Mathemetics Text books

TEXT – BOOKS

Text-books are standardized collection of the subject-matter that has to be taught to the students. They facilitate the teaching of new concepts and skills and maintain the knowledge already acquired and help the correlation of the theoretical knowledge with the practical aspects of life Need for a Good Textbook in Mathematics Though there are contradicting opinions regarding the use of textbooks for mathematics teaching and learning, the following points support the use of mathematics textbooks. A mathematics textbook is very useful for a teacher in the following ways.

1. A textbook is written according to the syllabus and gives the outline of the course. Therefore it helps the teacher to decide about the limits and depth of the content to be presented to the students while teaching.

2. A textbook provides insight to the teacher in planning the lesson, in selecting the problems to be worked out, the methods of teaching to be adopted and the teaching aids to be used.

3. The textbook is written by experienced teachers of mathematics. By using textbooks, a teacher of mathematics, especially a beginner, can avail the experience and expertise of the authors.

4. The logical and psychological sequence followed in a textbook helps the teacher in presenting the subject matter in an orderly and systematic sequence.

5. A good textbook presents a variety of worked out examples on each topic. This helps the teacher in getting acquainted with different types of problems and the methods to solve them. This gives him more self-confidence while teaching.

6. The well-graded exercises provided after every topic in the textbook help the teacher in assigning suitable homework and assignment to the students to suit their intellectual capacity.

7. A textbook saves a lot of time for the teacher as he need not spend time to prepare problems and the solutions as they are readily available in the textbooks.

8. A mathematics textbook provides the teacher with the basic information considered essential in attaining the objectives of mathematics education and this helps the teacher to plan appropriate learning experiences.

A textbook is an important aid for learning mathematics. It is useful for the students in the following ways:

1. The textbook helps the pupils to relate, what they are learning, to life.

2. It helps to foster the right study attitude among the students since the textbook presents definite and concrete details in a scientific and intensive manner which could arouse the students' interest and curiosity.

3. The textbook provides important source of materials for reviewing and recapitulating the lessons taught in the class.

4. It places within the reach of the pupil the theoretical development, worked out with much thought and a wide view of the bearings of the subject. This helps in meaningful learning.

5. The textbook helps in pre-preparation of the lesson and gets the students acquainted with lessons to be taught.

6. It provides adequate materials for drill and practice and thus helps in fixing the mathematical principles and formulae in the minds of the students.

7. It saves time and labour of the students as they need not copy the illustrative problems, exercise problems and homework problems.

8. It encourages self-study and independent work among the students.

9. It supplements classroom learning and helps in the realization of the objectives of mathematics education.

10. Textbooks help in clearing the doubts and misunderstanding relating to mathematical concepts, formulae and principles. It also helps in correcting the mistakes that occur while copying the formulae and problems from the blackboard.

11. The textbook helps in the extensive study of the subject as it presents different problems and various approaches to problem-solving.

12. New learning activities such as individual projects, laboratory experiments and demonstrations suggested in the textbook can be carried out by the students. It permits each student to read and carry out the activity at his own rate of comprehension.

Importance of text – books Usefulness to the teacher:

1. It provides suitable subject matter and guideline regarding the syllabus of the subject. So the teacher neglects no portion of the syllabus and does not waste time on relevant details.

2. The text books help the teacher planning his lessons, deciding his method of teaching and preparing suitable aids.

3. It provides certain well illustrated examples about a topic.

4. Text books are usually written by the well experienced teachers and subject experts. A teacher can make use of their services by making use of their Text-books

Usefulness to the students:

1. They provide the students with well graded exercises for drill, revision and review.

2. Text books help in pre-preparation. At their home, students may get themselves prepared for studying the next day lesson.

3. Text-books help in doing self-learning, self-study and helping the students to acquire the habit of independent learning.

4. Text-books are also quite useful in case a students has to remain absent from class due to one (or) the other reason.

Characteristics of Good Text-books:

1. It presents the subject-matter strictly in accordance with the latest-syllabus.

2. It is written by experienced teachers.

3. It should contain well graded problems for revision.

4. The day-to-day needs of the students and their physical and social environment should find due place in the text book.

5. It should be according to the aims and objectives of teaching Mathematics in that particular class.

6. The new development and invention in the filed of Mathematics should find their place in the text-book.

7. The psychological as well as logical order should be followed in the organization of the subject matter of the text-book.

8. All the definitions, concepts and principles given in the text book should be as clear and definite as possible.

9. It should make use of the national and international standard terminology in terms of symbols, formulae and definitions.

10. The principle "from simple to complex" should be followed in the arrangement of the topics of the text-book.

11. It should meet the abilities, experience and interest of the students for which it has been written. It should cater to the needs of all types of students – slow, average and fast learners.

QUALITIES OF A GOOD MATHEMATICS TEXTBOOK The qualities of a good textbook in mathematics can be broadly classified under the following heads.

1. Physical features.

2. Author.

3. Content.

4. Organisation and presentation.

5. Language

6. Exercise and Illustrations.

7. General

Physical features:

1. The paper used in the textbook should be of superior quality.

2. It should have quality printing and the binding of the book should be strong and durable.

3. The printing should be bold and easily readable.

4. It should have an appealing and attractive cover page.

Author:

1. It should be written by qualified, experienced and competent teachers of mathematics or a committee of experts constituted by the state government.

Content:

1. The textbook should be written according to prescribed syllabus and every aspect of the Syllabus should be adequately covered.

2. It should be in accordance with the aims and objective of teaching mathematics in that Particular class.

3. The content presented in the textbook should be accurate and up-to-date. It should include the recent developments in the mathematics relating to the content dealt with.

4. The contents of the textbook should have a direct, practical and social utility value.

5. Oral mathematics should find its due place in the textbook.

6. The answers given at the end of each section should be correct.

7. It should satisfy the demands of examination.

Organisation and Presentation:

1. It should provide for individual differences. It should meet the needs of students of varying abilities, interests and attitudes.

2. There should be sufficient provision for revision, practice and review.

3. The textbook should relate the classroom learning to the real life needs and the physical and social environments of the learners.

4. The subject matter in the textbook should be carefully organized with reference to the logical as well as psychological considerations which make teaching effective.

5. The content should be organized in the increasing order of difficulty. Principle of verticle correlation should be followed to relate the present knowledge with the past and future.

6. The presentation of the content should foster right attitude towards self-study and self-reliance among pupils by suggesting project work, field work and laboratory work.

7. It should facilitate the use of analytic, synthetic, inductive deductive, problem solving and heuristic approaches to teaching.

8. The textbook should stimulate the initiative and originality of the students.

9. It should offer suggestions to improve study habits.

.Language:

1. The language used in the textbook should be simple and easily understandable and within the grasp of the pupils

2. The style and vocabulary used should be suitable to the age group of students for whom the book is written.

3. The terms and symbols used musts be those which are popular and internationally accepted.

4. All terms, and concepts and principles used in the text should be clearly and accurately stated and defined.

Exercise and Illustrations:

1. The presentation of the subject matter must be attractive and interesting with appropriate illustrations in terms of pictures, diagrams and figures.

2. The diagrams used in the textbook should be easily recognizable and geometric constructions should be in proportion with the measurements prescribed by the problem.

3. The illustrations should be accurate, clear and appropriate.

4. It should provide adequate opportunities to motivate the students to solve problems by Presenting adequate number of worked out problems and problems constructed from daily life. Situations requiring the student to apply mathematical principles and formulae for their Solution.

5. The text should contain some difficult problems or exercises to challenge the mathematically Gifted students.

6. There should be well graded exercises give at the end of every topic to satisfy the needs of all Calibers.

General:

1. The textbook should be of latest edition with necessary modifications.

2. The book should be of moderately priced and readily available in the market. Qualities of a good text-book:

I. **Subject matter**:

1. Its usefulness

2. Proper organization

3. Coverage of the prescribed syllabus.

4. Accordance with standard of students.

5. Logical and psychological sequence of presentation.

6. Up-to-date content.

II. Language and style:

1. Simple and clear language.

2. Simple language of question.

3. Number and type of questions.

4. Use of well-defined and authorized technical words.

5. Free from errors and mistakes.

III. Form of price:

1. Impressive get up

2. Good and mistake less printing.

3. The type of print according to age group of student.

4. Clear printing of figures and graphs.

5. Use of good paper.

IV. Author and publication:

1. Qualification. Rank and Teaching Experience of the author.

2. Expert of the subject & specialization.

3. Reputation of the publisher.

4. Year of publication.

CRITICAL ANALYSIS OF VIII, IX, AND X TEXT BOOKS:

The selection of content should be carried out on the basis of following principles. These are also termed as “Principles of curriculum” construction.

