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## UNIT 10 APPROACHES TO ASSESSMENT OF LEARNING MATHEMATICS

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### 10.0 INTRODUCTION

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Assessment of learning is an inseparable part of the teaching-learning process. In the Block 4 of the Paper 3 Pedagogic Processes in Elementary Schools, there is extensive discussion on the types and processes of learning assessment. In this unit we shall be discussing those aspects of assessment specifically relevant for mathematics learning in elementary schools.

Mathematics is commonly perceived as the most difficult subject at all stages in the school curriculum. Further, its abstractness is highlighted in the textbooks and classroom transactions, although all the concepts included in the mathematics curriculum at the elementary stage are related to the real life experiences of the child. It is a common belief that mathematics concepts cannot be learnt without being taught. As a consequence, mathematics education in schools is mostly teacher centered.



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You might have realized by now that we have made a conscious effort to convey you that mathematics learning can be learner centered or more appropriately it can be learning centered where both learners and teachers together can explore several ways of learning mathematics concepts with pleasure. Keeping this perspective in view, we have tried to highlight some of the assessment techniques appropriate to the learning centered approaches in mathematics learning.

To complete this unit you shall require about 6(*Six*) hours of study.

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## 10.1 LEARNING OBJECTIVES

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After going through this unit, you shall be able to:

- Explain different dimensions of mathematics learning assessment.
- State the characteristics of assessment in learning centered approach in mathematics.
- Incorporate emerging trends of the process of assessment for facilitating mathematics learning.

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## 10.2 NATURE OF ASSESSMENT OF MATHEMATICS LEARNING

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### 10.2.1 Dimensions of Mathematics Learning Assessment

When we try to explore different approaches to assess mathematics learning, we need to know the nature of mathematics learning at the early stage of schooling.

#### Nature of Mathematics Learning at the Early Stage of Schooling:

- Children develop mathematical thinking through active interaction with the world around them (rural children are rich in oral mathematical tradition) utilizing the cognitive resources available in the environment. Every object and event in the immediate environment of the child can be used for learning mathematics at the early stage.
- Children's initial understanding of mathematics is 'concrete' and 'contextual'.
- Active manipulation with concrete elements leads children to construct mathematical concepts and processes.
- Mathematics learning appropriates the developmental (intellectual/cognitive) concerns required to design learning continuum from concrete to abstract concepts.



**Principles of assessment of mathematics learning:** The three fundamental educational principles which form the foundation of all assessment that supports effective education are equally applicable for assessment of mathematics learning:

- *The Content Principle:* Assessment should reflect the mathematics that is most important for students to learn. Assessment should reflect the mathematics that all students need to know and be able to do.
- *The Learning Principle:* Assessment should enhance mathematics learning and support good instructional practice. Assessments should be learning opportunities as well as opportunities for students to demonstrate what they know and can do. Although assessment is done for a variety of reasons, its main goal is to improve students' learning and inform teachers as they make instructional decisions. As such, it should be a routine part of ongoing classroom activity rather than an interruption
- *The Equity Principle:* Assessment should support every student's opportunity to learn *important mathematics*. Assessment should be a means of fostering growth toward high expectations rather than a filter used to deny students the opportunity to learn important mathematics. In an equitable assessment, each student has an opportunity to demonstrate her or his mathematical power; this can only be accomplished by providing multiple approaches to assessment, adaptations for bilingual and special education students, and other adaptations for students with special needs. Assessment is equitable when students have access to the same accommodations and modifications that they receive in instruction.

Besides these three principles, a good assessment of mathematics learning needs to satisfy the following three criteria:

- Assessment should be an **open** process. Three aspects of assessment are involved here.
  - First, information about the assessment process should be available to those affected by it, the students.
  - Second, teachers should be active participants in all phases of the assessment process.
  - Finally, the assessment process should be open to scrutiny and modification.
- Assessment should promote valid **inferences** about mathematics learning. A valid inference is based on evidence that is adequate and relevant. The amount and type of evidence that is needed depends upon the consequences of the inference. For example, a teacher may judge students' progress in understanding place value through informal interviews and use this information to plan future classroom activities. However, a large-scale, high-quality assessment requires much more evidence and a more formal analysis of that evidence.



