



Structure to Research Pedagogy is a Complete Knowledge Package for a Mathematics Teacher

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Abstract

Present paper focuses on Structure to research pedagogy for mathematics teacher. This pedagogy gives knowledge about structure of mathematics subject, levels of objectives, curriculum, syllabus, textbook, analysis of one unit of mathematics, find the place value of units in structure, its connection with other units, know the different ways of teaching, how to have a proper blending of method and content using different methods for same content and changing the scope and difficulty level of content keeping the method of teaching same. This pedagogy can develop metacognitive skills and research attitude of mathematics teacher and can lead the teacher towards need based teaching. 21st century demands teachers who have knowledge about different ways of teaching and research attitude to fulfil the learning wants of students having different capacities.

Key Words: Pedagogy, Knowledge Package

Introduction

Every human being must satisfy his primary and secondary needs to enrich his life. Education is the only agency which functions to impart knowledge about the ways and means of satisfaction of all these needs. According to *John Dewey (1938) education is the strong agency to provide two sources of knowledge for individual*. There is the knowledge that student acquires from interaction with environment is called intuitive knowledge. Primary

characteristic of this knowledge is reality. The second source of knowledge is formal instructions, disciplined knowledge, school knowledge, and subject knowledge. This type of knowledge is called structured knowledge or goal oriented knowledge. A primary characteristic of this knowledge is authority. Teacher has an authority to impart this knowledge to students by the students own learning ways to fulfil the above needs and wants of life.

Mathematics:

Out of all school subjects, mathematics is a practical subject; it contributes a lot to fulfil needs and wants of human life. It is a very broad term which touches various aspects of the human life. Teaching mathematics is a challenging task which if sincerely and systematically undertaken will challenge the best efforts of the best teacher. Best mathematics teacher should not teach mathematics just for the heck of it but should feel the call for it because unless the teacher learns the pedagogy of teaching mathematics he cannot inspire his student for studying it. Mathematics teacher should have **scientific, systematic and organised bend** of mind requires **metacognition**. It is the multidimensional set of skill that involves knowledge and its regulation.

Structure to research Pedagogy:

Teacher has to regulate the knowledge by using the pedagogical approach from structure to research. Pedagogy is an art, science and profession of teaching. It helps to structure the knowledge for teaching. To regulate the knowledge of mathematics for best teaching and learning demands the pathway from structure to research can be the pedagogical approach to organise the teaching knowledge of mathematics. It includes the study of structure of mathematics, its curriculum, syllabus, textbook, place value of particular unit in the structure and its connectivity to other units, analysis of teaching units, teaching plans using different methods and changing the difficulty level and scope of topic depicts the research in teaching for modification.

Objectives:

- To use metacognitive abilities to regulate the knowledge for teaching mathematics.
- To prepare and understand the structure of mathematics.
- To write the levels objectives included in pedagogy.

- To understand about curriculum of mathematics at secondary stage – it's components, principles of framing and its methods of construction.
- To segregate the spread of syllabus.
- To find the place of particular unit in structure and its connection to other units.
- To analyse the unit for teaching.
- To prepare teaching plans using different methods or models of teaching.
- To prepare teaching plan changing the difficulty level and scope of content.
- To use different skills to plan lessons.
- To generate system for mathematics teaching.
- To think about research in teaching for modification.

Content

Structure of subject

Structure of subject is the outcome of teachers metacognitive, information processing and encoding abilities. Preparing structure is initial and vital step in mathematics teaching. Structure is horizontal as well as vertical spread of content of subject. It catches the central ideas and key words of content. In mathematics structure horizontal spread depicts different branches of mathematics like arithmetic, algebra, geometry, statistics--- and vertical spread depicts the topics of content from concrete to abstract level in contains different forms like concepts, rules, laws, facts, definitions, proofs, theorems ---etc. Structure works as an inquiry tool about depth and scope of discipline. According to *Schwab (1962)* "**Structure is a central mode of inquiry and knowledge finding tool of discipline**". Structure reflects the **ultimate objectives** of mathematics

Curriculum

Because of bread and butter value of mathematics subject, mathematics curriculum occupies strong place in school curriculum. Teaching of mathematics involves practical attitude, habits and ideals. Curriculum is only a tool which is always prepared in view of the work to be taken by it. Curriculum includes different components like general curriculum objectives, syllabus, and different ways of teaching and evaluation system. Every mathematics teacher should know that curriculum should reflect mainly real and felt needs, psychological needs and economic needs of society. Curriculum gives teacher the knowledge about different methods of curriculum construction like concentric, linear, pyramidal and spiral ---- etc.

