3.
COMMUNITY RESOURCES AND LABORATORY

8. COMMUNITY RESOURCES AND LABORATORY

8.1 INTRODUCTION

National Curriculum Framework for Teacher Education (2009) emphasises upon the role of community knowledge in education. It says,- "It is important for the development of concepts in children as well as the application of school knowledge in real life, that formal school knowledge is linked with community knowledge." Community knowledge, here, refers to the knowledge that people construct, develop and amass as a result of their everyday and ecological experiences. So, indigenous and local knowledge should be given ample importance for the learning

Community Definition:

Community, the term has evolved from the old French word etymologically 'communite' and classical Latin word 'communitas' or 'communis' which means common.

As revealed from various sources,

Community is a group of people sharing a common understanding who reveal themselves by using the same language, manners, tradition and law. It can be seen as the condition of having certain attitudes and interests in common.

It can also be viewed as a particular locality, considered together with its inhabitants or a group of people within a society with a shared ethnic or cultural background, especially within a larger society. It also gives a sense of the people with common interests living in a particular area. So, as a whole it can be understood as a society in general.

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8.2 LEARNING RESOURCES FROM IMMEDIATE ENVIRONMENT

The best initial resources for mathematics learning can be found at home and immediate environment itself. The home, as first exposure of informal community to the child, provides ample opportunities where mathematical ideas are experienced, explored and learnt. There are various objects available at home and that too with ease, which can help in learning of mathematics.

- Currency notes can be used to develop the understanding of number system. These can be used to learn fundamental operations in mathematics.
- The walls, floor, ceiling, electrical wires, table, chair, utensils, etc. can be used to develop spatial understanding and formation of geometrical shapes.
- Wall and gate can be used to learn trigonometry.
- Playing cards and glass balls can help in learning of probability.
- Distribution of biscuits and chocolates, etc. can make the learner understand the basic operations in statistics like presenting information in terms of numbers and making a frequency table.
- Paint needed to paint the wall or classroom or cupboards.
- Checking of grocery bills.
- Not only this, even rituals at home can be used as learning resources in mathematics.

(*There are many books written by Qvarsell and Wulf (2003) mentioning how rituals can be used for learning*).

8.3 USING COMMUNITY RESOURCES FOR MATHEMATICS LEARNING

Community in a generalised sense can be viewed as the society. The local context of the learner can be viewed as the best resource for learning. Community resources give an opportunity for better inquiry system for learning. Community resources can play a vital and facilitating role. Students are advised to explore more upon these sources of evidence.

For developing and schematising concepts through various sources of evidence like,

- reasoning;
- Observation
- representation,
- dialectic and
- ethical values

In shaping mathematical world of the learneras a part of community, the below three formal stage play significant role, namely,

I. School

II. Block

III. District

At all these levels, various resources are there which can help in learning of mathematics.

I. School Level:

At school level, these may be

- school premises
- school buildings,
- corridors,
- verandas,
- classrooms and walls,
- mathematics laboratory or corner,
- mathematics club or forum,
- group of mathematics teachers or mentors and
- mathematics exhibitions.

Group coordination and cooperation among mathematics teachers can help better teaching-learning of mathematics and improve performance in mathematics as revealed by Horn (2008).

II. Block Level:

At block/ cluster level, there may be

- cluster level exhibitions,
- cluster level mathematics centres,

- a panel of all mathematics teachers at block level,
- Block level mathematics competitions.

III. District Level:

At district level, there may be

- mathematics centres,
- mathematics exhibitions,
- mathematics fairs,
- committee for mathematics activities,
- mathematics laboratory

At District Institute of Education and Training (DIETs), we can create opportunities for sharing or exchanging experiences and ideas among thinking community of mathematics practitioners and learners.

8.2.1 BRINGING THE COMMUNITY INTO YOUR CLASSROOM

Materials through the Mail.

- By necessity, most learning activities occur in the classroom.
- Organizations listed in the Directory can provide materials that enrich the curriculum and provide unique experiences for children.
- These inexpensive or free materials may be overlooked since they are not produced by educational publishing companies.
- Diaries or a book from community libraries, a program available from Archaeological Survey, includes a set of artifacts for sand box explorations.
- Techniques, Technology, and Trade, a curriculum available from community (e.g.:- bank manager, statisticians, architect, business man etc.) can be used to give second hand experience to students.
- Numerous national organizations have also developed curriculum materials;
- guidance materials from professional organizations are useful(ties to the workplace.

***Electronic Connections*:**

Many concepts in the text book have activities and programs that involve the Internet or e-mail communication and can be valuable additions for classes that have Internet access.

For e.g. students can learn the various concepts of statistics like data collection, classification, analysation, and plotting graph of given data through internet, where

- Students create prototypes and communicate by e-mail with other participating schools about it.
- In the GLOBE Program, students take environmental measurements and post their data on the Internet.
- Weather Net, listed under National Weather Service in the Directory, is an Internet resource that includes weather data and links to the home pages of more than 300 weather-related organizations.

Guests.

Guest speakers from the community can provide new information and experiences to students and link the school to the world outside. Staff of state agencies can serveas classroom partners or as knowledgeable resource people.

For example, Valuable links to the community as well as connections between school subjects and the workplace may be created by inviting,

- staff from a conservation agency might be able to aid schools in setting up an outdoor classroom or civil engineers from the highway department may be able to show plans for a bridge project;
- cafeteria worker who could talk about using proportions in increasing the size of recipes;
- the owner of a feed store can teach simple basic arithmetic operations;
- Bank Managers can be invited to school, for teaching the concept of shares and debentures, profit and loss, discount and tax etc.
- Guests who can come back to the classroom numerous times may enhance the learning experience for the students.

Following points could be kept in mind while inviting the guests in the school.

- The teacher should spend time with the guest before the visit so they can discuss the age level of students and kinds of activities and information appropriate for this age group;

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- the needs of the guest during the visit and his or her general com fort level with children;
- the topic of the presentation and the students' general knowledge about this topic:
- and what the teacher can do before to make the visit a success ?

8.2.2 TAKING CLASS TO THE COMMUNITY - FIELD

Taking students on field trips or using other community resources in their classes is not a new idea for teachers. Often, however, these experiences are thought to be frills or rewards that compete with instructional time in the classroom.

Curriculum reform in science and mathematics calls for a new look at using community resources. The National Standards in Science and Mathematics suggest that good programs require access to the world beyond the classroom so that students will see the relevance and usefulness of mathematics both in and out of school.

Benefits of field visits:

Changing the educational experiences of children by moving beyond the classroom walls can,

- diversify the array of learning opportunities and
- connect school lessons with daily life and real problems
- improves the imagination and creativity
- help students connect school mathematics with applications in the community, as well as helps students better learn basic concepts
- help learn mathematics from many sources, in a range of different ways, and for a variety of purposes.
- give unique insights are a few ways to increase their learning experiences.

For example, imagine the interactions that occur as a small group of students experiments with an interactive museum exhibit. They talk about,

- what they see and what they know,
- relating what they are doing in the museum to what they have learned in and out of class they experience,

- create, and solve problems together
- Social discourse and direct experience help them construct an understanding of the phenomenon.
- The exhibit puts constructivism in action.

The outdoors can reflect mathematics principles as well. Data gathered by student teams may present more solid examples than textbook representations.

For example, Let the students discover the constant π.