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## Approaches to Assessment of Learning Mathematics

- Assessment should be a **coherent** process. Three types of coherence are involved in assessment.
  - First, the phases of assessment must fit together.
  - Second, the assessment must match the purpose for which it is being conducted.
  - Finally, the assessment must be aligned with the curriculum and with instruction.

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E1. What are the three basic principles of assessment of mathematics learning?

E2. Which aspect of mathematics learning makes its assessment a systematic process?

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### *Nature of Assessment of Mathematics Learning:*

Since assessment is a continuous process and follows closely the learning experiences, the nature of assessment in mathematics approximates the nature of learning process of mathematics very closely. Assessment of mathematics, therefore, is:

- *appropriate to sequence of mathematics learning.* Since, mathematics contents follow a logical and sequential order and as such assessment process which follows the learning sequence must be in that order.
- *experiential and contextual.* As pointed above, mathematics concepts can be learnt through direct interaction with the objects and events in the immediate environment of the child, assessment can also utilize those or similar materials and processes that the child experiences in the environment. Again, since mathematics concepts at the early stage are learnt effectively being embedded in a context familiar to the child, assessment is also effective if it is also conducted in a similar context.
- *concrete-contextual to abstract.* Like the sequence of mathematics learning i.e. beginning with concrete and contextual experiences to abstract concepts, assessment of mathematics learning need to begin with manipulation of concrete materials and experiences to methods and processes dealing with abstract concepts.
- *orality to performance-activity to written.* In consonance with the above mentioned nature of assessment of mathematics learning, even process of assessment should begin with oral assessment and then proceed to the performance tasks and then to written tests which use comparatively more of formal mathematical symbols and procedures and seem abstract to the children in the elementary schools.
- *combinatorial.* Since, there is more than one way of learning a mathematical concept; therefore, assessment of learning that concept, requires more than one



mode of assessment. Further, learning a concept not only enhances achievement, it also brings about the change in several aspects of learner's socio-personal characteristics. That is why assessment of mathematics learning has to take recourse to several modes and approaches separately or in combination.

**Dimensions of assessment of mathematical learning:** The process of assessment in mathematics includes the following dimensions of mathematical learning at the elementary school level (NCERT, 2009):

- **Concepts and procedures** – Although a great deal is known from research about the nature and developmental trends of mathematical concepts and procedures. It is expected that every teacher while teaching mathematics in the classroom, should explore the nature of their students development of the concepts and procedures. This is because every child has his/her own uniqueness in development of the concepts and procedures in his/her context which is different from those reading in other schools. In such exploration of children's nature of learning mathematical concepts, assessment has crucial importance.

At the elementary stage, all the mathematical concepts and procedures can be included in ten broad areas:

- Number (Real number system)
- Number operations (Four processes)
- Fractions (including decimals)
- Space and spatial thinking
- Measurement (both standard and non-standard measures)
- Problem solving
- Patterns
- Data handling
- Basic algebraic processes (only in upper primary stage)
- Simple equations (only in upper primary stage)

For ensuring comprehensive assessment of mathematics learning at this stage, appropriate tools and methods for assessing the concepts, skills, procedural knowledge, thinking skills, vocabulary and argumentations included in each of the above mentioned areas have to properly planned.

- **Mathematical reasoning** - Mathematics is distinguished by its strong logical order even from the earliest stage of learning. Inductive and Deductive reasoning, is dominantly employed in the mathematics learning at the elementary stage. The emphasis on reasoning in mathematics learning not only influences the ways of solving and presenting the solutions of mathematical problems, it also impacts



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learners' language, ways of presenting communications logically, and even different activities conducted by the learners in their daily life. Therefore, assessment of mathematics learning cannot exclude this important aspect. Assessing mathematical reasoning shall include several methods including the tests, both oral, written, and performance, observation of learners' activities etc.

