

*Mathematics Assessment in Primary Classes – Formative or Summative,
or Seize the Moment*

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Abstract

There is a need to move away from the present day conflicts and tensions that surround formative and summative assessments. Much assessment is happening in the primary mathematics classrooms which is informal, spontaneous and is often undertaken as the normal process of teaching rather than under the overemphasized aegis of formative or summative assessments. The type of professional judgements made instantly by the teacher when she seizes a 'teachable moment' on the run in a busy classroom by assessing the situation the child is in and giving immediate feedback, during the normal course of teaching, often go unnoticed. It is this quality of the teaching practice which makes the teacher help the child to take small steps to go to the next higher level of understanding, and is the need of the hour and not assessments in their formative or summative disguise. Based on research from India and overseas, some causes of the perceived tensions between the formative and summative functions of the assessments are explored and aspects of quality assessment practice in primary mathematics are looked at in this paper.

Keywords: Assessment, formative, summative, teaching practice, primary classrooms, feedback

1. INTRODUCTION

For over a quarter of a century, assessment practices have been an on-going focus of educational research so much so that in this period of time numerous new tools have been developed and the focus of curriculum has leaned towards the learning outcomes in the classrooms (Black & Wiliam, 2003). In fact, for most of the last century, assessment was seen as a way of finding out what students had learnt. Teachers, researchers and people in general argued about different forms of conducting assessments like portfolios, standardized tests, year end and terminal examinations, etc because seemingly there was a disagreement among them as to what they thought was important in education. The common point that stemmed up from these arguments was that they all agreed on assessments being primarily concerned with evaluating the effectiveness of instructions. Towards the end of the century people and researchers in the field of education began to look more intensely and systematically at the role of assessments in enhancing student learning instead of just measuring it and this led to the demarcation of its function as ‘assessment for learning’ and ‘assessment of learning’ (Gipps and Stobart, 1997).

The description of the formative and summative functions as ‘assessment for learning’ and ‘assessment of learning’ respectively is comparatively recent in educational thinking and arose from the view of learning that positions the child as an active agent in constructing his own learning. Central to this view is also the role of the teacher in providing a range of supports designed to maximise both the extent and the rate of learning.

Major shifts in assessment practice in the recent years are summarized in the following table.

Major Shifts in Assessment	
Away from Traditional Practice....	Toward.....
Atomised learning outcomes, student’s knowledge of specific facts and isolated skills	Assessing student’s full mathematical power
Treating assessment as independent of curriculum or instruction	Aligning assessment with curriculum and instruction
Regarding assessment as sporadic and conclusive	Regarding assessment as continual and recursive
Not permitting any discrimination between rote application of algorithms and conceptual thinking & reasoning	Designed to discriminate between the two
Basing inferences on restricted or isolated sources of evidence	Basing inferences on multiple sources of evidence

Restricting to use of only paper and pencil	Relying more on concrete materials, manipulatives and making knowledge connections
Making assessment process secret, exclusive and fixed	Making assessment process public, participatory and dynamic
Developing assessment by oneself	Developing a shared vision of what to assess and how to do it
Viewing students as objects of assessment	Viewing students as active participants in the assessment process
Simply indicating whether or not answers are correct	Communicating with students about their performance in continuous and comprehensive manner
Generally avoiding conversation and oral one to one discussion	Involving the child in a conversation and one to one discussion to explore her thinking

2. ASSESSMENT- IN CONTEXT TO PRIMARY CLASSROOMS

The term ‘assessment’ derives from the Latin word ‘assidere’ meaning ‘to sit beside’. In many respects this simple phrase tells a lot about the essence of assessment in the context of the primary school classroom. Its tone is soothing yet affirming and it points towards a bond based on mutual trust and understanding and reminds us that there should be a positive rather than a negative undertone between assessment and the process of teaching and learning in the school.

In the broadest sense assessment is concerned with the children’s progress and achievement. Classroom assessment may then be seen as the process of gathering, recording, interpreting, using and communicating information about a child’s progress (Harlen, Gipps, Broadfoot, Nuttal,1992)and achievement during the development of knowledge, concepts, skills and attitudes and sharing it with teachers, students, parents and other stakeholders. Assessment, therefore, involves much more than testing and is an on-going process that encompasses many formal and informal activities designed to monitor and improve teaching and learning in all areas of the curriculum.