1. Send teams of students outside to measure circular objects:
   - trees,
   - flagpoles,
   - trash cans,
   - utility poles.
2. They may want to use yarn or string or a tape measure to wrap around the object for measurement of the circumference.
3. To determine the diameter, use three yardsticks or meter sticks.
4. Place a stick on each side of the object, making sure the two sticks are parallel and at the same height from the ground.
5. Then use the third stick to measure the distance between the extended portions of the two parallel sticks—that is the diameter.
6. The teams can post the measurements for their various objects on a statistical table.
7. They may also want to note the radius for each of the objects.
8. Ask the students to look at the data and see if they notice any special relationships among the various measurements.
9. Ask each team to divide the value for the circumference by the value of the diameter and post the results.
10. The constant ð, 3.14 or 3 1/7, will emerge from these results.

8.3 POOLING OF LEARNING RESOURCES

As our everyday experience, we find various concrete and abstract sources of learning, all around us, which act as learning opportunities for meaningful construction of knowledge. One can find everywhere around

her/him the sources for learning, and everything (either concrete or abstract) around the learner can make the learner experience so many concepts. Mathematics learning too is not an exception in this case. Though mathematics learning opportunities and resources are available in plenty as part of our everyday life, still there is a need for pooling these resources in some organised and orderly, formal and informal manner, so that they become more accessible and transparent. This pooling can be ensured at various levels viz., school level, block level, district level, state level, national level and international level. Pimm and Johnston (2005), while talking about resources and ideas for enhancing the teaching-learning of mathematics, enlist various resources like textbooks and schemes, practical apparatus, homework, parents, learner's room, the history of mathematics, role play, simulation, video and television, school libraries, mathematics clubs and trails.

At national and international levels, science centres, museum, seminars, conferences, symposium, journals, teachers' association etc. can be good resources for mathematics learning. These will be later dealt in Unit 10 of this book.

Here, we will talk about learning resources at:

I. School level
II. Block level
III. District level

Let us discuss these in detail.

I. School Level

a. Mathematics Laboratory/Corner

In every school, a mathematics laboratory or corner can be established, which will have various equipments, apparatus, charts, models: working and static, etc., that can help in building the learning of abstract concepts in mathematics by having experimentation, activities, hands on experience, verification, etc. In mathematics laboratory, electronic calculator, graph machines, mathematical games, puzzle boards, mathematical kit, mathematics videos and clinometers, etc. can be made available.

Mangal and Mangal (2009) has given an elaborated list of hardware instructional aids, viz., magic lantern, epidiascope, projector, radio, tape recorder, television, closed circuit television, video cassette recorder, motion pictures, computers and software instructional aids, viz., blackboard or chalkboard, bulletin board or information board, flannel board, pictures, charts, graphs, maps, globes, diagrams, photographs, cartoons, posters, newspapers, flash cards, models, slides, filmstrips, transparencies, programmed learning packages, many of which can be a part of mathematics laboratory. The need is to think how these can be used for better learning of mathematics.

As NCF–2005, too mentions that one of the important aims of mathematics education is "to develop the child's resources to think and reason mathematically to pursue assumptions to their logical conclusion and handle abstractions." Mathematics laboratory or corner can best develop the habit of thinking, reasoning and rationalising through logical conclusions and handling abstractions.

b. Mathematics Club/Forum/ Community/Society

In school, a club of mathematics students can be established under the guidance of mathematics teacher. The attention should be more towards ensuring membership to all, especially to them who are not thought to be good in mathematics.

Various sorts of activities, discussions, quiz at school level, mathematics excursion and tour, lectures by experts, workshops, competitions can be organised and coordinated by such a club/forum. It can be in the form of a club or forum, community or society.

Various activities are mentioned by Thomson and Hartog (1993) in 'Activities to teach mathematics in the context of environmental studies' pertaining to number and number relationship, computation and functions, algebra, statistics, probability, geometry and measurement.

The students who are good at linguistics too can be motivated to establish a reading club, and they can meet weekly to discuss the beauty, nature and recent development in mathematical concepts, and hence, it will help in mathematics learning. Group projects can be taken in such a forum which can pave the way for better learning of mathematics with a

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shift from independence to interdependence, from structured to freedom, from disciplinary to interdisciplinary, and from product to process.

c. School Library

School library can be visualised as one of the prominent learning resource for mathematics. There are various textbooks, reference books, activity books and puzzle books that can be made available in the library. These books can be issued to students. Various journals pertaining to mathematics learning can be put inside the library for awareness about mathematics learning and pedagogy of mathematics teaching.

d. Mentoring

Though mentoring is still a developing concept in Indian context, but it can be effectively used as one of the learning resources in the school. As revealed from the various sources, a mentor is an experienced person, trusted counsellor or guide who provides information, advice, support and encouragement to a less experienced person, often leading and guiding by example of his/her success in an area.

Working definition of mentoring can be, A one to one learning relationship between an older person and a younger person for the development of the later.

Mentors help in strengthening academic skills in general leading to student's success.

Mentoring is a structured one to one relationship or partnership that focuses on the needs of the mentored participant.

Daloz (1990) views effective mentorship as similar to "guiding the student on a journey at the end of which the student is a different and more accomplished person. In a formal learning situation, mentoring functions can be understood as providing support, challenge and vision."

During mentoring too, formal and group work can be given ample emphasis. Mac Bean, Graham and Sangwin (2004) had a study on school and university students namely 'Group work in mathematics: A survey of students' experiences and attitudes' and concluded that students show a very positive attitude towards group work, but with utilitarian view of its benefits.

II. Block Level

a. Inter School Collaboration

There can be collaboration among schools to provide a place to establish a platform for mathematics. This collaboration will give rise to opening of new opportunities for mathematics learning. This collaboration may be at two different levels: Student's level and Mathematics Teacher's level. Studies have revealed that collaboration of mathematics teachers gives rise to better understanding of learners and learner's problems in mathematics. They discuss various problems pertaining to pedagogy, methods, fundamental problems and sharing available facilities.

b. Cluster Level Competitions or Exhibitions

Cluster level competitions are other learning resources in mathematics. At cluster level, we can have mathematics exhibitions, mental mathematics quiz competitions, mathematics table writing competitions, etc. All these competition can develop a healthy attitude towards competition, cooperation and coordination among students.

c. e-Learning Laboratory cum Block Resource Centre

e-learning can be understood as learning through electronic means, modes and resources. This may be online or offline, synchronous or asynchronous, etc., but the type, the learner uses, must be an electronic form. In Indian context, if it is not easy to have e-learning laboratories at each school, then as an alternative we can have e-learning laboratory at block level. While talking about e-learning, Bhatia (2009) mentions that e-learning should be used to supplement and not supplant traditional forms of teaching- learning.

Main features of e-learning are:

i. connectivity or networking
ii. flexibility
iii. interactivity and collaboration
iv. virtual learning environment like texts, visuals, quizzes, etc.

Various e-learning tools can be used for mathematics learning like e-mails, blogs, wikis, e-portfolios, animation, videos, links, specialised softwares, etc. Noss (1988) had a study with 13 years old LOGO

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experienced children, on and off the computer. Children were asked to solve ratio proportion problems using computer as well as paper and pencil. He used pencil and paper for ratio test. It Was found that the performance was better in case of students solving the problems on the computer. Along with these computers related facilities, other learning AIDS can also be put in block resource Center. student are suggested to go through various packages produced/being produced by Regional Institute of Education (NCERT), Bhubaneswar and CIET for pedagogy-technology integration discussing various e-tools and their integration in teaching-learning process.

