

Mathematical Assessment - Issues, approaches and a format for development.

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“What is assessed is valued.”

Lynn S. Joffe

For teachers the issues of what, why and how we assess are fundamental. What do we intend to assess as mathematical skills, will it be concepts, computation, problem solving and understanding? What is the purpose of the assessment? Do we need a diagnostic tool? Is it to evaluate a programme? Will we screen applicants? All of these are legitimate reasons for an assessment system, however they affect what will be included and the methodology that will be used. Will the assessment be a written test? If so has it been screened for literacy difficulty? Will calculators/computers be allowed? What do I need to know about my students? This question is crucial for me as a teacher. Yet this is often distinct from the needs of the organization implementing the assessment process.

Assessment is often designed without fundamental analysis of its goals and structures. Without this analysis what you achieve is improvement in efficiency and effectiveness. However these are essentially quality control issues. Quality control is important only when the system is appropriate.

In Israel Feurstein has developed his “Learning Potential Assessment Device” to investigate:

- ability to grasp the principle underlying a problem
- amount and nature of teaching required to get the principle
- how well is the principle transformed
- does the student respond differently to language, figures, numbers, pictures
- how strategies affect performance

This device emphasizes the relationship between examiner and examinee as an integral part of the process. The result obtained is not a numerical score but an identification of weaknesses and strengths. These are utilized to design the programme to be taught and the teaching approach.

The National Training and Development Institute provides vocational training for people with special needs. In thirty-six centres throughout the republic of Ireland students participate in vocational training via the European Social Fund. Historically the people attending these courses have had learning impairment, physical disabilities or mental health difficulties. NTDI (formerly Rehab) endeavours to deliver high quality service. In providing this training NTDI rehabilitation uses teams made up of

area managers, instructional staff, psychologists and remedial teachers. Among other developments much work has gone into the development of an assessment system customized to the programmes and students. The goal of the assessment system is to contribute to the individual programme planning process and ensure the appropriate placement of students on courses. An in depth analysis of the literacy and numeracy requirements of each vocational course was carried out. This analysis produced a set of broad headings of mathematical skills perceived as relevant by course instructors. Effectively the assessment system was designed to deliver a profile of the student's skills and weaknesses. This information is used to target interventions. Each student participates in the development and implementation of their individual programme plan. This plan is effectively a profiling system which monitors each student's progress through their training programme. The process also gives individual members of the team responsibility for actions, evaluation and reporting. The review system (every three months) evaluates students' progress through their training time and agrees further goals.

The goals of assessment in NTDI have much in common with the Feurstein's "Learning Potential Device" and as such have raised fundamental questions about the use of standardised tests. Tests of mathematical attainment have traditionally concentrated on proficient computation rather than the understanding of concepts and their application in problems. This approach reflects the industrial needs of the early twentieth century rather than the information society. Poor student performance is interpreted as a lack of aptitude. Significantly socially marginalised groups e.g. women and black people (in U.S.) are frequently identified as lacking this aptitude. Perceptions of lack of aptitude means that resources are often not targeted., due to little expectation of success. In Ireland this perception often applied to other marginalised groups, e.g. travellers, socio-economically deprived and the disabled.

Coming from an education system that teaches mathematics as a fixed collection of concepts and skills, taught and mastered in a strict order (Romberg 1990) students with disabilities have often encountered a glass ceiling. This invisible barrier is legitimately imposed by teachers. When a system that demands computational skills are pre-requisite to learning more advanced concepts, this barrier is imposed as a legitimate screen process by teachers. For example many students have simply never experienced the teaching of division because they had not mastered multiplication. This ability to compute is assessed by standardised tests, conforming to the traditional model. Practical problem solving is not addressed in this scenario.

The "routine" of mathematics classes identified by Romberg reinforces the old model of teacher as teller with students passive recipients. This role is comfortable for teachers who have acquired their skills in the same tradition. For teachers like myself who have entered the field of mathematics education via the literacy door, the need for intensive in-service training is all important. To deliver appropriate mathematics assessment and education teachers need to have developed their own understanding of mathematics and be highly skilled in assessment.

Current assessment practice rewards students who can acquire lots of factual knowledge rather than solve problems. This type of knowledge is readily assessed by written tests. Students with learning difficulties therefore find such tests inaccessible.

Other factors to be considered in designing a system of assessment are the detrimental effect on performance of a written test. Joffe quotes a figure of 20% decrease in such tests for people who could master the task in a practical or oral discussion. Multiple choice answers force answers and give no indication as to the approach taken. This information has much greater potential for both student and teacher.

In my work I have experienced students who performed very badly in written tests yet could use strategies which allowed them to compute money, measure either weights or lengths and participate effectively in the mathematical demands of everyday adult life. The ability of students to surprise myself and other experienced members of staff when they are confronted with practical problems causes me to question how this potential could be appropriately identified.

Contextual learning is critical for all students but all the more so for people with learning difficulties. Since transfer of learning to new situations presents problems for students with learning difficulties, access to contextual learning opportunities must be ensured. Employers demand that workers can participate as part of a team. Students are empowered when they are enabled to have the experience and understanding to participate constructively in society (Romberg).

Having identified what and why we need to assess, we can begin to design a new system of assessment. The design of an effective system requires a fundamental change. Any new system will examine the roles of the participants and the structures needed to implement it. Romberg suggest that we look at these topics when assessing mathematics:

- mathematics as problem solving
- mathematics as reasoning
- mathematics as communication

This outline provides a basis on which any assessment of mathematics could be based. The North Tipperary V.E.C / Applications Oriented Maths. Foundation certificate adheres to this structure. In attempting to develop an alternative assessment system, equality of access is very important.

When NTDI developed its assessment system the standardised tests were meant to supplement the information gleaned from a practical assessment. The delivery of this was to involve the demonstration of tasks and following training the evaluation of student's ability to carry these tasks out without assistance. This form of practical assessment has a dynamic relationship between examiner and examinee. This test could be creatively combined with a structured interactive interview. My hope would be that this process would identify potential more effectively, ensure access for all and answer the requirements of students, teachers and educational organisation.

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