

DIGITAL COMPETENCE OF TEACHERS WORKING IN HIGHER EDUCATION INSTITUTIONS OF ODISHA

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Paper Received On: 22 Jan 2024

Peer Reviewed On: 16 Feb 2024

Released On: 01 March 2024

Abstract

The objectives of the study were to study the level of digital competence of teachers working in higher education institutions and to compare the digital competence of teachers working in higher education institutions with respect to gender, age, qualification, and experience. A survey was conducted with a sample of 53 higher education teachers selected through stratified random sampling techniques. A self-developed rating scale consisting of 41 items based on five components of digital competence, such as information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving, was used as a tool for data collection. The collected data were analysed using frequency count, percentage, and chi-square in SPSS software. The findings of the present study indicated that more number (47.16%) of the teachers were an average level of competence. There is no significant difference in the digital competence of teachers working in higher education institutions with respect to gender and qualification. The study also indicates that teachers with age group up to 40 years have better digital competence than teachers with higher age group and teachers with less than ten years of experience have better digital competence than teachers with higher experience group. It is proposed that teachers in higher education should be encouraged and motivated to learn digital skills and competence. The state authority can organize capacity-building programs to enhance teachers' digital competence through the use of ICT in teaching and learning.

Keywords: *Digital Competence, Information and Data Literacy, Communication and Collaboration, Digital Content Creation, Safety, Problem-Solving*

Introduction: The digital transformation of teaching and learning in higher education not only requires the application of digital technologies to education, but also advocates the deep integration of digital technologies in education to develop new education systems adaptive to the digital age (Muller & Aleksa Varga, 2020). Digitalization of higher education by integrating ICT (Information and Communication Technology) and related technologies is a notion that can empower the educational administrator to manage the advancement of any educational and managerial plan and reforms in the whole nation and provide service in a much better manner to all stakeholders. Today, students learn facts, skills, knowledge, and attitudes from computers, the internet, and social media. Technology has created a significant difference in various processes related to education.

Digitalization of higher education includes the use of digital tools and technologies for educational administration, teaching-learning process, evaluation, research, and extension activities. It provides a way to work together, share resources, coproduce, co-act, and engage in activities that benefit all (Sangeetha, et al. 2021). Trindade and Albuquerque (2022) pointed out that education provided by universities and colleges has become ever more digitalized and has resulted in new challenges for university teachers in providing high-quality teaching and adapting to the needs of changing student generations. Technology is constantly acting as a catalyst to revolutionize education, and for education to keep pace with the rapidly changing technology it is imperative to make technology an integral part of the educational system. NEP 2020 emphasizes new technologies involving artificial intelligence, machine learning, smart boards, handheld computing devices, and adaptive computer testing. It also emphasizes a rich variety of educational software and it must be made available for teachers at all levels to improve teaching learning and assessment (Amhag, et al. 2021). Hence all teachers of higher education must possess a good degree of digital competence in order to provide appropriate educational experience to the learners.

Digital competence: Digital competence is the set of knowledge, abilities, and attitudes (including abilities, approaches, values, and consciousness) that are required when using ICT and digital media to execute tasks, solve problems, convey, manage information, collaborate, create and share content, and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, and reflectively for leisure, work, involvement, learning, socializing, consuming, and empowerment (Dar & Ponraj, 2022). UNESCO (2018) has developed the ICT Competence Framework for Teachers, which is the intersection of the three approaches to teaching—technology literacy, knowledge deepening, and knowledge

creation—with the six aspects of a teacher's work, namely, understanding ICT in education, curriculum assessment, pedagogy, ICT, organization and administration, and teacher professional learning. Digital competence is a competence that involves confident, critical, and responsible use and interaction with digital technologies for learning, work, and participation in society. It includes information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving (Morze & Buinytska, 2019).

Information and data literacy refers to browse, search, and filter data, information, and digital content; evaluate data, information, and digital content; and manage data, information, and digital content. Communication and collaboration means interoperability through digital technology with an understanding of digital communications for specific content; the sharing of digital technologies (the exchange of digital content through various digital technologies); and digital technology collaboration with the use of digital tools and technologies for collaborative activities, processes, resources, and new knowledge. Digital content creation content consists of creating and editing digital content in various formats; integration, and conversion of digital content in order to create original, new content; understanding and knowledge of the distribution of copyright and licenses applicable to digital content; and programming. Safety refers to device protection; protection of personal data and privacy; protection of health and well-being in the use of digital technologies; and protection of the environment from the impact and use of digital technologies. Problem-solving refers to the identification and resolution of technical issues, identifying needs, and seeking and making technological solutions.