III. District Level

a. Science Centre

At district level, there are some science centres. These centres inherit mathematics as a science component. There are exhibitions and several other activities at science centres pertaining to mathematics also which may really help in learning of mathematics.

b. DIET

At district level, there are District Institutes of Education and Training (DIET). These institutes have enriched mathematics laboratories which can help prospective teachers to learn more about mathematics and teaching of mathematics, which in turn will help learners. Most of the models and aids in these institutes are being prepared by student-teachers. It can be revealed from NCFTE (2009) that student teachers learn to integrate ideas, experiences and professional skills through hands on experience of developing learning materials.

IV. Open Educational Resources, Web Resources and Virtual Classrooms

Now a days, more emphasis is being given on open educational resources. Since most of the resources on internet are paid resources, it is not possible for all to access and use these resources for learning. While it is very important that everybody should learn mathematics in the current era, how can we deprive a major section of the society new technology and resources for learning of mathematics? The answer to these questions is open learning resources. There are several websites which make web content freely available for all. A very well known

name is 'wiki'. Wiki means 'what I know is'. This is a very large project and comprises of various components. The most popular open education resource is Wikipedia. Its website address is http://wikipedia. org. It comprises editable text material and information on almost every topic. If it is not there, anybody can create a page for that particular topic. The information can be seen in almost every language, including English and Hindi. Wikipedia also hosts a number of sister projects which are equally important. Some of these are Commons, Wikiquote, Wikispecies, Wikinews, Wikibooks, Wikiversity, Wiktionary, Wikisource and Meta-wiki. All these resources are open for all anytime, anywhere, and that too free of paid services. These sources give freedom to edit and express for every individual. There are Google applications too as other resources.

Some other good web resources in mathematics are:

http://mathforum.org
http://www.algebasics.com
http://www.cutescience.com
http://mathworld.wolfram.com
http://www.ipl.org
http://www.emis.de
http://www.mathmistakes.com
http://www.nctm.org
http://www.awm-math.org
http://www.eric.ed.gov
http://www.e-book.com.au
http://www.dli.ernet.in
http://wikieducator.org

V. Virtual Classroom:

There is another resource known as virtual classroom.

- In virtual classroom, people interacting simultaneously are not face to face, but still there is a sort of synchronous communication among all people.
- In such a classroom, anybody can express anything anytime, during the class and all others will come to know and respond to the query or views expressed.

- It all happens when people are sitting at their respective places either at home or at likewise setting.
- So, in such a learning situation, they are not required to assemble altogether at the same place. While talking about importance of virtual classroom,

Amin (2010) says "Teachers' physical presence is not needed all the time. Even at higher education level, a person from one country can have their mentors or teachers from other country. This has created a greater impact and given broad outlook to education."

The versatility of such resource is that there can be learners sitting in different continents like Asia, America, Africa and Australia simultaneously and interacting with each other.

A website as an example for such classroom can be given as:

www.wiziq.com

Students, while using any website, are advised to be cautious about their possible harms too, as some of the websites may hack their computers, misuse their data, transfer virus to their computers. One of the possible solutions/precautions may be that the computer should have been installed with latest updated anti-virus. One of the free anti-viruses is 'Clam Win', which may be downloaded from link provided on website of UNESCO (2011). Students are suggested to check the current status for this anti-virus.

8.4. IMPROVISATION OF APPARATUS

Experience over the years has shown that teachers have been depending on excessive use of words to express, to convey ideas or facts in the teaching-learning process. This practice is termed the "chalk-talk" method. Today, advances in technology have made it possible to produce materials and devices that could be used to minimize the teachers talking and at the same time, make the message clearer, more interesting and easier for the learners to assimilate.

For example,

- The use of graphics in teaching creates definitiveness to the materials being studied.

- Graphics communicate facts and ideas clearly through combination of drawings, words and pictures.
- They help to visualize the whole concepts learned and their relationships with one another.
- Graphics include charts, posters, sketches, cartoons, graphs and drawings.

8.4.1. MEANING OF IMPROVISATION

Improvisation in science, technology and mathematics education is the preparation and use of materials and equipment obtainable from the local environment for the enhancement of the effectiveness of teaching and learning. Science, technology and mathematics teachers have different attitudes towards the use of improvised local equipment and materials for their teaching. Inyang (1997) he acknowledges the preference of teaches use of talk and chalk method.

According to Igwe (2003)-" Improvisation is the making or inventing of a piece of math teaching equipment in emergency. It is an essential part of laboratory management for the purpose of maximizing the use of the available resources.

Improvisation helps in the following instances:

- improvised material would improve the lesson's effectiveness.
- Make use of locally available materials.
- improvised materials would serve the same function as the standardized one.

NTI (1990) sees improvisation an as technique of originating a totally new tool, instrument, material device or modifying an already existing one for a particular purpose.

Improvisation is a very important technique in all human enterprise. It can very much refer to as resourcefulness and it is a very important aspect of our educational practice.

8.4.2 WHY IMPROVISE?

- well-designed simple or improvised apparatus of good quality will help the pupils to understand the idea behind the experiment more easily

- overcome the problem of lack of apparatus
- Save money by using local materials: often help pupils develop positive attitudes towards science.

8.4.3 NEED FOR IMPROVISATION

In an ideal world, all science students would be taught in small classes held in well-equipped laboratories. In the absence of those well-equipped laboratories, the place of practical activities cannot be over emphasized, yet those materials required for teaching of math are very much in short supply as lamented that these is a total or partial absent, in adequacy of the science teaching resources and gross inadequate finances most especially for the purchase of science equipment, galloping inflation using enrolment of students, general down ward trend in the Nation's economy, poor maintenance culture and at times attitudes of some school heads towards science and science equipment call for efforts at making math teaching and learning what it is supposed to be.

With all these heinous problems, it seems that the best option is the improvisation of science teaching materials in the classroom teacher and even students; improvisation becomes imperative in a situation where there are scarce resources and facilitates. The system today is experiencing a boost in population explosion, giving use to greater demand for classroom laboratory facilities and equipment with limited government resources, with limited government resources, the teachers ingenuity to improvise becomes tasking for learning to be effective and productive.

3 benefits if pupils construct apparatus;

- acquire manual skill
- learn to apply principles of mathematics
- supply school laboratory with equipment

8.4.4 TYPES OF IMPROVISATIONAL

Ofoefuna (1999), points out that we have two main types of improvisation these are:

- Improvisation by substitution, where an already existing local material is used in place of equipment that is not available.

- The other is improvisation by construction in this case a teacher or the student constructs a new material entirely to teach his lesson, when the required material or equipment is not available.

Igwe (2005) while supporting improvisation went further to discuss the types of improvisation. In doing this he said that the improvisation of the basic equipment for teaching can be through two main ways.

- By role substitution
- By role simulation

Role substitutions of instructional materials:

This method involves the slight modification or adaptation or the original subject in order to make it perform new function in the laboratory.

Role simulation

This involves the construction of items or apparatus. It is necessitated by an emergency or a need that cannot be met for reasons of cost and availability. This may be accomplished by using direct labour, locally available materials and skills. In some cases, an apparatus has to be improvised if the specification of the conventional one does not serve the desired purpose of the experiment.

