

DIPLOMA IN ELEMENTARY EDUCATION (D.El.Ed.)

Course-504 ***Learning Mathematics at Elementary Level***

Block -3 **Learner Assessment in Mathematics**



NATIONAL INSTITUTE OF OPEN SCHOOLING

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The Chairman's Message

Dear Learner

The National Institute of Open Schooling (NIOS) is an autonomous organization under the Government of India, Ministry of Human Resource Development(MHRD). It is the largest open schooling system in the world with around 2.02 million learners currently on roll at the secondary and senior secondary level. NIOS has national and international network with more than 15 Regional Centres, 2 Sub-Centres and about 5,000 study centres for its Academic and Vocational Programme within and outside the country.It provides access to learner centric quality education, skill up-gradation and training through open and distance learning mode. The delivery of its programmes is through printed material coupled with face to face tutoring (Personal Contact Programmes), supplemented by use of Information and Communication Technology- Audio/Video Cassettes, Radio Broadcast and Telecast etc.

NIOS has been vested with the authority to train the untrained teachers at Elementary Level. The training package for D.El.Ed. Programme has been developed by the NIOS in collaboration with other agencies working in field. The Institute offers a very innovative and challenging Two-year Diploma in Elementary Education Programme for in-service untrained teachers in different states according to RTE 2009.

I take the pleasure of welcoming you all to this Diploma Course in Elementary Education Programme of National Institute of Open Schooling (NIOS). I appreciate your contribution in elementary schooling of the children of your state. As per RTE Act 2009, it becomes essential for all school teachers to be professionally trained. We understand that your experience as a teacher has already given you requisite skills needed to be a good teacher. Since it is now mandatory by law, you will have to complete this course. I am sure your knowledge and experience, so far accumulated by you, will certainly help you in this Programme.

This D.El.Ed. Programme is through Open Distance Learning (ODL) mode and provides you ample opportunity to be professionally trained without being disturbed from your regular working as a teacher.

The self-instructional materials developed specifically for your use would be helpful in creating understanding and help you in becoming a good teacher apart from becoming qualified for your job.

Best of luck in this great endeavour!!

S.S. Jena
Chairman (NIOS)

Credit points (4=3+1)

Block	Unit	Name of Unit	Theory Study Hours		Practical Study
			Content	Activity	
Block-1: Importance of Learning Mathematics at the Elementary Stage of Schooling	U1	How children learn mathematics	3	2	Seminar on mathematics is for all, mathematics phobia
	U2	Mathematics and Mathematics Education - Importance, Scope and Relevance	4	2	-
	U3	Goals and Vision of Mathematics Education	4	2	Taking mathematics learning beyond classroom Identification of problems in mathematics education in your class
	U4	Learner and Learning – centered methodologies	5	3	Organizing mathematics club in your school
Block 2: Enriching Contents and Methodology	U5	Numbers, Operations on Numbers	5	2	-
	U6	Shapes and Spatial Relationships	5	2	-
	U7	Measures and Measurements	4	2	-
	U8	Data Handling	4	3	Statistical analysis of data
	U9	Algebra as generalized Arithmetic	4	2	-
Block 3: Learner Assessment in Mathematics	U10	Approaches to Assessment of Learning Mathematics	3	2	Development of a lesson plans and preparation of concept maps in mathematics
	U11	Tools and Techniques of Assessment	4	3	Development of exhibits for mathematics laboratory
	U12	Follow up of Assessment of Learning Mathematics	3	2	Identification of problems and preparation of remedial measures in learning mathematics
		Tutoring	15		
		Total	63	27	30
Grand Total			63+27+30=120 hrs.		

Block 3

Learner Assessment in Mathematics

Block Units

Unit 10 Approaches to Assessment of Learning Mathematics

Unit 11 Tools and Techniques of Assessment

Unit 12 Follow up of Assessment of Learning Mathematics

BLOCK INTRODUCTION

You as a learner will study block 3: learner assessment in mathematics. This block consist three units related to assessment in mathematics. Every unit is divided into sections and subsections. You have already studied about importance of learning mathematics at the elementary stage of schooling. In block 1. In block 2, you have studied about enriching contents and methodology.

UNIT-10 This unit will empower you to understand the nature of assessment of mathematics learning, its dimensions and characteristics. There are some emerging trends in assessment like self assessment, peer assessment, Assessment through assignments and continuous and comprehensive assessment.

UNIT-11 This unit will empower you to understand continuous and comprehensive assessment in mathematics, types of test items like objective based and open ended items. An understanding about developing question bank in mathematics is gained There are Some tools of assessment for mathematics learning like project, Portfolio, Mathematical Quizzes and Games etc.

UNIT-12 You will be acquainted with follow up of assessment of learning mathematics. An understanding about ways of collecting information and recording is gained. How issues are identified in Mathematics learning like identifying strength & weakness, identifying and addressing typical problems etc.

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UNIT 10 APPROACHES TO ASSESSMENT OF LEARNING MATHEMATICS

Structure

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10.1 Learning Objectives

10.2 Nature of Assessment of Mathematics Learning

10.2.1 Dimensions of mathematics learning assessment

10.2.2 Characteristics of assessment in learning centered approach

10.3 Emerging Trends in Assessment

10.3.1 Self assessment

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10.3.3 Assessment through assignments

10.3.4 Participation in different activities

10.3.5 Continuous and Comprehensive Assessment

10.4 Let Us Sum Up

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10.0 INTRODUCTION

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.

10.1 LEARNING OBJECTIVES

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.

10.2 NATURE OF ASSESSMENT OF MATHEMATICS LEARNING

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.

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

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

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.

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

10.3 EMERGING TRENDS IN ASSESSMENT

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.

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.

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

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

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.

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

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.

10.4 LET US SUM UP

- 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.

10.5 MODEL ANSWERS TO CHECK YOUR PROGRESS

- 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.

10.6 SUGGESTED READINGS AND REFERENCES

Driscoll & Bryant (1998). *Learning about assessment learning through assessment: A report of the National Research Council, Mathematical Sciences Education Board*. Washington, DC.

Gronlund, N.E. & Linn, R.L. (2000). *Measurement and assessment in teaching*. Singapore: Pearson Education.



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NCERT (2008). *Source book on assessment for classes I – V Mathematics*. New Delhi: NCERT.

NCTM (2000). *Principles and standards for school mathematics*.

Shepard & Bleim (1995). *Parents' Thinking About Standardized Tests and Performance Assessments*. Educational Researcher.

10.7 UNITS-END EXERCISES

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.



UNIT 11 TOOLS AND TECHNIQUES OF ASSESSMENT

Structure

- 11.0 Introduction
- 11.1 Learning Objectives
- 11.2 Continuous and Comprehensive Assessment in Mathematics
- 11.3 Types of Test Items
 - 11.3.1 Objective based items
 - 11.3.2 Open ended items
- 11.4 Developing Question Banks in Mathematics
- 11.5 Assessment for Mathematics Learning
 - 11.5.1 Project
 - 11.5.2 Portfolio
 - 11.5.3 Participation in Exhibition
 - 11.5.4 Mathematical Quizzes and Games
 - 11.5.5 Observing children during mathematics activities
- 11.6 Let us sum up
- 11.7 Model Answers to check your progress
- 11.8 Suggested Readings and References
- 11.9 Unit-End Exercises

11.0 INTRODUCTION

Evaluation and assessment are intimately associated with the teaching-learning process. In the previous unit you have already read about the characteristics of assessment in mathematics. You have also learnt about modern trends and techniques of assessment in mathematics. Besides, in the Block 4 of the Course 3, you have extensively discussed the role of assessment in learning, the tools and techniques of assessment and the uses of assessment results in enhancing learning.

Mathematics is an important school subject in developing mathematical thinking and reasoning as well as in developing critical thinking among the learners. Uninteresting classroom transaction as well as stressful assessment procedure create phobia towards mathematics learning. In this unit attempts have been made to acquaint you with various



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tools and techniques of assessment in the context of continuous and comprehensive evaluation (CCE) in Mathematics.

Use of different types of test items in mathematics is crucial to assess the child's learning in different areas like knowledge, understanding, application etc. Further, the use of open ended items in mathematics enables the learner to think of solution of a particular problem from different dimensions. In this unit, you will learn about the usefulness of open ended items. Besides the use of various techniques of assessment like project, portfolio, quiz, exhibition, game will help you to make the assessment process child friendly and more useful. Those techniques of assessment are discussed in this unit for your understanding.

For completing this unit, you will need about 8 (*eight*) hours study.

11.1 LEARNING OBJECTIVES

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

- prepare different types of objective based test items in Mathematics to assess learner's progress through continuous and comprehensive assessment processes;
- construct and use open ended test items in Mathematics,
- understand the necessity and utility of question bank in Mathematics
- use different types of activities like mathematics exhibition, quiz, puzzle, games to assess the learners' interest in mathematics

11.2 CONTINUOUS AND COMPREHENSIVE ASSESSMENT IN MATHEMATICS

Continuous and comprehensive assessment (CCA) emphasizes on two fold objectives. These are continuity in assessment and assessment of all aspects of learning. Thus the term '*continuous*' refers to assessment on intermittent basis rather than a onetime event. When the assessment exercises are conducted in short intervals on regular basis, the assessment tends to become continuous. In other words, it can be said that if the time interval between two consecutive assessment events can be lessened or minimized then the assessment will become continuous. In order to make the assessment process continuous, the assessment activities must be spread over the whole academic year. It means regularity of assessment, frequent unit testing, diagnosis of the learning difficulty of the learners, using corrective measures, providing feedback to the learners regarding their progress etc will have to happen maximally.