In operational sense, digital competence is the ability to use digital devices and applications for information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. The digital competence and its different aspects is graphically presented in the figure-1.

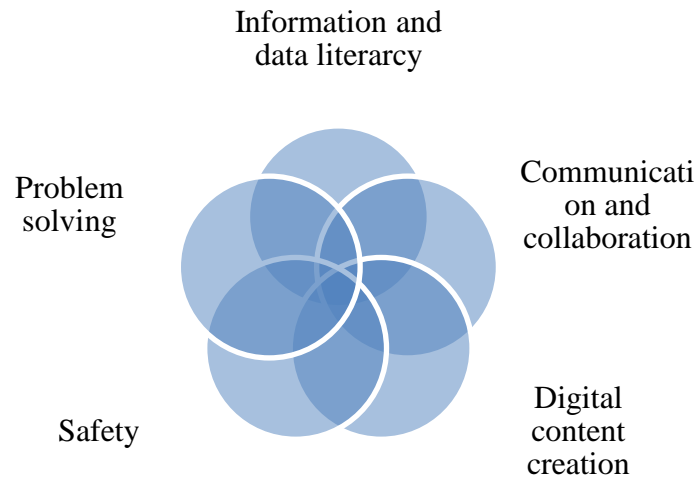


Figure -1: Components of digital competence (Morze & Buinytska, 2019).

Rationale of the study: The present age is the digital age. Digitalization has influenced all aspects of human life, including teaching and learning. It has great potential for quality improvement in higher education. Hence, teachers of the digital era should not only have content knowledge; they should also have pedagogic as well as technological knowledge so that they can transact knowledge with students in an advanced way. The teacher should also use digital technology for their preparation for delivering the lesson as well as inside the classroom to make the students better understand the particular lesson. Teachers can also use technology for assessment purposes, like a digital portfolio. Hence, the prospective teacher must possess digital competence to effectively deal with digital native students in the future. In this context, the government of India and its states have provided ICT facilities to all higher education institutions. It is high time to examine the level of digital competence of teachers working in higher education institutions so that suitable interventions can be planned (Abbasi et al., 2022).

Recently, many researchers have taken an interest in the digital competence of teachers in higher education institutions. Some of the relevant studies are discussed in the following paragraph.

Santos et al. (2021); Tondeur et al. (2023); and Morante et al. (2023) revealed that higher education professors have an intermediate proficiency level in digital competencies. No statistically significant effects were detected for variables such as gender, age group, length of career, institutional funding sector, or administrative region. Radhamani & Kalaivani (2023) found that there is a significant difference in digital competence among teachers based on their age, major subject studied, and completion of computer courses, whereas there is no significant difference in digital competence of teachers based on locality. Zhao et al. (2021) revealed that

there are significant differences in favour of male college teachers in the perception of digital competence. In relation to the teaching experience, teachers with less teaching experience thought themselves better in the areas of communication and collaboration, digital content creation, security, and problem-solving. Dias-Trindade & Albuquerque (2022) found that there were no significant differences in the digital competence of teachers according to gender, age, faculty, and experience. Cabero-Almenara et al. (2021) found that there are statistically significant differences between the level of DTC and the age, experience, and time of ICT use in the classroom. Guillen-Gamez et al. (2022) found that teachers with 15 or more years of experience represent the group with the most significant differences in regard to their level of digital competence and also found that there were no significant differences in the level of digital competence of teaching staff between the two genders. Rubio-Gragera et al. (2023) revealed that years of experience in the implementation of technology in the classroom do not influence the level of teachers' digital competence and also found that the daily time spent using technology in the classroom does lead to significant differences in terms of the level of digital competence. Dias-Trindade and Moreira (2020) found that teachers' digital competence level is moderate; the dimensions with the lowest values are "teachers' pedagogic competences" and "learners' competences. Grande-de-Prado et al. (2020) showed that female teachers made greater use than male teachers of mobile devices in computer and mobile device use (78.7% vs. 64.6%). In contrast, 32.3% of male teachers reported only using a computer, compared with 18.7% of female teachers. Perez-Calderon (2021) confirmed that the teachers perceived a medium-high level of knowledge and use of ICT. Sangeetha and Saileela (2021) found that female faculties had a mean score for digital skills greater than males. Jain and Shetty (2022) revealed that there is no significant difference between male and female school teachers in digital competence.