8.4.5 BASIC CONSIDERATIONS IN IMPROVISATION

On embarking on any improvisation in the teaching and learning process certain basic pedagogical consideration are necessary.Some of these considerations include:

i. What is to be taught?

The degree of sophistication of the improvised materials will be determined by what is to be taught and the objective of the lesson.

ii. The objectives of the lesson:

Does the improvised material fits the objective of the lesson.

iii. The background knowledge of the learners:

Knowledge of the student's academic background would provide the teacher with insight to whether the improvised materials would appropriate to learn the task at hand or not.

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iv. The durability of the improvised materials.

It is also necessary to give consideration to the durability of the improvised materials. A durable material on a long-term basic reduces cost as well as saves time and labour, in the cost advantage.

v. The cost advantage of the improvised material.

It may be more beneficial to acquire an already existing cheaper factory made material than to spend time and labour to embark on the improvisation of such materials.

8.4.6INFLUENCE OF IMPROVISATION MATERIALS IN MATHEMATICS TEACHING AND LEARNING

Improvisation becomes imperative in situation where there are scarce resources and facilities. The school system today is experiencing a boost in population giving size to greater demand for classroom facilities and equipment. With limited government resources the teachers ingenuity to improvise becomes tasking for learning to be effective and productive. According to Stan 40th anniversary conference proceedings (1997), some influence improvised materials would have on mathematics teaching learning process are:

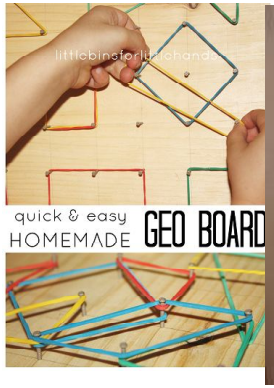
i. Improvised materials provide a cognitive bridge between abstraction and reality to students.
ii. Improvisation undertaken by the teacher enables him/her to think and research for cheaper, better and faster methods of making the teaching and learning process easier for students.
iii. Improvisation presents next to real situation to students in the absence of the real materials.
iv. Improvisation saves cost and in addition the teacher and the student make positive efforts towards effective instruction.

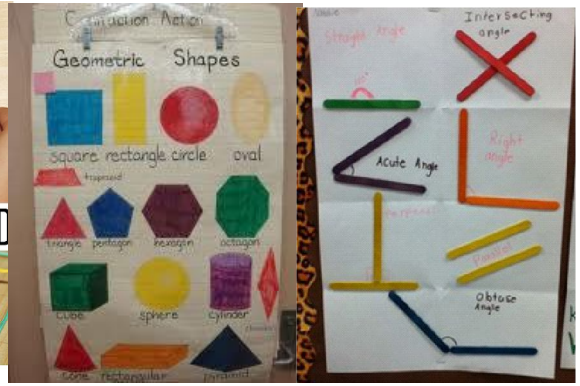
8.5.7 EXAMPLES OF IMPROVISED APPARATUS

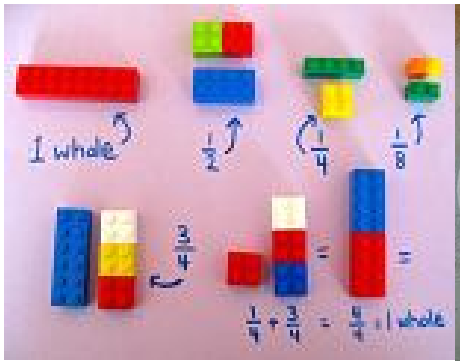
Following are the few examples of Improvised Apparatus for teaching the concepts of geometry, numbers and fractions.

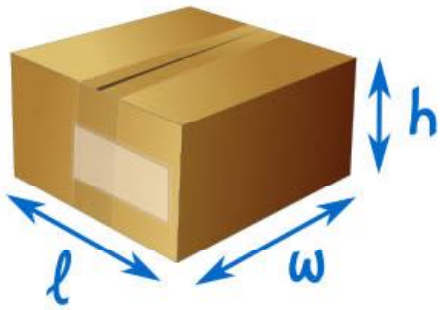
In a school where there is no mathematics laboratory, the teacher together with the students can readily improvise and create what we call the mathematics corner in the classroom as can be found in the picture

below. The teacher can start by creating a corner in the class as mathematics corner where he/she can be depositing periodically mathematics equipment or ask the pupils to bring, with pride and boldness, local mathematics materials like different geometrical shapes so as to facilitate a successful take off and unhindered success of the establishment.









8.4.8 GUIDES ON IMPROVISATION

Having known what improvisation really is it becomes necessary to have guides for people embarking on it. In other words, improvised materials should possess certain qualities and these are:

i. Appropriateness of teaching aids to the age of the learners for whom they are meant.
ii. Its clarity in illustration and simplification of concepts.
iii. Its adequacy in size.
iv. Its relevance to the lesson they are meant to serve.
v. It should be interesting to the learners, durable and improvable among others.

Boulind (967) stated that when the desirable is not available then the available should become the alternative if it performs the same or similar functions as the desirable. It should be borne in mind that resource materials do not achieve any of the attributed values on their own. The usefulness depends on what the teacher makes out of them i.e. the influence made on the students by the teacher with the materials.

8.4.9. ADVANTAGES AND DISADVANTAGES OF IMPROVISATION

Advantages of improvisation

Some advantages of improvisation are:

1. It enables the learners and teachers make proper use of their environment this is because in improvisation we mainly make use of the available materials in the environment.
2. The use of local materials reduces cost in terms of financial expenditure in buying ready-made materials.
3. The development of resource materials for instruction can lead to discovery of new knowledge.
4. When parent or learner or community members assist in improvising a resource material such a donating personal material, this will improve school-community relationship.
5. They provide experience not easily obtained through other means and contribute to efficiency, depth and variety of learning.

6. Improvisation helps to bridge the gap between theoretical knowledge and practicability.
7. When the teacher and learners succeed in improvising an instructional material, there is a high sense of achievement and they are encouraged to higher exploits
8. Talents in the students are discovered.

Disadvantages of improvisation

A major problem militating against improvisation is lack of adequate professional training of staff. It is noted that improvisation demands adventure, creativity, curiosity and perseverance on the part of the teacher, such skill are only realizable through well-planned training programmes on improvisation.

Another factor that would hinder the realization of the objectives of improvisation is lack of funds. It is noted that improvisation whether they cost less than standardized manufactured ones or not cost money. This money is usually not readily available or teachers. Improvisation can also expose teacher and students to some-hazards.

8.5. MATHEMATICS KITS

One of the most significant recommendations of the National Curriculum Framework (NCF)–2005 is the mathematisation of the child's thought processes. In achieving this goal, concrete mathematical experiences play a major role. A child is motivated to learn mathematics by getting involved in handling various concrete manipulants in various activities. In addition to activities, games in mathematics also help the child's involvement in learning by strategizing and reasoning.

For learning mathematical concepts through the above-mentioned approach, a childcentred Mathematics Kit has been developed for the students of upper primary stage based on some of the concepts from the newly developed NCERT mathematics textbooks.

The kit includes various kit items along with a manual for performing activities and playing games. The kit broadly covers the activities in the areas of number system, geometry and mensuration.

