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CHAPTER-2

THEORITICAL BACK GROUND

2.1: Use of Multimedia in teaching of Mathematics:

The main aim of education is the development of whole some personality and also to unsettle the minds of the young children and inflame their intellect. In an increasingly complex world, it is critical that all students have extensive practice in what it means to think like a scientist. The skills essential in science education are “not only needed by scientists, but by every citizen in order to become a scientifically literate person able to function in a society where science has a major role and impact [on daily life]” (Huppert et al., 2002, 807). Advances in every arena, from computer technology to healthcare to food production to the automotive industry have changed our world in ways that few could have anticipated. Students need a firm grasp of science in order to fully comprehend their world and make informed decisions. The questions presented by new technologies may not have an answer or may have multiple answers. Students who have experience applying scientific inquiry and reasoning to real-world problems.

Modern Technologies offer tremendous possibilities in enhancing students’ learning, developing teachers’ professional capability and strengthening institutional capacity. It enables opportunities for educators to enhance the quality and accessibility of their Instructional material. The society is highly networked to create knowledge-intensive environment to efficiently create, share, use and protect knowledge.

In this modern age of Science and Technology, emphasis is given on Science such as Physics, Chemistry, Biology, Medicine and Engineering. Mathematics, which is
a Science by any criterion, also is an efficient and necessary tool being employed by all these Sciences. As a matter of fact, all these Sciences progress only with the aid of Mathematics. So it is aptly remarked, "Mathematics is a Science of all Sciences and art of all arts."

Mathematics is a creation of human mind concerned chiefly with ideas, processes and reasoning. It is much more than Arithmetic, more than Algebra more than Geometry. Also it is much more than Trigonometry, Statistics, and Calculus.

Mathematics includes all of them. Primarily mathematics is a way of thinking, a way of organizing a logical proof. As a way reasoning, it gives an insight into the power of human mind, so this forms a very valuable discipline of teaching-learning programmes of school subjects everywhere in the world of curious children. So the pedagogy of Mathematics should very carefully be built in different levels of school education.

In the pedagogical study of mathematics we mainly concern with two things; the manner in which the subject matter is arranged or the method the way in which it is presented to the pupils or the mode of presentation. Mathematics is intimately connected with everyday life and necessary to successful conduct of affairs. It is an instrument of education found to be in conformity with the needs of human mind.

Mathematics being a compulsory subject of study, access to quality mathematics education is every child’s right. Keeping in mind the Indian reality, where few children have access to expensive material, hence mathematics education should be affordable to every child, and at the same time, enjoyable. This implies that the mathematics taught is situated in the child’s reality, and that for the system, it is not the subject that matters more than the child, The National Policy on Education
1986 went further: Mathematics should be visualized as the vehicle to train a child to think, reason, analyze and to articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning. The National Curriculum Framework for School Education (NCFSE) 2000 document echoes such sentiments as well. Yet, despite this history of exhortations, mathematics education has remained pretty much the same, focused on narrow aim. While inadequate teacher preparation and support acts negatively on all of school mathematics, at the primary stage, its main consequence is this: mathematics pedagogy rarely resonates with the findings of children’s psychology and inadequate teacher preparation reflects as inability to link formal mathematics with experiential learning. Later on, it reflects as incapacity to offer connections within mathematics or across subject areas to applications in the sciences, thus depriving students of important motivation and appreciation. Mathematics, it is widely understood, plays a key role in shaping how individuals deal with the various spheres of private, social, and civil life. Educational technology has emerged as a new discipline in the field of education. Modern Technologies enabled teaching-learning encompasses a variety of techniques, tools, content and resources aimed at improving the quality and efficiency of the teaching-learning process. Ranging from projecting media to support a lesson, to multimedia self-learning modules, to simulations to virtual learning environments, there are a variety of options available to the teacher to utilise various modes/modern technological tools for effective pedagogy. Each such device or strategy also involves changes in the classroom environment, understanding of which has a bearing on its effectiveness. Availability of a wide range of such teaching learning materials will catalyze transformation of classrooms To Sharma(1992) Educational technology implies to all the modern media , methods , materials practices, theories and principles for maximizing the learning outcomes. It facilitates learning
outcomes. It facilitates learning by the control of environment, media and method. In the student centered approach the strategies are designed to provide the students with highly flexible system of learning, which is geared to individual’s life and learning styles. There are varieties of different media such as slides audiotapes, models, practical exercises, computer based materials and other teaching aids can be readily incorporated in the teaching learning process which results in enhancement of achievement of students in their respective subjects which paved the way for the rise of the multimedia.