The second term '*comprehensive*' means assessment of both scholastic and co-scholastic aspect of student's development. Since all the abilities of the learners'



development cannot be assessed through written and oral activities, there is a need to employ variety of tools and techniques (both testing and non-testing techniques) for the assessment of all the aspects of learners' development. .

Assessment in mathematics is linked with the aims of teaching mathematics. In the primary schools years, the aim of school mathematics is to develop useful capabilities and also to develop the ability to think and reason mathematically. Useful 'capabilities' include conceptual and spatial understanding, problem solving and mathematical modeling. While learning mathematics children develop and express self confidence, creativity, ability to communicate and use mathematical concepts and symbols (Fig. 11.1). The focusing points of learning assessment in mathematics at primary level are related to understanding:

- how children learn mathematics,
- the mathematical concepts included in primary school curriculum, and
- child understanding of mathematics.

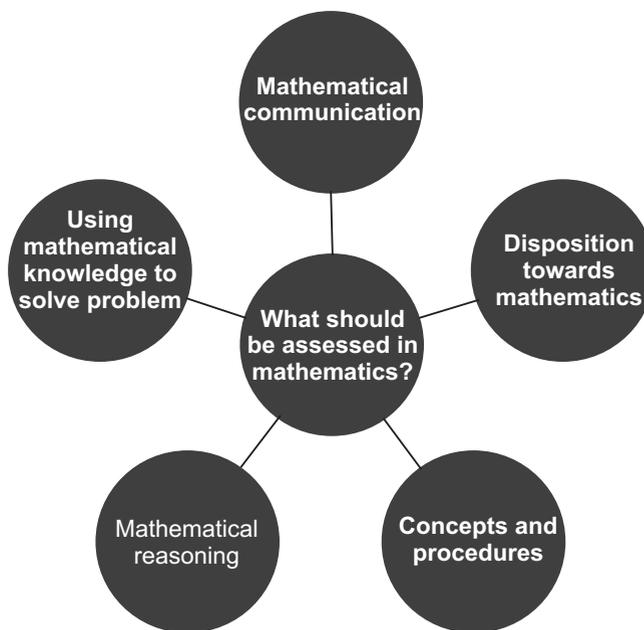


Fig. 11.1 Aspects of Assessment of Mathematics Learning at Primary Level

Source: NCERT(2008)

There is a wide choice of methods or *tools and techniques* which can be used by the teacher to assess different dimensions of child's learning in mathematics. Apart from the traditional paper pencil test and oral tests, the teacher can use other modes of observation, assignments, projects, portfolio, checklists, rating scales, anecdotal records etc. Use of multiple tools are required to enable you to assess the learners in a more



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comprehensive and objective manner. A simple test should be record every day the number of questions asked by distinct students in a maths class/activity more the number of questions, more the learning

11.3 DIFFERENT TYPES OF TEST ITEMS IN MATHEMATICS

As discussed in the previous section, the teacher needs to assess the students progress in mathematics learning and to help him for further learning on the basis of the assessment results. The teacher may use different types of test items for this purpose. Teacher made tests which are constructed by the teachers for use within their classroom are quite useful for this purpose. You have already read about the principles of construction of teacher made tests and different types of test items in the Unit- 14 of the Course 3. In this section you will learn about how to prepare different types of test items in mathematics.

11.3.1 Objective-Based Items

As you know, before starting the teaching-learning process, objectives are to be formulated and by employing appropriate teaching learning process, the teacher and students jointly try to achieve the predetermined set of objectives.

The objective based test item is supposed to measure a specific objective of instruction (learning outcomes). Such types of items describe the learners' achievement more accurately. The items are based on the specific objectives of a particular concept. Let us discuss some objectives along with items in mathematics. Observe the table given below:

Table 1: Examples of Specific Objectives of Mathematics Learning

Objectives	Behavioral specifications
Knowledge	<ul style="list-style-type: none"> ● Recalls facts, rules, theorems, definitions, principles, terms. ● Recognizes facts, relations, definitions, formulae etc
Comprehension	<ul style="list-style-type: none"> ● Detects errors in figures, statements and rectifies these. ● Interprets the principle in his/her own term ● Converts words into symbols and vice versa ● Classifies on the basis of certain criteria ● Provides more example on a principle/rule



	<ul style="list-style-type: none"> • Verifies the mathematical conclusions • Discriminate between similar things
Application	<ul style="list-style-type: none"> • Suggests alternative plan or method for solution of a mathematical problem • Makes generalization on the basis of given facts • Takes decision about sufficiency of the given facts • Makes predictions and verifies them
Skills	<ul style="list-style-type: none"> • Uses geometrical instruments correctly • Represents a given data diagrammatically • Draws geometrical figures with accuracy and speed.

Now look at the following objective type of items:

- Which is the smallest prime number?
- What is the sum of the measures of the interior angles of a triangle (in degree)?
A. 90 B. 180 C. 270 D. 360
- The number 9 is an odd number, because
A. It is the biggest one digit number.
B. It is not divisible by 2.
C. It has three factors.
D. It is the square of 3.
- In which of the following conditions a triangle ABC *CANNOT* be constructed?
A. $AB = 5\text{cm}$, $BC = 4\text{cm}$, $CA = 3\text{cm}$
B. $AB = 6\text{cm}$, $BC = 5\text{cm}$, $CA = 3\text{cm}$
C. $AB = 5\text{cm}$, $BC = 4\text{cm}$, $CA = 1\text{cm}$
D. $AB = 7.5\text{cm}$, $BC = 4\text{cm}$, $CA = 3.9\text{cm}$

All the four items are objective type of items. You have already read about different types of objective type of items in unit-14 of paper- .

Try to say, which type of items are there in (a), (b), (c), (d)?

Observe that, the item in (a) demands the learner's ability in recalling specific facts. If you will observe the table given above, you will definitely mark that this item is a



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knowledge based item. This type of items is known as knowledge based item. Some examples of knowledge based objective type items are given below.

- What is the formula to find out the perimeter of a rectangle?
- What is the definition of rational number?
- An equilateral triangle has
 - a. three equal sides
 - b. two equal sides with an angle of 90 degree
 - c. three unequal sides
 - d. one obtuse angle
- What is the sum of the measure of the interior angles of a quadrilateral?

if you will observe all the four items, definitely you will mark that all the items demand either *recall* of facts, principles, rules, formula etc or *recognition* of facts, relations etc. To answer such type of items, the learner has to recall the facts or information he has acquired earlier.

**ACTIVITY-1**

Prepare ten knowledge based objective type of test items from the concept of numbers in class-IV

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Now let us consider the item in (b), this item does not require mere recalling the facts directly from the text, rather allows the learner to restate the problem and respond logically. Such type of items are termed as understanding/comprehension based items. Here are some examples:

- The three angles of a triangle can be respectively-
 - A. Obtuse angle, Acute angle, Obtuse angle
 - B. Right angle, Obtuse angle, Acute angle
 - C. Acute angle, Acute angle, Acute angle
 - D. Right angle, Right angle, Acute angle



- A triangle cannot be constructed with three angles measuring
 - A. $75^\circ, 55^\circ, 60^\circ$
 - B. $60^\circ, 35^\circ, 85^\circ$
 - C. $90^\circ, 40^\circ, 50^\circ$
 - D. $5^\circ, 10^\circ, 165^\circ$
- Which of the following represent a set of parallel straight lines?
 - A. Spokes of a cycle wheel
 - B. Opposite edges of a book
 - C. Concentric circles
 - D. Minute hand and hour hand of a clock at 12 noon

Observe these items carefully. The learner can answer these questions if he/she has understood the mathematical concepts and processes. Simple cramming the principles will not help the learner to answer these questions.

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- E1. Some statements are given below. Choose the statements which are *true* for an understanding based item.
- i. Understanding based items demands simply recalling of the facts.
 - ii. Understanding based items requires higher order thinking in comparison to knowledge based items.
 - iii. It is easier to frame in comparison to knowledge based item.
 - iv. Sole purpose of understanding based items is memorizing the facts.
 - v. Drawing conclusions from an event is an understanding based item.
-

In the application based items, the learner has to apply the acquired knowledge and comprehension in a new situation. Responding to such type of questions requires higher mental functioning than the knowledge and understanding based questions. Examples of application based questions are given below:

- Using the property of a triangle regarding the sum of the measures of its angles, find out the sum of the measures of the angles of a quadrilateral.
- In which of the following cases the principle of inverse variation can be used?
 - a. One pen costs 8 rupees. Find out the price of 10 pens.
 - b. 10 boys get 3 chocolate each. Calculate the total numbers of chocolates required for 10 boys.
 - c. 10 persons complete a work in 8 days. In how many days 5 persons will complete that work?
 - d. One child is given 2 toffees. How many children will get 10 toffees?



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- If the length and breadth of a rectangle are increased by two times, then the area of the rectangle will be :

A. Increase by 2 times	B. Decrease by 2 times
C. Increase by 4 times	D. Decrease by 4 times

To develop the application based questions, you may refer table no-1 given in this unit. The behavioural specifications given against the application objectives will help you to design application based test items.

**ACTIVITY-2**

Go through the Mathematics textbook for class-V. Analyze the test items given in the exercises, examples and practice works. Note down the application based items from them.