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8.5.1 ADVANTAGES OF MATHEMATICAL KITS

The kit has the following advantages:

- Availability of necessary materials at one place;
- Multipurpose use of items;
- Economy of time in doing the activities;
- Portability from one place to another;
- Provision for teacher's innovation; and
- Low-cost material and use of indigenous resources.

8.5.2 FEATURES OF MATHEMATICAL KIT

Here are some of the special features of the kit items:

- Plastic strips with slots and markings have been provided. These help in creating angles, triangles and quadrilaterals. The slots facilitate the adjustment of the strips over one another so that triangles and quadrilaterals of different dimensions can be made.
- Markings have been provided on the strips and these markings help in measuring the lengths, wherever required.
- The 360° protractors can be fixed on the strips while forming angles, triangles and quadrilaterals, and are used for measuring angles.
- Nets of different solids in laminated papers have been provided for the formation of solids by folding.
- Then another interesting item is an innovative 'Geoboard'. It is a board of dimensions 19cm x 19cm x 1cm. Holes have been drilled on the board on side A at equal distance of 1 cm each.
- Small pins (Called Dowels) can be fitted in the holes and with the help of rubber bands different geometrical shapes can be formed.
- Cut-outs of plastic corrugated sheets in the form of parallelogram, triangle, trapezium and circle help in learning concepts related to areas.
- For an activity regarding different views of solids from various perspectives, plastic cubes have been provided. Each cube has a notch on one of its faces which helps in fixing it to other cubes to form different shapes like cubes or cuboids. These plastic cubes are

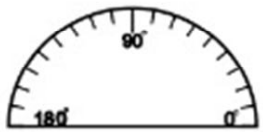
also helpful in learning regarding surface area and volume of solids and fractions.

- An abacus has been prepared to inculcate understanding of place values of numbers. In the base dowels have to be fixed in them indicating different place values.
- Beads have been specially provided to be put in these dowels. This abacus is useful in creating an understanding of addition and subtraction of decimal numbers.
- Counters of different colours have been put in the kit for the activities related to integers. These can also be used for playing one of the games using integers.
- A number board marked with numbers from +104 to –104 has also been provided for this game. For game on factors of numbers, 100 pieces of laminated cards numbered 1 to 100 are provided. It makes the game enjoyable for children.

LIST OF KIT ITEMS

1. Plastic Strips (6)
Use: In creating angles, triangles and qudrilaterals.

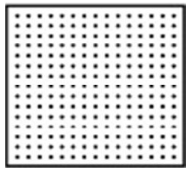
2. Protractor
Use: in measuring the angles
(a) Half protractor (4)



(b) Full protractor

3. Fly Screws (12)
Use: To connect the plastic strips

4. Geoboard
Use: Geoboard is used to represent planar shapes/ figures and also to find the approximate areas.
(a) Geoboard (190cmx190cmx1cm)



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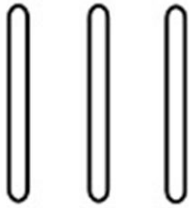
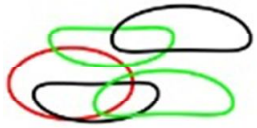
(b) Dowels/Pins (25)
Use: For use with geoboard.

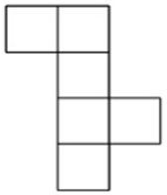


(c) Rubberbands (10)

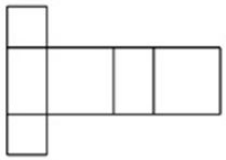


5. Paper nets for solid shapes
Use: Used to make solid shape

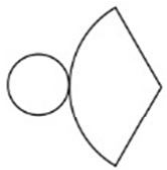
(a) Cube



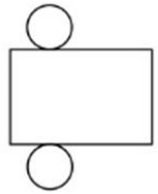
(b) Cuboid



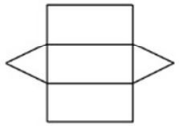
(c) Cone



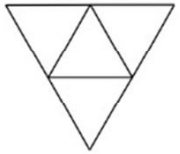
(d) Cylinder



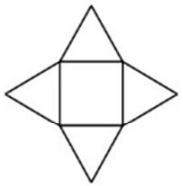
(e) Prism



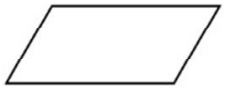
(f) Pyramid
(i) Triangular base



(ii) Square base



6. Cutouts of
(a) Parallelogram



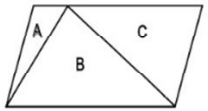
(i) Triangles cut from a parallelogram

(ii) Trapezium and triangle to form a

rectangle

(iii) Two congruent triangles

(iv) Parallelogram showing triangles in it. Triangles A and C fitting on triangle B.



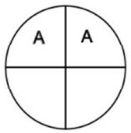
(v) Two congruent trapeziums forming a parallelogram

(b) Circle

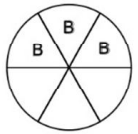
Use: Used for exploring "Area of Circle" and activities related "Frations"

Used in activity "Viewing Solids from Different Properties and Exploring their Surface Areas and Volumes".

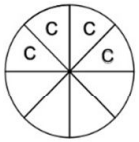
(i) Four equal parts of a circle, 2 marked with A.



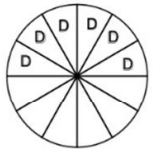
(ii) Six equal parts of a circle, 3 marked with B.



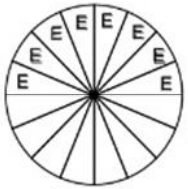
(iii) Eight equal parts of a circle, 4 marked with C.



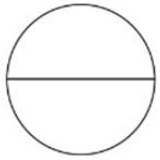
(iv) Twelve equal parts of a circle, 6 marked with D.



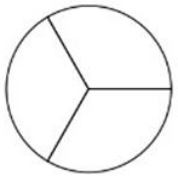
(v) Sixteen equal parts of a circle, 8 marked with E.



(vi) Two equal parts of a circle.

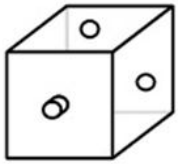


(vii) Three equal parts of a circle.



7. Study-four plastic cubes of unit length and of four different colours.

   Use: Used in Activity "Viewing Solids from Different Properties and Exploring their Surface Areas and Volumes.

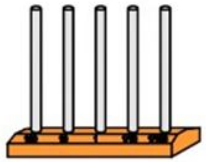


8. Counters: Whose one side is blue and other side is red. (20)

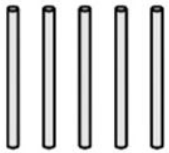
   Use: Used in activity "Addition and Substraction of Integers".

9. Abacus

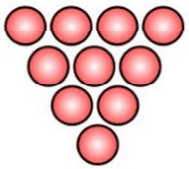
   (a) Abacus Stand



   (b) Aluminium dowels (6)

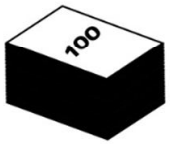


   (c) Beads of one colour (50 in total)



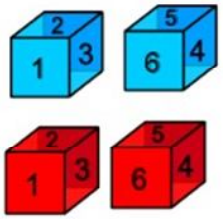
10. A pack of cards numbered from 1 to 100

    Use: Used in game 1 for factorisation of numbers.