2.1.1 Background of Multimedia in Teaching Learning Process:

Multimedia is used to present information in many exciting ways by combining hypermedia techniques with instruction. Good presentations can be created when they are based on cognitive objectives that focus on the learning of topics at different levels of comprehension. Interactive multimedia has the potential to create high quality learning environments which actively engage the learner, thereby promoting deep learning. However there is growing evidence that the potential of Interactive Multimedia enables designers to choose from a range of media elements to convey a particular message, whether that is text to display simple instructions or moving images to represent a process. Multimedia can support multiple representations of the same piece of information in a variety of formats. This has several implications for learning. Learners are not a homogenous group. Some learners prefer to represent information verbally when thinking (verbalizes) and others visually (imagers). Riding and Douglas (1993) found that learning performance was affected if information was not presented in a learner’s preferred type. Imagers performed better than verbalizes in text-plus-pictures conditions, whereas verbalize performed better than imagers in text plus-text conditions. However it is not just a question of cognitive style preference. Sutcliffe
and Faraday (1994) suggest that different types of media best represent different types of information. A tension exists between the best presentation medium as determined by information type and presentation medium as determined by cognitive style. The reinforcement and supplementation of information through multiple representations, whether in the same or a different format, also creates a redundancy effect, which aids the process of conceptualization.

While multiple representations are not necessarily multimedia, and not all multimedia is equally effective (Mayer, 2005), the ways that scientists use multiple media and multiple representations can teach us a great deal about how to use these materials in the classroom. Learners are better able to grasp new pieces of information and discern patterns when they are presented with “numerous, effective examples” (Rose and Meyer, 2002). If we view science learning as a process of inquiry and investigation, it makes sense to use multiple representations as an inquiry tool, in much the same way that scientists in the field do (Kozma and Russell, 2005).

Students often develop scientific understandings as a result of their own observations and what they can see to be true. This approach is problematic when the phenomena under investigation are unseen or at least unobservable in the confines of the classroom. Computer-based modeling tools can help students overcome these difficulties. These tools “create exciting opportunities for students to create, manipulate, and interact with their own constructions, which in turn support them in developing understandings through their first-hand experience” (Barnett et al., 351).
2.1.2 Meaning and Definitions of Multimedia:

(a) Definitions of Multimedia: (Elsons-cook 2001): Multimedia is a combination of variety of communication channels into a co-ordinate communications experience for which an integrated crossed channel language of interpretation does not exist.

This definition gives way for two approaches one that is termed as “multiple media” utilization and the other in which a combination of different channels acquires unification as a medium. The latter approach leads us to the next definition.

Reddi-2001: Multimedia can be defined as an integration of multiple media element (Audio, Video, Graphics, Text, Animation, etc) into one synergetic and symbiotic whole that results in more benefits for the end user than any one of the media elements, can provide individually.

Philips (1997): The term interactive multimedia is a catch all phrase to describe the new wave of computer software that primarily deals with the provision of information. The multimedia component in characterized by the presence of text, picture, sound, animation and video. Some or all of which are organized into some coherent program. The interactive empowering the user to control the environment usually by a computer.

2.3 Interactive Multimedia Strategies

Multimedia can be used to present information in many exciting ways by combining hypermedia techniques with instruction. Good presentations can be created when they are based on cognitive objectives that focus on the learning of topics at different levels of comprehension. Interactive multimedia has the
potential to create high quality learning environments which actively engage the learner, thereby promoting deep learning. However there is growing evidence that the potential of interactive multimedia enables designers to choose from a range of media elements to convey a particular message, whether that is text to display simple instructions or moving images to represent a process. Multimedia can support multiple representations of the same piece of information in a variety of formats. This has several implications for learning.

Multimedia has been touted as the preferred medium in revolutionizing education. Multimedia is a combination of different elements –text, graphics, animations, simulations, and sound and various other teaching aids. It is used to form an informative and interactive environment. The role of multimedia is also evident in the documentation of various concepts, principles, and generalizations in mathematics. The traditional method of teaching helps to some extent. But when multimedia is introduced to teach concepts, it motivates the learners towards self achievement.