1. **Principles of utility (or) criterion of practical value**:
   In Mathematics, firstly an attempt is made to include these topics which are useful in day-to-day life. From this point of view, there are certain aspects of mathematics which are indispensable for everybody. E.g. four fundamental operations of simple calculation, concept of weight and measurement area profit and loss, average, percentage, interest, tax tables and graphs, simple and common geometrical figures etc are most useful content for elementary mentioned topics is well known since their knowledge is indispensable for each of us in leading our day-do-day life.

A topic or content should be including in the curriculum, if it is useful.

1. In everyday life.

2. In the study of other subjects.

3. In some vocations.

4. In understanding and appreciating the role played by mathematics in the development of civilization and other branches of knowledge.

2) **Principle (or) Criterion of Preparatory**:

According to this principle, on the one hand the content of a curriculum should be helpful to prepare the students for leading his future life smoothly and on the other; it should also prepare them for further advanced education. Therefore, the content should be so selected that it should be preparatory for higher ed., also should be terminus or complete ed., for those who would be preparing to enter in actual life. Since the majority of students intend to enter in to real life such as domestic, occupational business government service etc., and only a small percentage of students have a will to acquire higher education.

3) **Principle or criterion of Disciplinary value**:

The mathematics possesses a real disciplinary value due to its nature. It means the study of mathematics trains or disciplines the mind. To discipline the mind is not only function of Ed/: The education must be useful and functional. So, the disciplinary value of a topic can not be made the sole criterion to include it in the students in some other way also. The real useful problems train the mind in better way than the unreal formal problems.

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While selecting the topic or content to be includes in the curriculum of mathematics those topics should be preferred which can provide both useful knowledge and mental training or discipline. If a topic is taught in an effective and logical manner it will certainly create some mental habits.

4) **Principle (or) Criterion of Cultural Value**:

To develop the desirable attitude and ideals is another important aim of mathematics teaching therefore the topics which can be helpful in the development of habits of logical reasoning, accuracy, co-operation, sympathy, tolerance and appreciation should be include in the curriculum. Mathematics has played on important role in the advancement of culture and civilization. There are so many topics related with this fact. There are certain ideas and facts of mathematics is that from an integral part of modern culture and society, so, the ideas and facts which have become an integral part of culture, therefore, in the selection of topic for curriculum of mathematics. The cultural value of the content should be taken as criterion.

5) **Principle of child – Centeredness:**

The Education, subject – centered but now-a-days more and more emphasis is put to make it child-centered. The school and subjects are meant for the child and not for the child for the school. Therefore, while taking a decision about usefulness of the content we should always keep in mind the child for whom it is meant. The child's present and future needs, his interests and aptitudes, his abilities and difficulties should be given due to consideration in each activity of Educational process, i.e., everything has to be made to suit the child. Therefore, in the selection of topic or subject matter to be included in the curriculum, the child's needs, interests, abilities, age levels etc, should be kept in mind.

6) **Principle of Relation with community**:

The curriculum must be vitally linked with community life. It should bring the child into closer contacts with some of its significant and important activities. So, the social life outside the school must have some bearing on the activities to be taken up in the school. It has been emphasized that the need of the society determines the aims of schooling which in turn becomes the determining factor for selection of content.

7) **Principle of Flexibility:**

In a dynamic society, the aims of educational go on changing since they depend on the needs of changing society. Therefore, a rigid and inelastic curriculum cannot meet the requirements of the present day schools. Besides it, the developments in the subjects also necessitate a change in curriculum. So, any rigid curriculum cannot be followed forever. Thus, the curriculum should be flexible enough to be adapted to the needs of changing society.

8) **Principle of correlation and Integration:**

It has been universally admitted that a new piece of knowledge is not an isolate fragment. The knowledge is not to be imparted in isolated units but it should take place through a wellintegrated and interlinked process. Thus, the contents of curriculum should be correlated and integrated with each other. This correlation in the curriculum aims at realizing and acquiring the unity of knowledge through which the different needs of a particular stage and at different stages can be fulfilled.

9) **Criterion of Teacher's views and experiences**:

An experienced teacher knows the levels of students and the suitable content which should be taught to them. But, mostly it happens that curriculum is imposed on teachers and they are unaware about the significance of changes in the curriculum if any. Though few teachers are included in the curriculum

committee to represent the teacher's side but their selection is arbitrary rather than academy specialist. An attempt should also be made to collect the views of general teachers of a particular subject matter to any change or modification in the syllabus of that subject.

MATHEMATICS LIBRARY

Mathematics is quite a vast subject. Even if a teacher wants to restrict himself to a certain amount of subject-matter according to a particular class, that too can be done in many ways. A mathematics teacher should not follow only one Textbook. The teacher must study some standard books from the library; this will provide him a deeper insight into the subject and through command of the same. The teacher will be able to plan and organize his teaching in a better way, better than that given in the textbook.

Mathematics library is quite useful to the students when students read (or) refer some books from the library their doubt's become clear. The study of library books acquaints with new exercises (or) problems and prepares them better for the examination. A good mathematics library also helps in inculcating proper attitudes, interests and appreciation in the students. It can acquaint then with the historical background of different topics and the contributions in various mathematics.

Importance of Mathematics Library:

Library plays a key role in scheme of education classroom teaching must be supplemented with the dissemination of knowledge through library. In mathematics the students are required to a lot of practice work which they can do so most efficiently in mathematics library. Different types of books in mathematics library can help the students to tackle all types of problems emerging from different topics prescribed in their syllabus. They are also acquainted with different types of approaches in study the problems. Classroom teaching sometimes leaves many gaps and doubts. They can be removed if the students make use of good books available in the library.

Need of separation mathematics library:

Separate arrangement of mathematics library help to bring efficiency in the organization of library service.

1. Mathematics teacher remains in constant touch with the latest books in mathematics.
2. To include interest in the subject.
3. The student gets better library facilities.
4. It helps the activities of mathematics club.
5. If can be helpful to gifted and bright students.

Material for Mathematics Library:

1. The prescribed Text-Books of mathematics for the different classes.
2. Books on teaching mathematics meant for teachers such is books of high standard.

3. Books on biographies and history of mathematics.

4. Books showing contribution of mathematics to other fields.

5. Mathematics Journals.

6. Books of recreational activities

MATHEMATICS CLUB

There should be a place for a school of today to widen the knowledge of his students. A good teacher can involve his students in a number of co-curricular activities. Among them, mathematics club is also are to create interest and maintaining interest in mathematics using the structures be encouraged to themselves into mathematics club. Certain activities like discussions, lectures, certain mathematical games can be arranged. Totally this is helpful to the students in having an idea of the practical utility of mathematics in addition to creating their interest in mathematics.

Objectives of Mathematics club:

The objectives of mathematics club can be summarized as under. ·

- Mathematics club helps in the proper utilization of leisure time. ·
- It helps in arousing and maintaining students' interest in mathematics. ·
- It provides the students with opportunities to develop their explorative, creative and inventive faculties. ·
- It inculcates the habit of self-study and independent work among the students. ·
- It offers an ideal avenue for a free exchange of mathematical ideas and for frank and helpful criticism of these ideas. ·
- It provides an informal and a social atmosphere, which the classroom can hardly provide. ·
- It offers excellent opportunities for free consideration of matters of special interest to the members without the necessity of following any particular sequence as required in a classroom. ·
- It helps in developing heuristic and problem solving attitude among the students. ·
- It provides opportunities for students to translate the theory into practice and to apply their learning in daily life situations. ·
- It helps the student to imbibe social qualities like co-operation, tolerance, adjustment and open-mindedness, as they work in groups. ·
- It helps to meet individual needs of the students are every member gets an opportunity to work in his areas of interest. ·
- The informal knowledge acquired through mathematics club activities supplements classroom learning. ·
- Mathematics clubs extend learning beyond the limits of the classroom. ·
- Mathematics clubs may meet during school hours, their activities may often extend to out of school hours at home in the laboratory, in the field etc. ·
- Club activities provide first hand experiences to the learners as they participate in model making, arranging for exhibition, field work, laboratory work and so on.