The above discussion reveals that an attempt has been made by the researcher to examine the use of digital technology and devices by teachers in higher education. Most research was conducted abroad. Few studies were conducted on teachers working in higher education institutions. In this context, a study on teachers working in higher education institutions is relevant. The investigator has raised following research questions for investigation.

- a) What is the level of digital competence of teachers working in higher education institutions?

- b) Is there any difference in the digital competence of teachers working in higher education institutions with respect to gender, age, qualification, and experience?

Objectives

- a) To study the level of digital competence of teachers working in higher education institutions.
- b) To compare the digital competence of teachers working in higher education institutions with respect to gender, age, qualification, and experience.

Hypotheses

- a) H_0 : There is no significant difference in the digital competence of teachers working in higher education institutions with respect to gender.
- b) H_0 : There is no significant difference in the digital competence of teachers working in higher education institutions with respect to age.
- c) H_0 : There is no significant difference in the digital competence of teachers working in higher education institutions with respect to qualification.
- d) H_0 : There is no significant difference in the digital competence of teachers working in higher education institutions with respect to experience.

Methodology: The investigator used a quantitative research design for the present study to study the level of digital competence of teachers. The survey method was employed to gather quantitative data on the digital competence of teachers working in higher education institutions. The sample for the present study consists of 53 higher education teachers in the state of Odisha. This sample was selected from higher education institutions by using a stratified random sampling technique. The investigators used a self-developed rating scale consisting of 41 items intended to assess the level of digital competence of higher education teachers. These items are based on five components of digital competence, such as information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. The Likert-type scale of three options, such as high competency (HC) (3 points), moderate competency (MC) (2 points), and low competency (LC) (1 point) used as a scale. The content validity of the rating scale was ensured by taking experts' opinions on the items. On the basis of the comments and suggestions, the tool was finalized. The Cronbach Alfa reliability (0.87) was estimated, which was found to be significant. The collected data was coded numerically and entered in MS Excel for analysis. The researcher used frequency count, percentage, and chi-square for data analysis and interpretation in SPSS software.

Data analysis & interpretation: The first objective is to study the levels of digital competence of teachers working in higher education institutions. The investigator grouped teachers as high, average, and low competent on the basis of the Quartiles. In this section, the researcher presented the levels of digital competence of higher education teachers in terms of frequency and percentage.

Table-1: Level of digital competence of higher education teachers

Sl. No	Score Range	Number & Percent of Teachers	Level of Digital Competence
1	119 above	15(28.30)	Low
2	102 to 119	25(47.16)	Average
3	Below 102	13(24.52)	High
Total		53	

The table-1 reveals that, among the 53 higher education teachers, 28.30% have a high level of digital competence, 47.16% have an average level of competence, and 24.52% have a low level of digital competence. This observation clearly indicates that a majority of teachers in higher education possess an average level of digital competence, as shown graphically in Figure 1.

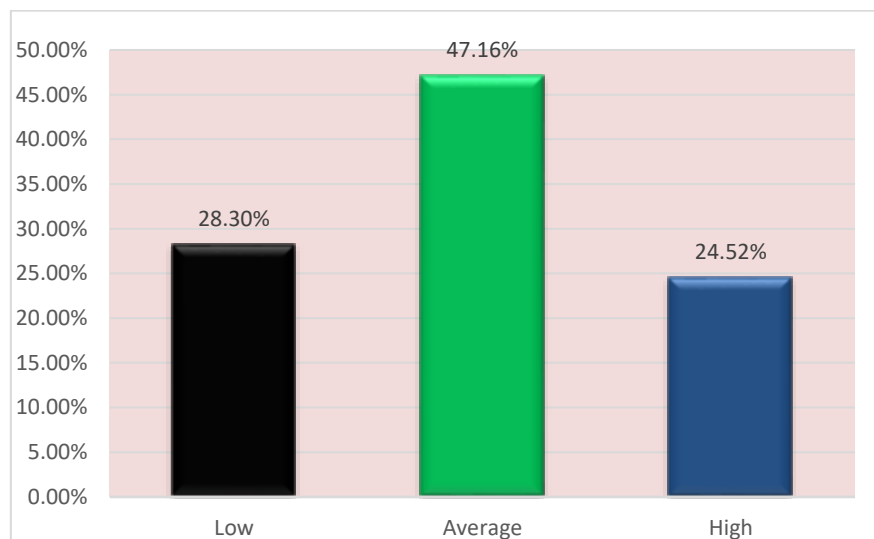


Figure -2: Percentage of higher education teachers with different digital competencies

The second objective of the study is to compare the digital competence of teachers of higher education institutions with reference to gender, age, experience, qualification. The investigator has compared the digital competence by using Chi-square, which is presented in following paragraphs.