Teacher should focus upon the principles of curriculum like dynamism, child –centeredness, utility and practical value, flexibility, unity, integration of theory and practice, comprehensiveness. According to *Webster’s New World Dictionary (1973)* “*Curriculum is the course of study. It includes objectives, topics, material aids, techniques, life situations, related activities, possibilities of correlation and guidelines for teachers and list of text books and reference books to cover different topics.*”

Syllabus

Syllabus is the part and parcel of curriculum and also its core component. It constitutes content objectives, actual content and evaluation system. It is a road map of content organisation. It is an integrated teaching unit. Mathematics syllabus always demands for segregation of similar units. Mathematics teacher should have the knowledge of organisation of units. He should focus on inductive, deductive and cluster these different approaches of unit presentation. Mathematics syllabus is a focused outline for mathematics teacher. Mathematics teacher should study the mathematics syllabus for particular standard to delimit the content activities.

Textbook

Textbook is an organised physical manual for instruction covering a variety of topics for specific subject area. *According to (Encyclopaedia of Education, 2008b)* “*Textbook is a printed and a bounded artefact for each year or course of study. It contains facts and ideas around a certain subject.*” Text means security, guidance and support for mathematics teacher. Textbook is a frame work which regulates teaching. Mathematics teacher should know how to evaluate textbook as a best teaching resource. He should consider the quality indicators like, logical way of presenting content, prerequisite knowledge and mathematical skills, real life application, diversified needs, developmental activities, interdisciplinary approach, higher level thinking skills, comprehensive evaluation scheme while examining the textbook as complete resource package.

Content Analysis

Bernard Berelson defined content analysis as “a technique for objective, systematic and quantitative description of manifest content of communication.”

Content Analysis is the crucial step in mathematics teaching. While analysing the content, mathematics teacher should focus on different units given in syllabus. According to Samford *“Unit is an outline of carefully selected subject matter which has been isolated because of its relationship to pupils’ needs and interests”*. When mathematics teacher analyses the content, actually he has to split the unit in subunits and subunits to different forms of content like concepts, facts, statements, rules and laws ----etc. According to content matter, mathematics teacher has to plan outcomes in the forms expected behaviour, focusing all domains of objectives. Specifically mathematics teacher has to plan for different computational and cognitive skills and focus on interactive domain includes verbal and non-verbal interactions. Selection of appropriate medium for teaching is the next step, here teacher has to think about different alternatives to teach that content and select most appropriate strategy, method or model. Student’s age, level of cognition, interest, and learning style should be focused while arranging learning experiences for particular teaching medium. Content analysis demands comprehensive evaluation system. Evaluation system should reflect all planned expected outcomes.

Locate the place of teaching unit in the structure

In this act, mathematics teacher has to highlight the teaching units in the structure and find its place value. He has to think about its connectivity and relation with other topics.

Preparation of teaching plans using different methodologies for the same unit:

Mainly there are Inductive – deductive, analysis – synthesis, experimental and heuristic methods and concept attainment, advance organiser and inductive thinking models from information processing for teaching mathematics. Every methodology has its unique action plan for implementation. Here teacher can achieve the teaching freedom preparing different action plans using above different methodologies for same content and suggest the tuning of methodology with content. This also suggests teacher’s different roles of teaching the same content.

Preparation of teaching plans, increasing and reducing the scope and difficulty level of the topic by keeping the same methodology

Here teacher has to change his teaching parameters. He has to modify his cognitive process according to level of content. Teacher has to change his role according to level.

Present era is passing through a period of silent revolution in the field of education. Knowledge and population explosion are two factors that are trying to change the web of life. Use of computer technology is the only solution and innovative step should be taken in the field of education. Mathematics teacher should be well prepared for this. He can make use of computer in both the ways like computer as a support system and computer as a teaching device.

Preparation of a teaching plan using computer as a support system

Because of development in technology and universalization of use of computer in teaching, mathematics teacher should know how to use computer as an aid in teaching mathematics. Teacher can use power point to show different figures, diagrams, clippings and web reference while teaching. Mathematics teacher can modify and improve his act of teaching using computer as a support system.

Preparation of a self learning plan using computer as a teaching device

Programmed instruction is a new path towards automation and individualised instructions. A mathematics teacher should use computer as a teaching device which demands self-learning programmed instructions. It requires knowledge of types of programming like linear, branching and mathematics. As per demands of content and system teacher should use different types of programming to prepare self-instructional packages for mathematics teaching.

Research

In present education system, the changing learning needs of students call for research in teaching field. Research is a dire need in mathematics teaching. Mathematics teacher always faces a problem to make the teaching interesting and to make the students understand the specific contents. By doing research, a teacher can find and develop different ways and means in the form of solution. In education field mainly applied, product and action research are used and so a teacher should have knowledge of all these researches to face the challenges in teaching field.