Importance:

1. It is useful in arousing and maintaining interest in mathematics.

2. It stimulates the active participation of the students.

3. The knowledge gained by students in various functions of such club activities supplements the classroom teaching.

4. It provides the students and opportunity of free discussion and they are benefited from one another's view.

5. Gifted students get an opportunity to satisfy their needs and interest by actively participating in the activities of such clubs and organization.

6. It gives the students basic training in such programmes.

7. It is helpful in making proper utilization of leisure time.

8. It helps in developing the habit of self-study among the students.

9. It proves helpful in acquainting the students with the latest knowledge and developments in mathematics.

10. It gives them opportunity to translate the theory into practice and to make use of their learning in day to day life.

11. It provides opportunity to discuss the classroom topics in detail and this helps in knowing more and more about the subject.

12. It gives an opportunity to work together then the students learn the lesson of co-operation.

13. The students get opportunity of mathematical hobbies relation, projects, games, discussions talks etc.

14. It provides an opportunity of listening to experts and teachers from outside.

15. It provides an opportunity to inter school and intra school mathematical competitions.

16. It can organize excursion and visits of mathematical value.

17. It is an agency to prepare and display mathematical illustration.

18. It helps in the decoration of mathematics classroom.

19. It provides inspiration for independent in such work and thus helps in grooming future mathematics.

20. Through its various programmes, it provides opportunity to the parent and other members of the community to familiar with the school.

21. It provides to same students to the opportunity of leadership.

22. It can arrange mathematical exhibitions.

23. It can help in educational and vocational guidance in respect of mathematics.

Organization:

A Mathematics club if properly organized will be a great help in teaching of mathematics. Such a club should be run by the students under the guidance and supervision of their teacher.

For proper running of the club the most important thing is the preparation of a draft constitution of the club. This draft is prepared by the Mathematics teacher in consultation with the head of the institution. The draft constitution should provide all important details about the name of the club, aims and objectives of the club, details regarding membership and the fees etc. To be paid by members, purpose for which the expenditure can be incurred and person competent to approve such an expenditure.
For efficient and successful working of Mathematics clubs is expert body has suggested the organization as under.

1. Head of the institution as its patron.

2. A senior mathematics teacher as adivisor.

3. Membership of the club is open to all the mathematics students of the school.

4. Associate-membership may be allowed to some other students interested in Mathematics.

5. The club should have an elected executive committee for the academic year.

This execution should include the following duties of members of maths club.

a) Chairman b) Secretary c) Assist. Secretary d) Treasurer

a) Chairman:

He being the elected representative of the student should be asked to preside over all the formal functions organized by the club. He has also to preside over the meetings of the executive committee of the club.

b) Secretary:

He is also an elected member of students and is to look after and maintain a proper record of various activities of the club. He should keep a true record of the meeting of the executive committee. He is also responsible to carry out all correspondence on behalf of the club and to extend invitation to speakers and guests for various functions of the club.

c) Assistant Secretary:

His main role is to assist the secretary in performance of their duties, i.e., in the absence of secretary he has to carry out all the functions of the secretary.

d) Treasurer:

He is the person who is responsible for collection of membership fees for the club. He has also to maintain proper account of receipts and expenditure of the club. These members of executive committee are expected to extend their active cooperation and participate actively in clubs programme. He should utilize his knowledge and influence to make the programmes of the club success.

Activities of Mathematics club:

i) Organizing inter-class, inter-school competitions on some interesting mathematical topics.

ii) Arranging a lecture by some renowned mathematics teacher and scholar.

iii) Celebrating days and events pertaining to the history of mathematics or men of mathematics.

iv) Organising discussions about the practical applications of mathematics.

v) Organising recreational activities in mathematics such as puzzles, riddles, catchproblems, number games etc.

vi) Making or collecting charts, models, picture, graphs etc. for the mathematics laboratory.

vii) Conducting related project activities.

viii) Preparing items for well magazine I

ix) Organizing mathematical exhibitions (or) fairs.

x) Organizing certain outings of mathematical interest such as visits to post-offices, banks, market places, big business concerns etc.

xi) Making arrangements to listen to certain radio broadcasts on mathematical topics.

xii) Organizing seminars and career course relating to mathematics.

Thus we see that mathematics club can cover a wide variety of topics relang to the subject. If the students parcipate in such acvies whole-heartedly, then we derive great benefit. The club can go a long way in arousing and maintaining interest of the students. They will develop love for the subject. The ulity of mathemacs club depends upon the interest shown by the teacher and the extent to which the students are movated to take part in the acvies of mathemacs club.

MATHEMATICS EXHIBITION and FAIR

Introduction:

Every school should organize mathematics fair at least once a year. They should include the exhibits of the students as well as demonstrations. Film on mathematics topics, debates and declamations, music show etc, can also be organized. Both the teacher and the pupils should collaborate towards the success of the fair, through it should be mainly an activity of the students because the back ground of all the mathematic work is practical it can make an appeal to visitors, which the academic type of an activity

may fail to provide. The students who take part in arranging and organizing the fair get a better understanding of the purpose of experiments and the method used. Organization of Mathematics Fair: The organization of Mathematics fair should be a teacher, Pupil activity and everything should be of well in advance.

The following procedure is suggested for the organization and administration of the mathematic fair. **Planning:**

Before taking up the project of organization the mathematic fair, it is very essential that the planning is thoroughly done in which the limits of the fair. During planning the following aspects should be considered.

a) Objectivity and aims of the fair.

b) Scope of the fair-whether limit to the school (or) open to other schools, type of programmes etc.

c) Procedure

d) Financing.

e) Place, time and duration.

f) Other factors and facility.

Distribution of work: After planning, the work should be assigned to different individuals or groups. A number of committees may be formed which look after the different programmes and sections of the fair. For example executive, recording, reception, general management, committees and subcommittees all these committees are guided by the teacher, while distributing the work, the interest and the talents of the student should be kept in view.

Execution:

The different committees now execute the planning of the fair the exhibition is arranged and other programmes like demonstrations, talks, films, magic shows, charts, collections, models etc. are organized. The selected students should be made in change of various experiments and they should be given full explanation of each experiment a day before the exhibition is opened, the fair can be in arranged by some important man of mathematics people from other schools and from the community may be invited. Judging: The fair should be Judged by different committees of Judges for different items of the fair Judges may be chosen from amongst the individuals in the community having some back ground of math's scientist college professors, maths teachers etc.

The Judging system should be made as objectives.

Judging Performa should be developed for each item. Performa be developed on the lines suggested below.

1. Mathematic approach.

2. Originality – in planning and execution.

3. Technical skill and workmanship.

4. Dramatic value exhibit attractive labels large and descriptions neatly presented.

5. Personal interview presented with the respective students who exhibit.

The Judging criteria should be made well-known to the participants in the fair. These criteria may even be displayed at a prominent place for public view. After the fair is over, the teacher and the students should evaluate it and find out whether the objectivity of the fair have been achieved (or) not. If not where day the fault lie and then try to improve it next time. Mathematics is an integral part of our daily lives. To help the pupils to understand this mathematics exhibitions are organized at the schools.

Objectives of the Mathematics Exhibition

1. To build different mathematics skills and concepts.

2. To show the interconnection and interdependency of different subjects with mathematics.

3. To help students learn best when presented with a concept they can manipulate and visualize.

4. To build the confidence of the students in their mathematics skills.

5. To add the fun element to the tea

Importance of Mathematics Exhibition/Fair

1. Mathematics fairs can help talent to surface and foster mathematical gifts in learners. They provide challenging opportunities to the gifted children.

2. Exhibition helps students to express themselves through attractive models. The Demonstration value of models makes them more appealing.

3. Mathematics fairs are also effective in brining desired changes in average or even slow learners.

4. The students, who lost interest in mathematics due to its abstract nature, change their attitude after understanding the concepts in a concrete way.

5. While preparing and working with models, they come very close to teachers which help them to participate in the learning process more actively.

6. There is every chance of getting appreciation from visitors and teachers, which in turn inspires them to think and work with self-confidence.

7. Students show interest in mathematics.

8. Fair and exposition are thought to make mathematics concrete and to give an opportunity to the learner to relate his/her creative talent to the learning of mathematics.

