4

Assessment Integrated with Learning of Mathematics at Elementary Stage

Dr A. K. Rajput*

ABSTRACT

A paradigm shift is suggested in teaching processes at school levels in the National Curriculum Framework-2005. It is suggested that teachers should facilitate learning and should be able to create an environment for experiential learning. The learners in this era of technological advances have more number of learning resources in comparison to those just a decade ago. Children not only learn from the interactions that take place in the classroom, but also outside the classroom. So the learning takes place continuously as a result of interactions between the child and the environment provided. When learning is a continuous process and results after each and every experience that a child has, the assessment of learning should also be done continuously. In mathematics learning, it is more important as, by nature, mathematics is sequential, i.e., a concept cannot be learnt without understanding the prior related concepts. In present paper it is intended to give some ideas to teachers of elementary mathematics to integrate assessment with classroom interactions.

In teaching-learning process, it is pertinent to know how learning is taking place and finally how much children have learnt. For this purpose generally the terms like assessment, evaluation and grading are used. These terms are related but not the same. Assessment emphasises finding out what students know and can do and recording that information in a suitable form. Evaluation refers to the criteria for judging different levels of proficiency or performance. After gathering and recording students' performance the grading of the performance is required like whether the performance is excellent, satisfactory or needs improvement. Grading involves reporting the result of evaluation in some conventional manner like A, B, C … or percentages, etc. In general, grades reflect about

**Associate Professor*, Mathematics, PMD, NCERT, New Delhi-110016

assessment and evaluation, but traditional grading schemes actually say little about what specific skills or concepts the child has learnt.

For a teacher the collection of information about student learning is much more important. When determining grades, teacher should develop grading plans that reflect performance of students on instructional objectives. After students had adequate time and experience to learn concepts and skills, assessment is done to validate that learning. Grading can emphasise the mastery of understanding at the end of instruction because learning is gradual and cumulative.

Assessment carried out during the learning of a skill is referred to as formative assessments. Observations, interviews, daily class and home works, projects done (individually or in groups) are some of the commonly adopted ways of continually checking student skills and understanding. When students have had extensive experience with a skill or concept summative evaluation draw a conclusion about the achieved level of mastery. Summative evaluation is most appropriate to use for making grading and reporting decisions.

The above discussion reflects importance of assessment and also differentiates the three terms used. Ms Anjali, a teacher at primary grades, had designed some tasks for the learning objective — 'the student understands the strategies of addition of two like fractions'.

As a concrete task she folds a paper to show $\frac{1}{8}$ and $\frac{3}{8}$. Then for addition of these fractions she asked students to count the parts of the whole representing both the fractions to reach at the conclusion that $\frac{1}{8}+\frac{3}{8}=\frac{4}{8}$. Similarly she gave a round paper sheet to a group of students and asked them to model $\frac{2}{6}+\frac{3}{6}=\frac{5}{6}$. She then asks students if they know a rule for adding two like fractions. Then the students were asked to show sum of two fractions of learner's choice by paper folding. Ms. Anjali formed this performance task to assess at the concrete level of representation. She then gave pictures of fractions illustrating $\frac{3}{11}$ and $\frac{5}{11}$ and asked students to paint another figure divided into 11 equal parts, to show the sum by using the rule and explain the rule. This task she gave to assess the learning through pictorial representation. After such experiences to learners, she provided another experience for learning to students by way of addition sums $\frac{2}{7}+\frac{3}{7}, \frac{1}{4}+\frac{3}{4},$, $\frac{2}{5}+\frac{3}{7}, \frac{3}{8}+\frac{2}{6}, \frac{5}{13}+\frac{4}{13}$, etc.

She asked students to circle all the sums that show the rule of adding like fractions. She further asks students to write more sums that show rule. She then goes beyond basic addition facts and ask students

to tell the sum of the other fractions having difficult to be represented by concrete objects or pictures like $\frac{2}{710}+\frac{305}{710}, \frac{1102}{10000}+\frac{701}{10000}$, etc.

She also asked questions like: How did you think about this problem? How did you know the answer? and then she asked to give some more examples for the rule. These tasks were designed by her to assess the symbolic levels of representation. In the sequence she asked learners to solve her problem "One day she bought two pizzas of same size for her family. Each pizza was divided into 8 equal parts. Her daughter ate half of the pizza and son took 5 parts. How much of the pizza both children ate?" She allowed learners to use any of the methods they find easier. With this task she wanted to assess the application and problem-solving skill of the learners. At each stage she might get an idea about the performance levels of students, through carefully designed performance tasks at different instructional levels like concrete, pictorial, symbolic and problem-solving.

In framing the performance tasks, the teacher also chooses which ways are to be used to gather information about the performance. Most commonly used ways include observation, interviews, guided or independent practice, quizzes, projects, problem-solving tasks and portfolios.