Table-2: Comparison of digital competence of higher education teachers (gender wise)

Level	Male (N & %)	Female (N & %)	Chi-Square	Sig.
Low	8(27.58)	7(29.16)	0.174	0.677
Average	13(44.82)	12(50)		
High	8(27.58)	5(20.83)		

The table-2 reveals that 27.58% of male teachers have a high level of digital competence whereas 20.83% of female teachers have same level of digital competence. While 50% of female teachers and 44.82% of male teachers both possess an average level of digital competence. Furthermore, 27.58% of male teachers possess a low level of digital competence, while 29.16% of female teachers possess the same level of competence. The Chi-square value (0.174), which is not significant at 0.05 levels, and thereby the null hypothesis that there is no significant difference in the digital competence of teachers working in higher education institutions with respect to gender, is not rejected. Thus, it can be said that male and female teachers do not differ significantly in their digital competence.

Table 3: Comparison of digital competence of higher education teachers (with respect to age)

Level	Up to 40 years (N & %)	41-50 years (N & %)	51 and above years (N & %)	Kruskal- Wallis Test	Sig.
Low	7(26.92)	2(10.52)	6(75)	6.213	0.045
Average	11(42.30)	13(68.42)	1(12.5)		
High	8(30.76)	4(21.05)	1(12.5)		

1. The table- 3 indicates that 30.76% of teachers below 40 years old, 21.05% of teachers between 41 and 50 years old, and 12.5% of teachers 51 years of age and older have high levels of digital competence. Similarly, the table also reveals that 42.30% of teachers below 40 years old, 68.42% of teachers between 41 and 50 years old, and 12.5% of teachers over 51 years old have an average level of digital competence. Further, the table also indicates that 30.76% of teachers below 40 years old, 21.05% of teachers between 41 and 50 years old, and 12.5% of teachers 51 years of age and older have high levels of digital competence. The Kurskal value (6.213), which is significant at 0.05 levels, Hence, it can be inferred that there is a significant difference in the level of digital competence of teachers with respect to age. Teachers with age group up to 40 years have better digital competence than teachers with higher age group.

Table 4: Comparison of digital competence of higher education teachers (qualification wise)

Level	PG with NET (N & %)	M.Phil. with NET (N & %)	Ph. D (N & %)	Kruskal- Wallis Test	Sig.
Low	2(28.57)	2(18.18)	11(31.42)	1.696	0.428
Average	1(14.28)	7(63.63)	17(48.57)		
High	4(57.14)	2(18.18)	7(20)		

The table-4 reveals that 57.14% of PG teachers with NET qualifications, 18.18% of M.Phil. teachers with NET qualifications, and 20% of Ph.D. teachers have a high level of digital competence. Similarly, the table also indicates that 14.28% of PG teachers with NET qualifications, 63.63% of M.Phil. teachers with NET qualifications, and 48.57% of Ph.D. teachers have an average level of digital competence. Similarly, the table also indicates that 14.28% of PG teachers with NET qualifications, 63.63% of M.Phil. teachers with NET qualifications, and 48.57% of Ph.D. teachers have an average level of digital competence. Furthermore, the table reveals that 28.57% of PG teachers with NET qualifications, 18.18% of M.Phil. teachers with NET qualifications, and 31.42% of Ph.D. teachers have a low level of digital competence. The Kurskal value (1.696), which is not significant at .05 levels, and thereby the null hypothesis that there is no significant difference in the digital competence of teachers working in higher education institutions with respect to qualification, is accepted. The study found that PG teachers with NET qualifications, M.Phil. teachers with NET qualifications, and Ph.D. teachers have same level of digital competence.

Table 5: Comparison of digital competence of higher education teachers (experience wise)

Level	Up to 10 Years (N & %)	11-20 Years (N & %)	21-above Years (N & %)	Kruskal- Wallis Test	Sig.
Low	4(19.04)	5(20.83)	6(75)	6.504	0.039
Average	10(47.61)	14(58.33)	1(12.5)		
High	7(33.33)	5(20.83)	1(12.5)		

The table- 5 indicates that 33.33% of teachers with less than ten years of experience, 20.83% of teachers with eleven to twenty years of experience, and 12.5% of teachers with twenty or more years of experience have high levels of digital competence. Similarly, the table reveals that 47.61% of teachers with less than ten years of experience, 58.33% of teachers with eleven to twenty years of experience, and 12.5% of teachers with twenty or more years of experience have an average levels of digital competence. Furthermore, the table indicates that 19.04% of instructors with less than ten years of experience, 20.83% of teachers with eleven to twenty

years of experience, and 75% of teachers with twenty or more years of experience have a low levels of digital competence. The Kurskal value (6.504) is significant at 0.05 levels. Hence, it can be inferred that there is a significant difference in the level of digital competence of teachers with respect to experience. Teachers with less than ten years of experience have better digital competence than teachers with higher experience group.

