Practices and beliefs about assessment and reporting in mathematics:The effect of teacher gender and teaching level

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This paper reports on the responses of 1242 Queensland teachers to a survey on mathematics assessment in terms of teacher gender and teaching level. These responses were noticeably consistent across the different school systems and locality; however, comparison of responses between females and males, primary and secondary, and gender by teaching level, revealed some interesting differences.

Over the last five years, there has been a series of Federal initiatives in education that have had a major impact on mathematics education, for example, Australian Education Council (1991), Employment and Skills Formation Council. (1992), Finn Review Committee (1991), Mayer Committee (1992), and Discipline Review of Teacher Education in Mathematics & Science (DEET, 1989). A result of this was increased emphasis on outcomes based education, and the translation of the national statement on mathematics (Australian Education Council, 1991) into the national mathematics profile (Department of Employment, Education and Training, 1993). As a consequence, the Queensland Department of Education adapted the profile into a reporting system called Student Performance Standards (SPS) (Department of Education, Queensland, 1994). Queensland teachers of mathematics in Government schools in Years 1-8 are required to report on student performance using SPS for the mathematics topics of number, space and measurement by the end of 1995, and for the remaining topics by the end of 1996.

The use of SPS is built upon the assumption that teachers are able to use tasks in the course of instruction to gain information about students' mathematical understanding. Traditional assessment methods, for example, standardised written tests, provide the teacher with limited information about a narrow set of cognitive skills. Thus for SPS, there was a need to develop alternative forms of assessment which aim to capture a broader range of mathematical performance, i.e. to develop teacher-based performance assessment. Hence, to be able to use SPS, Queensland mathematics teachers were in need of professional development in three key areas: (a) developing a variety of tools that can be used for teacher-based performance assessment; (b) upgrading competencies in mathematics content and teaching methods; and (c) understanding and implementing SPS within their own specific context.

The relationship between attitudes and practices in assessment and characteristics such as gender and school level is an area in which there appear to be few studies: an ERIC search found no such articles. Grimison (1993) found that secondary mathematics teachers preferred traditional written tests and had a negative attitude to alternative forms of assessment. Martin (1993) noted

that secondary mathematics teachers, unlike their primary counterparts, appeared to flounder when faced with alternative assessment schemes which deviated from the well established mode of standardised tests and external examinations. Mousley (1991) and Clarke & Hollingsworth (1994) reported that externally driven changes to assessment methods influence classroom practice significantly.

In response to the need for teacher inservice, the Queensland Association of Mathematics Teachers (QAMT) sponsored a project, funded by the National Professional Development Project, with the aim of providing opportunities for professional development in teacher-based performance assessment in mathematics to every Years 1-10 mathematics teacher in Queensland. As a first step in monitoring this project and as a method of obtaining statewide information about teacher assessment beliefs and practices, a survey instrument was formulated by the authors of this paper and trialled with a two groups of teachers. Based on the trials, a modified instrument was developed, the Teacher Survey, and administered to over 10% of teachers of mathematics in Queensland.

This paper reports on the results of the section of this survey that deals with the background and current assessment beliefs and pratices in terms of differences in teacher gender (female-male) and teaching level (primary-secondary). As such, it is able to make a contribution to an understanding of factors which influence attitudes and practices in assessment of mathematics.

Methods
Sample
The sample consisted of 1242 teachers from 176 schools chosen purposefully, using the fixed interval method of randomisation, so that all the following categories were represented: (a) systems - state, Catholic and independent; (b) regions - Department of Education regions for state schools and diocesan regions for Catholic and independent schools; (c) level - primary and secondary; (d) position - rural, town and city; and (e) size - large, medium and small. The sample represented 17% of Catholic schools in Queensland (46 schools and 315 teachers), a school return rate of 77%; 19% of independent schools in Queensland (19 schools and 102 teachers), a school return rate of 95%; and 9% of state schools in Queensland (111 teachers and 825 teachers), a school return rate of 86%. Of the sample schools, 68% were primary schools, 27% were secondary, and 5% were primary schools with secondary departments.

Instrument
The instrument was a six page questionnaire set out in three sections: (a) assessment, recording and reporting for mathematics; (b) mathematics teaching and learning; and (c) background information. A survey instrument was chosen over interviews to enable the number of teacher responses to be maximised. To ensure representative responses and a high return rate, a purposeful sample of schools was chosen and then each one was followed up by telephone.

Procedure
Lists of all primary and secondary schools in Queensland were compiled - stratified by system, region, level , position and size of school. The fixed interval method of randomising was employed to generate a random sample of schools of about 10% of the population for the State system, and about 20% of the population for the Catholic and Independent systems.