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From the above discussion on objective based objective type items, you should not think that objective types of items are only suitable for assessment of learning outcomes in Mathematics. On the contrary, it is the nature of learning outcome (specific objective) that determines the type of item to be used for assessment. For example, let us consider the following situations of assessing the objectives of mathematics learning:

- *Objective: 'Represents a given data diagrammatically'.*

A suitable item would be a performance type item in which we can give some data (say, the average attendance figures of boys and girls in different classes of your school during a month and ask them to draw graph on it.

- *Objective: 'Suggests alternative plan or method for solution of a mathematical problem'.*

Instead of an objective type of item, you should ask your students to give alternative method of solving a mathematical problem elaborating its steps.

Therefore, you should develop skills in construction of different types of items, not just objective types, which would help you to choose appropriate type of item in assessing the objectives effectively. For discussion on constructing different types of objective based items, study the Unit 15 of the Course 3 carefully. Use of open-ended items is now considered more effective in assessment for learning than the objective types.



11.3.2 Open-ended Items

In this section, you have been acquainted with different types of objective type of test items which are based on certain learning objectives. You might have observed that the objective type of test item has a definite and unique answer that helps scoring the response easily and objectively.. Such types of items are described as closed ended items. But there are test items which allow a variety of correct responses and elicit different kind of students thinking. Such types of items are known as *open ended items*. You have already learnt about open ended items in the Block 4(unit 14) of Course 3.

Compare both the test items given in each row.

Closed ended items	Open ended items
<p>a. Find out the average of 78, 83 and 91.</p> <p>b. Find out the greatest common factor of 10, 15 and 25</p> <p>c. Find out the percentage of different parts of the rectangle given below.</p> <div style="border: 1px solid black; width: 150px; height: 40px; margin: 10px auto; display: flex; align-items: center; justify-content: center;"> <div style="border-right: 1px solid black; width: 60px; height: 40px;"></div> <div style="width: 60px; height: 40px; display: flex; flex-direction: column; justify-content: space-between;"> <div style="border-bottom: 1px solid black; width: 100%; height: 20px;"></div> <div style="width: 100%; height: 20px;"></div> </div> </div> <p>d. Calculate 58 divided by 8.</p> <p>e. Find out the perimeter of the rectangle whose length and breadth are 7 cm and 3 cm respectively.</p> <p>f. Say the following statement is <i>true</i> or <i>false</i>.</p> <p style="padding-left: 20px;">All rectangles are parallelograms.</p>	<p>a. The average of three numbers is 84. What are those numbers?</p> <p>b. Identify three numbers whose greatest common factor is 5.</p> <p>c. Divide and level the a rectangular shape garden plot in such a manner that 50% of the garden is planted with marigold plants, 25% is planted in dahlia flower plants and the rest 25% with other flower plants.</p> <p>d. A number is divided by 8 and leaves a reminder of 2. What might the number be?</p> <p>e. Draw a rectangle with perimeter of 20 cm</p> <p>f. Write correct statements choosing combinations from the bracket given below.</p> <p style="padding-left: 20px;">(<i>Kites, parallelogram, quadrilateral, rectangle, square, trapezium</i>)</p> <p style="padding-left: 20px;">All _____ are _____</p>



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In the above table, in each row there are two different test items. The item in the left side is a closed ended one while that of the right column is an open ended item. Each open ended item has more than one correct answer. Let us consider the item given at (a)

Question: The average of three numbers is 84. What are those numbers?

Answer: five numbers of students have written the answer to the above question as follows:

Student 1: 100, 150 and 2

Student 2: 82, 88 and 82

Student 3: 78, 83 and 91

Student 4: 66, 94 and 92

Student 5: 1, 11 and 240, 250, 1,1; 200. 45, 7.

The answers to the test item (a) given by all the five students are correct. Even the last student has given three responses which are all correct. Given chance every student can give more than one response.

Observe the open ended items carefully. Write down the characteristics of such type of items.

Check your list with the following characteristics/features of the open ended items in mathematics:

- No fixed answer i.e. many possible answers
- Solved in different ways and on different levels. Students of different abilities can be able to give at least one correct answer.
- Offer students scope for own decision making and natural mathematical way of thinking. Each child can think according to his own experience.
- Provide teachers with valuable information regarding individual student way of thinking and way of solving mathematical problems.
- Open to student's creativity and imagination when relates to real life context of their experience.
- Develop student's reasoning and communication skill when those are discussed in the classroom.
- Develop student's self-confidence for higher achievement. Since, such items have several possible correct responses, every student, even the poor performers; can provide at least one correct response. The better performing students can give several correct responses. All categories of students can aspire to perform in the subsequent occasions.



ACTIVITY -3

Construct **ten** open ended test items in mathematics for class- V children. Administer those open ended items to the class V students of your school. Analyze their responses. How many students have given more number of answers to an item?

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11.4 DEVELOPING QUESTION BANKS IN MATHEMATICS

Preparing objective based test items of different types in mathematics are quite important on the part of a teacher and at the same time, it is also not an easy task. But if you have a stock of quite a large number of items (questions) at your hand, you will have little difficulty in using appropriate test for your students at different times.

Now, the question may arise, “What are the *sources from which you can get variety of questions other than those available in the textbooks?*”

There are different possibilities:

- You can prepare questions by yourself,
- You can collect the questions prepared by the students during the course of teaching,
- You can bring some questions from different reference materials and
- Collect questions developed by other teachers of your schools or teachers in other schools.

Collecting questions from various sources, arranging and keeping (storing) them properly and using them as and when required are the purposes for which you need a question bank in each class of your school.

Purposes of question bank: The question bank is useful for the teachers in bringing reform in the traditional evaluation system. The National Curriculum Framework (2005) rightly observed that, the present evaluation system can be described as “one-exam-fits-all”, as one question paper is employed to all students during the examination. This is because the teacher has no other options but to use some questions which are



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available with him. But, if the teacher has a variety of questions in the question bank then he can prepare different question papers and use them for different learners as per their requirement. The other purposes of question bank are:

- Question bank is useful to prepare a test for instant testing of the learners
- Though the test items in a question bank are objective based, those are helpful for the teachers to evaluate the learning progress with respect to learning objectives.
- The learners can prepare themselves in the questions available in the question bank.
- The learners can also self-evaluate themselves by using the question bank.
- Questions not only help in assessment of learning, but also aid in classroom transactions for helping the students to learn better. Therefore, variety of items on different learning outcomes should be available to you and your students in the classroom. Question bank in the classroom serves this purpose effectively.

E2. State any four utilities of question bank in mathematics. Write two more utilities which have not been stated here.

Every school should prepare question banks on their own. This brings ownership of the materials by the teachers and students of that school (*why?*). While preparing question bank in mathematics and their proper use the following points should be taken into consideration.

- Both oral and written items on each chapter should be prepared. Oral items in mathematics are quite useful in measuring the skills of speed and accurate calculation. Those oral items can be used in assessing the child's ability in mental arithmetic.
- In each chapter, test items from knowledge, understanding, application and skill objectives may be developed. Besides, project activities and practical activities should be there.
- After preparation and collection of questions those should be edited by the experts. Teachers from different schools or a cluster may sit and discuss on each item and finalize them.
- It is better to write one or two questions on an **item card** - a post card size paper, instead of a register. Cards have several advantages in developing, sorting, using and storing. Sometimes different cards containing questions may be supplied to different students in the class to engage everyone in learning. (*If a register will be maintained. then what will be the consequences?*)
- Different color cards may be used for questions on different objectives and subjects. It will help the teachers to select and use the questions as per the purpose.



For example- red color cards may be used for knowledge type of items while blue and yellow color cards may be used for comprehension and application objectives. The teacher may use different color of cards for different purposes, like- different color of cards may be used for extended response type of items (essay type of items), restricted response type of items (short answer type and objective type) and open ended items.

<p>Class V Topic: <i>Fraction</i></p> <p>Objective: <i>Demonstrates fractions as part of a figure (Understanding)</i></p> <p>Problem: Shade $\frac{2}{3}$ of the square given below:</p> <div style="text-align: center; margin: 10px 0;"> </div>	<p>Type of Task: <i>Performance</i> Difficulty Level: <i>Medium</i></p>
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Answer on the overleaf

Fig. 11.2 Sample of an Item Card



ACTIVITY-4

Take any chapter from class-V mathematics textbook. Write down the expected learning outcomes of chapter. Develop items based on those learning outcomes. Prepare item cards on that chapter. Write a short report how you developed the question bank.

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E3. State any four uses of item cards.

11.5 ASSESSMENT FOR MATHEMATICS LEARNING

There are some techniques of assessment which also simultaneously help in enhancing learning. They are essentially used in formative assessment while the learning process is continuing. You can refer to discussion on assessment for learning in the Unit 12 of



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Course 3 where the principles and techniques have been explained in detail. Here, we present some of those techniques which can be suitably applied to Mathematics learning.

11.5.1 Project

Here a situation is given. A teacher in a rural school conducted an activity to enable the learners to learn mathematical concepts as well as to enjoy mathematics.

*Dinesh is working as a primary school teacher in a rural school. He tries to create interest among the learners in learning mathematics. He plans different varieties of activities for his students to make mathematics learning more interesting and meaningful. One day he thought to give students a **project** on “Graphical presentation of occupational patterns of the community members”. He discussed with the students how to carry out the project. The following points were discussed:*

- *Why do we do this work? What benefit will we get from this work?*
- *How will we do it?*
- *What are the tasks involved?*
- *Who will do what work?*
- *What type of information we need to prepare the graph of different occupations?*
- *Estimated no of households to be visited to get required information*
- *Preparation and organization of different items of the work*
- *Keeping record*
- *Execution of different activities*
- *Preparing the report*
- *Evaluation of the entire work*

Then the students carried out the project.