- *Dispositions towards mathematics* - Mathematics learning both influences and is influenced by learner's perception, interest, attitude and personality characteristics. When taught and assessed properly in a learner friendly environment, the learners can enjoy learning mathematics and can get rid of the anxiety and phobia associated with mathematics learning at the early stage of schooling.
- *Using mathematical knowledge and techniques to solve problems* – This does not need much elaboration because of the fact that mathematics learning in schools means; solving the problems in the textbooks or some other problems similar to the textual problems. And in the course of solving the problems, the students acquire skills in using new techniques and methods. The traditional trend of assessment of mathematics learning has focused on assessing the textual problems. But the real test of mathematics learning is the extent of use of mathematical knowledge and techniques learnt in the classroom in solving the day-to-day real life problems. Comprehensive assessment of mathematics learning cannot afford to miss this aspect.
- *Communication*: One of the important outcomes of mathematics learning is the development of the way of communication which is typically precise, logical, relevant and disciplined. Both in oral and written communications, these characteristics can be observed. In addition, use of symbols, figures, graphs and charts makes the written communications more precise, and orderly. These aspects of mathematical communication have to be included in both formal and informal modes of assessment.

Classroom assessment is an approach designed to help teachers, find out what students are learning in the classroom and how they have learned it. Generally, assessment in classroom is organized in different phases such as before, during and after the teaching learning process. In the words of Cameron et al. "Learning occurs when students are, "thinking, solving the problems, constructing, transforming, investigating, creating, analyzing, making choices, organizing, deciding, explaining, talking and communicating, sharing, representing, predicting, interpreting, assessing, reflecting, taking responsibility, exploring, asking, answering, recording, gaining new knowledge, and applying that knowledge to new situations." The purpose of assessment is to support this learning.

We have tried to discuss here the different dimensions of assessment of learning mathematics from another consideration:



**Scholastic/Curricular:** You are more concerned with scholastic/curricular assessment, as most of the instructional objectives are written in this form. These objectives are assessed through written, oral and performance. These objects also deal with recall, recognition and identification etc. of knowledge, understanding and application. This type of assessment is mainly related with curriculum. You are more or less familiar with this dimension of assessment.

**Assessment can be:**

- Both formal and informal
- Oral, written or performance based
- Quantitative or qualitative based on teacher's observation in different situations
- Individually conducted or conducted in groups or as a whole class

**Co-scholastic/Co-curricular/other curricular areas:** Besides assessing scholastic or curricular aspects you need to assess performance of learner in various other areas where he/she uses the knowledge of mathematics acquired in the classroom like the participation and performance in mathematics quizzes, debates, competitions, Mathematics Olympiad, modeling, exhibitions, developing TLMs in mathematics, etc. You need to encourage your students in participating in as many activities and to adopt various methods for assessing their participation and performance in these activities.

**Interest and attitude:** Learner's interest, and attitude towards mathematics is considered crucial for effective learning which you can assess by observing their classroom activities, their mode of questioning and their participation in different co-curricular activities.

**Creative ability:** Learner's creative abilities in mathematics are indicated by his/her ability to solve problems in novel ways, framing unusual and yet important questions, developing innovative learning materials, writing interesting articles on mathematics, drawing unique graphs, diagrams and pictorial representations of mathematical data and processes, creating materials and activities for fun in mathematics and such other unusual activities. Using these activities as indicators, you can assess your students' creative abilities in mathematics.

**Recreational activities:** Recreational activities like mathematical puzzles, contests, games, reading mathematics fun books and history of mathematics, preparing charts, preparing different designs help to create interest and zest for mathematics learning. You can assess your students in these areas through their involvement in the programmes and activities.

**Socio- personal qualities:** Exactness, precise expression, logical approach to all activities, higher order thinking are some exemplars of socio-personal qualities



associated with mathematics learning. By keen observation, interaction with students individually or in groups, evaluation of students' products like writings, and materials are some of the methods of assessing socio-personal qualities associated with mathematics learning can be assessed.

