UNIT 7 LEARNING RESOURCES AND ICT FOR MATHEMATICS TEACHING-LEARNING

Structure
7.1 Introduction
7.2 Objectives
7.3 Learning resources
  7.3.1 Importance and Use of Learning Resources
  7.3.2 Learning Resources from Immediate Environment
7.4 Mathematics Lab and Mathematics Corner
7.5 Mathematics Club and Forum
7.6 ICT Need, Importance and Use in Learning of Mathematics
  7.6.1 Need and Importance of ICT
  7.6.2 Use of ICT in Learning of Mathematics
7.7 Selection and Use of Appropriate Media
7.8 Let Us Sum Up
7.9 Unit End Exercises
7.10 Answers to Check Your Progress
7.11 References and Suggested Reading

7.1 INTRODUCTION

The constructivist learning approach calls for the extensive use of various learning resources as self-learning is emphasised in classrooms. Abundant use of learning resources gains attention of learners in the learning processes and at the same time it helps the teacher to sustain the involvement of learners in learning. Apart from that, the learning turns into an enjoyable activity and all round development of learners is assured both in cognitive and co-cognitive aspects. Keeping the relevance of learning resources in mind, the widespread use of learning resources is suggested both at elementary and secondary level. In this unit, we would deliberate on the use of learning resources at school level. Also the different types of resources that can be used in mathematics classrooms will be discussed. Thus, the unit will help you in identifying and using various digital learning resources in your classroom.

7.2 OBJECTIVES

After going through the unit, you will be able to:

- describe learning resources and their importance in learning mathematics;
- identify various learning resources from immediate environment;
- develop activities for effective use of learning resources in mathematics classrooms;
• explain the importance of math laboratory and math corners;
• identify the activities that can be undertaken by maths clubs and forums;
• describe importance and use of ICT in learning mathematics; and
• discuss the factors considered in the selection of appropriate media.

7.3 LEARNING RESOURCES

What are learning resources? Learning resources are texts, audio video materials and digital aids that assist you in effective transaction of curricular content. The major learning resource is the text book prepared by central and state governmental educational agencies while a number of other learning resources are also available. These may be manmade, improvised or material available in the nature. You can also find learning resources in the immediate environment, which will be discussed in sub section 7.3.2. It is also to be noted here that, with the advancement of technology, a number of digital learning resources are also developed. Some of the common learning resources are listed below:

<table>
<thead>
<tr>
<th>Textbooks (Print and Digital)</th>
<th>Teacher Guides</th>
<th>Social networking Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work books</td>
<td>Laboratories</td>
<td>Blogs</td>
</tr>
<tr>
<td>Activity Books</td>
<td>Models</td>
<td>Wikis,</td>
</tr>
<tr>
<td>Flashcards</td>
<td>Reference Books</td>
<td>Discussion forum</td>
</tr>
<tr>
<td>Posters</td>
<td>E-resources</td>
<td>Mobile learning</td>
</tr>
<tr>
<td>Educational games</td>
<td>Television</td>
<td>E-text</td>
</tr>
<tr>
<td>Magazines and Periodicals</td>
<td>LCD projector</td>
<td>Virtual reality</td>
</tr>
<tr>
<td>Study Guides</td>
<td>Computer</td>
<td>OER</td>
</tr>
<tr>
<td></td>
<td>Internet Resources</td>
<td>Second Life</td>
</tr>
</tbody>
</table>

Figure 7.1: Various Learning Resources

7.3.1 Importance and Use of Learning Resources

Learning resources serve many purposes. As you know, lecture method is the easiest/common method. Many times, subject contents are not conveyed appropriately to the learners through lecturing style. But, the creative intervention of teachers can bring dynamism in the classrooms by employing learning resources in lecture method. The same is true for other teaching methods. Learning resources are imperative in teaching-learning situations due to the following features. These resources:

➢ help learners to be involved fully in the learning process as learning resources are powerful tool to gain and sustain motivation,
➢ facilitate learners to comprehend subject concepts effectively as they can correlate the verbal instruction with real experience,
➢ assist learners to learn effectively and remember concepts for long,
help learners to comprehend concept with clarity and bring vividness in learning,
help learners to concretize abstract concepts, and thereby enhances the comprehension,
reduce verbal communication on the part of teachers, and
help learners to develop inquisitiveness, curiosity and interest in learning.

Apart from the above stated points, learning resources are important because of the fact that learning is enhanced as learners experience hands on training and real practice. At this point, make note of the following figure that also validates the importance of learning resources.

As a mathematics teacher, you may look for options that would enable you to use learning resources effectively in your classroom. Let us discuss an example.