This type of activity is known as a project, which is carried in a natural setting. Project creates scope for learning mathematical concepts in a real life situation. This involves the application of knowledge.

On the basis of the situation now try to answer the following questions.

- i. Is learning of mathematical concepts be possible in this approach?
- ii. Can the learning be meaningful?
- iii. Can the learning be a pleasurable activity for the students?



- iv. Can the project provide information about child's progress and learning?
- v. On the basis of this activity, is it possible to know the learning acquisition by the students?
- vi. What can be assessed through this type of activity?

Projects are undertaken over a period of time and generally involve collection and analysis of data. Those provide opportunities to explore, work with one's hands by undertaking projects the learners observe any situation/phenomena, collect data, analyse, organize and interpret data and draw generalizations. Project works provide opportunity to work in groups and real life situations. Projects help the learners to learn in an integrated approach i.e. from a mathematical project not only the mathematical concepts can be learnt, simultaneously knowledge in other curricular areas also developed.

Projects can be used as an effective tools and techniques of assessment in mathematics. Here the assessment becomes an integral part of the routine classroom activities and the teaching learning process. The teacher has to observe the behaviour of the child during the execution of the project, his interest towards the work, process of collection, recording, interpreting the data. Accordingly the teacher can assist the learner and helps in improving the learning.

E4. Enlist *three* projects you want to give learners at primary level. Indicate the mathematical concepts involve in each project.

11.5.2 Portfolio

We have already discussed in block III of this paper regarding various tools and techniques for assessment. Only the pencil-paper tests can not assess all dimensions of learner's development, rather other modes of assessment are quite useful both for assessment of learner's progress as well as to ascertain the needs of the learner for further learning. Portfolio is one of the modes which can be used in assessment for learning in mathematics. Here a case study is given, go through it.

*Rohini, teaching in primary classes uses different ways of learner assessment. She also uses portfolio as one of the way. While teaching the concept of "percentage" in the class, she discussed with the students different activities to be conducted collaboratively. Once the students and Rohini decided to collect and store different products prepared by the individual learner. The students were encouraged to write or collect essays, poems, stories, collect paper cutting and giving their own remarks on the articles/ issues, narrative or descriptive piece communicating a significant experience, riddles, mathematical puzzles, teaching-learning materials etc involving the concept of **percentage**. The students were engaged in creating and collecting different products. They were given a*



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period of 10 days to complete the task. After 10 days all the students along with their teacher sat, the students displayed their creations and describe them in detail. The creations (portfolio) of some students are given below.

- *Dinesh wrote a story involving the concept of percentage.*
- *Madhabi discussed with her father who is a bank employee and collected the interest rates given by various banks on fixed deposits and saving deposits. She also prepared a chart on this.*
- *Shyama has gone through textbooks and reference books of other schools of their locality and collected 10 different types of examples to understand the concept of percentage.*
- *Sudhir collected some news from the newspaper and pasted on a chart paper. He also wrote his own views on some of the articles.*
- *Anjan visited some of the households in his habitation, collected data on number of school going age children in each family. Calculated the percentage of the school going children to the no of persons and prepared a chart etc.*

All the students enjoyed the activity.

“Portfolio is a purposeful collection of students work that exhibit the students’ efforts, progress, or achievement in (a) given area(s). This collection must include:

- Students participation in selection of portfolio content,
- The criteria of selection,
- The criteria of judging merit, and
- The evidence of student self-reflection.”(Reckase, 1995).

Thus, portfolio provides an opportunity to the child to express his/her feelings and for the teacher to understand what is happening to the child outside the class. It is a collection of children’s work over a period of time. It could be a day to day work or selection of the child’s work. It provides a cumulative record. In the process, a picture of how a skill or knowledge develops emerges. It encourages the child to show and tell what they know and think about what they have included in their portfolio. The child becomes an active participant in learning and assessment (*how?*).

-
- E5. Prepare a list of different materials that can be put together while preparing a portfolio.
- E6. State two ways of using portfolio for assessment of learning mathematical concepts or skills.
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On the basis of the discussion try to reflect on the following points relating to portfolio:

1. Can a portfolio help a teacher to assess the learners?
2. Whether such activity helps the learners to enjoy mathematics?
3. Can the performance of the children be assessed by his/her peers?
4. Can the learners assess their own performance?
5. Can the portfolio act as a tool for learning?



ACTIVITY -5

Select a concept from the mathematics syllabus. Discuss with your students on that concept. Encourage them to prepare and collect materials on that concept within 10 days. Ask the children to show and tell what they know and think about the material they have included in their portfolio. Ask the students to assess their own collection and collection of other students.

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11.5.3 Participation in Exhibition

We can also use exhibitions in mathematics to share and assess student’s learning. Mathematics exhibition creates opportunities for the learners to show their talent in mathematics outside the formal classroom activities. Such type of activity not only fosters mathematical awareness among the learners but helps in skill building, developing positive attitudes among the learners.

In the mathematics exhibition, the students learn certain concepts using concrete objects and verify many mathematical facts and properties using models, measurements and other activities. Thus, Spenser and Angus(1998) point out that student exhibition involve complex cognitive skills as they must “collaboratively synthesize and evaluate information, and effectively communicate their ideas to others.”

How to organize exhibition

Before organizing a mathematical exhibition, the teacher should discuss the time and venue of the exhibition. The children should be intimated well in advance the exhibition so that they will get sufficient time to share among themselves, teachers and their guardians regarding their materials to be demonstrated in the exhibition. The children may prepare different models, materials, charts and interesting facts, puzzles etc. in the exhibition the parents may also give scope to participate. Different types of activities may be organized during the exhibition. Those are:



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- Demonstration of models, charts by the students and teachers
- Photo exhibition (photograph of mathematicians reflecting their contribution)
- Teaching-learning material (TLM) preparation
- Popular talk on different mathematical concepts by the teacher or invited experts
- Demonstration of reference books in mathematics
- Activities for parents to show their talents and participate in different activities
- Different recreational activities in mathematics for the students

Now the question may arise, how this exhibition acts as a tool in assessment *for* learning and assessment *of* learning? This clearly indicates that, exhibition can be helpful in formative assessment as well as in assessing the learner's ability to apply the acquired knowledge in different situations. Observing the nature of learners' participation during different activities of the exhibition the teacher can assess the learner's understanding on a particular concept, his/her attitude towards mathematical learning. Further the teacher has to plan for further learning of the individual learner on the basis of the assessment findings. Further, it creates scope for learning from each other in an informal situation as well as peer assessment.

Look at the table given below. You will find that the information given in the box below will help you to assess the learners during the exhibition:

What are to be observed during the exhibition for assessing a learner?

- Rationale taken for the text and lesson demonstrated in the exhibition (whether it provides a clear sense of purpose and draws the understanding of learner?)
- Whether the main teaching and learning activities were appropriate, well designed and properly linked?
- Are the activities shown variety, flexibility, creativity and innovation?
- Whether the activities taken by the learners are likely to develop their understanding of mathematical principles?
- Whether the demonstration and description of the activity was informative and interesting?
- Whether the lessons and resources were user-friendly and realistic for the classroom?
- Whether the learner's demonstration and exhibition be able to communicate his/her ideas effectively to others?

E 7. Write some of the usefulness of an exhibition in mathematics for the learners?



11.5.4 Mathematical Quizzes and Games

Students learn mathematics when they were engaged in meaningful mathematical tasks.

Such tasks provide the learners to think mathematically. Tasks like mathematical quizzes, puzzles and games provide situations to learn mathematics without fear and anxiety. While participating in those activities, the teacher should observe the learners and assess their performance. On the basis of the observation, the teacher should find out the areas where further inputs can be provided to the learners. Let us discuss the procedures of assessment through these activities.

Quiz:

The dictionary meaning of the term quiz is ‘series of questions testing people’s general knowledge especially as a form of entertainment’. You might have seen the quiz competition either in your school or in any other place. Normally in the quiz programme oral questions were asked to the participants and those were responded orally. But sometimes the respondents were allowed to use paper-pencil to get the answer. The question may be asked to an individual participant or to a group of participants (preferably 2 or 3). such techniques may be applied to conduct mathematical quizzes. While conducting mathematical quiz the following points may be kept in mind:

- After teaching some concepts the quiz programme may be arranged, this will enable the learners to practice the concept and apply those in different situations.
- Questions based on real life situations may be asked to the learners
- Different round of answering like-answering using paper pencil, answering without paper-pencil, answering with clue and quick answer round may be conducted.
- Questions based on audio-visual support may be used to arouse interest among the learners.
- Questions prepared by the learners during the course of teaching-learning process may also be used during quiz programme.
- All the children may be allowed to participate in the quiz programme.

Quiz programme enable the teacher to understand the student’s progress in learning. It helps the teacher to know the learners interest towards mathematics learning. The teacher will observe how the students choose the answer and how they respond to the questions.

Games:

Game is a spontaneous activity for the children in which they participate naturally without any fear. Normally mathematics is associated with fear and failure. But participation of the child in different types of games and interesting puzzles removes the fear from the child. Such games and puzzles enable the child to understand the



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basic mathematical process without memorizing the facts and formulae. Also, the teacher creates situation to link the bookish knowledge to the real life situations.

