

ATTITUDES OF SOME N.S.W. SECONDARY MATHEMATICS TEACHERS TO ALTERNATE METHODS OF ASSESSMENT IN MATHEMATICS.

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In a paper presented at Merga - 15 in 1992 at University of Western Sydney - Hawkesbury, N.S.W., the author reported on the beginnings of a study of teacher's attitudes to possible changes in assessment practices within secondary school mathematics classrooms within this state. It was reported how content laden the secondary mathematics curriculum is in N.S.W. and just how prevalent is the utilisation of timed pencil and paper tests in this state. Because these assessment procedures are so conservative, methodology employed within the classroom is similarly traditional and does not really reflect changes occurring in procedures in secondary mathematics classrooms in some overseas countries and interstate within Australia. Nonetheless, some changes are occurring.

This paper will report further on a series of questionnaires that have been conducted with practising secondary mathematics teachers on the subject of alternative modes of assessment, and endeavour to make some recommendations for the future.

Across the world changes are being advocated in the way that mathematics is to be taught and learned at the school level. These changes are based on sound research findings in the field of mathematics education. The types of mathematical skills which are being encouraged are very different from the narrow objectives which have typified the teaching and learning of the subject in the past. Problem solving and its applications in mathematics is now being emphasised along with the advocacy of co-operative group processes including the use of language. Computers and calculators have changed permanently our vision of what constitutes an adequate mathematical education. But when it comes down to the crunch, our assessment procedures utilised in internal and external school mathematics examinations always dictate in the mind of the learner, what in their mathematics education is of greatest importance.

It is quite clear that secondary mathematics teachers continue to predominantly assess their students' understanding of the subject via the timed pencil and paper test. Despite many calls for change, both overseas and in Australia, (e.g. U.S.A. - N.C.T.M., 1989; United Kingdom - Department of Education and Science, 1990; Australia - National Mathematics Statement, 1990), resistance by teachers is very common and although some change is occurring, it is patchy and fairly slow. As outlined at MERGA - 15, the situation in New South Wales secondary schools is particularly resistant (Grimison, 1992). The mathematics curriculum is characterised by a very solid syllabus in mathematics for Years 7 - 12 which is almost universally assessed by the pencil and paper test (both internally and externally). This is especially true once students enter Year 9 and beyond.

Some experimentation with alternate forms of assessment was reported to be occurring in the largely mixed ability classes in Years 7 and 8, and ofcourse in the primary grades within this state (Grimison, 1992). Some progress has also been made in the internal assessment procedures in the recently developed (1989) Year 11 and 12 course, Mathematics in Practice. But this course is only currently attracting about 2000 out of the 60000 Higher School Certificate candidates. For the vast majority of students of mathematics in N.S.W., the method of assessment remains very traditional. Overseas and in a number of other Australian states, advances are occurring in the widening of secondary mathematics assessment procedures as reported by Leder (1992) and Stephens and Izard (1992).

In N.S.W. secondary schools, mathematics teachers are communicating to their classes the value of the product rather than the process of mathematics via the assessment techniques employed. Recent literature is filled with the repercussions of always using the test as the sole method of assessment in mathematics (e.g.

Clarke, 1987, Clarke and Lovitt, 1989, Mousley, 1991, etc.). This research literature makes it quite plain that if we desire to communicate process as being important in mathematics learning as well as product, then this necessitates a broadening in the range of assessment tasks utilised. Timed pencil and paper tests rarely assess understanding in the higher cognitive levels, including comprehension, application, analysis, synthesis and evaluation. To function in these desirable higher cognitive levels, skills need to be developed through a broader range of activities other than pen and paper knowledge or product type tests.

Some of the assessment alternatives which have been suggested in the literature include student journals, work profiles, interviews, observations, oral tests, parental and student self assessment, practical activities and investigational tasks. Historically, secondary mathematics teachers have been opposed to these alternative forms of assessment and have always relied on the tried and tested traditional form of the formal hand-written test. This is what they themselves experienced in their own schooling and they consider these practices to be fair and equitable. Yet as Clarke claims "it is through our assessment that we communicate most clearly to our students which learning activities we value" (Clarke, 1987).

Secondly, mathematics is seen to be objective in comparison to subjects such as the humanities and social sciences. This very objectivity of mathematics is seen to be one of the subject's great advantages as there is much less of a problem encountered in its marking, as occurs in the subjectivity of marking essays in the humanities or social sciences. There is thus a very firm belief that using tests in mathematics will be fairer on all the students.

The current assessment techniques employed in N.S.W. secondary mathematics classrooms are suited most closely to the few students at the top of the class, who perform well in traditional formal tests. The remainder of the class are left to contemplate failure which naturally lowers their confidence and self esteem. With this in mind, it is important to research the current attitudes of secondary mathematics teachers towards alternative forms of assessment.

