STUDENTS AND ASSESSMENT

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Students in six New Zealand secondary schools in the final year of the combined mathematics and statistics curriculum, the sixth form (year 12), were surveyed about their attitude towards their previous year's national mathematics examination result, their reason(s) for continuing in mathematics, the types of mathematics assessment they had experienced and their opinion on the relative fairness of different modes of assessment in mathematics. The results from one of these schools, a large state co-educational school, are used as a case-study to explore gender differences, and differences between indigenous New Zealanders (Maori) and other students (non-Maori) are also explored.

BACKGROUND

Mathematics and statistics in New Zealand schools

In 1992 in New Zealand statistics formally became one of six streams (mathematical processes, number, measurement, geometry, algebra and statistics) in the national mathematics curriculum covering all levels of schooling (Ministry of Education, 1992 and 1993). It is not until the final year of secondary schooling, the seventh form (year 13), that two mathematics papers are available: *Mathematics with Calculus and Mathematics with Statistics.*

Although mathematics technically becomes an optional subject at the fifth form (year 11) most schools regard it as 'compulsory', and there is virtually full participation of students at this level. Most students sit their first national examination, School Certificate, at the end of this year. Almost 40,000 students sat School Certificate mathematics in 1995 (about 80% of students entering the secondary school in the third form (year 8; average age= 13 years). Of these, approximately half were female. About 14% of students identified as Maori which is less than the proportion of Maori in this age group - 24% of the 15-19 year age group (Statistics New Zealand, 1997). As in School Certificate, there is only one national mathematics paper available at the sixth form (year 12), Sixth Form Certificate. In this year students begin to exercise their choice to study mathematics and, in recent years, between 80-90% of male students take mathematics and about 75% of females. The participation of Maori is much lower - less than a third (Forbes, 1997).

There have been small but consistent gender differences (in favour of males) and marked differences between Mäori and non-Mäori students in School Certificate which have remained virtually unchanged for the last twenty years. In 1995 the mean score for

female non-Maori candidates was 55% compared with 56% for male non-Maori candidates. The mean differential between Mäori and non-Mäori students has consistently been more than 10 percentage points and in 1995 was 43% for Maori females and 42.5% for Maori males (Forbes et al, 1996).

The research

Students in the final year of the combined mathematics and statistics curriculum, the sixth form (year 12), were surveyed in six New Zealand secondary schools in 1996. They were questioned about:

- attitude towards their previous year's national examination result
- their reason(s) for continuing in mathematics
- the types of mathematics assessment they had experienced
- their opinion on the relative fairness of different modes of assessment

A case-study school

This paper presents the results for students in one of these schools, a large state co-educational school, together with an analysis of the relationship between the students', attitudes towards assessment and their past performance. Gender differences, and differences between indigenous New Zealanders (Maori) and other students (non-Maori) are also explored. This school is situated in a smallish New Zealand city. The population in this area contains a higher proportion (35% compared to 15%) of Maori than the national average. The proportions of one parent families, people with no formal qualifications and the unemployment rate are also higher than average (Statistics New Zealand, 1996). The school was chosen in order to get sufficient Maori students in the study. The number of European descent and Maori female students were roughly equal but there were almost twice as many European descent than Maori male students. This probably reflects the increased 'drop-out', rate for Maori males at this level - in 1995 the retention rate of Maori students from year 9 to 13 was about 26% compared to over 50% for non-Maori students (Ministry of Education, 1996).

METHODOLOGY

All of the sixth form (year 12) mathematics students in this school (four classes) were surveyed at the beginning of the school year. Almost all of these students had sat School Certificate mathematics in the previous year (1995). They were asked to record

their mark (percentage) or grade (A,B,C,D,E) and whether they had done better, worse or as expected in the examination. Students who indicated that they had done better or worse than expected were then asked to select from a number of choices what they considered was the major influence on their performance. Students were also asked which of the following forms of assessment they had been given, and which they most preferred:

- written test with a time limit
- written test without a time limit
- multichoice test
- group project
- individual project
- 'take-home' written test
- 'open-book' written test
- written report/essay/essay question
- oral presentation.

The category written report/essay/essay question was subdivided into - written report/essay and essay question - then students were asked to *rank* these 10 forms of assessment according to their perceived *fairness.* Throughout the year students were assessed in a 'take-home', individual statistics project and one of the questions in the end-of-year three hour written examination was based on the same statistics content.

RESULTS

Full results were not obtained for all students to all aspects because of non-response to particular questions, absences, leaving school, etc. Of the 80 students who completed questionnaires 39 were females (17 New Zealanders of European descent, 16 Maori, 5 belonging to other ethnic groups and one of unknown ethnicity) and 41 males (24 of European descent, 16 Maori and one of unknown ethnicity).

Previous years performance

Although all students had previously 'passed', School Certificate (a few proceeded with a mark between 40-50%) there were differences in attainment. The mean score (standard deviation) for female students of European descent was 68% (sd=15%)

compared to 66% (sd=8%) for female Maori students, 72% (sd=11%) for European descent male and 63% (sd=10%) for Maori male students. When ethnic groups are compared within each gender the only significant difference (at the 5% level) was between European descent and Maori males. In this school it appears that female Maori students proceeding in mathematics had done almost as well as European descent females proceeding, but this was not the case for males where there was still a substantial differential between the two groups.