Let us go through the game conducted by a teacher:

Rajeeb a teacher in an elementary school while teaching the concept of inside, outside, between, regions, across and boundary faced problems to enable his students to understand. He thought to conduct a game as follows:

Two groups of children are selected: those who attempt to change from the red base to the green base, when the whistle is blown, and those who begin at the “catchers region”. As the children are changing from the red to green base, the catchers run from their region and tag those who are changing, as long as they are outside either the red or green bases. The game is over whenever there are no more children to run between the red and green bases.

During the game each child was active and all the children discussed among each other to develop the strategies.

On the basis of the game described in the box, try to give answer to the following questions:

1. Can this game help the children to learn mathematical concepts? How?
2. Can this game help the teacher to assess the learners? How?
3. Can this game enable the teacher to plan for further learning of the children?
4. How the games are useful for the children to learn mathematics?

No doubt, the mathematical games create interest among the learners than the traditional teaching inside the classroom. But the teacher should plan carefully how the mathematical understanding is developed among the children through the game. Observing the children during the game (i.e. how they are planning & performing, communicating with each other, building strategies) helps the teacher to assess whether they are able to apply the mathematical ideas in other situations.

Like games mathematical puzzles (problem designed to assess knowledge or ingenuity) create interest among the learners to participate in it and enjoy mathematics. Here is an old riddle:

Three travelers stopped at an inn and asked for supper. The inn-keeper could offer only baked potatoes. While the potatoes were baking, the travelers feel asleep. Soon one of them woke up, saw the dish of potatoes, and took a third of them without waking the others. Later the second one woke up, saw the dish, and ate a third of the remaining potatoes. Later the third one did the same. When all three were sleeping once again, the inn keeper cleared the table and found 8 potatoes left. How many were there to start with?



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Similarly a lot of games and puzzles can be used to teach different mathematical concepts. The teacher has either to prepare them or collect them. But using them at right time in right way will definitely motivate the learners to the mathematics class.



ACTIVITY-6

Prepare or collect at least 2 games. Write down the rules to conduct each game. Which concepts will you teach through the games you have selected? How will you assess the learners?

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E 8. A mathematical game is described below. Read it and answer the questions given below the game.

Play the “large to mouse but small to an elephant” game. Ask questions such as: “what objects in the room seem small to you but would seem large to a mouse? What objects in the room would seem small to a mouse? What objects that seem large to you would seem small to an elephant? Are there any objects that seem small to you that would seem large to an elephant? Why?” continue asking questions until all of the possibilities have been exhausted.

- With the help of this game acquisition of which concepts can be measured?
- Can this game help the students to learn that concept? How?
- Assessing the learning progress of the learner through this activity differs from the paper-pencil test. - Is it true?

11.5.5 Observing Children During Mathematics Activities

Observing the children during mathematics activities (during the course of teaching) is a technique of *assessment for learning* or formative assessment. Through observation information can be gathered about children in natural settings. Some observations can be done in course of teaching from the behaviours like: how the child is answering the questions asked to him/ her, how he is describing the facts, how he is responding to the answers of other children, what type of questions he is asking the teacher, how he is presenting the group reports, how he is participating in the discussions etc. The teacher could record number of questions asked by distinct students during the activity. The will be a valuable information indicating whether a learning was taking place.



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Through observation various aspects of the child's personality development can be assessed. It can be used to assess individuals and groups. If a task is assigned to different groups then you can assess the performance of a group. Through observation, the teacher can get evidence of child's performance based 'on-the-spot' record. Over time, detailed observations of behaviour as well as interests, challenges-patterns/trends emerge which allow teachers to create a comprehensive picture/view of the child. So observations are to be made by the teacher over a period of time, across different activities and settings. When the child is engaged in a number of tasks/activities, it will be easier on the part of the teacher to observe the child and assess him. So teaching based on the *lecture method* cannot create scope for the child to do much works. Thus, the child may be engaged in a lot of activities (individual/group) which will help the teacher to assess the child's learning as well as enable the child to identify his own weaknesses and rectify them.

Some of the examples are given below:

Example 1:

Divide class into small groups and tell them that they are going to use measurement to find some secret objects inside the school campus. Provide each group the name of a set of objects including the secret objects. The measurement of the secret objects may also be given to the children such as- the length of the object is 2 m 15 cm and its width is 1 m 10 cm etc. Each group must measure objects provided to them until they identify the objects described by the measurement.

Example 2:

Ask the children to draw many 4 by 4 squares, and shade half of each, in as many different ways they can think of.

(This activity can be extended to have children draw different shapes on the squared sheet, and shade exactly half of each. A child should be able to justify why the part she has shaded exactly half.)

While the child is busy in the activity you can observe him/her from a very close quarter without disturbing their attention on the activity. This would provide information on the children's style of learning and their learning difficulties.

- You can observe the level of participation of students in the activities in the classroom. Many students are afraid of mathematics and do not like to get involved in group activities in mathematics. Detecting their reservations, you can take appropriate actions to improve their participation in mathematics activities.
- Observation provides better opportunity to detect the degree of involvement of each child in the activities, several personality characteristics, the strengths and weaknesses of students on the topics of concern.



- Observing students in mathematics class, you may gain insight into several aspects of their learning of mathematical concepts like interest for mathematics activity, aesthetic sense of mathematics, symptoms of mathematical anxiety and phobia, typical errors committed, alternative methods applied for solution of problems, specific points of difficulty etc.

11.6 LET US SUM UP

- The progress and achievement of learners in mathematics can be known by assessment, as well as the effectiveness of the teaching-learning process, materials can also be ascertained by assessment.
- Assessment should not be a onetime event, rather be a continuous one. Use of unit tests, giving assignment, observing the child during teaching-learning process and preparation of TLM, project work and portfolio makes the assessment process continuous.
- Comprehensive assessment means assessment of both scholastic and co-scholastic areas of the curriculum. To assess both the areas the teacher has to use a variety of tools and techniques.
- The objective based test items in mathematics are supposed to measure a specific objective of instruction (learning outcomes). Such types of items describe the learner's achievement more accurately. Particularly in mathematics the teacher should prepare and use knowledge, comprehension, application and skill based questions.
- Question bank in mathematics help the teacher to conduct a test instantly and also enables the learners for self study and self evaluation.
- Participation of the learners in activities like project, portfolio, mathematical exhibition, quiz, mathematical games helps the learner to learn in an informal way. Such activities help the teacher to assess the learner in an informal situation.
- The teacher has to observe the learners during activity and assess to what extent the learner has acquired the knowledge in a particular concept. Through those activities the assessment process can be made child friendly.

11.7 MODEL ANSWER TO CHECK YOUR PROGRESS

- E1. Statements in (ii) and (v) are true for understanding based items.
- E2. The question bank can help the learners to be acquainted with the answer pattern which will enable them to prepare for the examination. Further, the teacher who



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are not able to prepare variety of test items on a particular concept, can be benefited and use variety of items for their students. *Similarly you can write down more utilities of question bank.*

- E3. Instant use by the teacher in the classroom for unit testing, using to prepare objective-based tests, selecting items according to difficulty level, helping students to prepare questions, etc.
- E4. The projects like the following can be undertaken at primary classes:
- Collection of rates of few commodities from the local market in an interval of 15 days. Compare the increase or decrease of the rate. Discussing with the seniors try to know the reasons of such increase or decrease of the rates. (helps to learn the concept of percentage of increase or decrease of the rate)
 - Understanding of a local cottage industry: the child has to collect information about nature and sources of raw materials, number of persons employed in the cottage industry, how much they are earning per month, the progress of industry from year to year etc. (helps the children to learn about the profit and loss, managing business and other concepts of commercial arithmetic).
 - Development of a profile of 10 households with respect to their number of family members, illiterate members, employed persons etc. Representing all the information in a tabular form and drawing inferences from the data. (Helps the children to learn the tabular and graphical representation of data, the concept of percentage and ratio can also be taught through this work).
- E5. The following materials can be included in portfolio:
- A collection of different items like pictures from magazines, newspaper clippings, photographs, poems, drawings, collection of stamps, coins, essays, stories, letters etc. Self-initiated works of the children with or without limited help of the teacher, items contributed by family and community members.
- E6. The teacher can evaluate the work of the students using rating scale or other techniques, the peers can evaluate through comparison of each others work, Self-evaluation by observing others' work. (any two).
- E7. The mathematics exhibition is useful for the learners due to the following reasons:
- It removes the phobia from the mind of the learners and motivate the learners to participate in the mathematical activities
 - Mathematics is learnt by *doing*, not only by *reading*
 - Teacher and the learners collaboratively plan for different activities.

- Learners got opportunity to verify and discover the properties and principles
- Enables the learner to go beyond the textbook and linking the bookish knowledge to the knowledge outside the school.

(You may add some more points to it)

E8. When the children will be engaged in this game they will learn the concept of 'measurement of volume'. This game is quite useful in learning the concept because of the following reasons:

- The children work in an informal environment free from fear and tension, which is a conducive environment for learning.
- The game is based on the day to day life experience of the child which causes learning
- There is scope for peer support for learning.

The teacher can assess the learner through this activity. He has to observe how the child is applying the mathematical principles in the game.



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11.8 SUGGESTED READINGS AND REFERENCES

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Deale, R. N. (1975). *Assessment and testing in the secondary school*. London: Pearson Education

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11.9 UNIT-END EXERCISES

1. Take any unit from the mathematics test book of class-V. Prepare different types of objective based objective type of test items. Suggest some projects from that chapter.
2. How assessment through a project differs from the assessment through portfolio.
3. Prepare a list of activities for your students to be demonstrated in the mathematics exhibition.



