I have been an academic involved in teaching mathematics for 20 years, a parent of students studying mathematics at primary and high school, and I have worked with high schools in mathematics enrichment activities over 20 years, with a particular involvement in the last 5 years.

It seems to me that there has been a gradually deepening problem in the teaching of mathematics at all levels over the last 20 years. I have views about how this might be addressed. However, in the present context, the issue to be considered is assessment.

Assessment

Assessment serves multiple purposes, and these different purposes may tend to conflict. In particular, these purposes include:

(a) providing guidance (feedback) concerning what ideas and topics are well understood by the student, so that these topics can be revisited, with a view to obtaining a more complete understanding;

(b) contributing to a *grade*, which may then, in turn, form part of an overall assessment of the standard achieved by the student.

The first of these objectives is fully supportive of genuine education, i.e. increasing the depth and breadth of understanding, knowledge and confidence of students. The second objective is primarily concerned with the needs of organisations and institutions with which schools must work.

Over-emphasis of the second of objective has the potential to detract from the first objective. It might seem that there could be a division of assessment into two types, which would alleviate this conflict. However, if the second type of assessment is highly emphasised (which is often the case, especially at the higher levels), all assessment will tend to be viewed, by teachers and students, as preparation for the highly competitive final assessment, so that assessment which is learning-oriented will receive little emphasis. Let us refer to assessment primarily focussing on the first objective *educational*, and assessment focussing on the second objective *competitive*.

How much emphasis is placed on competitive assessment may be a difficult issue to address for this particular committee. The "need" for ranking of students is generated by processes outside the school system. However, the QLD Parliament as a whole has responsibility to influence how much emphasis there should be on competitive assessment.

One approach to alleviate the possibility of harm to be caused by poor assessment is to seek to reduce unfairness to a minimum. Criteria need to be explicit, clear, and published, and equally visible to all members of the educational community (students, parents, and teachers).

However, it appears that in the current environment, the level of detail in the assessment criteria may be excessive, which can lead to the process of assessment becoming artificial and misdirected. Explanation of the criteria has become exaggerated and over-complicated.

An Example

I have seen instances where a highly elaborate assessment scheme has been constructed to accompany the solution of a mathematics problem which was incorrectly understood and "solved" by the teacher. In this situation, students were able to infer the answer intended by the teacher, despite the fact that their own solutions, when correct, did not support the conclusions which they were clearly being encouraged to draw.

As a consequence, in this example, it was more important to pick up clues from the teacher as to what answer was expected than to develop the skill and understanding to develop a solution of their own.

This is the way bad teaching looks at all levels. Instead of students gaining knowledge and skills that enable them to be independent thinkers, and to experience genuine pleasure in learning, they feel a pressure to deliver ideas and ways of thinking that have been approved by the system.

A Fanciful Story

Two neighbouring states in the south Pacific were following similar paths of development in transportation. Both nations were very well-intentioned and innovative. Nation A introduced displays at all bus stations which provided information about when the next bus to all the available locations was next arriving. Nation B, for a reason no-one can remember, introduced a system of displays which provided similar information about the buses which had most recently departed.

In Nation B, because employers liked employees who were punctual and well-organised, the Transportation Department expanded their system to include patron surveillance and comprehensive reporting, with helpful details like: "By stopping to pat the dog at the intersection with James St, you missed the 8.35 and had to wait an extra 15 minutes."

Nation A, on the other hand, introduced wireless communication on the buses and made its information about bus connections available to its patrons via their mobile phones and ipads.

Overemphasising the competitive and reporting aspect of assessment is behaving like Nation B. It implies a negative philosophy of education: that all students miss the bus; and emphasises the issue of reporting – by how much did the student miss the bus, rather than the task we all want to achieve – to get to the destination.

A Solution

If it is agreed that the primary objective should be the development of deeper understanding, knowledge, skill, and creativity in our students, at least a partial solution to the challenge of providing fair, objective, and educationally effective assessment is as follows:

All assessment should include multiple stages, which enable students, and teachers, to learn from their mistakes. The process of revising ideas and methods should always be fully respected in the assessment process. By the time of "final" assessment, students should have had an adequate opportunity to improve their understanding of the topics under consideration.

The development of an elaborate architecture of criteria of understanding by means of which to analyse outcomes, on the other hand, does not seem appropriate for mathematics and the sciences in general. In these fields there are a whole range of difficult concepts which take time and practice to master. It is therefore more appropriate to base the assessment on the relatively simple question: have these key concepts been understood? The fact that this assessment criterion can be stated so simply does not detract from the depth of understanding needed to meet it.

In this approach, there is no reason to suppose that any student, given appropriate resources and desire to learn, should not achieve an excellent result. On the other hand, given the different levels of preparedness and motivation for learning, and also the conditions under which it is taking place, there will most likely be a wide range of outcomes.

Marks for Right Answers

Is it sufficient to simply mark each answer (including the working) and the aggregate the marks to produce fair and accurate assessment of learning?

It depends on the questions. A well-defined assessment instrument will include question which test the knowledge and understanding of the student in a variety of ways, and at a variety of levels. As a consequence, there is no constraint on the sophistication of a test constructed according to this simple model. Also, the rules are more clear to all parties. It is therefore quite reasonable to consider re-introducing this simple approach to assessment.

I hope this contribution is felt to be worthy of submission to the committee and is able to contribute to a successful report.

Yours sincerely,

Ron Addie