2.4: Benefits of Interactive Multimedia Strategies in Classroom Instruction

There are enormous benefits from the Interactive Multimedia Strategies in Classroom Instruction. The benefits of Interactive Multimedia Strategies in Classroom Instruction are summarized below.

- Improves efficiency both in teaching and learning
- Increases motivation
- Paves way for Personality Development
- Active Participation of students
- Self-paced Learning
- Very flexible and rich medium for students to access the information
- Better learning, Retention and Students’ performance
- Multisensory learning experience.

![Figure-1-Components of Multimedia](image)

**Interactive Multimedia Strategies**: The strategies were developed by the researcher to teach the selected topics of standard 1X mathematics using an array of media i.e., multimedia such as models, charts, flip over charts, computers and aids etc.,

**Models**: These are the type of interactive multimedia which can give concrete experience to the students about the concepts. These are the replication of real objects which can bring a clear picture in the mind of the students. Mathematics is such a abstract subjects with full of abstract concepts, formulas, generalization and principles which can be concretized to the mind of the students with the help of these models which helps in longer retention of the concepts.
**Charts:** These are another type of Interactive Multimedia which are self explanatory which gives the complete picture of the concepts and stimulates teaching and arouse interest in the subject and helps in the longer retention of the subject matter. Usage of the charts helps the teacher to make the concepts clear and motivates students for better learning.

**Flip over Charts:** These are the series of charts which constitute another set of Interactive Multimedia which stimulates the curiosity and thinking among the students and make teaching learning process and interesting and effective. This helps the students participate actively in the classroom teaching and enhance his performance and thinking skills among the students.

**Videos:** This constitute another example for interactive multimedia which stimulates the senses of the students and bring novelty in the teaching of mathematics and the abstract concepts are dealt with a real hand on experience with the help of videos which can be used in the classroom teaching which aids the teaching. Even this helps in longer retention of concepts.

Motion video, including commercial tapes, movies, and videos related to various concepts, is often a major element of interactive multimedia software, but computers need special hardware and/or software to display video. Video presentations are generated from video files that consume a lot more storage space than simple animations.

Taylor (1992) had recognized that video is not an ideal medium for presenting detailed material, but is better used for broader, abstract material, possibly with an emotional appeal. An abstract video segment may serve well as the medium for an advance organizer, and, similarly, for a lesson summarization. Hooper and Hannafin (1988) have found that media that employ both print and video are likely
to result in deeper processing than a medium that employs just print. Taylor (1992) also reports that most learning occurs when audio and video are redundant, is synchronized with content, and repeats and reinforces the concepts being presented.

**Power Point Presentation** : These are another set of multimedia known as technology based lessons which creates interest in learning and appeal to the senses of learner and lots of activates, videos, text, graphics, animation can all be included and make teaching effective and learning efficient. By using flash and PowerPoint with Dot NET technologies, a unit is chosen which is divided into meaningful lessons. Each lesson is designed in such a way as to move from one slide to another slide with meaning continuity. All the concepts are developed based on simple to complex logic so that learner does not find difficulty in adopting learning. At the end of each lesson, a self evaluation chart is provided.

**Graphic organizers:** Graphic organizers are the devices that show the organization or structure of the concepts as well as the relationships between the concepts. Spatial arrangements depicting the information’s structure reduce the cognitive demands on the learner. It is a visual and graphic display depicting the relationships between facts, terms, and ideas within learning tasks. It is a graphical or spatial representation of text concepts; it is an instructional tool that can help the students to organize structure the information and concepts to relate to the other concepts.

In reviewing researches on Graphic Organisers, Hudson et al. (1993) note that positive outcomes for curricular enhancements require the use of effective teaching practices. Merkley and Jefferies (2001) note that “it is important, however that Graphic organizers planning extend beyond construction of the visual “. Thus
instructional context is another determinant of the effectiveness of graphic organizers for improving learning.

Studies have shown that meaningful learning can be assisted through the use of graphic organizers. Students who use graphic organizers as a learning strategy performed better than the students with conventional learning.

It is a powerful tool for problem-solving, conceptual development, critical thinking and evaluation which help to make the learning process much easier for the students.