An assessment activity can help learning if it provides information to be used as a feedback, by the teachers and by their pupils in assessing themselves and each other, to modify the teaching and learning activities in which they are engaged. When assessment is taken across the whole class, the teacher can gain insights into her own pedagogic practice which help her identify areas where she needs to focus more or alter her current practices.

The attitude towards becoming a learner of mathematics and towards mathematics itself are strongly formed by the nature of experiences children have while learning mathematics in primary classes and this in turn influences their motivation and ability to learn. This includes not only the abilities of computation, mathematical reasoning and problem solving but also the appreciation of the beauty of mathematics. The developmental concerns also require that we provide ample opportunity for children to show their mathematical understanding independent of school-learning based

symbolic representation. Hence several tasks, which are oral, require one-on-one interaction, and involving the use of materials, manipulatives and pictures are very important.

Even the child's statement 'I don't know' provides us is more valuable information, and we must not mark 'zero' for the question. In addition to telling us that the child does not know the answer, it does tell us that the child is confident and comfortable enough to say that she does not know.

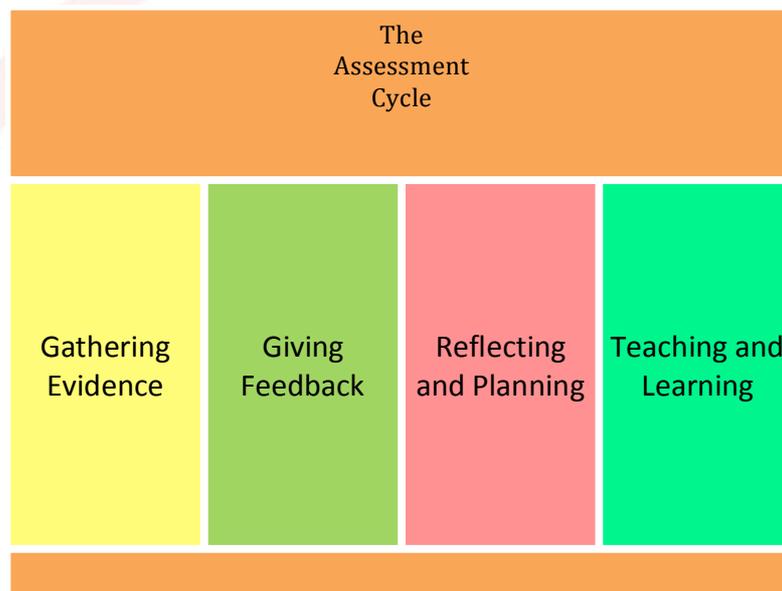


Figure 1

3. ASSESSMENT FOR LEARNING (FA) Vs ASSESSMENT OF LEARNING (SA)

The terms formative and summative were introduced by Michael Scriven almost 36 years ago (Scriven, 1967), and tracing the history of these terms and their various 'pluses and minuses' seems like a worthwhile exercise.

Scriven made the first distinction between Summative Assessment (SA) and Formative Assessment (FA) in terms of their being more related to interpretations and time. According to him the process of assessment is a single process and that FA is the same process as SA. In addition, for an assessment to be formative, it requires feedback which essentially would reduce the gap between the required standard and the quality of work produced. It also should indicate as to how the level of work can be improved to reach the required standard. So both SA and FA are both essentially the same process and differ only in the type of information that can be inferred at two different timings that can either lead to changing the set of instructions leading to better learning or can lead to a cumulative judgement about the learning that took place at the end of the program.

According to Black et.al (2004) assessment for learning is any assessment for which the first priority in its design and practice is to serve the purpose of promoting pupils' learning. It thus differs from assessment of learning which is primarily designed to serve purposes of accountability, or of ranking, or of certifying competence or learning outcomes..

The available research evidence increasingly suggests that formative assessment is more effective in terms of achieving learning outcomes (William & Thompson, 2007). The enormous volume of research advocating assessments for learning have led to a splurge in the products and services disguising themselves as ‘formative assessments’ but practically they contain very little in essence of what makes up the formative functions of assessment (Shepard, 2007). There has been a substantial increase in the advocacy of assessment for learning and it is increasingly being recommended, but regarding its relationship to summative assessment, there is much that has to come in as yet (Taras, 2005a).