Maya, a mathematics teacher was teaching the concept of ‘perimeter’ to her learners. What she did was, instead of verbally introducing the concept, she asked the learners to sit in groups. Thereafter, she asked them to complete the assignment given on the computer (The class is conducted in the computer lab and a group of five learners were assigned one computer). She was making use of one of the web resources. This is a simple example. You may explore more.
Activity for Practice

1) Prepare the list of learning resources and their usefulness in teaching mathematics.

7.3.2 Learning Resources from Immediate Environment

The learning resources that we have discussed above are readily available or are man made. But, for you as a teacher, it may not always be possible to procure these resources for many reasons. In such cases, you can opt for natural (immediate environment) learning resources. Such resources are available in the classroom, own house or nature. Nature is the biggest reservoir of learning resources. These resources are also known to be improvised aids or improvised learning resources. **Improvised learning resources are those resources that are prepared from waste material or material available in the immediate environment.** For example, if you want to teach 3D shapes, you can bring empty match boxes, unutilized utensils, and so on. Even can prepare boxes with unutilized cardboards, or thick paper cuttings, etc. Let us discuss an example of using learning resources from our immediate environment.

Mrs. Radhika, a secondary school teacher of mathematics decide to teach the concept of **non intersecting** lines, **secant** and **tangent** of a circle in her class of Xth standard. When a circle and line is given in a plane, there are three possibilities: (i) the line will not touch the circle; (ii) the line will touch at two points or the line may touch at a single point as shown in figure 7.3. In the first case, we call the line segment PQ, a non-intersecting line, the second a secant, and the third a tangent of the circle. To teach these concepts, rather than drawing on the black board, she has used learning resources from her immediate environment. It is interesting to know what she used. Radhika brought a few sticks and bangles, which were kept unutilized at her home. With those objects, she was successful in organising the group activity and thereby helping the learners to learn the afore mentioned concepts.
You may think of such learning resources as you plan your learning activities.

![Diagram of Non Intersecting Line, Secant and Tangent of a Circle](image)

**Check Your Progress**

**Note:**
1. Write your answers in the space given below.
2. Compare your answers with those given at the end of the Unit

1) Learning resources are important in mathematics teaching. Justify the statement.

2) List some of the learning sources found in nature, and explain, how you would use the same in your classroom for mathematics teaching.

---

### 7.4 MATHEMATICS LABORATORY AND MATHEMATICS CORNER

Learning resources also include mathematics laboratory (math lab) and mathematics corner, which slightly differ in their organization and material possessed. Let us discuss the major differences among them: "Mathematics laboratory is a unique room or place, with relevant and up-to-date equipment, known as instructional materials, designed for the teaching and learning of mathematics and other scientific or research work, whereby a trained and professionally qualified person (mathematics teacher) readily interacts with learners on specified set of instructions" (Adenegan, 2003). Math lab is a place where learners get opportunity to engage with mathematical objects, experiment mathematical theories, solve mathematical puzzles and problems, play mathematical games, experience hands on training, and so on. The material or
equipment that can be found in the mathematics laboratory includes, among others, constructed (wooden/metal/plastic made) 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 (Adenegan, 2003).

Math lab consists of a number of materials and objects. Mathematics corner is a miniature form of math lab. Math lab is highly organised, consists of several objects/materials/instruments and requires specialized skills in developing them, but math corners are simple and contains few mathematical objects and items. You can setup a math corner at the corner of any other lab or on the corner of classrooms. Usually, math corner is a place where learners find the ordinary/common kinds of mathematical items and you can utilize these items during the classroom interaction. In a way, math corners include math related teaching-learning aids. It is to be noted that, the objects found in math labs can also be found in math corners.

![Figure 7.4: Mathematics Laboratory](Source:http://karnatakaeducation.org.in/KOER/en/index.php/Mathematics_Laboratory)

Now let us discuss the importance of math labs and corners. The math labs/corners are important due to the following reasons:

- It helps learners to comprehend mathematical concepts effectively by utilizing concrete objects and experiencing real situations.
- Learners can test and experience the theoretical knowledge and discover different mathematical properties.
- It enhances the interest and motivation of learners to learn mathematics.
- Math labs provide objects and materials, which help learners to relate concepts with their daily life activities and nature.
- Individual learning is promoted while exploiting math labs as learners engage in exploration of mathematical contents in their own way.
- The cognitive development is supported and enhanced as learners exercise both mind and body by engaging in learning activities.
- The teacher can demonstrate learning concepts by connecting with multiple learning resources present in the math labs.
It helps in the development of skill of enquiry and critical thinking.

The principle of ‘learning by doing’ can be practiced by learners.

Now, let us see the objects that are generally found in math labs. It is your obligation as a mathematics teacher to initiate steps to develop math labs in your school. It is not necessary to have many items instead the basic objects must be organised in the lab. While developing math labs, the following objects/materials/equipments can be included in it.