In modern times many new strategies, techniques methods are used to make mathematics more concrete and interesting. The development of reasoning power and discipline are the two major aims of learning mathematics. According to Locke,” Mathematics is a way to settle in the mind of reasoning” the ultimate aim of teaching mathematics should develop the mental powers so that children gain confidence in their ability to reason and justify their thinking. This cognitive ability grows as the children learn that mathematics is not a subject where simply memorizing rules and procedures be stressed but mathematics is a subject learner to learn the process through the learning. A class room that values reasoning also values problem solving all of which are the components of broad goals of the entire school curriculum.Interactive Multimedia Strategies should enhance the achievement of students in mathematics.

2.5: The Role of Interactive Multimedia Strategies in enhancing AIM

It is well known that achievement motivation and achievement related beliefs play an important role in achievement behaviors such as persistence, choice and performance (Uguroglu and Walberg, 1979), important achievement related beliefs includes self concept achievement expectation and achievement values. There has
been increasing interest in developing multimedia strategies which specify how these beliefs are related to one another and to bring the change in the behaviour and learning which would enhance the academic achievement of the students. The strategies which help for the students to create to apply and make them socially matured shows the enhancement of skills.

The schools roles are very important. achievement are the study habits of the students, the teachers, the school environment, the socio economic status of the students, the neighborhood, the background character, the perception of self and others, particular interest, family income, parents level of education, negative situation in the home(Julie P. Noble, William L. Roberts and Richard L).

According to Carter V. Good (1973), achievement means accomplishment or proficiency or performance in a given skill or body of knowledge, helps in declaring the examinee successful or unsuccessful, choosing the students for various professional and academic courses and selecting the candidates for different jobs”.

Achievement in Mathematics means the extent to which a student have achieved something, acquire certain information, demonstrated proficiency in certain skills usually as a result of instruction in the subject of mathematics. In the present study, it is represented by the scores of students in the achievement test in Mathematics prepared and validated by the researcher.

### 2.6: Interactive Multimedia Strategies for fostering Critical thinking Ability

The main objective of interactive multimedia strategies is to develop to enhance academic achievement and critical thinking Ability among the students. Then thinking may thus be defined as a pattern of behavior in which we make use of internal representations of things and events for the solutions of some specific
purposeful problem. Thinking as a mental process, is usually classified into the different categories. The following figure shows various types of thinking.

Though there are several types of thinking as explained by many educationalist and psychologists (Dewey, Debono, Bruner etc) most of them are interesting and slightly overlapping with each other in some aspect of cognitive process. But, critical thinking is one among the above and more suitable in the present day mathematics instruction to achieve higher order objectives at the secondary school level. Fostering of good thinking as traditionally been viewed by philosophers as an educational aim. It is primarily since the start of 1970 that the interest in critical thinking has crystallized into a moment for educational reform.

Critical thinking consists of mental processes of discernment, analyzing and evaluating. It includes all possible processes of relative tangible and intangible terms in order to form solid judgement that reconciles scientific evidence with common sense. Such critical thinking is based on concepts and principles, not on hard and fast or step-by-step procedures. Thus critical thinking is principle-based not procedure-based.

Critical thinking may be distinguished, but not separated, from emotions, desires and traits of mind. Failure to recognize the relationship between thinking, feelings, wants and traits of mind can easily lead to various forms of self deceptions, both individual and collective. A person without intellectual traits of mind will have weak critical thinking ability where as a person with fair mental traits has a strong sense of critical thinking ability. Thus critical thinking requires intellectual humility, empathy, integrity, courage, autonomy, confidence and other intellectual traits. A person who thinks critically will ask appropriate questions, gather information efficiently and creatively, sort out this information, reason logically
from this information and come to realize and trustworthy conclusions about the world that enables one to live and act successfully in it.

Critical thinking is type of thinking that helps a person to go beyond his own personal belief, prejudices and opinions and sort of the facts, discover the truth even at the expenses of belief system. In this way it is a challenging thought process leads a person to new avenues and knowledge and understanding.

2.6.1 TYPES OF THINKING

Thinking may thus be defined as pattern of behavior in which we make use of internal representations of things and events for the solutions of some specified purposeful problem. Thinking as a mental process, is usually classified into the different categories. The following figure shows various types of thinking.