Regarding the position of assessments of learning or summative assessments in the recent years – it seems that teachers are strongly against the notion of this type of assessment. Biggs (1998) however has tried to argue that summative assessments should be seen as a part of a comprehensive assessment plan and that it does have a very important role to play in classroom assessments. He advocated this by using graded portfolios as a form of summative assessment as well as formative assessment and through this suggested that whether an assessment was formative or summative was largely a matter of ‘timing’. Samples of students’ works collected at the end of a teaching sequence can perform a summative function providing a record at one point of time. In contrast, collected during a teaching sequence, the same sample could provide formative information helping the teacher to improve her planning.

4. CONFLICTS

Educational assessments are conducted in a variety of ways and their outcomes can be used for a variety of purposes. There are differences in who decides what is to be assessed, who carries out the assessment, where the assessment takes place, how the resulting responses made by students are scored and interpreted, and what happens as a result. In particular, each of these can be the responsibility of those who teach the students, while at the other extreme, all can be carried out by an external agency. Apart from these, there are also differences in the purposes that assessments serve. For example, it is often widely assumed that the role of classroom assessment should be limited to supporting learning and all assessments with which we can hold educational institutions to account must be conducted by an external agency, even though in some countries, this is not the case. However, the fact that the different functions that assessments may serve are in tension, is quite evident.

Many educationists have come forth with the argument that in order for these tensions and conflicts to be resolved, a unitary assessment system cannot suffice to serve all functions and that distinct systems are required. No matter how suggestive the argument in favor of this suggestion may be, it seems that it must not be given in to because the consequences are so non-conducive for learning. Separate assessment systems result either in the exclusion of teachers from summative assessments, or requiring them to operate parallel but distinct assessment systems for summative and formative functions, which almost always results in the marginalization of the formative function (Black & William, 2004).

Perhaps the most injurious aspect is that FA is seen as a magic formula which is not only separate and distinct from SA, but incompatible with it. This is the perceived

'tension' between SA and FA (Taras,2005a). The advocacy of FA over SA is not only becoming fashionable but elitist too and in the humorous yet hard hitting words of Taras (2005,b)- ' FA is the antiseptic version of assessment and SA has come to represent all the negative social aspects.'

There is a need to dissolve the tension between SA and FA by whichever way possible but it seems like a major undertaking and cannot be handled by isolated arguments. There must be a denial to accept SA and FA as being insoluble with each other (Wiliam, 2000b). There are reports suggesting teachers refuse to separate FA and SA and that evidence collected from teachers suggest that there is usefulness in using summative assessment for formative purposes (Black *et al.*, 2004).

This development means that the current frameworks of assessment require teachers to repeat and duplicate the assessment process if both SA and FA are needed (Black, 2003; Torrance, 1993; Wiliam, 2000b ; Wiliam and Black, 1996). The perceived necessity of duplicating assessment has been prohibitive to the development of FA: teachers, already harassed and overstretched, will not willingly agree to double their workload. Indeed, Black (2003c, p. 1) states that the teachers were persuaded to take on FA as 'extra work'.

Furthermore: experience in many countries indicates that very few teachers are able or willing to operate parallel assessment systems - one designed to serve a 'summative' function and one designed to serve a 'formative' function. (Wiliam, 2000b)

The current issue of the Central Board of Secondary Education (CBSE) recommending three FAs and one SA in primary classes in each term, in the name of Continuous and Comprehensive Evaluations (CCE) in India has evoked a lot of discussion around assessments in the country. Eighteen teachers from six South Delhi private schools who have started following these CBSE guidelines when interviewed, clearly stated that the new system under the CCE would definitely increase the workload of the teachers, much of which could have been utilized in concrete classroom activities instead. Thirteen of them felt that formative assessments were actually summative assessments and would hardly improve the child's learning even if feedback is given and that the decisions taken by the teacher within the classroom to modify her own methodology are much more effective than any assessment taken even at the end of the teaching unit. These teachers were qualified mathematics teachers from schools which are reputed to be progressive.

5. SEIZE THE MOMENT!

True assessment tells you why something went wrong. The only way for remediation is by observing the child's failure and trying to understand it. The whole idea of observing the child is to pin-point areas of difficulty and also the level of difficulty which the child is facing while working on a problem and that is the essence of assessment. For assessment to be truly effective and meaningful for the child it is the moment of identification of the problem and thereafter the immediate remediation which are of significance to the child. Added to it is also the pleasure or the sense of victory for the child that he has been able to 'crack the problem'. These are very 'encashable moments' for the teacher without her having to wait for the test results to

be consolidated and a formal feedback to be given. At the same time it is given to the child as 'a matter of fact' and not with the usual frills or threats of regular assessments when the child is aware that he is being assessed. A timely contact at the right moment with the child to give a push can make all the difference serving as a motivating factor jolting the student into action, to getting the grey cells in his brain activated over the task in hand. And all this in the least threatening way!