Overall, there were small positive correlations between the School Certificate mark and both the mark obtained in the statistics final examination question ($r = 0.27$) and the statistics project mark ($r = 0.41$), as well as between the statistics finals question and project marks ($r = 0.24$). However, there were no differences in mean scores in the statistics finals question and all groups had similar mean performance in the statistics project (51-54%) apart from Maori females (45%).

Perception of School Certificate performance

Students responses to the questions on whether their School Certificate performance was better, worse or about what they expected showed that males were more likely than females to indicate that their performance was as expected (47% versus 21%) and less likely to indicate it was better than expected (13% versus 38%). In her 1990 review Willis cited evidence that girls express greater uncertainty about their mathematics performance at all ability levels than boys (Joffe and Foxman, 1984; Leder, 1988; Thomas and Costello, 1988). The only ethnic difference observed was that both Maori females and males were slightly more likely to indicate that their performance was better than expected than European descent students. A spread of reasons (table 2) were given by both males and females for better than expected performance. The most common reason given by both male and female students for worse than expected performance was “not enough work” (about 45% of each). The numbers are too small to make inferences about ethnic differences.

Table 1. Student’s perception of expected versus actual School Certificate performance

	Females		Males		Total
Expected:	European	Maori	European	Maori	
As expected	3	3	12	6	24
Better	5	7	8	7	27
Worse	6	5	4	1	16

Total	14	15	24	14	67

Table 2. Reasons given for better than expected performance

Reason/Sex	Good luck	Hard work	Work covered in class	Revision classes/ tutor	Other or multiple reasons	Grand Total
Female	2	2	3	2	2	11
Male	1	1	1	2		5
Grand Total	3	3	4	4	2	16

Table 3. Reasons given for worse than expected performance

Reason/ Sex	Bad luck	Not enough work	Not good at maths	Not enough time	Test too difficult	Not covered in class	Personal circumstance	Blank, other or multiple reasons	Total
Female	0	5	1	1	0	1	1	3	12
Male	1	6	1	0	1	1	0	5	15
Grand Total	1	11	2	1	1	2	1	7	27

Perceived fairness of different forms of assessment

Those students who had indicated that the assessment forms were not equally fair were asked to rank the 10 different forms of assessment according to their perceived fairness (rank 1 = most fair, rank 10 = least fair). Only 18 students overall completed this section. The only form of assessment that all these students had experienced was the timed written test; less than half had had un-timed tests, group projects, written reports, essays or oral presentations. Table 4 gives the average rank for each assessment method. This shows that students themselves perceived the timed written test as the most fair and generally regarded the group of ‘alternative’ assessments (projects, oral and written reports, essays and ‘take-home’ or ‘open book’ tests) as unfair. However, this could just indicate the student’s level of familiarity with the assessment form.

Preferred assessment method

Table 5 gives the preferred method for those students that indicated one clear preference. The most obvious gender difference observed is that 49% of males preferred multi-choice tests (49%) whereas for the females both timed written tests and multi-choice tests were equally popular (23% and 21% respectively). Males of European descent were more likely to prefer tests or multichoice(19 of the 21) than the other three groups (approximately two-thirds of each).

Table 4. Average rank given to each form of assessment

Timed test	Untimed test	Multi-choice test	Group project	Indiv. Project	'Take-home'	'Open book'	Written report	Essay/ Essay question	Oral
1.8	3.8	2.2	5.2	5.2	5.9	4.7	5.1	6.2	6.9

Table 5. Preferred assessment method

	Timed test	Untimed test	Multi-choice test	Group project	Indiv. Project	'Take-home'	'Open book'	Oral	Total
Females	9	6	8	2	3	4	4	0	36
Males	4	5	20	1	0	3	1	1	35
Total	13	11	28	3	3	7	5	1	71

Relationship between preferred assessment method and performance

There does appear to be a relationship between the student's School Certificate performance and the type of assessment chosen as the 'most' preferred.

As table 1 indicates A students are more likely to chose written or multichoice tests and C or D students more likely to chose other forms of assessment. By grouping the timed and un-timed written tests as *tests*, *multichoice* separately and the other forms of assessment as *other* a 3x3 table is formed. A chi-squared test of this table indicates a significant (at the 1% level) association between the student's School Certificate performance and the type of assessment chosen as the 'most' preferred.

SUMMARY

In this school, as seen in other studies, the female students were more likely than the male to say their previous mathematics performance was 'better than expected'. Both males and females most commonly put 'worse than expected' performance down to lack of work. Students generally believed that the timed written test was the most fair method of assessment, and 'alternative' forms of assessment the least fair. However, multi-choice tests were the most popular with male students, and multi-choice and timed written tests equally popular with female students. Those students who had a high level of attainment in the previous years examination were the most likely to prefer one of the written test options.

Table 6. Preferred form of assessment by School Certificate Grade

School Certificate Grade				
Preferred assessment	A	B	C/D	Grand Total
No single preference	1	5	1	7
Written test-time limit	4	7	1	12
Written test -not timed	4	3	2	9
Multichoice	5	9	10	24
Group project	0	0	2	2
Individual project	0	1	2	3
'Take-home' test	1	0	0	7
'Open-book' test	0	1	2	3
Oral presentation	0	0	1	1
Grand Total	15	26	27	68

In conclusion, students acceptance of the fairness of, and their preference for, different forms of assessment seems to be linked to both their familiarity with the method and their previous performance in this form of assessment. As this study indicates there are likely to be gender and ethnic differences in these attitudes towards assessment methods.

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