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- E3. State the order of the sequence of mathematical concepts to be assessed in the primary classes.
- E4. What are the socio-personal characteristics associated with mathematics learning that need to be assessed along with the assessment of achievement in mathematics concepts?
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### 10.2.2 Characteristics of Assessment in Learning-centered Approach

For effective learning emphasis is being shifted from teacher-centered approaches to learner-centered approaches and more specifically to learning centered approaches. The learning centered approach is mainly based on the tenants of constructivism whose basic belief is that the learner constructs his/her own knowledge. The major characteristics of the learning-centered approach are:

- Emphasis is on the process, techniques and strategies of learning. If the process of learning is better, then acquisition of knowledge and competencies would be easier.
  - Learning takes place in a natural and contextual situation.
  - Learning is dominantly controlled by the learner. As a consequence, the learner learns at the pace he/she desires. In that sense, learning is quite flexible and democratic.
  - Learner is active and the teacher facilitates for active learning.
- The major role of the teacher is facilitating and supporting learning.
- Methods that activate the learner for learning i.e. activity-based methods are employed in this approach.

The characteristics of assessment in the learning-centered approach are:

- In this approach, the major objective is to assess the process and techniques of learning rather than the product and competencies supposed to be acquired.
- Assessment is done while the learner is engaged in learning process not necessarily at the end of the unit of content.
- Assessment is done in the context of learning and is related to the authentic learning experience in the real world situation. It is done while the learned is engaged in solving a real life problem.



- Cooperative, collaborative, portfolio, rubric and problem solving methods of assessment are preferred in this approach. Any method that leads to a sense of success is the preferred method of assessment in this approach.
- Flexibility in terms of timing and place of assess are provided for the learners to feel a sense of freedom while participating in such assessment process.

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E5. Write any *three* differences between traditional assessment and learner centered assessment in learning Mathematics.

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## 10.3 EMERGING TRENDS IN ASSESSMENT

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In our school context, teaching- learning and assessment are usually planned, takes place in groups, during a predetermined time and is supported by written texts and materials, which reduces the authenticity of the situations considerably. Moreover, the examinations are taken so seriously that assessment of mathematics learning has become a stressful experience for the children at the early stage of schooling. With emphasis on the continuous and comprehensive evaluation (CCE) in the RTE Act, 2009, traditional practice of conducting periodic examinations is undergoing total transformation which has been discussed in the block 4 of the paper 3 of this course. Here let us discuss how the transformation is changing the assessment of mathematics learning.

- Like in other subjects, the frequency of assessment in mathematics has increased and is being conducted at regular intervals in the form of unit testing, observation of performances in different activities.
- Assessment of attainment of mathematical concepts is no more confined only to the textbook questions. Different tools and techniques are being liked and used outside the purview of the textbook.
- It is not only the acquisition of mathematical concepts that is being assessed, but several other characteristics that are expected to develop as a result of mathematics learning are also being assessed. Change in interest and attitude towards learning mathematics, development of creative ideas in mathematics, solving problems in different ways are some of the examples of such dimensions of assessment that are being increasingly included in assessment programmes.
- Traditionally, mathematics texts, classroom transactions and assessment are based on abstract numbers, figures and contrived problems with little relation to the real life situations of the children. But there has been a distinct shift towards using real life problems in the context of the child's immediate environment. The objects, animals, trees, persons, land forms around the child can be used for natural learning of mathematical concepts at the elementary level. These elements and the real world problems perceived by children can also be used to assess the mathematics



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learning. Such authentic assessment has been advocated by the NCF, 2005 and is being included in the CCE programme in the elementary schools.

Can you think of anyone assessing students' learning other than the teacher? Although teacher continues to be the main person to assess students' performance, the student himself/herself and also with the peer group can assess their own performance in mathematics (as well as other areas of school learning) within the framework of learning centered education.

### 10.3.1 Self-assessment

Outcomes of an assessment provide information to the teachers and their students to assess themselves and one another to modify the teaching and learning activities in which they are engaged. Both students and teachers are responsible for learning. So the learners need to be included in the assessment process.

Self assessment occurs when students evaluate their own work and make a judgment about its quality. It is based on some basic beliefs:

- Involving students in the assessment of their work, especially giving them opportunities to contribute to the criteria on which that work will be judged, increases student involvement in assessment tasks.
- Closely related is the argument that self-assessment contributes to variety in assessment methods, a key factor in maintaining student interest and attention.
- Self-assessment provides information that is not easily determined, such as how much effort students spent in preparing for the task.
- Self-assessment is a more cost-effective than other techniques.
- Students learn more when they know that they will share responsibility for the assessment of what they have learned.