Structure to method pedagogy reflects the following principles suggested by Ausubel -

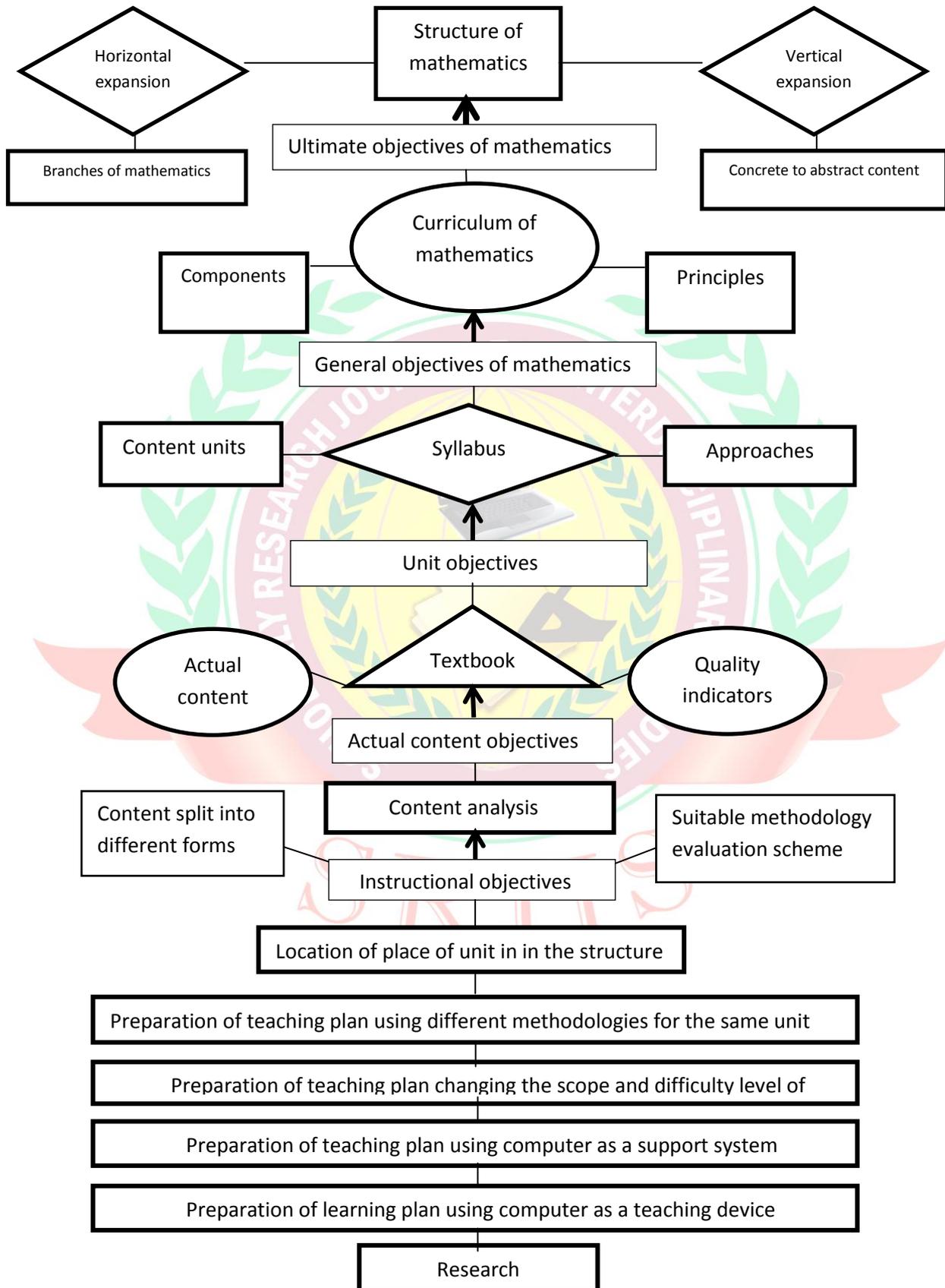
Progressive Differentiation – is a statement of the broad outline of a topic, followed by specific details.

Integrative Reconciliation – is a deliberate linking process of new ideas, researches and technologies with basic learned content.

In this pedagogy, when mathematics teacher constructs conceptual map of whole mathematics content and go for teaching single concept from mathematics is progressive differentiation. From new researches and new innovations to basic concepts in mathematics is integrative reconciliation.



Structure to research pedagogy – Complete Knowledge Package



Significance

- This pedagogy is a complete knowledge package for a mathematics teacher.
- It can develop metacognitive, information processing and information encoding skills of mathematics teacher.
- It can develop objective framing abilities of a mathematics teacher.
- It reflects teacher's power of knowledge construction and extraction.
- It can develop a teachers teaching independency.
- It can make the teacher a best critic by examining the teaching resources.
- It can develop decision making power and research attitude of mathematics teacher.
- It can prepare a mathematics teachers mind as the best self-instructional programmer.
- Mathematics teacher can accept the challenges of 21st century using this pedagogy for mathematics teaching.

Conclusion

In 21st century, a mathematics teacher should be a best constructor, developer, organiser, examiner and executer of knowledge to fulfil needs and wants of this dynamic society.

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