"It is easier to believe what you see than what you hear ; but if you both see and hear, then you can understand more readily and retain more lastingly."

—Albrecht Durer

12

Audio-visual Aids in Teaching of Mathematics

CHAPTER OUTLINES

Introduction
Need and Importance of A.V. Aids in Teaching of Mathematics
Various Types of Aids used in Teaching of Mathematics
Conclusion about the aids used
Developing Low cost Improvised Teaching Aids
Assignments

INTRODUCTION

A teacher has an inherent desire that his teaching should be as effective as possible. What he teaches should be clearly understood, grasped and fixed in the minds of his students. In order to realise his objective, the teacher makes use of different types of aid materials just as charts, models, concrete objects, apparatuses, instruments and other resources. All such material and resources which help the teacher of mathematics in the realisation of his objective of effective teaching can be termed as aids in teaching of mathematics.

These aids are also named as audio-visual aids in the sense that they call upon the auditory and visual senses of students. The aids like radio, tape recorder which help the individuals to learn through listening are called audio aids. The aids like filmstrip, projector, epidiascope, newspaper, magic lantern and black-board which help in learning through watching are called visual aids. Some aids like cinema, television, where one learns through listening as well as watching are known as audio visual aids.

NEED AND IMPORTANCE OF A.V. AIDS IN TEACHING MATHEMATICS

The use of audio-visual aids in teaching of mathematics may be supported on the following grounds :

1. Clarity of the subject. Audio-visual aids help in clarifying the various abstract concepts of mathematics instead of struggling hard only with the theoretical talks, if

the teacher takes the help of some aid material he can make the subject more clear and meaningful to his students. For example the simple facts of addition like 7+5 = 12 can only be taught effectively if the children are given opportunity to count seven and five concrete objects first seaprately and then in combination.

2. To make the subject interesting. Audio-visual aids help in creating and maintaining interest in the learning of Mathematics. The subject no longer remains as boring, dull and unreal one.

3. Based on maxims of teaching. The use of audio-visual aids facilitate to the teacher to follow the important maxims of teaching like, 'simple to complex', 'concrete to abstract', 'known to unknown', and 'learning by doing' etc.

4. Psychological value. Use of audio-visual aids has some psychological advantage also. Children always like to manipulate or observe the new things. Once they are attracted towards an object or activity, their attention can be easily captured and desired interest in the learning can be safely maintained. The satisfaction of various interests and innate tendencies through audio-visual aids thus helps much in the task of learning.

5. Fixing up the knowledge : The knowledge gained needs to be fixed in the minds of the students. It needs a lasting impression in their minds which can be easily engraved through audio-visual aids.

6. Saving of time and energyl. Much of the time and energy of both the teachers and the taught may be saved on account of the use of audio-visual aids as most of the abstract concepts may be easily clarified and understood through their use.

7. Use of maximum senses. Senses are said to be the gateway of knowledge. Audio-visual aids help in the maximum utilisation of sense organs and thereby facilitate the gaining of knowledge by the students.

8. Meeting the individual differences requirements. There are wide individual differences among children. Some are ear minded, some can be helped through visual demonstration while others learn better through doing. The use of various types of audio-visual aids helps in meeting the requirements of different types of pupils.

9. Encouraging activity. Teaching learning process becomes quite stimulating and active through audio-visual aids. Here passive listening does not help in the realisation of the objectives of teaching mathematics. Use of audio-visual aids helps in converting the passive environment of the class-rooms into a living one.

10. Development of scientific attitude. Use of audio-visual aids helps in cultivating scientific attitude among students. Instead of agreeing to the listened facts, they resort to observe or use them practically with the help of audio-visual aids and ultimately adopt the habit of generalization through actual abservations and experiments.

VARIOUS TYPES OF AIDS USED IN TEACHING OF MATHEMATICS

Mostly, the types of aids given ahead are used in the teaching of Mathematics.

1. Weighing and measuring instruments. Various types of weighing and measuring instruments help in acquainting the students with different scales and units

of weight and measurement. The teacher should try to take help of such instruments like tape measures, balances and weights, graduated cylinders etc. for gaining practical knowledge of the mathematical facts.

2. Drawing instruments. Drawing instruments help much in learning mathematical facts and skills. Specially in geometry and mensuration the use of these instruments is a must. Therefore, every student of mathematics should be asked to keep a geometry box containing essential geometrical instruments and the teacher should try to take help of the wooden instruments for his demonstration work on the black-board.

3. Real objects. As an aid real objects are said to be the most useful and effective means of providing direct experiences to the students. The list of such objects may consist of objects like beads, ball frames, coins, toymoney, seeds, sticks, pebbles, coloured balls or solids, pencils, the material used and produced in various work-experiences areas etc. Various topics and concepts concerning four fundamental rules, average, percentage, fraction, profit and loss etc. may be successfully taught through these objects. The real life situations may also be exploited as an aid in the teaching of mathematics. Classroom may work as a real object for teaching area of the four walls. Similarly, black-board, classrom tables, play-grounds and gardening plots etc. may prove very helpful in teaching area and other facts of mensuration.

4. Models. Models are the copies of the real objects. When for some reasons or the other it is not possible or advisable to use the real objects, models prove very useful and effective means of educating the students. As far as possible a model should be least expensive and be made by the students themselves. Models can be successfully used to acquaint the students with the shape and forms of different numerals and geometrical figures. For this purpose even the square, round or rectangular process of cardboard or thick paper may serve as models. To give practice in writing numbers, numerals and digits engraved on the wooden or stone pieces may prove useful models. Also for teaching topics like area of four walls, cross roads and other squares, rectangular and circular figures models may be made out of thick paper and card-board.

Models may also serve the best purpose in teaching various concepts and facts related to geometrical theorems and exercises. For example to acquaint the students with the fact that 'sum of the three angles of a triangle is equal to two right angles', the model given ahead may be prepared.