- **Concrete Materials**
  - beads, pebbles, sticks, ball frames, seeds, balance, weighs, measuring tapes, scissors, pins, abacus, cardboard, board pins, chart paper, graph paper

- **Pictures and Charts**
  - Photographs of mathematicians, history of mathematicians, charts showing contributions of mathematics, biographic of mathematicians

- **Weighing and Measuring Instruments**
  - as measuring tapes, balances of different types, measuring jar and graduated cylinder, calculators

- **Drawing Instruments**
  - compass, rulers, protractors, stencils

- **Surveying Instruments**
  - Angle mirror, Transit, Plane table and alidade, Clinometers, Sextant, Proportional dividers

- **Others/E-Resources**
  - Models, Bulletin board, Black board, Computers, E-learning resources

---

**Check Your Progress**

**Note:**

a) Write your answers in the space given below.

b) Compare your answers with those given at the end of the Unit

3) What is a mathematics laboratory? How is it different from mathematics corner?

As a teacher, your concern should be how to use math labs and corners. Let us discuss with an example.
Mr. Kishore was teaching the Herons formula to his ninth class learners. He started the class as given below:

_Kishore_ : How are you?
_Learners_ : Fine sir

_Kishore_ : today, we are going to study a new concept.

After saying this, he took a photograph kept in the math corner. After showing the photograph, he continued asking

_Kishore_ : Do you know whose photograph is this?
_Learners_ : No sir

_Kishore_ : It’s ok. We will see who this mathematician is. Before that, I will give you some triangles. Hope all of you know how to calculate the area of triangle. Is it?

_Learners_ : Yes, Sir.

Thereafter Kishore provides (The same is available in math corner and math laboratory) different triangles to a group of 5 learners. Then he continues;

_Kishore_ : Learners here is the task for you. You have to find the area of the triangle given to your group.

This is a snapshot of the conversation of Kishore, where he was trying to teach method of calculating the area of triangle using Heron’s formula. You might have noticed that, to teach the concept, Kishore has used the photograph of Heron and triangles of different area. This example is just a hint that shows ‘how a teacher can utilize the material/objects/equipments of the math lab/corner’. You may think of such instances during teaching.

**Activity for Practice:**

2. You have seen how Kishore has used math lab in teaching mathematics. Suggest an activity that may be employed in math lab/corner as a learning aid.
7.5 MATHEMATICS CLUB AND FORUM

Similar to math lab/corner, mathematics club and forum is also another important learning resource. NCF (2005) suggested ‘mathematisation of learner’s thought processes’ as one of the major goals of mathematics teaching. How do we develop the skill of mathematisation among learners? You may motivate learners to engage in math clubs and forums. Math clubs/forums are to be viewed from two angles; a learning resource and as a place to engage learners in extracurricular activities. Leaning resource in the sense that mathematics teachers can utilize math club/forum to engage their learners to discuss, debate and deliberate on various topics of mathematics. On the other hand, different co-curricular activities such quizzes, study tours etc. can be organised by mathematics clubs/forum.

Math club/forum is a group of individuals getting together to organise events, discuss, debate on various topics pertaining to mathematics. The club arranges various events such as birthdays of mathematicians, math days etc. Also, the clubs and forums are engaged in organising discussions, debates, seminars, study tours, etc. Ultimately, math clubs/forums help learners in developing interest and motivation in mathematics learning. There are different ways of involving learners in learning mathematics; math club/forums play a major role. So as a math teacher it is your duty to initiate processes to develop math clubs/forums. The math club/forums work under the guidance of the math teacher.

Apart from this, math clubs/forums are important because of the following reasons:

- Math clubs/forum help learners to engage in various activities related to mathematics learning.
- Facilitate and arouse interest and motivation in learners to learn mathematics.
- The leisure time can be properly utilized by involving in programmes organised by math clubs/forums.
- Learners are exposed to various activities of math clubs/forums thus help them to test theories learnt in their math classes.
- Provide opportunity to learners to initiate different programmes.
- Help learners to enhance skill of leadership, problem solving, joint responsibility, hard work, etc.
- Math clubs/forums help learners to engage in activities where they can discuss, contest and ponder over various themes of mathematics.

Let us see, how mathematics clubs/forums can be set up? What is the general structure of such clubs? You might have seen various clubs/organisations in your school and nearby areas. Such clubs organise events such as blood donation camps, eye testing, cultural campaigns and so on. In such organisation, we find office bearers and executive committees. In similar fashion, math club/forums are set up in schools. For this, the initiation must come from you as a mathematics teacher. So, it is pertinent to say that, you have a bigger role in creating math clubs/forums.