#### *Self assessment in mathematics will improve learning because, it ?*

- Focus student attention on the objectives measured
- Motivate the students
- Learn how to think about their learning and how to self-assess
- Construct their own understandings
- Know how to use assessment information and improve performance

#### **Techniques of self assessment in mathematics learning:**

- *Scrutiny*: After the learner completes a task or develops a model he/she has to minutely scrutinize the outcome after each step followed to complete the task and the final outcome against the expected outcomes.



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- **Comparison:** The learner then compares his/her own performance (in class work, home assignments, project work, participation in teaching learning process etc.) with those of other learners in the class.
- **Self analysis:** The learner analyzes his own response/result/solution in terms of the steps, formula, principle and techniques followed to solve the problems with own answer. In course of such analysis, he/she tries to detect omissions, repetitions, mistakes etc in his/her performance.
- **Reflection:** After the analysis of his/her own performance, the learner reflects on the quality of the totality of his/her performance and tries to estimate it. And while reflecting on the performance he/she draws a mental balance sheet of his mistakes, limitations and excellence in the performance and accordingly estimates the results.



**ACTIVITY-1**

*Do you think self-assessment helps to improve performance in mathematics?  
List the benefits of self-assessment for mathematics learning.*

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Self- assessment is beneficial for learning, especially for mathematics learning. It helps in becoming conscious of the formulae, steps and procedure of solving a mathematics problem in a correct way, discriminating correct way from the incorrect ones, recognizing the mistakes and thereby knowing the ways to correct the mistakes. It provides intrinsic motivation and enhances self esteem and self-confidence to attempt challenging problems.

In spite of its proven benefits, it is not easy for any learner to assess himself/herself as it is very difficult to develop the abilities like self-analysis and reflection. Without these abilities one cannot conduct self-assessment without being biased. Sometimes, the fear of mathematics disables the learner for correct scrutiny and analysis. Therefore, you can help the learner to develop the ability for carrying out self-assessment.

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E6. State two ways to inculcate the ability for self-assessment in mathematics among learners in the elementary classes.

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### 10.3.2 Peer Assessment

It has been observed that learning is better facilitated in peer groups. Therefore, in learning centered approaches learning in groups is always encouraged. Some authors are of the opinion that learning activities carried out in groups should normally be followed by the group assessing the learning performance of each individual learner in the group (Lussier & Turner, 1995). Peer assessment is the same process but students look at the work of others.

In a mathematics class, you may assign problems to solve in groups in which the learners in the group solve it through group interaction. Solving mathematical problems in groups encourages peer learning and develops among the group members several social skills like sharing, fellow feeling, helping each other which can also be assessed by the group.

#### Assessment of tasks performed by peers/group by nature:

- *Open, candid and trustworthy:* Since, in the peer group, the interaction is free, frank and friendly, the assessment is done in an open manner in an environment without any external restriction. Again the result of assessment is arrived at through the involvement of all, hence it is more meaningful and trustworthy for each member in the group,
- *Enhances effective sharing and communication:* While during group work sharing and communication skills are developed and strengthened, those are also utilized effectively during the group assessment. In course of assessing mathematics learning and the socio-personal skills associated with it, the communication among the members of the group and also with the teacher is free and yet more systematic and disciplined than any other subject. This is because of the nature of the problems and methodical approach of solving mathematical problems.
- *Develops a range of thinking skills:* As solving mathematics problem requires reasoning of varied complexity, assessment of those abilities also requires all those skills which are being assessed by the group.

The trickiest matter in the group assessment is that of ensuring levels of contribution of each of the group members. It is natural that in a group all the members might not be contributing in equal degree, and as such the assessment of the members would vary. But in extreme cases, a few members would be dominating while some would remain totally passive. In such cases peer assessment would not have uniform and valid conclusions regarding the aspects of a learner being assessed by the group.