A grade 4 teacher in a class of fractions asked the students to write out what fraction of the figure was shaded. The figure (1a) was a rectangle with 4 equal bands with one band shaded. One of the students wrote $\frac{1}{3}$. The teacher seeing this decided to ask the students to shade $\frac{1}{3}$ of another figure (1b), a rectangle with three equal bands, immediately after. The child did this correctly and instantly went back to the previous problem to rub out the wrong answer and write $\frac{1}{4}$.



(1a)



(1b)

Figure 1

The teacher had helped the child correct himself without explaining anything but intelligently giving another problem which would make the child realise his mistake and rectify his mistake.

It also happens quite often that the teacher finds a student engaged in a learning task prescribed by her and as a response to the child's difficulty in doing the particular task gets into a 'dialogue' with the child. The discussion that follows makes the child change her actions to arrive at the solution. Primary teachers perceive this kind of an activity as a normal process of teaching rather than feedback from assessment. This is instant feedback that has helped the child learn.

In the words of Wiliam (2000) there are moments that arise continuously in classroom teaching, where teachers are constantly having to make sense of students' responses, interpreting them in terms of learning needs, and making appropriate responses. But they also arise when the teacher circulates around the classroom, looking at individual students' work, observing the extent to which the students are involved in the activity especially in the teaching of mathematics. Such reflective moments in education, in which the teacher contemplates what has passed and what is still to come, are important.

Spontaneous assessment may be anticipated by the instructor but is unplanned and arises during the course of the lesson to provide evidence of student learning. For example, during a discussion the students might say something that the teacher had not anticipated and which leads the teacher to ask further probing questions. These questions are not pre-planned but are prompted by student responses. Such assessment is informal and spontaneous and involves the teacher recognise a teachable moment and acting upon it. The teacher is able to assess the situation the

child is in and give immediate feedback in such a way that the child moves ahead with the learning. These moments are neither recorded nor consciously noticed since the teacher instinctively responds to them as a part of her routine teaching activity.

6. WHAT NEXT?

Consider the scene at a workshop conducted for primary mathematics teachers in a school in South Delhi:

The topic of discussion was equivalence of fractions. A teacher was asked to give an example of how she would take a student to the next higher level of understanding fractions if the child shades $\frac{2}{3}$ of the figure given below correctly.

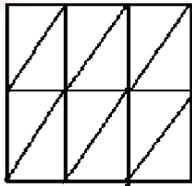


Figure 2

The teacher was able to tell that the idea of equivalence was implicit in the problem but was not able to come up with a concrete follow up idea. She had good conceptual knowledge of equivalence of fractions but it seemed in a classroom situation with students completing a task successfully she would need to promptly think and be ready with 'what to do next' activities.

According to Watson et al (2008) primary mathematics teachers can recognise and predict responses likely to be given by students (including both correct and incorrect ones) but when it comes to identifying the next step needed to develop different levels of student understanding, they face considerable difficulty. This issue has considerable scope for sustainable professional development of the teachers focussing on minute by minute judgements within the classrooms to bring about substantial increase in students' learning .

Figure 3 tries to depict the levels of difficulty encountered by the teacher in a classroom.

Easy

Providing a task addressing a desired mathematical concept
Selection of quality material

Easy

Predicting likely responses
Grouping responses into categories of correct and incorrect

Difficult

Identifying what to do next
Taking students to the next level of understanding

Figure 3

6. PREPAREDNESS FOR 'THE TEACHABLE MOMENT'

7.1. Dialogue and Discussions - Interactive character of the teaching process

It is impossible to talk about assessment sans pedagogy. Classroom is the real field of work and efforts to improve learning outcomes of the students need a lot of focus on teacher practice. Teachers make a difference (Hattie, 2009). The interactive character of the teaching process (Treffers, 1991) often defines the quality of the assessment that happens on the spot. Basically interactive teaching is giving students something to do, getting back what they have done, and then assimilating it yourself, so that you can decide what would be best to do next.