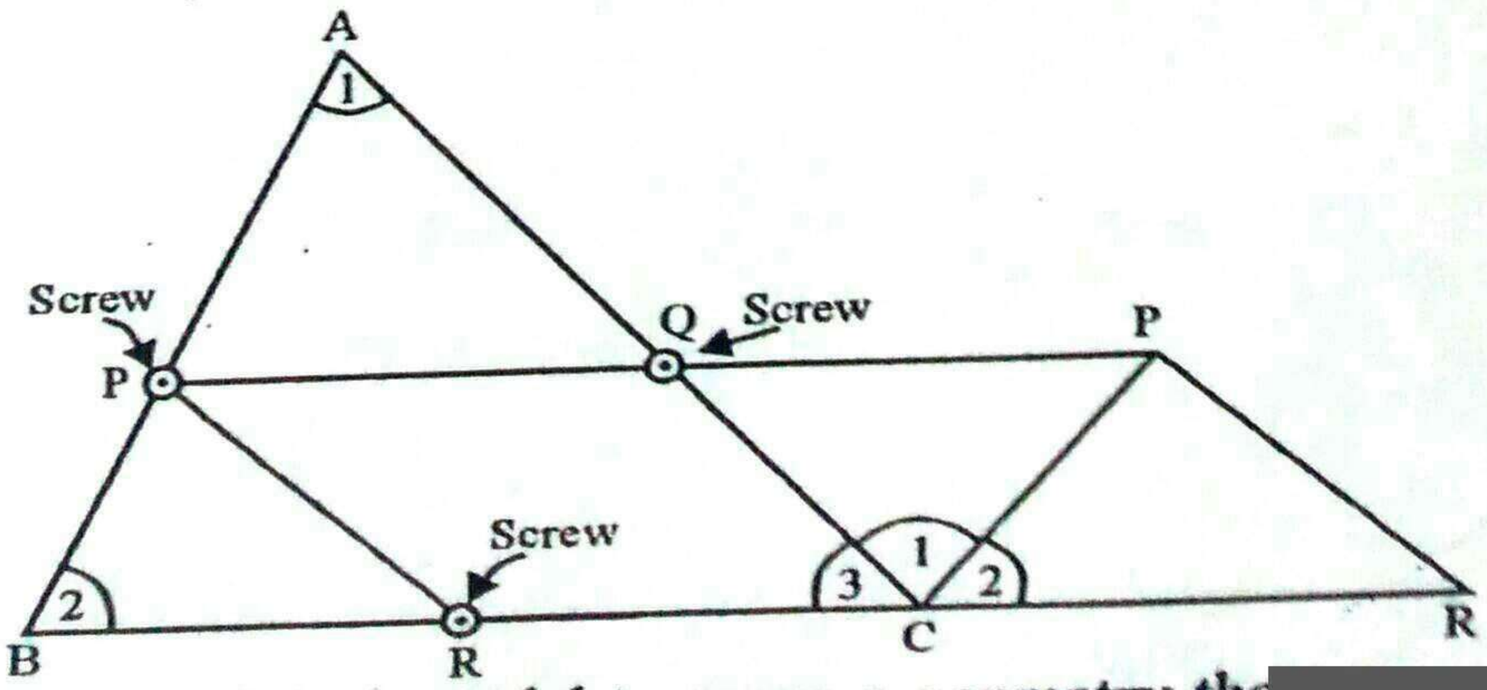

Fig. 12.1. A model to prove a geometry the

The straight wooden pieces may be used to construct such model. The screw P, connects the pieces AP and PB to make the side AB and similarly the two other screws Q and R form the sides EC and AC. Now $\angle A$ ($\angle PAQ$) may be arranged in the form of the portion PCQ and $\angle B$ ($\angle PBR$) in the form of the portion PCR by disconnecting the screws. In this way the three angles, $\angle A$, $\angle B$ and $\angle C$ may fit together to form one straight angle.

5. **Pictures and Charts.** In case where it is not possible to have an appropriate model or use real objects, pictures and charts prove very useful aid in teaching Mathematics. For example to teach fractions-simple, compound and decimal, fractional parts (rectangular or circular) may be drawn on the charts. In teaching profit and loss, unitary method, percentage, interest and work and time the help of charts may be taken to work out principles and formulae. Pictures may also be used to make the students understand the basic things about the problems. In the problems related to area, volume and mensuration, charts may be used for analysing the problems. In geometry, the use of charts may be made in showing figures concerning the proof of the theorem or proposition and helping the students in the construction of various geometrical figures and diagrams. In algebra, the charts may be effectively used in teaching of directed numbers, four fundamental rules and problems based on equations. The general formulae may also be demonstrated through charts. The pictures and charts prove a helping hand to the teachers as they save their time and energy otherwise wasted in drawing figures and diagrams on the balck-board In addition to this, they may prove constant source of inspiration and means of imparting self-education to the students. For this purpose the following types of charts and pictures may be hung in the classroom :—

(*i*) Charts concerning geometrical figures and shapes.

(*ii*) Charts depicting different principles and formulae.

(*iii*) Charts concerning various units of weights and measures.

(*iv*) Pictures concerning great mathematicians.

(*v*) Pictures related to the history of mathematics.

(*vi*) Pictures and charts showing use of mathematics in day to day life.

The following points should be kept in mind for the effective use of the pictures and charts :—

(*i*) There should not be too many things or facts demonstrated through a simple chart. It should concentrate on a single definite purpose.

(*ii*) Charts should be coloured and attractive.

(*iii*) Charts should have a proper size. The drawing and writing must be so distinctive and clear that all the pupils may get benefitted through its use.

(*iv*) No irrelevant thing or theme not connected with the topic should be demonstrated through a chart.

(*v*) As far as possible the charts and pictures should be got prepared by the students.

6. Black-Board. As an aid in teaching of mathematics, black-board is so much effective that it is usually termed as the right hand of a mathematics teacher. The secret of the popularity of the black-board lies in the fact that one can write or remove what has been written on it at his own will without involving any significant expenditure. The teacher writes and explains his writing while writing on the black board. In this way students get both the benefit of observing and listening at a time. The use of black-board is indispensable for all the branches and topics of Mathematics. It begins with the first lesson of mathematics and then goes up to highest learning in the subject. In all tasks like drawing of diagrams and figures, giving definitions, writing the language of the problem and their solutions, drawing generalizations and giving principles and formulae, having practice and drill work and assigning home-task, black-board proves a good helping hand. The black-board with graph lines may be successfully used for drawing all types of geometrical figures, plotting graphs, presenting statistical data, solving problems on areas and volume. In short, what a teacher wants to communicate to his students may be succesfully done through this readily available aid and it helps in quick understanding as well as fixing up of the knowledge of the subject. But for getting the desired advantages, the teacher must know its proper use. The following may serve a useful purpose in this direction :—

(*i*) The black-board should be properly cleaned before making its use. It should be got polished or painted from time to time.

(*ii*) The teacher should have sufficient practice for writing, sketching and drawing legibly on the black-board.

(*iii*) The black-board writing should be in straight lines. It should be visible to all the students in the class.

(*iv*) Teacher should try to speak what he is writing on the black board.

(*v*) He must be very careful for not writing anything wrong and inappropriate on the black-board.

(*vi*) He must learn how to face the black-board while writing on it. He should have a watchful eye over his students while keeping himself busy on the black-board.

(*vii*) The problems solved or the work done on the balck-board should follow a logical as well as psychological sequence.

(*viii*) Teacher should always make use of the standard terminology and symbols on the black-board so that the students may not get confused.

(*ix*) The chalk used should be of a superior quality. It should be properly pressed while writing.

(*x*) Coloured chalks should also be used for emphasizing particular facts and making the diagrams and sketches more attractive and meaningful.

(*xi*) The students should also get proper opportunity for solving the problems and drawing the diagrams on the black-board.

7. Magic Lantern. This instrument of science had proved very useful for teaching mathematics. It helps the teacher to demonstrate different types of figures, diagrams, pictures related to various topics of mathematics through the slides. For

getting better results, the teacher may also give explanation of the things demonstrated on the magic lantern. The demonstration may further be followed by group discussion for the clarification of the various issues on the topic.

8. Epidiascope. This instrument is used for enlarging and then demonstrating the contents, figures and diagrams of the printed or handwritten pages. It has shown its value in teaching of mathematics too, specially at the time when the teacher feels difficulty in drawing or giving things on the black-board.

9. Film-Strip Projection. In a film strip, 15 to 20 slides concerning useful topics are photographed on a 35 or 16 m.m. films. These film strips are then projected on the screen through a projctor. The teacher may demonstrate the pictures for any period of time irrespective of speed as the situation demands. These film strips give altogether a new colour and attraction to different ideas in mathematics. The film strips may be easily obtained from the market or borrowed from the Central Library, Department of NCERT and SCERT and some leading foreign embassies.

10. Cinema. Cinema, the popular means of entertainment may be succesfully used for the teaching of various principles, definitions and facts of mathematics. The life history of mathematicians, their discoveries and the historical landmarks of the development of mathematics may also be successfully demonstrated through cinema films. The films may be used effectively for teaching demonstrative geometry. The students may learn how to use various geometrical instruments, draw different types of figures and diagrams, survey and measure the different dimensions areas and volumes and use graphs. Through films students may be acquainted with the use of mathematics in solving day to day life problems used in different occupations and field of actions. In this way the use of cinema films may prove quite effective, stimulating and useful for the teaching and learning of mathematics.

Cinema is such an aid that calls on both the visual and auditory senses. The students at the same time may listen as well as observe the facts and therefore it provides to them a greater stimulating and motivating value for learning something new. It can help not only the students but also the teachers in acquainting them with the growing knowledge, and methods of teaching being adopted in other countries. In a school hall or big room, the teacher may demonstrate films through some good projector. The films for this purpose may be borrowed from state or central education departments and libraries. The NCERT and similar state level bodies as well as some foreign embassies may also help in this direction.

11. Radio and Television. Radio and television both have established their due credit in the field of education. Almost all the important centres of A.I.R. broadcast programmes concerning education. For the programmes on mathematics education, either the regular classes on topics of mathematics are being held or the important discussions and speeches concerning principles and laws of mathematics, life history and contributions of mathemticians, historical development of the knowledge of mathematics, the application of mathematics in practical life are broadcast. Highly experienced teachers, teacher educators, mathematicians and research scholars take part in such programmes. The Radio as a means of communication takes their voices to the millions of students and teachers listening to their programmes. Television has far greater advantages as it not only conveys the voices

scenes also. The students sitting far away from the T.V. stations may be benefited through the telecasting programmes almost in the same way as it is happening just before their eyes. A teacher of mathemtics should try to take advantage of such learning opportunities by making himself and his students fully conversant with such programmes.