To set up math club/forum, you can organise a meeting with students. In the meeting, draft constitution of the club may be discussed and further course of
action may be initiated. The constitution can be prepared by you in consultation with the head of the institution (Principal/Head Master). The points to be included in constitution include; name of the club, aims and objectives of the club, details of membership, etc. The club/forum should have head of the institution as its patron and a mathematics teacher as convener. The office bearers such as President, Vice-President, General Secretary, Joint Secretary, and treasurer must be selected from the learners. After electing the office bearers, the programmes to be organised may be discussed, and finalised. One point to be noted here is that, it is not necessary to follow the format that we have discussed instead you have full freedom to modify as per your need and situation. The following activities can be undertaken by the math clubs/forums;

- Educational talks, lectures, key note addresses by renowned mathematicians, teachers, math specialists, etc.
- Celebration of birth days of mathematicians and organization of other important mathematical events, math days, etc.
- Discussions and debates on various topics and issues related to mathematics.
- Quiz programmes.
- Conduction of math fairs, math olympiads, exhibitions, etc.
- Exhibition of mathematical models, aids, charts, etc.
- Seminars and workshops.
- Publication of magazines and periodicals on weekly/monthly/yearly basis.

Check Your Progress

Note: a) Write your answer in the space given below.

b) Compare your answer with those given at the end of the Unit.

4) Discuss a few activities that can be undertaken by mathematics club/forums.

Now, let us discuss the practical application of math clubs/forums.

Mr. George was engaged in teaching the concept of perimeter in class 9. After teaching the concept, George directed the math club members to organise an exhibition. George further suggested to the learners that the members of the club should initiate steps to organise charts which contained different shapes and ways of finding its perimeter explained in it. At the same time, the club members could also develop models of the same. Learners agreed to it and club office bearers requested all learners to prepare models and charts and the same were displayed in the exhibition.
As we have discussed in 7.4, the examples that show the practical applications of math lab and math corner were to give you a hint. The practicalities of both vary as per the nature of the concept, type of learners, classroom environment and so on. You must be very cautious and creative in deciding effective adoption of these learning resources.

Activity for Practice

3. The club activity discussed above resulted in development of charts and models depicting the procedure for finding perimeter of various shapes. Analyze a similar activity in your class and organise an exhibition.

7.6 ICT NEED, IMPORTANCE AND USE IN LEARNING OF MATHEMATICS

ICT has become an inseparable component of teaching –learning process. What do you mean by ICT? ICT stands for Information and Communication Technology. ICT helps to store, process, disseminate, retrieve and transmit information with the aid of technological medium. The UNESCO defines ICT as “forms of technology that are used to transmit, process, store, create, display, share or exchange information by electronic means. It includes, not only traditional technologies like radio and television, but also modern ones like cellular phones, computer network, hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing”. Thus ICT includes all technological gadgets that help to store, transmit and communicate information.

What does ICT mean in educational context? Let us discuss with an example from classroom context. Imagine that a teacher wants to assess the progress of learning of his/her learners after teaching a particular concept, say for example; volume of a cube. In such a situation, the teacher will teach the concept and assess his/her learner using a computer made multiple choice test. Thus it is evident that the teacher has made use of computer to assess his/her learners in place of common paper pencil test. This is a way of utilizing ICT in the educational context. Similarly there are multiple situations in the educational process where you can employ ICT.

ICT in educational process is mainly employed in four ways, namely; teaching learning, evaluation, administration and professional development. Let us briefly discuss these aspects. Generally, teaching is primarily focused on transaction of subject contents through lecture method, but with the emergence of technology, many technological tools are employed for the same. For example, virtual experiments, power point presentation, video conferencing, internet, etc are used during the teaching –learning process. Thus, ICT is widely adopted in teaching-learning processes. Similarly, in the case of assessment and evaluation, multiple tools and software are used. For example, online testing, computer tests, e –portfolios, etc., are used to assess learners’ progress. ICT also finds application in administration and management. Storing learners data in excel sheet, management information system (MIS) etc., are some among them. ICT are used in professional development programmes.
Some of the latest technologies like, OERs, Massive Open Online Course (MOOC), Free and Open Source Software (FOSS) assist various stakeholders to professionally update and helps in career development. A snapshot of the multiple roles of ICT in education is given below.

**Figure 7.6: ICT in Education**

### Check Your Progress

**Note:**

a) Write your answer in the space given below.

 b) Compare your answer with those given at the end of the Unit.

5) Explain the applications of ICT in mathematics teaching-learning.