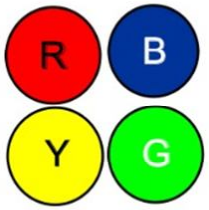


11. Sheet showing numbers from +104 to -104

12. Dice numberd 1-0
    a) Two blue dice
    b) Two red dice



13. Counters of different colours (8)



14. Kit box

8.5.3 EXAMPLE

Exploring Area with Geoboavrd

❖ **Objective**

To form different shapes on a geoboard and explore their areas.

❖ **Material Required**

Geoboard and rubber bands.

❖ **How to Proceed?**

1. Form an irregular figure on the geoboard as shown in Fig. 8.1, by using pins and rubber band.

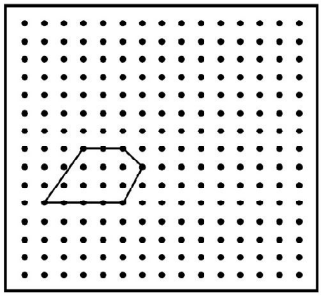


Fig. 8.1

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2. Find out the area of this Figure by counting the squares as follows:

a. Count the number of full squares enclosed by the Figure, taking area of one full square as one square unit.

b. Count the number of squares that are more than half enclosed by the Figure, taking area of one such square as one square unit.

c. Count the number of half squares enclosed by the Figure, taking area of one half square as half square unit.

d. Neglect the squares less than half enclosed by the Figure.

e. By adding the number of square units counted in the steps (a), (b) and (c), you get the approximate area of the above Figure 7+1+ ½ (3) = 9½ square units approx.

3. Now make some more irregular figures and try to find their areas.

Area of a Rectangle:

Form the shapes of different rectangles using rubber bands on the geoboard as shown in Fig. 8.2. Count the unit squares in each rectangle enclosed and fill Table A.

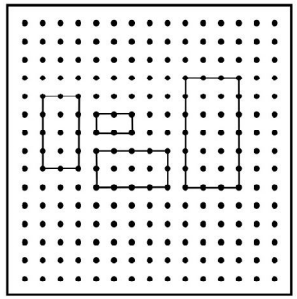

Fig. 8.2

Table A: Rectangle

S.No	Total number of unit squares in the rectangle	Length of the rectangle	Breadth of the rectangle	Length x Breadth
1. 2. 3. 4.				

Inference: Area of a rectangle_____.

Area of a Square

Form the shapes of different squares using rubber bands on geoboard as shown in the Fig. 8.3. Count the squares and fill Table B.

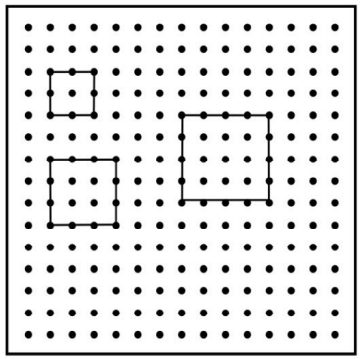

Fig. 8.3

Table B: Square

S.No	Total number of unit squares in the square	Side of the square	Side x side
1 2. 3. 4.			

Inference: Area of a square_____.

Area of a Right Triangle

Make different right-angled triangles with the help of rubber bands on the geoboard, as shown in Fig. 8.4. Count the squares and fill Table.

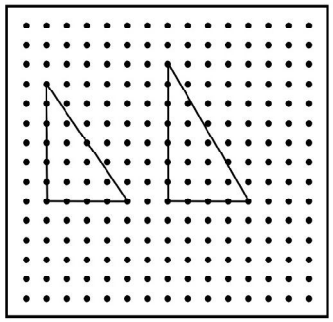

Fig. 8.4

Table B: Triangle

S.No	Total number of unit squares in the right triangle	Height (h)	Base(b)	½(b x h)
1 2. 3. 4.				

Inference: Approximate area of a right-angled triangle _____.

8.6 MATHEMATICS LABORATORY AS LEARNING RESOURCE

It is expected that the 21st modern day technique of teaching mathematics in our schools possibly facilitate their teaching pedagogies with the aid of modern mathematics laboratories to be able to achieve the objectives of the mathematics education into the 21st century project. Thus it is strongly recommend to all school teachers to liaise with their school principals/heads to facilitate the establishment of a mathematics laboratory or for a start, mathematics corner in their schools.

The laboratory of mathematics is a stimulus for teacher, for reflecting, focusing on specific needs and requirements, normally depending by the different class. The showed material can have useful adaptations, in relation to the individual situation of teachers and classes. In particular, in the primary school the laboratory of mathematics has an effective link with the game, by stimulating the imagination of children's through a fun approach to mathematics. In this way mathematics is perceived as a not heavy and helpful discipline.

The term "laboratory method" is commonly used today to refer to an approach to teaching and learning of mathematics which provides opportunity to the learners to abstract mathematical ideas through their own experiences, that is to relate symbol to realities. It is uncommon in our schools today possibly as a result of lack of fund or the absence of any government policy on the provision of such laboratory facilities. In short, its non-existence in our schools is one of the major contributory factors to mass failure in mathematics.

Laboratory as Learning Resource

As defined by Adenegan (2003)," the mathematics laboratory is a unique room or place, with relevant and up-to-date equipment known as instructional materials, designated for the teaching and learning of mathematics and other scientific or research work, whereby a trained and professionally qualified person (mathematics teacher) readily interact with learners (students) on specified set of instructions.

In a related term, a current version (miniature) of mathematics laboratory is the "mathematics corner". This indeed is still a new concept.

Some of the ways in which a Mathematics Laboratory can contribute to the learning of the subject are:

- ❖ It provides an opportunity to students to understand and internalize the basic mathematical concepts through concrete objects and situations.
- ❖ It enables the students to verify or discover several geometrical properties and facts using models or by paper cutting and folding techniques.
- ❖ It helps the students to build interest and confidence in learning the subject.
- ❖ The laboratory provides opportunity to exhibit the relatedness of mathematical concepts with everyday life.
- ❖ It provides greater scope for individual participation in the process of learning and becoming autonomous learners.
- ❖ It provides scope for greater involvement of both the mind and the hand which facilities cognition.
- ❖ The laboratory allows and encourages the students to think, discuss with each other and the teacher and assimilate the concepts in a more effective manner.
- ❖ It enables the teacher to demonstrate, explain and reinforce abstract mathematical ideas by using concrete objects, models, charts, graphs, pictures, posters, etc.

Materials and Equipment's in Math Lab

The materials or equipment that can be found in the mathematics laboratory include, among others constructed (wooden/metal/plastic made)

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- ❖ mathematical sets,
- ❖ charts and pictures,
- ❖ computer(s), computer software,
- ❖ audio-visual instructional materials such as projector, electronic starboard, radio, television set, tape recorder, video tape, etc,
- ❖ solid shapes (real or model),
- ❖ bulletin board,
- ❖ three-dimensional aids,
- ❖ filmstrips,
- ❖ tape photographs,
- ❖ portable board or whiteboard,
- ❖ abacus,
- ❖ cardboards,
- ❖ tape measure,
- ❖ graphics,
- ❖ workbooks,
- ❖ graphs,
- ❖ flannel boards,
- ❖ flash cards, etc.

8.6.1 APPROACHES TO LABORATORY WORK

Mathematics laboratory is relatively new in the teaching and learning of mathematics.