12. Newspapers. Newspapers may be used as an effective aid for teaching and learning of mathematics. They help in correlating teaching of mathematics with day to day happenings of life. The statistics given in the newspaper in the form of weather charts, the prices of various commodities, budgets of state and central government, interest rates of various private and government agencies, stock and shares etc. all provide good means for making the teaching of mathematics interesting, useful and purposeful. The cutting of the newspapers may thus be employed to help the students in learning the practical application of mathematics in day to day life.

13. Running cooperative store. A cooperative store running in a school may also be utilized for mathematics education. The students may learn practically the various principles and facts of mathematics regarding profit and loss, four fundamental rules, unitary method, percentage, weighing and measuring etc. by becoming shopkeepers or customers in such a store.

14. Mathematical games and riddles. Mathematical games and riddles besides playing their recreational roles, may be effectively utilised for learning, practising and using various principles and facts of mathematics. There are so many games which may be successfully utilized for mathematics education. In such games and riddles, competitions may be usually organised by dividing the students into groups. It will provide learning opportunities while playing.

15. Visits and excursions. Visits and excursions do play an effective role in learning mathematics by providing direct experiences. The students get opportunity of learning mathematics in the manner it is being used in practical life. For visits and excursions they may be taken to different places like workshops, industries, mills, and telegraph offices, station, market, agriculture fields, forest, some picnic spots and visiting places. During these visits students may face so many problems requiring the knowledge of mathematics for their solutions. The teacher may utilize such situations for giving the necessary knowledge of mathematics or sometimes students may get opportunities for applying the already gained knowledge.

CONCLUSION ABOUT THE AIDS USED

In this way it may be seen that there is no dearth of aids for making the learning of mathematics easy, interesting and useful. A resourceful teacher may choose the appropriate aids suiting to his needs, time and occasion. It is also true that financial resources put obstacle in the way of taking advantages from aids. But this is not the end of the story. One should not get disappointed. If a teacher has the courage and will he may get these aids prepared with the help of his students through indigenous and cheap material. In this direction the services of the agencies like education departments of central and state governments, teachers training institutions, NCERT and SCERT, and extension services centres may also be received for collecting the essential and useful teaching aids.

Let us now say something more about the resourcefulness of a mathematics teacher to develop indigenous and low cost aid material for teaching mathematics.

DEVELOPING LOW COST IMPROVISED TEACHING AIDS

As emphasized earlier mathematics is a type of subject the need of which is felt well for performing the day to day activities of our life. Not only this a child from his tender age observes the use and application of mathematics in the existence and activities of all the animal and inanimate objects sorrounding him. Infact nature itself is a big source and a treasurer of aid material for learning the facts and principles of mathematics. The children may thus be helped to gather valuable direct and indirect experiencies for the learning of mathematics from their local environmental sorroundings. In their local setup comprising of their homes, community, physical and social environment, they may get a lot of opportunity to practise and learn so many valuable concepts regarding the teaching learning of mathematics. There is a lot of cheap and sometimes waste material available in children's local environment that can be successfully utilised for the improvisation of valuable aid material for the teaching of mathematics. Let us see what type of aid material can be easily improvised for the teaching and learning of Mathematics.

1. Concrete material and objects. A wide variety of collection of different types of concrete material like beads, seeds, balls, sticks, match boxes, pebbles, different types of corns etc. may be made with the help of students. All that material may prove quite helpful in the learning of counting, four fundamental rules (addition, substraction, multiplication, division), multiplication tables etc.

2. Improvising an abacus. An Abacus containing a number of wood, metal or even thermocol beads in several wires can be easily improvised for teaching the students the facts of counting, four fundamental rules, place value system, etc.

3. Place value pockets may also be improvised. The required boxes for this purpose can be made with the help of thermocal, thick paper or wooden etc. and the system be made so operated as help in the learning of the concept of place value.

4. Preparation of models. By using the easily available low cost or waste material various types of models may be improvised. Let us have different types of such models representing the shape of various geometrical figures like rectangle, square, parallelogram, trapezium, triangle, circle, ellipse, cone, cylinder, pyramid, sphere etc. We can have models made of clay, match box sticks, thermocol, wood, wax etc. to demonstrate the various geometrical figures, their properties and operations. Area of the cross roads, Area of the four walls of a room, circumference and area of a circle, circumference and area of rectangle, triangle and so many other things related to the learning of mensuration may be easily taught through the use of the models made of the locally available low cost material. The waste paper, card boards, thick papers, wooden boxes etc. available in the packages of the household goods purchased from market can be effectively used for making that model with a simple use of pins, nails, scissors, hammers, threads, ropes etc. easily available in the houses and school workshop. For illustration purpose let me point out a working model for helping the students to understand geometrical concept and the related theorem "sum of the three angles of a triangle is equal to two right angles." It has been already mentioned in the present chapter. We may utilise the wood available from the carton boxes or the boxes received from shopkeepers during the purchases of fruits and other household articles for the improvisation of this model. Match box sticks and rubber bands may also be utilised for the construction of such model

5. Preparation of Charts and pictures. With the help of the chart paper and drawing material easily available in the market, the low cost visual aid mateiral may be easily prepared for the teaching learning of almost all concepts related to all the branches of mathematics. You may hang these charts in the mathematics classrooms, laboratory or library for the grasping of the essential mathematical concepts with no extra efforts. At the time of class room teaching, these charts and pictures may be successfully used for the clarity of the needed mathematical concepts, processes and operations.

A teacher of mathematics in this way may utilize the waste or last cost material available in the local sorroundings for the preparation and improvising valuable teaching-learning aids for bringing efficiency and effectiveness to the ongoing teaching Learning process. He may even utilise the real sorroundings as an aid to his teaching. for example while teaching about the area of the four walls of a room, he can have the class room as a living concrete model. In teaching the concept of mensuration, then he may utilise the sports ground, school, garden and neighbouring plots as a living models for necessary surveying and measurement. The scrap book prepared by the students through the news paper cuttings of the data of mathematical interest thus may also be used as one of the useful aid material for acquanting the students with the facts and principles of mathematics. As a matter of conclusion, thus teacher of mathematics should always try to exploit his resourcefulness, creativity and ingenuity for making the task of teaching-learning interesting and purposeful by trying to make use of the low cost improvised teaching aids as and when he finds opportunities to do so with the help of his students.

MULTIMEDIA SELECTION AND TEACHING IN MATHEMATICS

The importance of design in multimedia teaching

In this context identifying appropriate uses of media is both an increasingly important requirement of teachers and instructors in a digital age, and a very complex challenge. This is one reason for working closely with instructional designers and media professionals whenever possible. Teachers working with instructional designers will need to decide which media they intend to use on pedagogical as well as operational grounds.

However, once the choice of media has been made, by focusing on design issues we can provide further guidelines for making appropriate use of media. In particular, having gone through the process suggested in Chapter 7 of identifying possible teaching roles or functions for different media, we can then draw on the work of Mayer (2009) and Koumi (2006, 2015) to ensure that whatever choice or mix of media we have decided on, the design leads to effective teaching.

Mayer's research focused heavily on cognitive overload in rich, multimedia teaching. From all his research over many years, Mayer identified 12 principles of multimedia design, based on how learners cognitively process multimedia:

1. Coherence

People learn better when extraneous words, pictures and sounds are excluded rather than included. Basically, keep it simple in media terms.

2 Signalling

People learn better when cues that highlight the organization of the essential material are added. This replicates earlier findings by Bates and Gallagher (1977). Students need to know what to look for in multimedia materials.

3 [Avoid] Redundancy

People learn better from graphics + narration, than from graphics, narration and on-screen text.

4 Spatial contiguity

People learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen

5 Temporal contiguity

People learn better when corresponding words and pictures are presented simultaneously rather than successively.

6 Segmenting

People learn better when a multimedia lesson is presented in user-paced segments rather than as a continuous lesson. Thus several 'YouTube' length videos are more likely to work better than a 50 minute video.

7 Pre-training

People learn better from a multimedia lesson when they know the names and the characteristics of the main concepts. This suggests a design feature for flipped classrooms, for instance. It may be better to use a lecture or readings that provide a summary of key concepts and principles before showing more detailed examples or applications of such principles in a video.