The teacher watches while children perform a mathematical task or work on manipulatives. During classroom interaction, teachers observe which children are being successful with skill or concept. Careful observations not only help teachers in assessing the way children learn but also useful in finding the levels of learning at which each child is.

As a common practice the teachers ask children to explain and show what they know, some time casually during instruction. Interviewing is normally conducted in a one-to-one setting. This helps in understanding the child's thinking process. Structured interviews combined with observation allow students to show and tell what they understand. For example, when a child adds fractions like $\frac{1}{2}$ and $\frac{1}{3}$, what process she/he adopted? How she/he reached to the final conclusion? Huinker (1993) described the importance of interviews in assessment of mathematical learning in following words, "Advantage of using interviews includes the opportunity to delve deeply into students' thinking and reasoning, to better determine their level of understanding, to diagnose misconceptions, and to assess their verbal ability to communicate mathematical knowledge. An additional benefit of using interview occurs as students provide detailed information about what they are thinking and doing."

Quizzes form another tool for evaluation related to one or more objective, usually toward the end of an instructional unit when children are well prepared to show mastery. Students involved in framing questions, providing solutions and scoring the results of quizzes give a better idea of students' learning.

As students become more extensively involved in problem- solving activities, assessment of individual and group problem-solving skills give a better idea of student learning. These activities should be monitored while the students are engaged in an activity in problem-solving, so teacher can assess and evaluate the process as well as any finished product. A child may be put in situation where they need to use the mathematics they learned. For example, at primary level children may be asked to form games on addition and subtraction of numbers. At upper primary stage children's interest in pets and challenges can be used for problem-solving like the one given below:

"You have to build a kennel for new puppy you brought in. You have an open space of 10m by 15m, and 45m of wire fence. If you use whole numbers what different sizes of rectangular kennels can you make? Which shape will give your dog the most space inside the kennel? Which kennel would you make for your dog? Explain why you selected your kennel."

In this type of problems-solving task teacher can get adequate idea of students learning about perimeter and area of rectangular shapes. The practice problems that are given to a learner provide more information about learning levels.

Another important way of assessing children's learning during teaching is monitoring of daily class and home work to see if children are being accurate and successful. The focus should not be upon grading, but upon seeing where the problems or misunderstandings are. Analysing students' errors provide a window to look into their learning process.

The assessment portfolios include both student and teacher selected materials like textbook assignments, worksheet, drawings, tables, graphs, designs, description of individual and group problem-solving and project tasks. These provide specific evidence of a student's growth in attitude, reasoning, computational skills, use of problem-solving strategies, written and oral communication, and relationship between mathematics and other topics and events. Moreover, a child's portfolio reflects the way she/he is progressing in learning mathematics.

Self assessment by learners is another commonly used tool during teaching-learning process. Anderson (1993) has mentioned in his treatise *Assessment in the Mathematics Classrooms.* When assessment is perceived exclusively as teachers' domain students willingly wait for the teacher to judge their success or failure. When the emphasis

seem to be on external judgement, learners assume that they cannot and should not be decision-makers. Assessment exclusively by one judge leads children to forfeit their autonomy and self-validation. In contrast, when children continually participate in the assessment process, they learn to recognise their own expertise. As active assessors, they necessarily exercise a more autonomous and decision-making role in their learning. The remarks made by Anderson (1993) support the achievement of the goal of mathematics to help learners believe, they are successful and feel more confident about mathematics. That is why, questions having multiple correct answers are required to be put in while teaching and designing performance tasks. For example, the questions like "what are two numbers whose sum is 27?" has an edge over the questions like "what is sum of 15 and 12?" In the former case there are many correct answers to the problem. The child who answers correctly will have confidence of being discovering the solution and answer. Thus, for any performance task learners may be asked to develop their own evaluation scheme. This will also help teachers to be fairer in assessment and evaluation process.

With the change in teaching-learning process during last few years, it is important to bring change in the nature of assessment in school mathematics. This reliance of assessment and evaluation on assignments from book and information from standardized and textbook tests is no longer sufficient to assess learning. Moreover, in many cases such reliance may be detrimental to learning. This is, therefore, important and necessary to organise assessment as an integrated part of learning process and classroom interactions.

References

Anderson, A. 1993. Assessment: a means to empower children. In N.L. Webb (Ed.), *Assessment in the Mathematics Classrooms: 1993 Yearbook*. Reston, VA, NCTM, p. 103.

Huinker, D.M. 1993. Interviews: A window to students' conceptual knowledge of operations. In N.L. Webb (Ed.), *Assessment in the Mathematics Classrooms: 1993 Yearbook*. Reston, VA, NCTM, p. 80.

National Curriculum Framework. 2005. National Council of Educational Research and Training, New Delhi.