Peer assessment can supplement and enrich your assessment of the students but cannot be totally valid when considered separately. This is because of the fact that the perception of the young students might not be that mature as yours. But nonetheless,



the peer assessment can bring out some interesting aspects of mathematics learning which would be difficult for an adult (teacher or parents) to perceive.

***Socio-Personal skills that can be assessed in peer/group assessment:***

- Participation in the group work
- Sharing of experiences/ideas
- sharing the workload
- Helping peers
- Taking Leadership
- Doing self correction
- Listening and accepting others ideas

E7. Why the process of peer assessment is also considered as a learning process?

### 10.3.3 Assessment Through Assignments

In addition to classroom techniques, tests, assignment and homework are widely used to assess students learning. While the role of home assignments in mathematics for assessment and for learning is recognized by most of the teachers and parents, most of them want specific answers to the two crucial questions, “How much time should students spend doing homework?” and “What kinds of homework assignments are most effective?” Research studies conducted on the assignment in mathematics in answering the two questions are varied. However, the few consistent findings are:

- So far as duration and frequency of home assignment in mathematics are concerned, these studies hint at the possibility that shorter (duration of responding), but more frequent homework assignments may be most effective.
- Homework assignments that included both (a) practice of previously covered material and (b) introduced new, preparatory material for the next related topics along with content to be taught on the same day are superior to assignments that included only same-day content. Assignments including practice of past material and introducing future material are more effective than including same-day-only content.
- Distributing the content of mathematics homework assignments so that it includes material meant to practice past lessons or prepare for future lessons, or both, can be more effective than assignments that include only same-day content.
- Mixing hard and easy material throughout the assignment has a positive effect on measures of homework accuracy and completion rates. Also, students rate these



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assignments as being less difficult, requiring less effort, and requiring less time than the assignments that did not use the mixing up the difficult and easy items.

- When the students are offered choices for selecting their homework assignments, there is improvement in their interest, motivation, and, ultimately, achievement. This is probably because children do things without the presence of obvious external demands, or that include expressions of autonomy, they are more likely to internalize positive sentiments about the activity.
- No consistent improvement in students' achievement was observed when classes in which students were assigned individualized homework were compared with classes in which all students did the same assignment. The results also suggest that students who are struggling in school require more time to complete homework that are not individualized. By contrast, teachers spend considerably more time in constructing and monitoring individualized assignments.

You are very much familiar with the type of assignments in mathematics given to learners of different levels. It is very common to give home assignments in the form of some problems from the exercises in the mathematics textbook to solve. Sometimes, problems on the concepts taught are also given from outside the textbook. Besides the problems, textual or non-textual, several other types of tasks can also be given as home assignments which may include:

- Projects in mathematics (depending on the grade level several projects can be given as both long and short duration projects).
- Development of models for teaching and learning mathematics concepts.
- Preparation of graphs and figures based on some local data like occupation of community members (in %), Expenditure of family in days of a week, proportion of boys and girls in different classes of the school etc.
- Framing of non-textual and real life problems on the mathematical concepts taught.
- Solving given problems using more than one method of solution.
- Developing decorative designs using common geometrical figures.

The list can be quite long depending on your vision of using mathematical concepts for developing tasks for meaningful mathematics learning.

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E8. State any three natures of assignment which are beneficial for mathematics learning.

E9. Why the assessment of assignments is considered formative in nature?

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How are you going to assess the assignments?

Assignments are essentially meant to strengthen the learning of concepts taught in the classroom. Hence, assessment of assignments are formative in nature. Scoring or



marking the home assignments serves very little purpose. Feedback in the form of errors committed and highlighting the points of excellent performance are better forms of reporting assessment results. A long assignment can be assessed by rating the components of the responses as shown in the following table.