<table>
<thead>
<tr>
<th>Teaching and Learning</th>
<th>Administration</th>
<th>Assessment</th>
<th>Professional Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>• E-content</td>
<td>• Database</td>
<td>• E-assessment</td>
<td>• MOOCs</td>
</tr>
<tr>
<td>• OER</td>
<td>• MIS</td>
<td>• E-test</td>
<td>• SPOCs</td>
</tr>
<tr>
<td>• E-learning</td>
<td>• Record Keeping</td>
<td>• Online test</td>
<td>• Discussion Forum</td>
</tr>
<tr>
<td>• Blog</td>
<td></td>
<td>• Computer tests</td>
<td>• Online Communities</td>
</tr>
<tr>
<td>• Wiki</td>
<td></td>
<td>• E-portfolio</td>
<td>• Online Courses</td>
</tr>
<tr>
<td>• Mobile learning</td>
<td></td>
<td>• Quiz tools</td>
<td></td>
</tr>
<tr>
<td>• Interactive white board</td>
<td></td>
<td>• E-rubrics</td>
<td></td>
</tr>
</tbody>
</table>

### 7.6.1 Need and Importance of ICT

You know that ICT has influenced teaching-learning, administration, assessment and professional development of learners. Now, our discussion will focus on its impact on mathematics teaching-learning. First of all we will discuss the need and importance of ICT in the field of mathematics teaching-learning. The following depicts the need and importance of ICT.

- The emergence of various learning resources has made the process of learning easy for learners. Apart from that, teacher can succeed in developing interest and motivation among learners with the aid of ICT learning resources. The black boards, charts, models, etc. are the learning...
resources of pre-digital era. In addition, teachers can also use digital learning resources. Some of the digital learning resources are computer, e-books, educational software’s, etc. Thus you may employ such digital learning resources to make learning effective for learners.

- The shift in learning styles of learners proves the relevance of ICT in teaching learning. It is common that, learners rely on traditional print text books to comprehend subject knowledge. But, today’s learners are tech savvy and prefer to use multiple digital devices for learning. Thus you should supplement teaching with multiple ICT devices.

- Today constructivist approach of learning is practiced that help learners to develop their own understanding of subjects based on their previous experiences. In such a scenario, learners need to be supplied with multiple sources (preferably digital in nature) as a supplement to build their own knowledge and experiences of learning.

- Anywhere, any time learning is possible with the use of ICT. Learners get opportunity to access information at their pace and time. As they search for information, multimedia approach of education is encouraged. Thus, learners’s weakness and strengths in learning can be easily identified and remediated.

- ICT access helps learners to obtain latest information/knowledge in different subjects.

- Multiple channels of communication are available that help learners to interact, communicate and share information. Thus, flow of information and knowledge is achievable that consumes less time.

- Learners can access various online repositories, online libraries, online books, etc. Thus ICT provides opportunity for extra reading and rectifying abstractness of concepts.

- ICT offers various devices and learning sources that support the learning needs of learners with learning disabilities.

- ICT integrated education prepares learners to develop adequate skills and all-round development.

- The efficiency and smartness of learning is enhanced with the use of ICT. Learners learn better, comprehend knowledge with ease, retain the learned contents and easily apply them in practical situations. It helps in development of multiple skills both cognitive and physical.

- ICT helps teachers to present learning contents in multiple forms. The teaching of complex concepts is made easy for learners with the aid of ICTs. The theory of self and independent learning is promoted.

**Activity for Practice 4:**

4. Develop a blog focussing ICT’s importance in mathematics teaching learning. Prepare a report of it.
Check Your Progress

Note:  a) Write your answer in the space given below.

b) Compare your answer with those given at the end of the Unit.

6) “ICT has much relevance in constructivist approach of learning”. Comment on this statement.

……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………

7.6.2 Use of ICT in Learning of Mathematics

In this section, we will discuss some of the ICT resources and method of integrating them during teaching sessions. ICT includes multiple learning resources and technologies starting from the radio to the most modern augmented reality (virtual learning) like radio, television, LCD projector, computer, internet communication, social networking, blogs, wikis, discussion forum, mobile learning platforms, e-text, e-contents, virtual reality, OERs, MOOCs, etc.

The National Policy on Information and Communication Technology (ICT) in School Education published in the year 2012 and National Mission on Education through ICT (NMEICT)-2009, have advocated the adoption of ICT at school and higher education level. The National Policy on ICT in School Education (2012) recommended web-based digital repositories to host a variety of digital content, appropriate to the needs of different levels of learners and teachers. The National Repository of Open Education Resource (NROER) is one among them. NROER is a collection of videos, audio files, images, documents and interactive modules for all school subjects and grades in multiple languages. Similarly, “e-Pathshala” (Web-site containing approximately 364 eBooks, 137 videos and 100 audios this number is increasing day by day) is another major initiative of e-learning for school education.
One point to be stressed at this juncture is the creativity and thought process of you as a teacher that would enable you to utilize technology in teaching. Technology enabled learning is a major impact of ICT. There is a variety of ways by which ICT can be utilized; it could be blog, wiki, e-content, interactive white board and so on. Let us see how Naveen, a mathematics teacher, of a government school, utilized ICT in teaching ‘ratio among the volumes of right circular cone, hemisphere and right circular cylinder’. To teach the same concept, Naveen had two options; either lecture method or blended approach (using ICT). He went for the second option. What he did was that after the theoretical explanation, he realized, learners are confused and they found it difficult to comprehend the concept. At such a point, Naveen utilized the OER repository of NCERT (Two screen shots of the OER are shown below). This video is showing an activity, which help learners to understand the ratio among the volumes of right circular cone, hemisphere and right circular cylinder. Using this video presentation, Naveen could easily help learners to gauge the described concept. Thus the use of NROER is an example of utilizing ICT in teaching –learning.
The pedagogy followed by Naveen is a mode of presenting the content using ICT. So, you may bear in mind that, it is up to you as a teacher to decide the ways of using ICTs in teaching learning. There are no stringent rules or styles in using it. It depends on the imagination and creativity of the teachers.