UNIT 12 FOLLOW UP OF ASSESSMENT OF LEARNING MATHEMATICS

Structure

- 12.0 Introduction
- 12.1 Learning Objectives
- 12.2 Collection and recording assessment information
- 12.3 Identification of Issues in Mathematics Learning
 - 12.3.1 Identifying strength and weaknesses
 - 12.3.2 Identifying and addressing typical problems
 - 12.3.3 Providing feedback
- 12.4 Follow up measures of assessment
- 12.5 Let Us Sum Up
- 12.6 Model Answers to Check your progress
- 12.7 Suggested Readings & References
- 12.8 Unit-End Exercises

12.0 INTRODUCTION

Assessment is an integral and inseparable part of the learning-teaching process. Especially mathematics assessment tasks need to tap students ability to estimate the answer to an arithmetic calculation, construct a geometric figure, use a calculator, ruler or compass, produce a deductive argument complex problem solving. In the previous units (in unit-10 and 11), you have already learnt about the meaning and purposes of assessment in mathematics and different tools and techniques to collect valid and reliable information on the progress of the child in mathematics. The results on the performance and progress of individual child can be recorded either in the form of marks or grades. Besides, the qualitative description of child's performance and progress can be reflected in the progress card of the child. A systematic recording and reporting procedure is useful in providing feedback regarding the learner's progress to the parents, learner and other stakeholders.

In this unit, you will learn about the ways of collecting information regarding learner's performance and progress, the process of recording the learner's performance and how to report the assessment results to the learner, parents and other stakeholders. You will also learn about how to identify the issues in mathematics learning from the assessment results.

For completing this unit you need about 06 (Six) hours of study.



12.1 LEARNING OBJECTIVES

After going through this unit, you shall be able to

- identify the techniques of collecting and recording of the assessment information,
- understand the process of providing feedback on assessment to learners, parents and other stakeholders,
- plan for remedial and enrichment activities on the basis of diagnosing weakness and strength of the learners.

12.2 COLLECTION AND RECORDING ASSESSMENT INFORMATION

In the previous unit you have already learnt about different tools and techniques of assessing the learner's acquisition of mathematical knowledge and skills. Tools and techniques like written and oral tests, observation, interviewing the learner, portfolio analysis can help the teacher to collect data regarding the learner's performance in mathematics.

We accept that every child is unique and he/she learns differently from others. His/her learning mathematics does not take place only in the school or classroom. He/she learns the mathematical concepts from the immediate environment. For example: while purchasing articles from the market the child uses the mathematical calculations in his/her own way. Similarly, the community is the store house of a variety of mathematical knowledge and the child learns those in an informal way. So while collecting assessment information regarding the child, you have to keep the following points in your mind.

- What kind of information should be collected?
- What are the sources to collect information while assessing the child?
- In what way the information can be collected?

Different literatures on assessment suggest that a wide range of information should be collected regarding the assessment objects. Guba and Lincoln (1981) suggest that the evaluation generates five kinds of information:

- a) descriptive information regarding the evaluation objectives,
- b) information about relevant issues,
- c) information responsive to concerns of relevant audiences (here the parents and the teachers),
- d) information about values,
- e) information about standards to merits,



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While assessing the learner's performance in mathematics, you have to know the evaluation objectives which are essentially associated with the expected learning outcomes. In elementary school years, the learning outcomes are focused on developing *useful capabilities* and also on developing the ability to think and reason mathematically. *Useful capabilities* include conceptual understanding and ability to understand and solve problems in the areas of numbers, number operations, fractions, shapes and spatial thinking, measurement, problem solving, patterns and data handling (NCERT, 2008).

Including the above capabilities, the process of assessment in mathematics includes five major dimensions of mathematical learning for which the probable tools and techniques to be used are suggested in the following table (Table 12.1).

Table 12.1 Tools and techniques of assessment of mathematics learning

Aspects to be assessed	Tools and techniques
Concepts and procedures	<ul style="list-style-type: none"> • Written, oral and performance tests and tasks. • Observation of interactions in classroom and elsewhere.
Mathematical reasoning	<ul style="list-style-type: none"> • Tests and/or tasks (written or oral) • Oral description of the process of solving any problem • Observation of interactions in the groups. • Observation of orderly approach to normal tasks.
Disposition towards mathematics	<ul style="list-style-type: none"> • Observing the participation of the child in different mathematical activities like mathematics exhibition, puzzles, games • Observation of learner's interest in collecting and preparing TLMs, reading articles relating to mathematics, Portfolios. • Child's participation in performing mathematical tasks.
Using mathematical knowledge to solve problems	<ul style="list-style-type: none"> • Written and oral tests. • Projects and assignments. • Observing learner in co-curricular activities.
Mathematical Communication	<ul style="list-style-type: none"> • Content analysis of communications (written articles, diagrams, pictures, and recorded interactions, portfolios) • Observation, interviews and interaction in the classroom and elsewhere.

**Check your progress:**

E1. Observe the table -1 given above and suggest tools and techniques to assess the following areas of mathematics learning in addition to those given in the table.

- a) Mathematical reasoning
- b) Concepts and procedures
- c) Mathematical communication

Only assessing learner's performance in mathematics is not sufficient, the learner's performance should be recorded and reported properly. Acquisition of individual learner's subject based knowledge; understanding and skills in mathematics can be recorded by the classroom teacher. Simultaneously the learner's attitude, interest towards mathematics learning should also be recorded. As we are focusing on the continuous and comprehensive evaluation (CCE), the recording of the learner's progress should go hand by hand with assessment. But the question may arise here that, how we can record the learner's performance in mathematics? What is the format to be used for recording the performance of the learner? In order to get answer to the questions we can analyze the situation given below:

Why is recording of assessment results necessary?

The main purpose of recording the assessment results is to monitor the learner's progress in different dimensions of development- achievement in scholastic areas, physical, cognitive, social, emotional, creativity and personality and such other areas indicative of a holistic growth and development. The record of assessment serves the requirements of different stakeholders:

- *It provides feedback to learner regarding his/ her progress along with the areas of his/her strength and weakness which in turn motivates for improving his/her learning.*
- *It provides information to teachers on the recent and the earlier results to estimate the trend of progress/development of the learner so as to make appropriate decisions regarding the management of teaching – learning activities for improvement and enrichment of students' learning.*
- *It intimates the parents regarding the status of learning growth of their child making them aware of the care to be taken in specific areas in which the child has problem and requires help and attention from the family.*
- *It is a permanent source for the administrators and planners of education basing on which the school effectiveness is evaluated and appropriate planning can be made for enhancement of quality of learning in the school.*

Besides these, reporting helps to present several attributes of each learner in the class which ordinarily is not possible to capture for a teacher on a single occasion. Small incidents about each learner recorded in different times when reviewed afterwards presents a holistic picture of the learners learning progress.



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Let us look into one classroom situation where a teacher is facing multiple challenges in recording the results of assessment of his students.

*Mr Ravi is an elementary school teacher, who teaches mathematics in the elementary classes. He is very resourceful. He uses different techniques to assess the learner's performance. Once during the teaching the concept of **fraction** he used the following tools and techniques to assess the learner's performance.*

- *He observed every individual learner's participation in the classroom discussion and records them in their individual profile.*
- *While the learners were engaged in different types of activities, he observed them how they are doing the tasks. Then he recorded individual learner's performance.*
- *He asked the learners to prepare materials and store those materials in portfolio. These materials demonstrated the learner's ability how they use and apply mathematics.*
- *After the completion of the unit, the teacher conducted a unit test. He put some written test items, oral questions in the unit test. Then after evaluating the papers he gave numerical scores to individual learner. He recorded these scores in the marks register meant for the class.*

On the basis of the case study given above now try to answer the following questions.

1. Why is it required to record of the learner's performance?
2. During the teaching of a particular concept, what did Mr Ravi assess and how did he record the assessment results?
3. In your school, how do you record the learner's performance in mathematics? Have you any format to record the performance?

No doubt, it is very important to record the progress of the learner after every conceptual area. In unit-16 of paper-3 you have already read about the recording procedure of the progress of the learners and the considerations in recording.

Check your progress:

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- E2. On the basis of your experience, write down the considerations in recording the learner's progress in mathematics.
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Different types of report cards are being used in different schools across the country. But the individual progress card to record the learner performance in mathematics suggested by the National Council for Educational Research & Training, New Delhi is given below.



Table 12.2 Record of Progress

Child's Name: Class:	Recording results of			
	Item-1	Item-2	Item-3	
<p>Conceptual Area</p> <ol style="list-style-type: none"> counting & concept of numbers recognition of numerals and knowledge of number names writing numerals grouping round tens and ones <p>Mathematical reasoning</p> <p>Is able to appreciate alternate ways of solving problem</p> <p>Is able to invent his own new problem</p> <p>Is able to help others at solving problems</p> <p>Is able to appreciate source of others.</p> <p>Is able to use mathematical reasoning in other curricular area</p> <p>Mathematical Communication</p> <p>is able to explain why she did and hy/ how she solved the problem</p> <p>Is able to listen and follow explanations and solutions given by others</p> <p>Attitudes and Dispositions</p> <p>Is confident and willing to attempt new problems</p> <p>Is willing to persist with problems and does not give up too easily</p> <p>Seeks out and solves new problems.</p> <p>Enjoys doing mathematical problems</p>				

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(Source: Source Book on Assessment for Class I-V, Mathematics by NCERT)



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On the basis of the recording format given above, try to answer the questions given below.