8 Modality

People learn better from graphics and narration than from animation and on-screen text. This reflects the importance of learners being able to combine both hearing and viewing at the same time to reinforce each other in specific ways.

9 Multimedia

People learn better from words and pictures than from words alone. This also reinforces what I wrote in 1995: *Make all four media available to teachers and learners* (Bates, 1995, p.13).

10 Personalization

People learn better from multimedia lessons when words are in conversational style rather than formal style. I would go even further than Mayer here. Multimedia can enable learners (particularly distance learners) to relate to the instructor, as suggested by Durbridge's research (1983, 1984) on audio combined with text. Providing a 'human voice and face' to the teaching helps motivate learners, and makes multimedia teaching feel that it is directed solely at the individual learner, if a conversational style is adopted.

11 Voice

People learn better when the narration in multimedia lessons is spoken in a friendly human voice rather than a machine voice.

12 [No] image

People do not necessarily learn better from a multimedia lesson when the speaker's image is added to the screen.

In re-reading Mayer's work, I am struck by the similarities in findings, using different research methods, different multimedia technologies, and different contexts, to the research from the Audio-Visual Media Research Group at the British Open University in the 1970s and 1980s (Bates, 1985).

More recently, the University of British Columbia has done an excellent job of suggesting how Mayer's design principles could be operationalised. Staff at the University of British Columbia have combined Mayer's findings with Robert Talbert's experience from developing a series of successful screencasts on mathematics, into a set of practical design guidelines for multimedia production.

Talbert's key design principles are:

- Keep it Simple: focus on one idea at a time.
- Keep it Short: keep videos to a length 5-6 minutes max. to maximize attention.
- Keep it Real: model the decision making and problem solving processes of expert learners.
- Keep it Good: be intentional about planning the video. Strive to produce the best video and audio quality possible.

Teaching as a weak discriminator in media selection

Most teachers and instructors would put the effectiveness of a medium for teaching and learning as the first criterion. If the technology is not educationally effective, why would you use it? However, if a student cannot access or use a technology, there will be no learning from that technology, no matter how it is designed. Furthermore, motivated teachers will overcome weaknesses in a particular technology, or conversely teachers inexperienced in using media will often under-exploit the potential of a technology.

Thus design decisions are critical in influencing the effectiveness of a particular technology. Well-designed lectures will teach better than a poorly designed online course, and vice versa. Similarly, students will respond differently to different technologies due to preferred learning styles or differences in motivation. Students who work hard can overcome poor use of learning technologies. It is not surprising then that with so many variables involved, teaching and learning

is a difficult discriminator for selecting and using technologies. Access (and ease of use) are stronger *discriminators* than teaching effectiveness in selecting media.

Questions for consideration

Therefore, it is not enough to focus just on the design of multimedia materials, as important as design is, even considering just the pedagogical context. The choice and use of media need to be related to other factors (what Mayer calls 'boundary conditions'), such as individual differences between learners, the complexity of the content, and the desired learning outcomes. Thus when considering media from a strictly teaching perspective, the following questions need to be considered:

1. Who are my students?
2. What content needs to be covered?
3. What are the desired learning outcomes from the teaching in terms of skills development?
4. What instructional strategies or approaches to learning do I plan using?
5. What are the unique pedagogical characteristics of different media? How might different media help with the presentation of content and development of student skills in this course?
6. What is the best way to present the content to be covered in this course? How can media help with the presentation of content? Which media for what content?
7. What skills am I trying to develop on this course? How can media help students with the development of the requisite skills for this course? Which media for which skills?
8. What principles do I need to use when designing multimedia materials for their most effective use?

Working through these questions is likely to be an iterative rather than a sequential process. Depending on the way you prefer to think about and make decisions, it may help to write down the answers to each of the questions, but going through the process of thinking about these questions is probably more important, leaving you with the freedom to make choices on a more intuitive basis, having first taken all these – and other – factors into consideration.

COMPUTER APPLICATION IN TEACHING AND LEARNING MATHEMATICS

INTRODUCTION

The educational history of computers began in sixties with the realization of its potential to teaching and learning. That was a period of enchantment. According to Suppes et al. (1968) the change that was to come through computers could only be compared to the fact that how books had changed the way of people looking at the world. Computers would change the face of education in a very short period of time by eventually removing the teacher from the classroom scene. Looking in retrospect, can it really be said that his predictions were realized? Or is it just a "techno-romantism" (Underwood and Underwood, 1990) to believe that the computer is a panecea for all of the problems in education. Allthough not having been able to solve all of the problems of education by itself, this powerful machine, no doubt, will continue to occupy a very central place in education.

A major figure in the history of computers, besides Suppes, in education is Seymour Papert who is famous for his work "Mindstorms" (1980) which presents quite revolutionary ideas about the place of the computers in education. He, like Suppes argued that the computer would change the face of education, but unlike Suppes he advocated the use of the computer not as a teaching machine but as a device to develop learners' intellectual skills through writing their own programs to direct the computer and not let the computer direct themselves.

It seems that the effect of computer technology on education is greater in mathematics than in any other discipline. This may be because of the close links between the two disciplines. In fact the computer science was a part of mathematics and afterwards gained independence as a sole discipline.

3. The Study

Given the importance of the extent of degree and manner of computer use, the purpose of the study was therefore to determine comprehensively the various ways of use of computers in the teaching-learning process.

3.1 Use of Computers in Teaching-Learning Process

Use of computers is the incorporation of computer resources and technology-based practices into the daily routines, work, and management of teaching and learning. Taylor (1980) believed that the computer can be used as a **tutor** to teach students, as a **tool** for students to use as they would use other educational tools, and as a **tutee** that students can teach to programme instructions in a computer. Luehrmann (1980) has expressed as three roles of computer: learning about the computer, learning with the computer, and learning from the computer. Later on these three utilizations that Luehrmann has proposed are extended to five: **Learning About Computers** (computer awareness and computer literacy program or course); **Learning From Computers** (computers are used either to tutor a student e.g., tutorial software or to provide additional practice on specific skills e.g., drill-and-practice software); **Learning With Computers** (student makes decisions about how to interact, using the computer, within a simulation or game or problem solving, or uses the computer as a tool to shape information that is already possessed); **Learning About Thinking With Computers** (computer is used to help students develop new patterns of thinking that may assist them in many different learning situations using programming languages like LOGO/BASIC); **Managing Learning With Computers** (indirect use of computers in student learning – maintaining student profile, record keeping, diagnostics and remediation, communication). The question of how teachers can best use their computing resources to bring about positive and lasting effects upon students' learning has resulted in the development of two broad sets of curriculum practices (Hodson, 1990; Wellington, 1990). These are: (1) learning about the computer and its impact upon society – i.e. computing studies, (2) learning with, through and from computers – i.e. computers integrated across the curriculum. Today, both sets of curriculum practices command a significant proportion of schools' resources.

3.2 Ways of Computer Use

In the present study the term computer means a device which is used for instructional as well as pre-instructional and non-instructional purposes by teachers and students in teaching-learning process. The computer use is defined as ways in which teachers work with computers in the instruction of their students. After undergoing the related literature, the researcher would like to submit that any application of computer for instruction is known as **Computer-Based Instruction (CBI)** and that CBI is an umbrella term for use of computers in both instruction and management of teaching and learning process, which includes CAL (**computer-aided learning**), CMI (**computer-managed instruction**), and CAI (**computer-assisted instruction**).

3.2.1 Computer-Aided-Learning (CAL)

CAL describes an educational environment where a computer is treated as an aid to an overall teaching-learning strategy with other methods and aids such as lectures, demonstrations, projects, textbooks, supplementary books, worksheets, etc. It is used to complement regular teaching. Here, the computer becomes a tool - just like a chalkboard, a calculator, a pen, a chart, a model, a flash card, or a book - that helps teachers teach and helps their students learn. Teachers are resourced with multimedia (CDs or internet) content to explain topics better and make the teaching-learning process joyful, interesting, easy to understand. The computer motivates and caters for different learning abilities. The internet provides far more up-to-date information than text books. Therefore, this mode of instruction employs use of computer in mainly three ways - Whole Class Instruction; Teacher-Directed Student Assignments; Teacher's Self Learning (Figure 1).