THE STUDY:

The purpose of our research study was to examine the attitudes of some N.S.W. secondary mathematics teachers towards assessment alternatives. Firstly, we tested the hypothesis that those teachers with more years of experience of teaching would report attitudes revealing that the current traditional assessment techniques are able to assess the students adequately. This would mean that the level of satisfaction with pen and paper tests would depend on the years of experience in teaching. Secondly, we hypothesised that the more experienced teachers would report negative attitudes towards alternative assessment techniques in mathematics and those teachers who have less teaching experience would report more positive ones. Thirdly, the teachers were asked to respond in detail to a number of forms of alternative assessment and an endeavour was made to determine their objections to them.

The subjects in this study conducted in 1992 were practising secondary mathematics teachers in eleven Sydney schools. There were three private and eight Government schools from varying socio-economic areas of Sydney. A total of 60 teachers participated in the study. Schools were randomly selected. Seven university students enrolled in their third year of a four year professional honours Bachelor of Education Degree at the University of Sydney, together with the author, conducted this small piece of research. A questionnaire was developed by the group which was to be distributed to practising mathematics teachers in these selected schools. Both closed and open questions were included. A number of follow-up interviews with some of the subjects were intended to be carried out but this did not happen because of the time factor.

The questionnaire was administered to teachers in the 11 schools, with 60 completed returns obtained, having each been given about a week to complete. The 60 subjects were grouped into years of teaching experience by the following categories: 0 - 9, 10 - 19, 20 - 29 and 30 - 39. Their profile is shown in Table 1.

Years of Teaching Experience	Number of Teachers
0 - 9	14
10 - 19	24
20 - 29	16
30 - 39	6

Table 1

There were four questions in the survey instrument. Question 1 was included, as reported above, to enable the grouping of responses into length of time teaching. This then enabled the completed questionnaires to be sorted into these four groups.

Responses to Question 2 were recorded on a 5-point Likert Scale, which endeavoured to ascertain the respondents' attitudes to the usefulness, or otherwise, of paper and pencil tests for assessing students' ability in mathematics. These results were added together and averaged, counting the 5 point scale as ranging from 0/4 to 4/4, then converting these averages to percentages. This was done for Years 7-8, 9-10 and 11-12 and compared across each of the four groups.

Question 3 asked for a ticked response as to whether six methods of alternative assessment were used at all, or not, by the teacher. The alternative forms of assessment recorded in the question were oral, practical, observation, student journals, student analysis and parental assessment. These results were recorded and averaged and converted to a percentage for each of the four groups.

Question 4 endeavoured to ascertain the teachers' reasons for not utilising the six nominated forms of alternative assessment. These reasons tended to fall into five factors and they were then recorded as percentages for each form.

RESULTS:

Question 2

This question required the subjects to indicate on a scale how well paper and pencil tests assess student ability in Years 7-8, 9-10 and 11-12. These levels of satisfaction were converted into a percentage as explained above. The results are shown below in Table 2.

School Years	0 - 9 yrs teaching	10 - 19 yrs teaching	20 - 29 yrs teaching	30 - 39 yrs teaching
Yrs 7 - 8	67%	67%	74%	54%
Yrs 9 - 10	66%	72%	85%	71%
Yrs 11 - 12	77%	83%	94%	95%

Table 2

Question 3

This question required subjects to indicate alternate assessment techniques they used at all, from a given list. The results are shown in Table 3 below. The percentages indicate those in each category who used these alternate forms at all.

Type of Assessment	0 - 9 yrs teaching	10 - 19 yrs teaching	20 - 29 yrs teaching	30 - 39 yrs teaching
Oral	64%	83%	75%	83%
Practical	64%	67%	63%	67%
Observation	71%	79%	56%	83%

Student Journals	29%	17%	25%	0%
Self-assessment	29%	29%	38%	50%
Parental assessment	7%	13%	6%	17%

Table 3

Question 4

If alternate forms of assessment were not used, this question asked teachers to give reasons why they thought the six alternative forms of assessment offered in Question 3 would be unusable for them. These reasons fell into five factors.

1. Insufficient time for implementation / hard to organise
2. Unstructured nature
3. Unsuitable
4. Unreliable/subjective
5. Insufficient resources on hand to permit implementation

The percentages of respondents in each of the four categories of teaching experience giving the five factors as negative reasons for using each of the six forms of alternative assessment are shown in the Table 4 below:

Oral	0 - 9 Yrs	10 - 19 Yrs	20 - 29 Yrs	30 - 39 Yrs	Pract.	0 - 9 Yrs	10 - 19 Yrs	20 - 29 Yrs	30 - 39 Yrs
Fact 1	7%	0%	25%	0%		0%	5%	19%	0%
Fact 2	7%	0%	0%	17%		7%	0%	6%	0%
Fact 3	7%	5%	6%	0%		0%	5%	6%	0%
Fact 4	0%	11%	19%	0%		0%	0%	6%	0%
Fact 5	0%	0%	0%	0%		0%	16%	0%	0%
Observation					Journals				
Fact 1	0%	0%	6%	0%	Fact 1	0%	0%	13%	17%
Fact 2	14%	0%	6%	0%	Fact 2	7%	17%	0%	0%
Fact 3	0%	0%	0%	0%	Fact 3	12%	38%	13%	0%
Fact 4	0%	17%	19%	0%	Fact 4	0%	0%	6%	17%
Fact 5	0%	0%	0%	0%	Fact 5	0%	0%	0%	0%
Self-Asses					Parental				
Fact 1	0%	0%	0%	17%	Fact 1	0%	8%	0%	0%
Fact 2	0%	0%	0%	0%	Fact 2	7%	0%	0%	0%
Fact 3	0%	33%	0%	0%	Fact 3	0%	0%	6%	0%
Fact 4	43%	4%	13%	17%	Fact 4	64%	54%	50%	83%
Fact 5	0%	0%	0%	0%	Fact 5	0%	0%	0%	0%

Table 4

DISCUSSION:

In Years 7/8, the most experienced teachers in our sample reported lower levels of satisfaction with timed pencil and paper tests in mathematics assessment than teachers with less experience. This result did not support our first hypothesis for the junior years of secondary education. However with increases in grade levels from Years 9/10

to 11/12, the more experienced teachers reported much higher levels of satisfaction than do less experienced ones. General levels of satisfaction do increase as grade level increases, till over 90% of experienced teachers expressed satisfaction with solely timed pencil and paper tests in Years 11 and 12, and less experienced ones recorded about 80%. The belief that written tests are the most appropriate way of assessing "real" mathematics seems very strong. Except for Years 7/8, our first hypothesis is supported.

The results in the third question show that the most common forms of alternative assessment are oral, practical and observation. Student journals together with student and parental assessment were uncommon. The most experienced teachers expressed a universal opposition to the use of student journals as a mode of assessment. A problem with the phrasing of this question was that many teachers were confused as to whether the assessment was formal or informal, and this was often written on the questionnaire (eg. Do you mean formal or informal? I am assuming formal.) Many teachers indicated that many of the forms were used in their assessment, but only as informal assessment which did not contribute to the final mark. Clearly, in addition, a whole lot of confusion occurred as to the exact meaning of some of these alternative forms of assessment, many of which may have appeared foreign to Sydney secondary mathematics teachers.

The last question endeavoured to explore reasons why teachers were opposed to using specified techniques of alternative assessment. These results lend partial support to the second hypothesis, as the less experienced teachers reported fewer dissatisfied views about why these alternate forms were unsuitable. This could have some relationship to the recency of their pre-service teacher training which presumably, included an introduction into a range of alternative forms of assessment. The range of reasons for this conflict is varied. However, the most common opposition relates to the perceived subjectivity of alternatives and their perceived "unsuitability" to mathematics. These reasons for this resistance have many implications for the future manner in which some of these alternative techniques are introduced into the N.S.W. secondary mathematics curriculum and assessment system.

It is clear that the traditional written test dominates any other form of assessment form in the schools surveyed. Attitudes at present to using alternative methods of assessment in the classroom are fairly negative. Clearly, the way forward is to change the way that mathematics is assessed in the external School and Higher School Certificates, and to place much greater emphasis upon less traditional and formal mathematical assessment practices.

REFERENCES:

- Australian Education Council, 1990, *A National Statement on Mathematics for Australian Schools*. Curriculum Corporation.
- Clarke, D and Lovitt, C., 1989, *Assessment Alternatives in Mathematics, Mathematics Curriculum and Teaching Program*. Canberra: Curriculum Development Centre.
- Clarke, D., 1987, "A Rationale for Assessment Alternatives in Mathematics", in *The Australian Mathematics Teacher*, Vol 43 No.3.
- Department of Education and Science, 1990, *A National Mathematics Curriculum*. London: H.M.S.O.
- Grimison, L., 1992, "Assessment in Mathematics - Some Alternatives" in Southwell, B., et al., *Proceedings of the Fifteenth Conference of Mathematics & Education Research Group of Australasia*, University of Western Sydney - Richmond.
- Leder, G., 1992, *Assessment and Learning of Mathematics*. Melbourne: A.C.E.R.
- Mousley, J., 1991, "Years 7 - 10: Preparing for the VCE" in Reilly, J and Wettenhall, S., *Mathematics: Inclusive, Dynamic, Exciting, Active, Stimulating*. Mathematics Association of Victoria.
- National Council of Teachers of Mathematics, 1989, *Curriculum and Evaluation Standards for School Mathematics*. Reston, Virginia: N.C.T.M.
- Stephens, M and Izard, 1992, *Reshaping Assessment Practices: Assessment in the Mathematical Sciences Under Challenge*. Melbourne: A.C.E.R.