificial intelligence brings significant partner in Learning. Garito (1991) addresses the impact of AI on the educational sector way before AI became as advanced as it is in the 21st century. Barton (2020), examined the impact of artificial intelligence in education and teaching alternatives remotely during the pandemic. Gates even believes that AI will be able to improve human Learning in various ways. Based on these beliefs, we want to understand the effectiveness of artificial intelligence in education during pandemics and future Learning (Güzer & Caner, 2014; Engeström & Sannino, 2010).

Benefits of Artificial Intelligence: Paradigm One is characterized as AI-directed, learner-as-recipient, that is While the learner functions as the service recipient to follow the designated learning routes, AI represents the domain knowledge and guides the learning processes. One of the largest trends in education is personalization. Students now have a personalised approach to learning programmes based on their own distinct experiences and interests thanks to the application of AI. AI tutors and chatbots are a perfect solution in these situations. While no chatbot can truly replace a teacher, AI tools can help students sharpen their skills and improve weak spots outside of the classroom. AI can help students find answers to their most frequently asked questions in seconds through support automation and conversational intelligence. Paradigm Two, What is important, though, is how fully and how the learners' data is incorporated into the AI system in order to enhance the student model, reflect various facets of the student's learning status, and provide adaptive, AI-supported learning and instruction. AI-supported tools make learning accessible to all learners, anytime and anywhere. Each student learns at their own pace, and 24/7 access makes it easy for students to find what works for them without waiting for a teacher. In addition, students from all over the world can have access to high quality education without having to travel and live. AI-supported, learner as-collaborator. Paradigm Three, the goals of AI-Empowered Learning are to provide students full control over their learning, to optimize AI methods to deliver in the moments insights into emergent learning, and to rethink the changes in learning that AI has brought about in intricate, inter connected leaning systems. This paradigm, AI-empowered, learner-as-leader to facilitate learner agency, empowerment, and personalization, enable learners to reflect on learning and inform AI systems to adapt accordingly, and lead to an iterative development of the learner-centered learning. Virtual Reality (VR) is the another important way to facilitate learning. Virtual reality technologies have a very special opportunity to produce real educational experiences. In virtual reality, students will be able to

explore and interact with the complicated concepts in hands on way. For instance, virtual reality may allow students to experience a more realistic scenario of the world such as historical events, scientific experiments and complex machines that would give them an engaging and memorable learning experience. In addition, virtual reality has the potential to break down boundaries of time and space so that students can learn from anywhere in the world while exploring places they may not otherwise have access to. Another aspect of AI is Learning Management System. The improvement of efficiency and time management is crucial for setting up a Learning Management System in training institutions. In order to create the complete e-Learning LMS solution, it is important to integrate features such as calendars, student forums and communication channels. Whether it is online learning or face-to-face teaching, LMS has features for everyone. LMS has evolved to become an essential teaching tool, and it's no longer luxuries but a necessity of the modern era. Even in the face of unfavourable circumstances, this system is helping to keep learning going.

Challenges: AI can support teaching and learning but new ethical implications and risks emerge with the development of AI applications in education. Teachers may fear that an intelligent tutor system, an application of AI, can replace them. AI systems require large quantity of data, including student and staff information, which is confidential and leads to serious privacy issues. AI is very expensive compared to installation, maintenance and repair costs. The use of such advanced technology is possible only by heavily financed education institutions. When this technology is over-relied it can cause a lack of personal connection and harm users from this perspective. Other risks are like over addiction of use of AI, communication barrier, Decreases the thinking power of the students and Laziness in students.

Conclusion: Artificial intelligence is the biggest education change in history. The biggest contribution that AI could make to education in the Indian context would be to promote the idea of learning as learner centred. As already discussed there are numerous benefits of artificial intelligence for teachers, students and administrators, the possibilities of AI are also impressive. But still there are few very important challenges like how to shield students' privacy at the time of using data to help them. Artificial intelligence is an unusual technology with the potential to both harm and help us, Microsoft co-founder and now philanthropist Bill Gates urged. So to ensure it's a boon, we should put AI to work improving health and education. The main aim of AI is to facilitate the work of the human resource (teachers) but not to replace it.

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