**Table 10.1 Proforma for Assessment of Home Assignment in Mathematics.**

Sl. No.	Aspects to be assessed	Ratings of the Aspects		
		Good	Average	Poor
1	Understanding on the concept			
2	Style of presentation			
3	Logical steps for solution			
4	Use of own language			
5	Use of appropriate formula			
6	Use of proper mathematical symbols			
7	Length of the answer			
8	Correlation with previous knowledge and experiences			

### 10.3.4 Participation in Different Activities

Assessment of learning mathematics is broadly including all activities that teachers and students undertake to get information that can be used diagnostically to improve teaching and learning. Assessments are based on teacher observation, classroom discussion, participation in activities employed in the classroom, analysis of student work, homework and tests. In classroom students participated in discussion, question answer session, individual activities, group activities, mathematics quizzes, mathematics funs, mathematics projects, preparation of TLMs, put questions etc.

Example: Teacher arranged an artificial market in the school, distributed assignments among the students. After the completion of the work a discussion was made. Teacher assessed performance of the students how they have employed mathematical skills in their assigned works. During the discussion teacher ensured participation of the students in: i) preparation for the work, ii) co-operation with their peers, iii) organizing the task, iv) presentation of the assigned work in a systematic way, v) discussion with their peers, vi) innovation in work, etc.



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### Strategies to assess Students' participation in different activities:

- Invite students to discuss their thinking about a question in pairs or small groups and then ask a representative to share the thinking with the larger group (think-pair-share).
- Present several possible answers to a question, then ask students to discuss on it.
- Ask all students to write down an answer and then read a selected few out loud.
- Ask students to point out the formula (if any) used for solving the problem.
- Interview students individually or in groups, about the reasoning they are employed for solving problems.
- Assess student's interest by their participation in exhibition, quizzes and puzzles or in mathematical activities like solving mathematical problems, working out challenging problems from other books.
- Assess students from the questions they ask during a lesson.

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E10. What are the aspects would you focus for assessing the student's participation in the learning activity in the classroom?

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### 10.3.5 Continuous and Comprehensive Assessment

Like in any other school subjects, continuous and comprehensive assessment of mathematics learning is now being given importance.

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## 10.4 LET US SUM UP

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- The logical, sequential nature of mathematical concepts help in systematic assessment of mathematics learning in the classroom.
- The three fundamental educational principles i.e. the content, the learning and the equity principles equally provide foundation for assessment of mathematics learning.
- Mathematics assessment should be open, coherent promoting valid inferences.
- The nature of assessment in mathematics relates to appropriateness to sequence of mathematics learning, the movement from concrete-contextual to abstract concepts, from orality to performance to written forms.
- The dimensions of assessment in mathematics are concepts and procedures, mathematical reasoning, dispositions towards mathematics, solving mathematical problems.



- In the learning –centered approach the role of the learner is crucial at all stages of assessment while the teacher has facilitating and supporting roles.
- Self-assessment, peer assessment, rethinking assignment as formative assessment and assessment of learners’ participation in the learning process are some of the emerging trends in the mathematics assessment in elementary schools.

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### 10.5 MODEL ANSWERS TO CHECK YOUR PROGRESS

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- E1. Content, Learning and Equity.
- E2. Logical and hierarchical structure.
- E3. Concrete – contextual – abstract.
- E4. Exactness, precise expression, logical approach to all activities.
- E5. Traditional assessment: paper/pencil, less varied methods, more emphasis on scores/marks comparison leading to poor self esteem, focused on failures, student fits the method  
  
Learner centered assessment: Self, and Peer assessment possible, varied methods, emphasis on qualitative aspects.
- E6. Self-analysis and reflection.
- E7. Peer assessment is generally organized in formative assessment situation. Students try to improve their performance after interaction with the peers during this assessment.
- E8. Shorter and frequent home assignments, mix of hard and easy tasks as assignment, possibility of choice of assignment for students.
- E9. Assignments in mathematics help in correcting mistakes and improving performance.
- E10. Sharing, active involvement, asking and answering questions.

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### 10.6 SUGGESTED READINGS AND REFERENCES

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## 10.7 UNITS-END EXERCISES

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1. Explain different dimensions of mathematics learning assessment.
2. How assessment is different from present day examination system?
3. Write five benefits of assessment in mathematics learning through assignment.
4. How can a teacher assess student's participation in a Geometry teaching?
5. Discuss how self-assessment and peer assessment are assessment for learning with suitable examples from elementary school mathematics.