Figure-2: Types of Thinking
Though there are several types of thinking as explained by many educationist and psychologists {Dewey, Debono, Bruner etc.}, most of them are interesting and slightly overlapping with each other in some aspects of cognitive process. But, critical thinking is one among the above and more suitable in the present day mathematics instruction to achieve higher order objectives at the secondary school level. Fostering of good thinking has traditionally been viewed by philosophers as an educational aim. It is primarily since the start of the 1970 that the interest in critical thinking has crystallizes into movement for educational reform. This development has been accompanied by considerable theoretical analysis and debate. Critical thinking is sought to be conceptualized by curricular innovations including the development of critical thinking course. It should also revise the existing programme and curricular materials, development of new evaluation procedures and critical thinking requirements in various educational institutions and systems.

2.6.2 CRITICAL THINKING AND ITS PRINCIPLES

Critical thinking is a type of thinking that helps a person to go beyond this own personal beliefs, prejudices and opinions, and sort out the facts; discover the truth even at the expense of his basic belief system. In it represents a challenging thought process which leads a person to new avenues of knowledge and understanding. It is structured approach of thinking of find ways and means for the improvement of thinking process itself. On examining the vast literature on critical thinking, various definitions of critical thinking emerge. They are:

**Chance (1986):** Says critical thinking is “The ability to analyze facts generate and organize ideas, defends opinions, make comparison, draw inferences, evaluate arguments and solve problems”.
**Tama (1989):** calls it “A way of reasoning that demands adequate support for ones belief and unwillingness to be persuaded unless support in forthcoming”.

**Ennis (1992):** Defines critical thinking as “Reasonable reflective thinking focused on deciding what to believe or do”. (The definition will probably continue to change in the following decades, but one thing will remain constant –the need to provide effective solutions to complex problems experts on critical thinking explains that students feel their work gains significance when it is towards a purposeful end) to address a purpose come up with a solution they truly begin to identify analyze and solve problems to critical thinking.

**Scriven, 1996 “Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action”).**

**Angelo, 1995, p. 6 “Most formal definitions characterize critical thinking as the intentional application of rational, higher order thinking skills, such as analysis, synthesis, problem recognition and problem solving, inference, and evaluation”).**

**Center for Critical Thinking, (1996b). “Critical thinking is thinking that assesses itself”**

**Center for Critical Thinking, 1996c) “Critical thinking is the ability to think about one's thinking in such a way as 1. To recognize its strengths and weaknesses and, as a result, 2. To recast the thinking in improved form”.

**Beyer (1995):** Critical thinking... means making reasoned judgments" (p. 8). Basically, Beyer sees critical thinking as using criteria to judge the quality of something, from cooking to a conclusion of a research paper. In essence, critical
thinking is a disciplined manner of thought that a person uses to assess the validity of something (statements, news stories, arguments, research, etc.).

From above definitions one can visualize the definition of critical thinking ability as the process of analyzing, synthesizing, and evaluating the authenticity, accuracy and worth of information and arguments gathered through observation, experience, reflection and logical reasoning. It is the ability to make evaluations and judgement based on logic and ideas, rather than on intrinsic value.

Angelo (1995) “most formal definitions characterize critical thinking as the international application of rational, higher order thinking skills, such as analysis, synthesis, problem recognition and problem solving, inference, and evaluation”. Others take the position that critical thinking is metacognition, awareness of one’s own thinking (Center for critical thinking, 1996).

Categorizing the critical thinking by common features presents at least two general views: 1. International use of higher order thinking skills and 2. Metacognition.
To do this, Beyer says the thinker must have the following skills:

- Critical thinkers are skeptical, open minded, value fair-mindedness, respect evidence and reasoning, respect clarity and precision, look at different points of view, and change positions when reason leads them to do so.
- To think critically, must apply criteria or some standards
- Critical thinking involves identifying, evaluating, and constructing arguments
- The ability to infer a conclusion from one or multiple premises.
- Critical thinkers view phenomena from many different points of view.
- Critical thinking uses many procedures, such as asking questions, making judgments, and identifying assumptions.

From the above discussion one can understand that critical thinking involves careful consideration of a given situation in terms of all the information so as to evaluate or to arrive at appropriate generalization base on certain criteria.