Classroom assessment for learning relies heavily on dialogue & discussion between the child and the teacher (Callingham, 2008). In order to truly fathom what the students know and understand, one should discuss their answers with them. Rather than focusing on the registration of externally perceptible behavior, these observation and interviewing techniques are primarily intended to display the students' underlying thought processes and insights. Primary teachers know this and often take a call to reason out well with children who are making mistakes to know what is the level of understanding.

'How' the students solve the problems is the whole point. It is the way in which the student works on a problem that determines the level of understanding. And this can become evident to the teacher by interviewing the child or asking him how he solved it. Consider the scene in a grade 2 mathematics class in Mumbai where a child figures out $8 + 7$ by counting 7 further from 8 on. Another child figures out that $8 + 7$ is simplified by $8 + (2 + 5) = (8 + 2) + 5$. This latter discovery shows a high comprehension level. Once this is grasped, it becomes mere knowledge of the method. As soon as the teacher was able to figure it out by asking how the child had

solved the problem she guided that particular child to higher order problem solving by giving him a challenging problem where the child had to figure out $48+27$ using the same knowledge of the method. The child took a while but figured it out after a while and in the third problem which came his way from the teacher, he solved $35+49$ in no time at all. The child was helped by the teacher to master the knowledge of the method once she got an insight into his thought process by interacting with him at that moment when his mind had chanced upon the method.

For the teachers it falls under their regular and routine daily activities to reason out with the child as he is attempting problems in mathematics and is taken as the normal process of teaching rather than feedback from assessments and this perception has scope for professional learning (Callingham, Pegg & Wright, 2009). As Socrates discovered, a good question can accomplish this result better than, just telling the answer. The teachers monitoring students' participation in discussions and deciding when and how to encourage each student to participate are often able to make quick instructional decisions which benefit the whole class in better learning.

7.2. Learning to Observe Learning Processes

If one wishes to improve assessment, one must, (begin in the micro-environment by first helping teachers learn to observe learning processes. The teachers must become aware of when learning processes are taking place and when they are not. For this reason, learning to observe 'how students learn' is regarded as the principal part of all courses in mathematics education.

Assessment would also need to include classroom observation in the form of mental notes the teacher makes as she teaches and while children work, regarding aspects of each child's participation as well as individual work characteristics. Some of the aspects to note would include: does the child ask questions, is he/she able to follow arguments and make their own, what does she/he do when confronted with a new type of problem, etc.

Broaden and sharpen the teacher's awareness of the presence (or absence) of learning processes. The formalized tests are absolutely inadequate for this purpose. Information set in a rigid framework is useless for making a diagnosis. Moreover, the object is to open the eyes of the evaluator, which cannot be done by handing him mechanized tests.

7.3. Planning by the Teacher – Her Readiness !

The approach adopted by the teacher largely determine the quality of learning in the classroom (William & Thompson, 2007). Such kinds of approaches comprise of ways of assessment in the classroom scenario which help in identifying a student's readiness to learn (Griffin, 2000), so that planned learning experiences can be used fruitfully by the teacher. It is win-win situation for teachers to ask students to work together in small groups to solve a problem. It goes without saying that in group work a discussion would ensue that not only would serve in itself to build more robust knowledge structures, but also to motivate. The anticipation of immediate feedback in the form of reaction from their peers, or from the teacher is a very strong motivator. If

it is not embarrassing or threatening and students want to know desperately whether their understanding is progressing or just drifting aimlessly in concept space.

It is important to note here that for such type of assessment to go on smoothly the teacher needs tasks ready up her sleeve that seek to address and clarify misconceptions in the particular mathematical concepts. Her preparedness, readiness and foresight for handling classroom situations which inadvertently arise during the teaching-learning process would spearhead her attempts in grabbing these moments for meaningful assessments.

7. CONCLUSIONS

Interactive teaching is the call of the hour and the time has come to ignore the tussle between FAs and SAs. Aspects of quality assessment practice in the classrooms need to be looked at more closely and the conflicting cloak of formative and summative nature of assessments to suit political means, needs to be shed. Due acknowledgement and emphasis need to be built on role of classroom observations, dialogue and discussions between the teacher and pupil, teacher's planning for contingency tasks and right questioning and her ability to change pedagogical approaches on the spur of the moment. This needs sustainable professional development of the teachers focussing on minute by minute and 'on the spot' judgements within the classrooms to bring about substantial increase in students' learning.

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