1. In which content areas the learning progress of the learner can be recorded in this format?
2. What dimensions of mathematical reasoning can be assessed and recorded through this progress card?
3. What do you mean by mathematical communication? Is it necessary to assess the learner's skill in mathematical communication?
4. Are you assessing and recording the learner's progress in the areas like mathematical communication, learner's attitudes & disposition towards mathematics learning and his mathematical reasoning in your school?

While recording the learner's progress in this progress card you have to be cautious in the following aspects.

- You have to finalize the specific conceptual areas in which you want to assess the learner's performance.
- You have to conduct activities on that conceptual area, so that during the process of working you can assess the learner's performance.
- Acquisition of knowledge, understanding and skills in conceptual areas can be reflected in the progress card in the form of marks or grades. Task based assessments is emphasized, no assessment would be complete without paper-pencil tasks on worksheets.
- In addition, the common features on the specific content areas (aspects of mathematical reasoning, communication and attitudes) need to be observed objectively and recorded in appropriate form.

Not only the recording in this progress card will help you to get a holistic picture on the child's performance and learning progress, but the collection of material like teacher's analytical notes, sample of child's work, special work sheets designed to teach as well as assess can help you. Formal notes in the form of written records may be kept by you for future reference, but ongoing classroom observation in the form of mental notes you make as you teach and while children work should be a part of assessment.

**ACTIVITY -1**

An activity is given below. Read it carefully. Then note down the conceptual area(s) to which the activity relates. How this activity will help you to assess the learner's performance?

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.....

.....



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Divide the children of the classes into small groups of 4/5. Give a collection of shapes (either only 3-D, or only 2-D, or mixed) to each group. Ask them to list those having a particular attribute.

- a. Which of the following shapes have more than 3 vertices?
- b. Which have a curved face?
- c. Which of them have at least one pair of sides equal?

Such type of recording can give a comprehensive picture (qualitative description of learner performance in mathematics) of the learner’s progress. Besides, recording format to compare the performance (in the form of marks secured by the children in summative tests) of all the children can be developed by the teacher. Such type of recording format is very common and used in our schools as mark registers.



ACTIVITY -2

Take any conceptual area(s) in mathematics from any class. Design learning activities on those conceptual areas. Allow your children to do those activities. Record the progress of individual child in a suitable recording format.

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12.3 IDENTIFICATION OF ISSUES IN MATHEMATICS LEARNING

Only recording the performances of the children is not sufficient and can not solve the purpose of assessment, rather its utility to plan for further learning of individual child is very important. So the reporting system should not be confined to the papers only. That should be designed to serve a variety of functions in the school. These include planning for instructional uses, reports to parents and other stakeholders. In this section you will read about the use of assessment results. The use of assessment results will focus on three major heads:

- i. Identifying strengths and weaknesses from the assessment results
- ii. Identifying and addressing typical problems in mathematics learning
- iii. Providing feedback to learners, parents and other stakeholders

12.3.1 Identifying Strengths and Weaknesses

Once the record is filled in and ready, you have to analyze the data critically. Here the recording of the assessment results of two teachers are given. Compare both the recording done by both the teachers carefully.



Notes

Teacher-A

Aditi conducted an assessment on some selected conceptual areas of mathematics in class-V. She recorded the performance of the children as follows:

Table 12.3 Recording of assessment results

Sl no	Name of the child	Marks obtained by students			
		Oral (10)	Written (30)	Performance (10)	Total (50)
1	Sony	6	23	6	35
2	Sujata	9	24	8	41
3	Harish	3	12	5	20
4	John	5	19	9	26
5	Gabriela	8	16	4	28

Teacher-B

Sneha analyzed the same assessment activity in different way. She recorded the performances of the children as follow.

Table 12.4

Sl no	Name of the child	Marks obtained by students					Total (50)
		Fractions as part of a whole (10)	Fractions as part of a collection (10)	Fractions as division (10)	understanding equivalence of fractions (10)	Estimating fractional quantities (10)	
1	Sony	10	9	8	6	2	35
2	Sujata	10	10	7	10	4	41
3	Harish	7	6	5	2	0	20
4	John	7	7	6	4	2	26
5	Gabriela	8	8	6	4	2	28

Have you observed the difference between the two ways of recording of learner achievement?

In which aspects the first type of recording is different from the second one?

In the recording done by Mrs Aditi, the strengths and weaknesses of individual learner with respect to mode of responses to the test item can be obtained. But in the second



format, Mrs Sneha presented the assessment results with respect to conceptual areas given in the syllabus. In the second case, the teacher tries to analyze item wise, so that she can be able to identify the conceptual area which the child has not mastered. On the basis of the strengths and weaknesses of the child, plan for further learning can be made. So it is important on the part of the teacher to record the learning performances in such a way that he /she can get a comprehensive picture of each child's learning performances.

Identifying the strengths and weaknesses of individual learner from the recording helps the teacher in the following ways:

- The learner can be motivated to learn those concepts which he has not mastered. Different learning experiences may be provided to the individual child to learn those concepts which he has not understood.
- Those children who have mastered a particular concept may be engaged in a variety of ways such as: helping other children to learn the concept, developing TLMs on the concept, assisting the teacher in other classroom activities.
- Students with good mathematical communication skills and positive attitude towards mathematics learning may be engaged in leading learning of mathematics, in different types of mathematical activities like organization of mathematics club, mathematics exhibition etc.



ACTIVITY-3

*Develop a unit test for class-V children in mathematics on the concept areas of **fraction**. Administer that test to class V children of your school. Identify the strength and weakness of individual child after proper recording of their learning outcomes. Prepare a short report how you will use the results.*

.....

.....

.....

12.3.2 Identifying and Addressing Typical Problems

During learning mathematics some children face peculiar difficulties in some situations. Such difficulties can not be identified from the reporting formats discussed earlier in the Tables no-2, 3 & 4. Those peculiar mistakes committed by the children can not be reflected in marks and grades. Let us observe the case study given below:

Mahesh is a class III student in a primary school. While learning the concept of 'number name and writing the numbers', he commits some mistakes frequently.



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Once the teacher calls a number name and asked Mahesh to write the number like 103, 210 123. In response Mahesh wrote the numbers like 1003, 20010 and 10023 respectively. The teacher gave Mahesh zero mark and recorded the mark in his progress card.

You might have observed that Mahesh was unable to write the three digit numbers correctly. But the peculiar problems can not be identified from the marks or the progress report card.

In mathematics learning at the early school level, students commit several errors which are broadly of five types:

- Reading errors (R) - committed if the child could not read a key word or symbol in the written problem to the extent that this prevented him/her from proceeding further along an appropriate problem-solving path
- Comprehension errors (C) - committed when the child had been able to read all the words in the question, but had not grasped the overall meaning of the words and, therefore, was unable to proceed further along an appropriate problem-solving path.
- Transformation errors (T) - committed when the child had understood what the questions wanted him/her to find out but was unable to identify the operation, or sequence of operations, needed to solve the problem.
- Process skills errors (P) - committed when the child identified an appropriate operation, or sequence of operations, but did not know the procedures necessary to carry out these operations accurately.
- Encoding errors (E) - committed when the child correctly worked out the solution to a problem, but could not express this solution in an acceptable written form.

Newman(1977) suggested a diagnostic process of structured interview to identify the typical mistakes in mathematics learning committed by the learner . Such type of errors committed by the learners should be identified at the right time and appropriate interventions may be given to rectify them. Therefore, you should observe each child during the teaching-learning process. When you suspect that some children are committing typical errors over a period of time, you have to use further diagnostic processes to identify the errors. You may record these results using codes or descriptive sentences.

Check your progress:

-
- E3. Give one example in mathematics where children face typical problem. As a teacher what type of support would you like to provide to that child?
- E4. Give one example of each of the five types of errors committed by children in primary classes.
-



12.3.3 Providing Feedback

Helping the students and parents to take the decision on the basis of learning outcome is a part of the school evaluation system. A particular decision may depend upon specific information. So a viable reporting system should be in place to help the learner, his/her parents and other stakeholders to use the assessment outcomes. After discussing the reporting procedure, we shall look at who needs information and how these people use it.

(I) Feedback to the learners:

Learner is at the centre stage of all educational activities in the school. All the educational activities are planned according to the need and interest of the learner. Therefore, there has been increased emphasis in education on the importance of feedback to learners. The feedback to the learner is basically of two folds: to which level he/she has achieved the educational objectives and the way of communication of this information to them.

On the basis of the assessment outcomes, the child may be empowered to take decisions for his learning in mathematics. They may be guided to take right decisions in the following areas:

- The knowledge of learning achievement improves subsequent learning. The learner may be guided to take decision on the nature of curricular preparation.
- In which conceptual areas the child has specific learning difficulties should be informed to the learner. If the learner is doing mistakes in the division of fractional number, he/she need not be once again oriented on all the concepts of fractional number, rather he/she may be provided with additional instruction to perform division operations only.
- On the basis of the learning outcomes, the teacher may identify specific learning difficulties of individual learner. On the basis of that, daily interaction between the teacher and the student may be done. This will help the learner to be motivated to learn.
- Though the results of the formative assessment provide periodical feedback to the learner to identify his/her problems and eradicate the problems, on the other hand summative assessment helps the learner to take long term plan for improving the performance in mathematics.