One the basis of what has been said above we can draw conclusion about the nature of critical thinking, by terming it as higher order well disciplined thought process, which involves the use of cognitive skills like conceptualization, interpretation, analysis, synthesis and evaluation for arriving at the unbiased, valid and reliable judgement of the gathered or communicated information or data as a guide to one’s belief and action. In this way, a critical thinker is supposed to imbibe certain specific critical thinking skills along with proper dispositions and attitudes of utilizing these skills of his personal and social progress.
Critical thinking is an important and vital topic in modern education. Many educators are interested in teaching critical thinking skills to their students. Many academic departments hope that the professors and instructors will be well informed about the strategy of teaching critical thinking, identify areas in one courses to emphasize and teach with critical thinking skills.

Critical thinking may be distinguished from general or ordinary thinking in many ways. Its real value lies in its quality of being most skillful and responsible thinking that facilitates good judgement. It definitely sets some criteria for its own procedural advancement and is self-correcting and sensitive to the contemporary issues and circumstances. It proves to be a backbone and a reliable support for carrying out the process of problem solving. It does not reach or encourage the child to mug up things without proper understanding. Rather, it makes him a self-reliant, independent inquirer, a discoverer, a useful and progressive citizen, as needed by a rational and democratic society. Therefore, all our efforts should be to develop the required critical thinking potential among the youngsters.

Effective lessons on critical thinking connect subject matter, cognitive strategies and skills. Because critical thinking cannot be done meaningfully unless the student knows certain concepts and facts related fundamentally to the question under consideration. A successful critical thinker is also aware of differences in criteria and evidence used to justify propositions in different subjects, such as mathematics, science, history, economics, and geography.

Successful mathematics teaching and learning involves practice of critical thinking skills with recognition of how they fit together as part of a strategy or process. By contrast, practice of discrete skills is a relatively ineffective means of developing capability in critical thinking.
Development of critical thinking strategies or processes requires continuous practice under the direction of a skillful teacher. Direct teaching is useful means to introduce strategies and skills, but relying on this method is insufficient. Students must be stimulated to think critically on their own to resolve dilemmas, take stands on issues, judge propositions about knowledge or ideals.

### 2.8 ATTRIBUTES OF CRITICAL THINKING SKILLS AND ITS COMPONENTS

A shift occurred from listing skills to be learned toward attributes of classrooms that promote critical thinking skills as apart of the experience of that classroom. Such a class to promote critical thinking can be created by providing the conditions for the students to communicate with one another in order to reflect together on the solution to the problem. There are several attributes decide the nature of Critical Thinking Ability.
Wade (1995): identified several attributes of Critical Thinking Ability. The following figure indicates the attributes of Critical Thinking Ability.

**FIGURE -4 ATTRIBUTES OF CRITICAL THINKING ABILITY**

Cognitive psychologists have identified various components of critical thinking skills in different disciplines (Robert Ennis, Crump, Schlichter and Palk, Paul, Binker, Jensen and Kreklau). Critical thinking skills are essentially evaluative in nature. It involves precise, persistent and objective analysis of any claim, source of belief to judge its accuracy, validity or worth.

There are many components involved in the development of critical thinking skills. The following are the essential components of critical thinking skills according to (Crump, Robert Ennis, Terry Applogate and Anitha Harnadek).
1. Distinguishing relevant from irrelevant information.
2. Unstated assumptions
3. Making inference
4. Formulating hypothesis
5. Problem solving
6. Thinking independently
7. Comparing analogous situations
8. Developing confidence in reason
9. Questioning deeply
10. Making decisions

Classroom behaviour of the teacher is a highly complex phenomenon; operationally it may be understood as the use of various teaching skills involved in the teaching learning process. Interactive Multimedia Strategies is a powerful tool for problem-solving, conceptual development, critical thinking and evaluation which help to make the learning process much easier for the students.

2.7 Development of Interactive Multimedia Strategies: The researcher developed Interactive multimedia Strategies for the selected topics of standard IX State Board Mathematics Syllabus.

The researcher selected the topics based on the informal discussions with the students and teachers to trace the learning difficulties paced by the students in learning the topics in Mathematics. Keeping those things in view, the researcher developed and validated the interactive multimedia strategies. The researcher did thorough unit analysis followed by content analysis and listed out the specific behavioural objectives for the units like Sets, Circles, Mensuration, Matrices and Factors and Factorization. The Interactive Multimedia Strategies which were
developed by the researcher consists of Charts, Flip-over Charts, Models, Power Point Presentations and Graphic organizers to teach the topics and help the students to understand better the abstract concepts and overcome their learning difficulties and also help them to enhance their academic achievement.