It is a practical oriented classroom or place where materials useful for the effective teaching and learning of mathematics are kept. It is the latest design to make mathematics real.

Problem-solving Approach: With this approach studentsstudents enjoy working together with some freedom of action as it,

- ❖ Gives the learners an opportunity to become independent, organise their own learning and develop self-confidence.
- ❖ Provides the learners an opportunity to do open ended activities and experiments of exploratory nature.
- ❖ Helps in acquiring basic technical and inquiry skills

- ❖ Encourages to identify their own problem, collect and organise the data and reprt their findings.

Inductive Approach: This approach provides the students an opportunity,

- ❖ to develop concepts laws and principles through first-hand experience before the ideas are discussed in the classroom.
- ❖ to search patterns, relationship between different quantities and applications of the concepts while engaged in laboratory work.
- ❖ to discuss immediately after laboratory work to strengthen their ideas.

Deductive Approach: This is the common approach and is used for

- ❖ Discussing the theoretical aspect of the concept through first-hand experience.
- ❖ Verification of concepts, laws and principles of mathematics.
- ❖ Organisation of the concept based on the previous concepts.

  E.g. Proof of theorems

8.6.2 PLANNING AND ORGANISING LABORATORY WORK

Mathematics teachers must plan laboratory work well in advance for making best uses of available resources. It should be ensured that students have a sound theoretical knowledge for handling the apparatus and performing the experimental work. For this the following points should be considered:

i. Design and general layout of Laboratory:

Allocate place where students can easily and comfortably accommodate.

Following design is suggested by the educators**.**

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ii. Physical infrastructure and materials:

- ❖ Identify the necessary materials required in the laboratory by labeling them with name tags.
- ❖ Put or assemble all related equipment or materials on the same side/ place. e.g. geometric objects should not be placed where audio-visual materials are positioned.
- ❖ Put the bulletin board close to the entrance door in case of any information display.
- ❖ Arrange the benches and tables to allow for free movement in the laboratory.
- ❖ Hang relevant pictures and charts on picture rails and boards.(
- ❖ The starboard or white board must be positioned where every student can readily see it. Shelves can be constructed for keeping and demarcating materials.(
- ❖ Electronic materials such as projector, television, etc, should be properly displayed. Electrification of the laboratory should be professionally done to allow for safety use. Display materials on tables in an organized manner.
- ❖ The laboratory should be set in such a way that it must be well ventilated.
- ❖ Handy materials that can be easily destroyed or lost can be kept in a cabinet or separate shelve.
- ❖ Arrange the materials in places (on tables, shelves, board, etc) in a way that they can be easily accessed when needed and returned appropriately after use.

iii. Allocation of time :

- ❖ Divide the total available time judiciously between theory classes and practical work.
- ❖ Integrate the laboratory experiments with the teaching-learning experience.
- ❖ Choose simple procedures which can be performed within allotted time.

iv. Human Resource:

A laboratory assistant or attendant with minimum of graduation and professional qualification of bachelor in education should be made incharge to accompany the mathematics teacher in carrying out the experiments.

8.6.3 WORKING IN A GROUP IN THE LABORATORY

Having already discussed extensively the mathematics laboratory, we will proceed to itemize how to set a befitting and remarkable mathematics laboratory in the school.

Organisation and Distribution of Student into Groups:

It is useful and informative to start from real contexts, such as:

- ❖ Problems that have emerged spontaneously by children's in difficult situations;
- ❖ Problems that may arise in particular contexts.

About the modality of work, the class could be divided:

i. in groups of 4-5 children with inhomogeneous levels of learning;
ii. in pairs;
iii. with possible time periods of individual work;
iv. with the possibility to create new groups in relation to the peculiar characteristics of children's and work.

Functions of Mathematics Laboratory:

The functions of mathematics laboratory include the following:

- ❖ Permitting students to learn abstract concepts through concrete experiences
- ❖ Increase their understanding of the ideas.
- ❖ Enabling students to personally experience the joy of discovering principles and relationships.
- ❖ Arousing interest and motivating learning.
- ❖ Cultivating favourable attitudes towards mathematics.
- ❖ Enriching and varying instructions.
- ❖ Encouraging and developing creative problems solving ability.
- ❖ Allowing for individual differences in manner and speed at which students learn.

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- ❖ Making students to see the origin of mathematical ideas and participating in "mathematics in the making".
- ❖ Allowing students to actually engage in the doing rather than being a passive observer or (recipient of knowledge in the learning process.

8.6.4. MOTIVATING STUDENTS TO MAINTAIN THE REGULAR RECORD OF LABORATORY WORK

Some instructors insist that students in laboratories must keep notebooks. Whether required or not, the use of a notebook helps to develop good laboratory habits that will serve well in future career.

Laboratory notebook reflectspersonal style, but should be writtenso that everyone should be familiar with the subject of research could understand it. Students may need to refer to the notebook at a later date, therefore do not omit any information necessary to understand what they did, or to repeat it.

Following Instructions could be given to the students for making Lab records:

1. Selection of Note Book:

- ❖ Use a bound (not a loose leaf) notebook for the laboratory record.
- ❖ Make notebook entries as the experiment progresses, as a running record of the work.
- ❖ The notebook includes a complete history of all experiments performed, and their results.
- ❖ Use Quadrille-ruled pages with 1/4 inch squares to facilitate making data tables and rough graphs.
- ❖ Don't erase anything in a laboratory notebook and
- ❖ never remove pages from it
- ❖ Line out, and annotate, mistakes.
- ❖ Use permanent ink, for better readability.
- ❖ Abbreviate, but make all entries clear,
- ❖ Organized and complete and neat enough for, or someone else, to read.

2. Record Book Entries :

Here's a check list of items which you should record in the notebook:

- ❖ The date and time of each new record.
- ❖ The initials of the person making the record.
- ❖ Descriptive headings, titles, and subtitles.
- ❖ Lists of the equipment used (name, manufacturer, model and serial numbers), with relevant specifications.

3. Labelling:

Label figures, sketches, diagrams of the experimental layout etc., with all components.

4. Recording of Observed data:

- ❖ Record data in the notebook immediately.
- ❖ Do not recopy it from scraps of paper
- ❖ Organize the data in neat tabular form, with ample space for corrections and auxiliary notes.
- ❖ Symbols and notation of each column heading should match that used in the equipment diagram, equations, and other references in the discussion.
- ❖ When possible, identify the exact instrument used.
- ❖ Neatly line-out incorrect data. A large amount of incorrect data may require you to line-out (or overlay with a large X) an entire table.
- ❖ If you feel that an 'X' across a whole page looks unsightly, use a footnote to label it as "deleted."
- ❖ Always record the reason for such altered entries.

5. Display of calculated results:

Don't include every calculation, but do include a sample of each type. If needed to do this same sort of calculation later, the sample may save time.

6. Curves:

- ❖ Plot tabular data as curves whenever possible.
- ❖ Use the term "curve" to represent data points plotted with a smooth line drawn through them. The term "curve" applies even to straight lines.

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- ❖ The term "plot" refers to roughly sketched curves, perhaps done on the quadrille paper of the lab notebook.
- ❖ The term "graph" refers to the more neatly produced and annotated curves done on genuine graph paper, or in a form suitable for publication.