Mathematics is the school subject in which the children are subjected to demonstrate very high level performance by the parents and teachers irrespective of their levels of capacity to learn. Therefore, while providing feedback on mathematics to the young learners, you need to be extremely careful on the following aspects:

- The results of assessment should be provided correctly and accurately without any change.



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- The feedback should be conveyed to the learner individually and not in groups as far as possible.
- No disparaging comment should be given on poor performance by the learner.
- You should discuss with the learner in a very cordial and encouraging manner as to the ways of improving his/her further performance.
- Be honest with the learners. Do not adopt any pretension while providing feedback.

(II) Feedback to the parents

We have already discussed the system of record keeping of student's progress. Further the information regarding student progress needs to be systematically reported. Section 24(d) & 24(e) of the Right of Children to Free and Compulsory Education Act, 2009 states

A teacher appointed under sub-section (1) of section 23 will perform the following duties, namely;-

- (d) Assess the learning ability of each child and accordingly supplement additional instructions, if any, as required;*
- (e) Hold regular meetings with parents and guardians and appraise them about the regularity in attendance, ability to learn, progress made in learning and other relevant information about the child*

It is clear that, the teacher has to appraise the parents regarding the progress of the child in learning in the meetings. On the other hand, Parents also need to know how their children are doing in school and good reporting practices should result in improved relations between home and school. Reporting to parents on learning progress in mathematics can enable them

- To know to what extent the child has learned,
- To take care of the study at home,
- To monitor whether the child is doing the mathematical projects activities, homework given to him by the school,
- To discuss with the teachers on student's learning and development,
- To help the child by providing with other reference books and supporting materials.

Now the question may arise here what are different methods to appraise the parents about the child's progress and learning. No doubt, the progress card (written communication) can help the parents to get an information regarding child's learning and progress. But a comprehensive reporting system covers a variety of ways. Convening parent-teacher meetings, meeting of the Mother-Teacher Association (MTA) to discuss and share the learning outcome is very helpful. The parent-teacher meeting can act as an important supplement to the written report of student's progress.

While preparing and conducting the parents meeting to appraise them about the child's progress in learning mathematics the following points may be kept in mind:



Table 12.5 Considerations for parent-teacher meeting

What to do in the meeting?	Description
Teacher has to make plan for the meeting	<ul style="list-style-type: none"> ● the venue and timing of the meeting, ● what type of information regarding the child to be communicated. ● Organizing information well in advance what you are going to present before them. ● arrangement of written assignments and portfolio of the child that to be shown to the parents
Begin the meeting in a positive manner	<ul style="list-style-type: none"> ● welcome them to the meeting so that they will feel comfortable ● make positive comment on the child's performance
Presenting the student's strong points first	<ul style="list-style-type: none"> ● give appropriate examples on the student's strength ● show the parents evidence of students performance e.g. portfolio, pictures, projects, written assignments ● comparison of the improvement in two assessment event
Encourage parents to participate and share	<ul style="list-style-type: none"> ● listening the parents carefully ● noting down what are their expectations ● get information about the child's activities at home
Plan a course of action cooperatively	<ul style="list-style-type: none"> ● appraise them what they will do at their home ● say them how they can support their child
Using good human skills during the meeting	<ul style="list-style-type: none"> ● explaining in understandable words, try to avoid technical terms ● willing to accept their feelings , do not reject their suggestions ● do not compare one child's performance with another

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(III) Feedback to other stakeholders:

The learning achievements in mathematics are also providing useful feedback to the administrators, teachers, monitoring personnel.

- You, as the mathematics teacher, need to evaluate your own strengths and weaknesses which might have some impact on the performance of the learner. If the learners are doing well in some aspects of a conceptual area, but poorly in others, you need to examine your instructional procedure.
- The summative assessment outcomes indicate the effectiveness of the school and teacher. On the basis of the results, planning for teacher capacity building in mathematics may be made. In which areas of the content the teachers need content upgradation programme and what type of pedagogical skills they required.
- Learner's performances in mathematics provide useful feedback to take decisions regarding types of materials required for the teachers and learners in mathematics. The learner's behavior gives insight to review the vision of mathematics learning, the nature of textbook, the instructional strategies and the assessment procedure to be adopted by the school and the state authorities.
- The planning for monitoring of the teacher's activity and providing need based on-site support to the teacher can be obtained from the assessment outcomes of the learners.

Parents, teachers and administrators should work as partners in the learning of the child. The assessment outcomes provide feedback to all the partners. On the basis of the outcomes they should jointly plan for a better mathematics education in the schools.

12.4 FOLLOW UP MEASURES OF ASSESSMENT IN MATHEMATICS

You have already read about remediation in unit-16 of paper-3. Diagnosing students learning difficulties involves two levels of evaluation. First, students who need some form of remediation must be identified. Consistently poor performance in mathematics implies the need to intervene and modify student behavior. Second, the specific areas of weakness must be determined. One example of a class may be taken:

In a class during the teaching of division of fractions the following weaknesses were observed. Some children faced problem to divide a proper fraction with another proper fraction. Three/ four students performed the operation correctly, but can not communicate the operation correctly while some children found problem in dividing a proper fraction by 1.

After careful observation of the problems of the learners, the teacher can go for extensive diagnostic testing. Then the specific learning difficulties of individual learner may be



identified and noted in his personal profile. The teacher may plan for providing remedial activities to the learner to overcome his learning difficulties.

Item analysis data can also provide a basis for remedial work in mathematics. Though the test results in a class can clarify and correct many specific points, item analysis frequently brings to light general areas of weakness requiring more focused attention. On the basis of the specific learning difficulties of the learner, the teacher may revisit particular concepts. Item analysis may indicate a general weakness, in understanding principles or in the ability to interpret the data in a word problem in mathematics. Such information makes it possible to focus remedial work directly on the particular areas of weakness.

Nature of the remedial activities: After diagnosis of the specific learning difficulties of the learner the teacher has to plan for remedial activities to overcome the learning difficulties and help him/her in learning. The remedial activities could focus on the following:

- Individualized in nature.
- More interesting and provides alternate learning experience to the child i.e. different learning experience from the earlier one
- Based on the experience of the child.
- More material intensive.
- Presented in step wise. The task may be broken into smaller steps, where after each step the learning progress can be assessed.

Enrichment activities in mathematics: Like the children with learning difficulties, there are some children who are doing well. The teacher should help those children to enrich their potential. A conducive and enriched environment may be provided to those children so they can learn to optimize their ability. The nature of enrichment activities are follows:

- The activities involve higher order thinking.
- As far as possible open ended items may be given as enriched activities for them.
- While performing mathematical calculations, the time may be delimited for those children. Some times within a specific time period, they may be asked to solve more problems.
- The children may be encouraged to find alternate solutions to a given problem and formulate more mathematical problems as a part of enrichment activity.

This is how the recording and reporting of learning outcomes in mathematics can be done and used in our schools. A well designed recording and reporting practice can be



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helpful in creating a conducive learning environment in the school. The assessment results can be best utilized with a scientific recording and reporting system. The teacher can plan for optimizing the learning of individual learner on the basis of the outcomes.

12.5 LET US SUM UP

The main points of the unit are summarized here:

- In the primary class mathematics, the focus of assessment would be on understanding of how children learn mathematics, understanding the mathematical concepts and understanding now the child understands mathematics.
- Not a single tool or technique can help the teacher to assess all the dimensions. Tools and techniques like written and oral test, assignment, portfolio, project, observation etc can be used to assess learning progress.
- The teacher can collect information regarding the learning progress of the child through continuous observation during learning, performing home tasks and assignments and other activities.
- Recording is a process of systematic documentation of evidences of student's learning performance and progress in different school subjects gathered by using various tools and techniques.
- While recording the learner's performance in mathematics learning, the performance of the child in conceptual area, mathematical reasoning, mathematical communication, attitude and disposition have to be evaluated and recorded.
- The outcomes of learner's performance have to be shared among parents, teachers and other stakeholders.
- Individual strengths and weaknesses can be identifies and those can be used for planning learning experiences.
- After identifying difficulties, remediation programme may be planned for those children who have specific learning difficulties.

12.6 MODEL ANSWERS TO CHECK YOUR PROGRESS

E2. While recording the learner's progress the following points should be kept in mind:

- Recording has to be done individually.
- The recording format may vary depending upon the nature of data.
- Recording should be objective, continuous, valid and simple.



- Recording may be done in such a manner so that the stakeholders can get enough information from that.
- Recording should reflect both the quantitative data as well as qualitative description of learner's performance in mathematics learning.

E3. During the learning of mathematics, some children face typical problem in column wise additions. For example

$$\begin{array}{r} 14 \\ + 8 \\ \hline 94 \end{array}$$

Such type of problems may be arising due to the non-comprehension of the place-value concept. In this case, the child should provide with the concept of tens and ones with the help of concrete materials. Then the concept of column wise addition may be given.

12.7 SUGGESTED READINGS & REFERENCES

CBSE (2010). *Continuous and comprehensive evaluation-manual for teachers classes VI to VII*. New Delhi: CBSE.

Gronlund, N.E. and Linn, R.L. (2000). *Measurement and assessment in teaching*. Singapore: Pearson Education,

NCERT. (2008), *Source book on assessment for classes I – V: Mathematics*. New Delhi: NCERT.

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12.8 UNIT- END EXERCISES

1. Differentiate between recording and reporting.
2. Discuss the implications of reporting for teachers, parents and learners.
3. How would the progress chart benefit you as a teacher?