Activity for Practice:

5. Visit a few mathematics related websites and suggest learning activities utilizing the visited websites.

6. Prepare a write up on various ICT initiatives of Govt. of India and their usefulness in mathematics teaching

Check Your Progress

Note:  a) Write your answer in the space given below.

b) Compare your answer with those given at the end of the Unit.

7) How will you use NROER repository for mathematics teaching?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
7.7 SELECTION AND USE OF APPROPRIATE MEDIA

Do teachers use learning resource (media) at their own discretion and convenience?

Is there any particular teaching resource that is applicable to all classes/learners? Is it necessary to employ media with all teaching sessions? These are some of the questions that you should be cautious about as you plan for a media integrated teaching session. So you should definitely plan in advance and prepare for handling a media integrated teaching session. In this section, we will discuss some of the factors, that you should be aware of, for integrating the media.

As you know, in the earlier sections we discussed various learning resources/media that are useful for mathematics teaching. Thus, it is certain that, teachers have the freedom to select any media from the basket of learning resources/media. But how will a teacher select media? According to Romiszowski (1997) the following factors influence the selection of media:

1) **Task Factors:** It refers to the nature of job in hand i.e. what are the learning objectives? What are the behavioral changes that the teacher wishes to develop in learners? What are the pedagogical approaches going to be followed for transacting the curricular content? What time should be devoted to the process?, etc.

2) **Learner Factors:** Learner factors include learners’ age level, motivational characteristics, personality and individual differences, willingness for learning, etc. Today, inclusion is emphasized in classrooms. In such classrooms, learners with special needs are taught along with normal learners. Thus, while selecting the media/learning resource for teaching, care must be taken to meet the learning demands of both normal and learners with special needs.

3) **Economic/Availability Factors:** It includes the cost of learning resources/media, availability of media, working conditions of the media and so on. As we know, a calculator is less costly compared to a computer. So, if a mathematics teacher wish to teach concepts related to arithmetic calculations, she/he may prefer simple calculators in place of computer. This saves energy, time, complexities, etc. Similarly, situations that require a camera, may utilize mobile cameras which are handy and mostly available with teachers.

Now, let us discuss a practical example that interconnects all these three factors. To teach the concept ‘bisector of a given angle’, the following procedure may be followed. So, the task factor involved is “helping learners to comprehend the process of drawing bisector to a given angle”. In this case, the teacher anticipates that at the end of the class, learners would be able to draw bisectors to any given angle. To teach the concept, the teacher has 40 minutes and she/he planned a group activity. Why group activity? The number of learners in the class was 40 and it was difficult for her to provide computer to each learner. Thus, the learner factor involved here is the ‘number of learners in the class’ and economic/availability factor is the distribution of computers as computers are readily available in the computer laboratory. After deciding on the medium, the teacher directs learners to complete the task mentioned in the
self learning module. The module was set up in the computer before. This is an example that shows how a mathematics teacher employed the three factors discussed above.

Apart from the three factors discussed, you must also understand about the concept of Technological Pedagogical Content Knowledge (known as TPACK), a framework that help teachers to adopt technology in teaching learning. In TPACK, ‘T’ stands for technology and refers to the knowledge of teachers in technology that he/she wishes to employ in his/her classroom. What are these technologies; for example virtual learning, web 2.0 & 3.0 applications, internet, audio clipping, video shots, e-contents, interactive whiteboard, OERs, etc. ‘P’ is pedagogy that represents the knowledge of teacher in pedagogical aspects of teaching. What are those pedagogical aspects? For instance, the knowledge in various teaching methods, techniques, styles of teaching, developmental stages of learners, etc. The letter ‘C’ denotes the content knowledge. As you are aware, a teacher definitely should have mastery over the subject. The content knowledge includes the knowledge in terms, concepts, principles, theories, law, etc.