Major findings of the study

- 1) Twenty-eight percent of teachers working in higher education institutions have high digital competence, 47.16% have average competent, and 24.52% have low digital competence. Majority of the teachers of higher education have average level of digital competence.
- 2) There is no significant difference in the level of digital competence of male and female teachers working in higher education institutions at 0.05 levels.
- 3) There is a significant difference in the level of digital competence of teachers working in higher education institutions with respect to age at 0.05 levels. Teachers with age group up to 40 years have better digital competence than teachers with higher age group.
- 4) There is no significant difference in the digital competence of teachers working in higher education institutions with respect to qualification at 0.05 levels.
- 5) There is a significant difference in the level of digital competence of teachers working in higher education institutions with respect to experience at 0.05 levels. Teachers with less than ten years of experience have better digital competence than teachers with higher experience group.

Discussion of results: The researchers studied the level of digital competence of teachers working in higher education institutions with respect to gender, age, qualification, and experience. This study found that the majority of teachers (47.16%) have an average level of competence. This finding is supported by previous research studies (Perez-Calderon et al., 2021; Santos et al., 2021; Morante et al., 2023; Dias-Trindade and Moreira, 2020; Zayapragassarazan & Ramganesh, 2021). However, Grande-de-Prado et al. (2020) did not support these findings, finding that the majority of the teachers have a low level of digital competence due to a lack of knowledge and skills related to technology. The findings of the present study indicate that male and female teachers do not differ significantly in their digital competence. This is in accordance with the study conducted by Santos et al. (2021), which found that male and female higher education teachers possess a similar level of ICT competence. This is in contrast with the study conducted by Guillen-Gamez et al. (2021; Umar & Yusoff, 2022), which indicates that male teachers use ICT in the classroom significantly

more frequently than their female colleagues for teaching and learning as well as for creating presentation and delivery materials. However, Pera and Hodak (2022) revealed that female teacher educators' ICT competencies are better than male teacher educators' ICT competencies. Further, the present study revealed that there is a significant difference in the level of digital competence of teachers with respect to age. This is supported by previous research findings (Radhamani & Kalaivani, 2023; Cabero-Almenara et al., 2021; Sangeetha & Saileela, 2021). This is in contrast with the study conducted by Kaplan, A. (2022), who states that the digital competence of higher education teachers does not significantly differ in relation to age due to the digital transformation of higher education. The study found that teachers in PG with NET, M.Phil. with NET, and Ph.D. degrees all have similar levels of digital competence. This is supported by previous research findings (Klochko & Prokopenko, 2023). This is in contrast with the study conducted by Tkachov et al. (2023), which indicates that there is a significant mean difference among teacher educators on ICT competencies with regard to their academic qualifications. Teachers with Ph.D. degrees have higher ICT competencies than their counterparts with M.Phil. degrees and PG degree teacher educators. This study also found that there is a significant difference in the level of digital competence of teachers with respect to experience. This is supported by previous research findings (Pera et al., 2022; Zhao et al., 2021; Cabero-Almenara et al., 2021; Guillen-Gamez et al., 2022; Rubio-Gragera et al., 2023). This is in contrast with the study conducted by Akour and Alenezi (2022), which indicates that there is a significant difference in the level of digital competence of teachers with respect to experience because there is a lack of teacher training on ICT application in education.

Educational implications and conclusion: The study can be utilized to plan professional development programs in higher education institutions. The refresher course can be organized on a topic related to the use of technology in education by universities and colleges. The teachers of higher education institutions must be encouraged and motivated to learn digital skills and competence by attending online seminars and workshops and enrolling in MOOCs. For the development of digital competence, teachers in all higher education institutions must be equipped with digital devices and applications.

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Cite Your Article as

Bhadab Hembram, & Ramakanta Mohalik. (2024). DIGITAL COMPETENCE OF TEACHERS WORKING IN HIGHER EDUCATION INSTITUTIONS OF ODISHA. *Scholarly Research Journal for Humanity Science & English Language*, 12(81), 125–139. <https://doi.org/10.5281/zenodo.10801794>