Computer Aided Learning	
Ways	**Description**
Whole Class Instruction	Lessons presented by showing some-thing on the computer in the class; Entire lesson can also be delivered using computer.
Teacher-Directed Student Assignment	Students use the internet for information searches and computer applications (word, spreadsheets, presentation, or publisher software) for preparation of project reports, newsletters, presentations.
Teacher Self Learning	Computer is used to update teacher's subject knowledge and enhance teaching skills. This includes search on internet, networking with experts, colleagues and collaboration.

Figure 1. Computer Aided Learning

3.2.2 Computer-Managed-Instruction (CMI)

Computers are tools that can be used not only to assist teachers as they teach but also to help with classroom management. CMI is an instructional strategy whereby the computer is used to provide learning objectives, learning resources, record keeping, progress tracking, assessment of learner performance, prescribe and control individualized lessons. The student does not necessarily interact with the computer system. The learner may be on-line to take tests. In addition, the computer can diagnose the learning needs of students and prescribe optional sequences of instruction for them. Carlton (2000) provides a list of software designed to function as grade book spreadsheets, databases, question bank, analysis, as examples of CMI. This mode of instruction employs use of computer in management of adjunct functions/instruction-related tasks such as material generation, lesson plan preparation, schedule preparation, attendance monitoring, student's performance assessment, individualized education plans preparation, student reinforcement, communication (Figure 2).

Computer Managed Instruction	
Ways	**Description**
Instructional Material	Generate material like worksheets, hand-outs, manuals, banners, visuals, diagrams, for viewing on computer, for projecting, for use in print form.
Lesson Plan	Computer is used to develop lesson/unit plans.
School E-Circulars	Announcements, activities, schedules, Homework are notified via internet.
Student's Portfolio	Students' creative work, achievement and information is disseminated on school website.
Communication	Internet is used to share information with students, professionals, parents.
Student's Performance Assessment	Computer is used to build question banks, test papers, Students are given tests on the computer, offline/online.
Record Keeping	Students' attendance, assignment, grade records are generated and maintained on computers.
Diagnosis-Remediation	Based on test result, diagnose student's strengths/weaknesses; generate student profile for the purpose of guidance and counseling.

Figure 2. Computer Managed Instruction

3.2.3 Computer-Assisted-Instruction (CAI)

The term CAI has been used for any program where the computer does the teaching directly. In addition, CAI has often been used relatively synonymously with various other terms such as computer-assisted learning, computer-based learning, computer-enhanced instruction, etc. For the purposes of this study, CAI refers to mode of instruction in which a student directly interacts with a computer and learns through lessons programmed into the computer. Here, computer is used for instructional tasks. The role of the teacher is to provide guidance to students in using this teacher-independent, self-instructional material on a computer at school or at home. The CAI uses instructional software that may broadly be classified in one of the following: tutorial, drill-and-practice, simulation, instructional gaming, and problem solving (Figure 3).

Computer Assisted Instruction	
Ways	**Description**
Tutorial	Present information ask questions, monitor responses, provide feedback, keep records.
Drill-and Practice	Present item to work on, provide feedback on correctness and notes on incorrect responses, summarise results.
Simulation	Approximate real-life situations, control expense, access 'inaccessible', perform operations
Gaming	Computer acts as competitor, judge, and scorekeeper in motivational format.
Problem Solving	Solve basic problems related to calculation, experiment, exploration; maintain database.

Figure 3. Computer Assisted Instruction

“USE OF ICT IN TEACHING AND LEARNING”

INTRODUCTION:

ICT is the Information and Communication Technologies. "ICT in Education" means "Teaching and Learning with ICT". The role of technology in teaching and learning is rapidly becoming one of the most important and widely discussed issues in contemporary education policy (Rosen & Well, 1995; and Thierer, 2000). At every level of education, educational technology is perceived as a vehicle for curriculum enhancement. In the more advanced industrialized nations, there has been a staggering amount of research and publication related to ICT use for educational purposes during the past decade.

MEANING:

The term "**Information**" refers to "any communication or representation of knowledge such as facts, data or opinions in any medium or for, including textual, numerical, graphic Cartographic, narrative or audio-visual forms.

Technology is the practical form of scientific knowledge or the science of application of knowledge to practical.

DEFINITION:

- ✓ **"ICT implies the technology which consists of electronic devices and associated human interactive materials that enable the user to employ them for a wide range of teaching - learning processes in addition to personal use."**

- ✓ **"Information technology is a modern technology of teaching by which we can make a learning more effective".-**Habibullah

- ✓ **"ICT is a technology which increase the rate of learning by enabling the teacher to teach less and the learner to learn more"-** Md. Abdus Salam and Sohail Ahamed.

WHY ICT IN EDUCATION?

- ✓ The rapidly growing usage of technology in today's world is pushing teachers to consider the integration of ICT into the classroom.
- ✓ ICT can be used as a tool for motivating students to learn in a different way.
- ✓ ICT can be effective and efficient.
- ✓ ICT gives learners immediate access to richer source materials.
- ✓ It can be dynamic and interactive.

ELEMENTS OF ICT IN EDUCATION:

Elements	Readiness elements
Teacher	Understand the characteristics of ICT, and possible to facilitate learner's learning activities with ICT.
Learner	Use information resources with critical and collaborative manner with other people for learning.
Curriculum	National standardized educational object, contents, and assessment with ICT.
Educational Policy	Law, budget, institutions for fostering ICT in education
Educational Information Service	The networked service system for helping communication between teacher and learner, and assisting the utilization of educational contents.
Infrastructure	Computers, contents, facilities required to teacher and learners for teaching-learning process.

ADVANTAGES AND LIMITATIONS OF ICT IN TEACHING LEARNING PROCESS:

Advantages

- ✓ Offer the opportunity for more student centred teaching.
- ✓ Provide greater opportunity for teacher- to-teacher and student-to-student communication and collaboration.
- ✓ Give greater exposure to vocational and workforce skills for students.
- ✓ Provide opportunities for multiple technologies delivered by teachers.
- ✓ Create greater enthusiasm for learning amongst students.
- ✓ Provide teachers with new sources of information and knowledge.
- ✓ Prepare learners for the real world.
- ✓ Provide distance learners country-wide with online educational materials.
- ✓ Provide learners with additional resources to assist resource-based learning.
- ✓ Set specific criteria and targets to help classify and categorize the different development levels of using ICT in education.
- ✓ Leveraging ICT to assist and facilitate learning for the benefit of all learners and teachers across the curriculum
- ✓ Broadening access to quality educational services for learners at all levels of the education system.
- ✓ Improving the efficiency of educational administration and management at every level from the classroom, school library, through the school and on to the sector as a whole.
- ✓ Google have recently launched a programme called "**Google Classroom**" that aims at simplify, creating, distributing and grading an assignment in a paperless way.

IN BRIEF:

- ✓ ICT helps to stimulate, motivate and Engage Learners.
- ✓ Increase achievement.
- ✓ Enable better understanding.
- ✓ Cultivate improved communication.
- ✓ Have a positive impact on workload
- ✓ Quick access to information.
- ✓ Easy availability of updated data.
- ✓ Connecting Geographically dispersed regions.
- ✓ Catering to the Individual differences.
- ✓ Wider range of communication media.

- ✓ Wider learning opportunities for pupils.

LIMITATIONS:

- ✓ Computers limit students' imaginations.
- ✓ Over-reliance on ICT limits student's critical thinking and analytical skills.
- ✓ Students often have only a superficial understanding of the information they download.
- ✓ Computer-based learning has negative physical side-effects such as vision problem.
- ✓ Students may be easily distracted from their learning and may visit unwanted sites.
- ✓ Students tend to neglect learning resources other than the computer and internet.
- ✓ Students tend to focus on superficial presentations and copying from the Internet.
- ✓ Students may have less opportunity to use oral skills and hand writing.
- ✓ Use of ICT may be difficult for weaker students, because they may have problems with working independently and may need more support from the teacher.

CONCLUSION:

The rapid growth in ICT has brought remarkable changes in the twenty-first century in teaching-learning process. The effective integration of technology into classroom practices poses a challenge to teachers and learner. The above study indicate that teachers and learners have strong desire for the integration of ICT into education but they encountered many barriers to it. These findings therefore have implications for training the teachers to become regular users of ICT focusing on acquiring basic ICT skills. We think that if ICT is successfully integrated in Education then it enables wider learning opportunities into teaching-learning process.