The TPACK framework is a guideline that every teacher can follow in selecting the media. Before coming to that, let us explore a few more basic aspects of TPACK frame work. In general, TPACK is the knowledge of an individual in three components namely, technology, pedagogy and content. Apart from that, TPACK also elucidates a few other components such as Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK) and Pedagogical Content Knowledge (PCK), as shown in figure given below. Thus, TPACK denotes the interconnection of the individual components namely technology, pedagogy and content. So, being a teacher, you must ensure that, while a technology is selected for teaching a particular concept, these seven factors must be taken care of.

![Figure 7.8: The components of the TPACK framework (graphic from http://tpack.org)](http://tpack.org)
Check Your Progress

Note: a) Write your answers in the space given below.
    b) Compare your answers with those given at the end of the Unit.

8) Discuss the factors to be considered in the selection of learning resources/media for teaching.

Let us see an example for employing TPACK framework in teaching-learning process. Data handling is one of the important concepts in mathematics. In data handling learners study collection, organization, presentation and interpretation of data. Thus, they start with the collection of data. Now, suppose you are aiming at teaching collection of data. How will you choose an appropriate technology? Let us interconnect the concept to be taught and TPACK framework. TPACK says, the teacher should have knowledge in technology, pedagogy and content to integrate technology. In this case, then of course, the teacher should have mastery over the content; collection of data. Now, come to the second aspect of TAPCK; the pedagogy. So, what all pedagogical approaches will be suitable in this context? You have studied various teaching methods, techniques of teaching, models of teaching and so on. While selecting the pedagogy, you should keep in mind various factors like; learners’s age, maturity level, difficulty level of the topic and so on. Considering many such factors, you can opt, **Concept Attainment Model (CAM)** as suitable since the learners would be able to identify the concept of ‘collection of data’
themselves. CAM will work out in groups. Thus, **CAM and group activity** is the pedagogical part of TPACK framework.

The third aspect of TPACK is the selection of fitting technology. What do you have in mind? Which technology will be apt here? Remember, you may ask learners to search internet and collect data pertaining to temperature. But, will that be suitable for learners of standard 7th? It is better to select some other technology. Also, the feasibility factor would be a hindrance, but, it is up to you to select the technology suitable for your learners. Now, in this case let us choose LCD projector, PPT presentation and internet. To prepare PPT presentation, various data collected from internet would be used. Then, the PPT will be shown to the whole class and learners will be directed to identify the concept involved in it. The identification of the concepts will be attempted as a group activity. Thus, the third aspect of TPACK framework includes **LCD projector, PPT presentation and internet**. Some of the pictures used in for teaching ‘collection of data’ are given in figure 7.9. The same pictures can be used during PPT presentation.

<table>
<thead>
<tr>
<th>Place</th>
<th>State</th>
<th>Rainfall in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gangtok</td>
<td>Sikkim</td>
<td>71.8</td>
</tr>
<tr>
<td>Tadong</td>
<td>Sikkim</td>
<td>54.5</td>
</tr>
<tr>
<td>Gya Singh</td>
<td>Sikkim</td>
<td>34</td>
</tr>
<tr>
<td>Agartala</td>
<td>Tripura</td>
<td>34</td>
</tr>
<tr>
<td>Kailashahar</td>
<td>Tripura</td>
<td>10.8</td>
</tr>
<tr>
<td>Kohima</td>
<td>Nagaland</td>
<td>12</td>
</tr>
<tr>
<td>Cherrapunji</td>
<td>Meghalaya</td>
<td>121.2</td>
</tr>
<tr>
<td>Shillong</td>
<td>Meghalaya</td>
<td>18.5</td>
</tr>
<tr>
<td>Lengpui</td>
<td>Mizoram</td>
<td>23</td>
</tr>
<tr>
<td>Aizwal</td>
<td>Mizoram</td>
<td>14.3</td>
</tr>
<tr>
<td>Imphal</td>
<td>Manipur</td>
<td>3.1</td>
</tr>
<tr>
<td>Barpeta</td>
<td>Assam</td>
<td>59</td>
</tr>
<tr>
<td>Goalpara</td>
<td>Assam</td>
<td>71</td>
</tr>
<tr>
<td>Lumding</td>
<td>Assam</td>
<td>49</td>
</tr>
<tr>
<td>Lakhimpur</td>
<td>Assam</td>
<td>47.8</td>
</tr>
<tr>
<td>Mazbat</td>
<td>Assam</td>
<td>35.4</td>
</tr>
<tr>
<td>Dibrugarh</td>
<td>Assam</td>
<td>24</td>
</tr>
<tr>
<td>Guwahati</td>
<td>Assam</td>
<td>20</td>
</tr>
<tr>
<td>Silchar</td>
<td>Assam</td>
<td>13.3</td>
</tr>
<tr>
<td>Dhubri</td>
<td>Assam</td>
<td>13.4</td>
</tr>
<tr>
<td>Itanagar</td>
<td>Arunachal Pradesh</td>
<td>24</td>
</tr>
<tr>
<td>Pasighat</td>
<td>Arunachal Pradesh</td>
<td>6.4</td>
</tr>
</tbody>
</table>
Table 1: Pollution ranges of major pollutants (Diwali, 2011 and 2012), CPCB