The details of the Interactive Multimedia Strategies which were developed by the researcher for the selected topics in Mathematics of standard IX are furnished in the following tables.
Table -1: Showing the action plan of IMMS for the Unit-1

<table>
<thead>
<tr>
<th>Stages</th>
<th>Concept formation</th>
<th>Strategy</th>
<th>Media</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subunits</td>
<td>Teaching points</td>
<td>Strategy</td>
<td>Type</td>
<td>Duration</td>
<td>Procedures</td>
</tr>
<tr>
<td>1.</td>
<td>Meaning of sets, its representation in rule and roaster method, problems</td>
<td>Induction</td>
<td>Charts, Flip over charts</td>
<td>40 min</td>
<td>Work sheets</td>
</tr>
<tr>
<td>2.</td>
<td>Types of sets, examples problems based on it</td>
<td>Induction, deductive method</td>
<td>Charts, power point presentation</td>
<td>40 min</td>
<td>Work sheets and drill work</td>
</tr>
<tr>
<td>3.</td>
<td>Operations using sets: union of sets, intersection of sets, difference of sets. Complement of sets, problems based on it</td>
<td>Analysis and synthesis</td>
<td>Charts, graphic organizers,</td>
<td>40 min</td>
<td>Work sheets and drill work</td>
</tr>
<tr>
<td>4.</td>
<td>Representation of sets using Venn diagrams, properties of sets, and problem based on it.</td>
<td>Inducto-deductive method</td>
<td>Flip overs charts, power point representation.</td>
<td>40 min</td>
<td>Work sheets and drill works</td>
</tr>
</tbody>
</table>

At the end of this unit, test was given to test the performance of the students (for 25 marks, it includes MCQ, very short, short answer and essay type answers)
### Table -2 : Showing the action plan of IMMS for the Unit-2

<table>
<thead>
<tr>
<th>Subunits</th>
<th>Teaching points</th>
<th>Strategy</th>
<th>Media</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Meaning of Matrix, its representation order of matrix method, problems based on it</td>
<td>Induction</td>
<td>Charts.</td>
<td>40 min</td>
<td>Work sheets</td>
</tr>
<tr>
<td>2.</td>
<td>Types of matrices, examples, problems based on it</td>
<td>deductive method</td>
<td>Graphic organisers, power point presentation</td>
<td>40 min+ 40 min</td>
<td>Work sheets and drill work</td>
</tr>
<tr>
<td>3.</td>
<td>Operations using matrices: addition of two matrix, subtraction of two matrices, equality of two matrices and problems based on it</td>
<td>Inducto-deductive method</td>
<td>Charts, graphic organizers, and power point presentations</td>
<td>40 min+ 40 min+40min</td>
<td>Work sheets and drill work</td>
</tr>
<tr>
<td>4.</td>
<td>Multiplication of matrix and problem based on it.</td>
<td>Inducto-deductive method</td>
<td>Flip overs charts, power point representation.</td>
<td>40 min+40Min</td>
<td>Work sheets and drill works</td>
</tr>
</tbody>
</table>

At the end of this unit, test was given to test the performance of the students (for 25 marks, it includes MCQ, very short, short answer and essay type answers)
### Table -3: Showing the action plan of IMMS for the Unit-3

#### Unit -3- Factors and Factorization

<table>
<thead>
<tr>
<th>Stages</th>
<th>Concept formation</th>
<th>Strategy</th>
<th>Media</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subunits</td>
<td>Teaching points</td>
<td>Strategy</td>
<td>Type</td>
<td>Duration</td>
<td>Procedures</td>
</tr>
<tr>
<td>1.</td>
<td>Meaning of variable, constant and literal terms. Classification of terms into like terms and unlike terms and problems</td>
<td>Inductive method</td>
<td>Charts. Flip over charts, graphic organizers</td>
<td>40 min+40 min</td>
<td>Work sheets and drill work</td>
</tr>
<tr>
<td>2.</td>
<td>Meaning of polynomial, classification of terms into monomial, binomial, and trinomial and polynomial, examples problems based on it</td>
<td>Induction, deductive method</td>
<td>Charts, power point presentation, graphic organizers</td>
<td>40 min+ 40 min</td>
<td>Work sheets and drill work</td>
</tr>
<tr>
<td>3.</td>
<td>Meaning of factors, and factorization. Methods of factorization: by common factors, by grouping and problems based on it</td>
<td>Analysis and synthesis I-D Method</td>
<td>Charts, power point presentation etc.</td>
<td>40 min+40min+40min</td>
<td>Work sheets and drill work</td>
</tr>
<tr>
<td>4.</td>
<td>Factorizing by splitting the middle term, and problems based on it</td>
<td>Inducto-ductive method</td>
<td>charts, power point representation.</td>
<td>40 min</td>
<td>Work sheets and drill works</td>
</tr>
</tbody>
</table>