7. Graphs:

Important data may deserve a graph made on genuine graph paper, permanently attached to the notebook page. Avoid using tape, for it deteriorates with age. Use a thin line of glue to "tip in" such added material. Attach charts, diagrams and photographs in the same manner

- ❖ All graphs (and plots) must have a descriptive title, each axis labeled with quantity, symbol, and units.
- ❖ Choose a scale size such that one may read values from the curves with at least the same accuracy as the accuracy of the data.
- ❖ Make the data points very small (some use pinpricks) and emphasize them with small, neat circles.
- ❖ When you show several curves on the same graph, group related data points in some way using distinctive symbols, such as circles, triangles, and squares (use a symbol template, for uniformity).
- ❖ Provide a key, on the graph page, to the meanings of the symbols.(

8. Report Writing:

Lastly, to communicate your experimental work writes a laboratory report.Notes or explanations essential to proper performance of the experiment or interpretation of the results. This might include your explanation of how you overcame any difficulties encountered in the experiment.(A restatement of the questions posed, and your answers should also be included.

8.7 HANDLING HURDLES IN UTILISING RESOURCES

While utilising all above mentioned resources, there are some hurdles felt by either teacher or students. A hurdle, in general, can be understood as a difficulty or obstacle that has to be overcome. So if we want to utilise these for better learning of mathematics, we will have to overcome these hurdles. Broadly

we can categorise these hurdles into two categories: first, social and ethical hurdles, and second, technical hurdles. CALtoonz2006 and Roble (2008) talk about various aspects of these hurdles. Let us discuss these in detail.

(a) Social and Ethical Hurdles

As ethics are basically related to the society, so these hurdles can be put together with social hurdles due to their complementary nature. Various hurdles or attention seeking issues with reference to CALtoonz2006 and Roble (2008) can be mentioned as:

i. ***Secularity of the Content:*** India is a secular country as mentioned in our Constitution. So, we have to maintain secularity in the content of the resource. No resource can be utilised and accepted which harm our secularism.

ii. ***Gender Equity:*** Gender equity is another very important issue. Our resource should be based on giving equal importance to both the genders, male as well as female.

For the evolution of a modern and developed society, gender equity is important.

iii. ***Democracy***: Democracy is giving equal opportunity and equal rights to all. Our resource content should provide ample instances for reflecting democracy. If it does not reflect, it may not be accepted by the society.

iv. ***Respect for Elders***: The resource should give space for and should inculcate value of respect for elders. Our Indian culture is well known universally for respect for elders. So, if our content of resource reflects respect for elders, it will be heartily accepted by the learners as well as their parents.

v. ***Respect for the Disabled***: This era is the era of inclusion of all in every aspect of our society, including the field of education and betterment of life. Our resource should show equal opportunity to all, and it should pave a way giving respect to the disabled.

vi. ***Respect for all the Religions***: The resource content should give respect to all the religions. The content should not have any material which shows disrespect to any religion. This may help in fostering fraternity among learners.

vii. ***Concern for Animals:*** Oursociety is more concerned about animals and their welfare now days. The resource should respect such concern in its content and presentation.

viii. ***Respect for the Environment***: While we are stressing for eco-friendliness of everything we are using or producing, how can we leave our resource away from such an important issue. Our resource should be eco-friendly, encourage eco-friendliness, hence, should have respect for the environment.

ix. ***Plagiarism and Cyber Cheating***: Plagiarism is using and mentioning work of some other person without acknowledging that person, or mentioning in the name of oneself. This is just like cheating, and unethical that the work of some other person is being used or published in the name of self. So, using any resource in such a way should be avoided.

x. ***Illegal Downloads/Software Piracy***: Software and media companies are prosecuting offenders of illegal downloading and piracy of softwares. Hence, one should avoid illegal downloading and piracy of softwares.

(b) Technical Hurdles

Some of the technical hurdles are:

i. ***Colour***: Colour used should not be hot colours. Most of the colours should be soft colours and eye friendly. The learner should not feel stress while going through the content as well as pictures and

ii. ***figures.***

iii. ***Speed***: In case of multimedia resource, the speed should be optimum enough to provide learners with ample time to go through the content and concept. If speed will be too fast, learner would not be able to go through the entire slide, and if it will be too slow, learner would feel like wastage of time and it may create disinterest.

iv. ***Smoothness of Animation***: In case of animation, it should be smooth enough to facilitate learner for better learning. It should not create a sense of irritation among the learners.

v. ***Use of Screen***: Entire screen should be efficiently used. It should not be like that the entire content or picture is lying on a corner and majority

of the space of the screen is lying vacant or useless. If only text is there, it could have its orientation beginning from centre. In case of books and e-books too, each page can be considered as one screen.

vi. ***Special Effects***: Special effects, if any, should be learner centred. It should be in consideration with the age level, mental level, previous knowledge, attitude and aptitude level and readiness of the learner.

vii. ***Music***: Music, sound and voices used should be appropriate with respect to validity, timing and relatedness. It should be soft and ear friendly. Under no circumstances it should be harmful or irritating to the learner.

If all these social, ethical and technical hurdles can be overcome, then not only learners and teachers, but everybody related to the field of mathematics will use these resources for betterment of learning, and hence, for the betterment of the entire field of mathematics.

Addressing under utilisation of resources:

Some suggestions for overcoming the hurdles could be as follows:

i. ***Narration***: It can be better, if the text for using at school is in the form of narration. A narrator should always be present over there. It means, if a text is being represented, it should be shown in such a way that it is being narrated by some character instead of simply writing the text in open space.

ii. ***Teacher Friendliness***: It should be easy for the teacher to handle the resource. If the teacher, will not feel comfortable using the resource, it may create disruption from using the resource in future again.

iii. ***Teacher Training and Skill Development***: A teacher should be trained and provided with ample skills to use resources in learning of mathematics. It must be compulsory part of a teacher training programme, that prospective teachers be given training for skills to handle learning resources.

iv. ***Attitude and Ease of Access***:The source should be easily accessible to all the students and teachers. They may not have a positive attitude towards utilising these resources in learning and teaching, but ease of access will surely motivate them for utilising these resources in learning, 'teaching of mathematics.'

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If all these social, ethical and technical hurdles can be taken care, then not only learners and teachers, but everybody related to the for field of study of mathematics will use these resources betterment of learning and hence, for the betterment of the entire field of mathematics.

Summary:

Learning resources play a vital role in learning of mathematics. Here and there, several resources are spread which can be used for learning of mathematics. These can be in the form of textbooks, hand books, reference books, supplementary books, audio-visual multimedia or community resources. Sometimes, there is a need of pooling these resources at formal and informal levels. Various resources, mentioned here, provide powerful vehicles to engage and sustain children's interest in mathematics. If these resources are properly used as learning opportunities for mathematics learners, it will surely empower our learners to think like mathematicians.

EVALUATION:

1. How can the various community resources be used in teaching learning of mathematics? Explain
2. Write short notes on mathematics kit in teaching learning of mathematics.
3. Briefly explain about the different approaches to laboratory work.
4. How will you motivate the students to maintain regular record of laboratory?
5. How can we pool the learning resources for sharing purpose? Explain.
6. Briefly explain the improvisation of apparatus and its advantages and disadvantages.
7. How will you motivate students to maintain and organize the regular record of laboratory work?
8. Discuss about the problems faced my mathematics teacher in utilizing learning resources. Give examples in light of your experience.