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Pollutant</th>
<th>Pollution Range (Diwali, 2011)</th>
<th>Pollution Range (Diwali, 2012)</th>
<th>Prescribed standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min.</td>
<td>Max.</td>
<td>Min.</td>
</tr>
<tr>
<td>1</td>
<td>$SO_2$</td>
<td>6</td>
<td>40</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>$NO_2$</td>
<td>27</td>
<td>56</td>
<td>44</td>
</tr>
<tr>
<td>3</td>
<td>$PM_{10}$/$PM_{2.5}$</td>
<td>416</td>
<td>635</td>
<td>748</td>
</tr>
</tbody>
</table>

Source: Compiled from CPCB Press Release, 2012; all units are in micrograms per cubic metre ($\mu g/m^3$).
While selecting the technology, pedagogy and content, you may also give due weightage to other factors such as Technological Pedagogical Knowledge (TPK), Technological content Knowledge (TCK), Pedagogical Content Knowledge (PCK), and TPACK. If you find any mismatch on any of these components, then that technology won’t be apt for teaching that particular concept.

### Activity for Practice

7. Apart from the factors discussed here, what other factors do you consider important in selecting media/learning resources?

### 7.8 LET US SUM UP

The judicious integration of learning resources along with teaching methods makes learning effective. Your duty as a teacher, is to select the appropriate learning resources which would enable you to transact curricular contents and thereby making learning enjoyable to learners. Thus the learning resources that are readily available and also learning aids that could be procured from immediate surroundings have been discussed. Mathematics laboratories and mathematics corners also fall under the category of learning resources. The importance of maths labs/math corners, ways of developing labs/corners, materials to be kept in labs/corners is also discussed. In continuation to that, the relevance of math clubs and forums is also discussed. We know that, ICT plays a major role in the teaching –learning of mathematics. Therefore, the need and importance of ICT, strategies in organising learning activities by integrating ICTs are also discussed. The unit ends with the discussion on the factors that are to be considered in the selection of learning resources.

### 7.9 UNIT END EXERCISES

1) Observe teaching sessions of any senior teachers and make a report on learning resources that they use for teaching mathematics.

2) During the teaching practice sessions, set up a mathematics club in your classroom and discuss the steps followed in creating it.

3) If you set up a mathematics lab, what modern ICT devices you would prefer to include in it.

4) Discuss a learning activity for class X learners that involves ICT.

5) What factors would you consider while selecting learning resources/media for teaching mathematics?

### 7.10 REFERENCES AND SUGGESTED READINGS

IGNOU (2008). AMT-01 Teaching of Primary School Mathematics, AMT-01, Block 1-5, SLM. New Delhi: IGNOU.

IGNOU (2010). LMT-01 Learning Mathematics, LMT-01, Block 1-6, SLM. New Delhi: IGNOU.

IGNOU (2012). BES-009 Teaching of Mathematics for the Primary School Learner, Block 1-4, SLM. New Delhi: IGNOU.


http://tc2.ca/uploads/PDFs/TIpsForTeachers/CT_elementary_math.pdf retrieved on 05/12/2016

http://www.doublegist.com/teaching-resources-teaching-aids-enhance-teaching-desired-social-behavioural/ retrieved on 05/12/2016


http://mathmagic-elements.blogspot.in/2011/04/mathematics-laboratory.html retrieved on 05/12/2016

**7.11 ANSWERS TO CHECK YOUR PROGRESS**

1) The process of learning is made interesting, enjoyable and pleasurable activity with the use of learning resources. The use of learning resources also helps to fully involve learners in the learning process. Also refer section 7.3.1

2) For example, various bottles and other similar objects can be used to teach the concept of geometrical figures, 2D/3D shapes, etc.

3) Refer section 7.4

4) Seminars, Quiz programmes, Debates, etc.

5) ICT can be used in teaching –learning, assessment of learners’ progress, educational administration and professional development programmes. Using PowerPoint presentations during teaching, storing learner data in computers, etc are some of the practical applications of ICT.

6) The primary job a teacher in constructivist learning approach is that of a facilitator of learning. In such an approach, learners themselves develop knowledge by integrating their present knowledge with previous experiences gained from either at home or his/her surroundings. Thus teachers can aid learning by assigning learning tasks with help of ICTs. For example, learners may be directed to watch educational videos (video may be on seasonal change) and thereafter a group discussion can be organised. This will help learners to develop their own knowledge about the concept ‘Time’.

7) Answer yourself.

8) Learner factors, Task factors and Economic factors

9) Refer section 7.7