At the end of this unit, test was given to test the performance of the students (for 25 marks, it includes MCQ, very short, short answer and essay type answers)
## Table -4 : Showing the action plan of IMMS for the Unit-4

<table>
<thead>
<tr>
<th>Stages</th>
<th>Concept formation</th>
<th>Strategy</th>
<th>Media</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subunits</td>
<td>Teaching points</td>
<td>Strategy</td>
<td>Type</td>
<td>Duration</td>
<td>Procedures</td>
</tr>
<tr>
<td>1.</td>
<td>Meaning of circle, and its elements/components Problems based on it</td>
<td>Induction</td>
<td>Charts, Flip over charts, power point presentation</td>
<td>40 min+40 min</td>
<td>Work sheets</td>
</tr>
<tr>
<td>2.</td>
<td>Meaning of chord, r/s between radius and diameter problems based on it</td>
<td>Induction, deductive method</td>
<td>Charts, power point presentation</td>
<td>40 min</td>
<td>Work sheets and drill work</td>
</tr>
<tr>
<td>3.</td>
<td>Meaning of concentric circles and congruent circles. Relation between central angle and inscribed angle and problems based on it</td>
<td>Analysis and synthesis</td>
<td>Models and power point presentation,</td>
<td>40 min+40 min+40 min</td>
<td>Work sheets and drill work</td>
</tr>
<tr>
<td>4.</td>
<td>Theorem on circles and problems based on it</td>
<td>Analysis and synthesis</td>
<td>Flip overs charts, power point representation.</td>
<td>40 min</td>
<td>Work sheets and drill works</td>
</tr>
</tbody>
</table>

At the end of this unit, test was given to test the performance of the students (for 25 marks, it includes MCQ, very short, short answer and essay type answers)
### Table -5 : Showing the action plan of IMMS for the Unit-5

<table>
<thead>
<tr>
<th>Stages</th>
<th>Concept formation</th>
<th>Strategy</th>
<th>Media</th>
<th>Time</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subunits</strong></td>
<td><strong>Learning points</strong></td>
<td><strong>Strategy</strong></td>
<td><strong>Type</strong></td>
<td><strong>Duration</strong></td>
<td><strong>Procedures</strong></td>
</tr>
<tr>
<td>1.</td>
<td>Meaning of solid figures, and plane figures, meaning of square based pyramid, LSA and TSA of pyramid and problems based on it</td>
<td>Induction</td>
<td>Charts. Flip over charts, models and power point representation</td>
<td>40 min +40min+40 min+40min</td>
<td>Work sheets</td>
</tr>
<tr>
<td>2.</td>
<td>Meaning of prism, LSA and TSA of Prism . problems based on it</td>
<td>Induction, deductive method</td>
<td>Charts, power point presentation and Models</td>
<td>40 min+40 min</td>
<td>Work sheets</td>
</tr>
<tr>
<td>3.</td>
<td>Meaning of right circular cone. LSA and TSA of cone and problems based on it</td>
<td>I_D method</td>
<td>Charts, power point presentation and Models,</td>
<td>40 min+40 min+40min</td>
<td>Work sheets and drill work</td>
</tr>
<tr>
<td>4.</td>
<td>Meaning of cylinder LSA and TSA of cylinder and problem based on it.</td>
<td>Inducto-deductive method</td>
<td>Flip overs charts, power point representation. Models.</td>
<td>40 min</td>
<td>Work sheets and drill works</td>
</tr>
</tbody>
</table>

At the end of this unit, test was given to test the performance of the students (for 25 marks, it includes MCQ, very short, short answer and essay type answers)