From this list of schools, principals were contacted by phone in the first instance. They were informed about the QAMT professional development project, and the importance of the statewide teacher survey in that context. They were asked if they would be willing to encourage their teachers to participate in the survey: only a few declined. Participating principals agreed to

facilitate the process by receiving a survey package, distributing survey forms, collecting completed surveys from teachers, and sending these back in one reply paid envelope. Follow-up phone calls were required later in the process to encourage returns from some schools.

Results

The responses of teachers to the survey were organised, categorised and collated. Statistics was used to describe frequencies of responses and to test the significance of frequency differences. For this paper, comparisons are reported in terms of gender of teacher and level of school (primary-secondary). The results are presented in two parts: (a) demographics; and (b) current practice in terms of assessment, recording, and reporting.

Demographic results are presented below in terms of percentage of respondents, unless otherwise indicated.

Table 1   Age of Respondents.

AGE	Prim female	Prim male	Sec female	Sec male
< 25 yrs	17.9	12.9	11.5	5.6
26 - 35 yrs	32.4	29.0	32.5	23.0
36 - 45 yrs	29.0	33.5	33.8	48.0
46 - 55 yrs	16.3	21.7	17.5	18.4
> 55 yrs	4.4	2.9	4.7	5.0

Table 2   Years of Teaching.

YRS TEACH.	Prim female	Prim male	Sec female	Sec male
1 - 2 yrs	9.4	5.4	6.8	2.1
3 - 5 yrs	16.8	16.7	15.8	11.7
6 - 10 yrs	29.3	17.7	30.6	19.2
11 - 20 yrs	29.8	29.6	30.8	34.5
> 20 yrs	14.7	30.6	15.0	32.5

Table 3   Year Level Taught.

LEV TEACH.	Prim female	Prim male	Sec female	Sec male
Years 1 & 2	19.6	1.1	0.0	0.0
Years 3 & 4	27.2	10.8	0.0	0.0
Years 5,6 & 7	49.4	76.3	0.0	0.0
Yrs 8, 9, 10	1.7	5.9	18.8	13.2
Yrs 11 & 12	2.1	5.9	81.2	86.8

Table 4   Highest Formal Education.

FORMAL ED	Prim female	Prim male	Sec female	Sec male
2 year teach	7.3	11.3	3.8	3.6
3 year teach	38.5	29.5	15.8	9.1
A degree	17.9	24.2	17.3	28.9
Degree & Dip	33.1	31.2	55.6	48.8
Higher Deg	3.2	3.8	7.5	9.6

Table 5 Number of Tertiary Courses Taken.

# COURSES.	Prim female	Prim male	Sec female	Sec male
0	27.5	31.2	12.8	13.2
1 - 3	47.9	51.6	61.6	46.2
4 - 10	8.2	0.0	16.6	27.3
> 10	0.0	0.0	0.8	0.5
No response	16.4	17.2	8.2	12.8

Table 6 Years Since Taken a Tertiary Course.

YRS SINCE.	Prim female	Prim male	Sec female	Sec male
< 5 yrs	26.3	22.0	19.5	15.2
5 - 10 yrs	24.1	26.3	26.3	18.8
> 10 yrs	30.0	31.3	44.4	59.9
no course	19.6	20.4	9.8	6.1

Table 7 Number of General Inservice Courses Taken.

# INSERVIC	Prim female	Prim male	Sec female	Sec male
none	5.5	6.5	4.5	4.6
one	1.7	1.6	2.3	4.6
two	5.0	5.9	6.0	10.1
> three	87.8	86.0	87.2	80.7

Table 8 Number of Mathematics Inservice Courses Taken.

# INSERVIC	Prim female	Prim male	Sec female	Sec male
one	19.9	13.4	11.3	15.7
two	19.9	20.4	13.5	17.3
> three	17.6	14.5	30.5	33.5

Results on current use of, and level of confidence in using, assessment techniques are given below, followed by results on level of use in recording methods and confidence with reporting techniques. Mann-Whitney U tests carried out on the data indicated that there were significant differences between the genders and school levels on assessment instruments utilised and confidence in using them, and recording and reporting techniques.

Table 9 *Use and Confidence with Assessment Instruments.*

INSTRUMENT		Prim fem	Prim male	Sec female	Sec male
timed tests	use	18.0	29.0	83.0	87.0
	confid	63.0	86.0	96.0	95.0
homework	use	53.0	58.0	51.0	37.0
	confid	67.0	75.0	74.0	59.0
projects	use	20.0	20.0	9.0	9.0
	confid	64.0	73.0	63.0	55.0
practical	use	67.0	53.0	14.0	10.0
	confid	84.0	83.0	77.0	62.0
oral tests	use	49.0	44.0	20.0	21.0
	confid	86.0	84.0	60.0	55.0

Table 10 *Percentage of Using Recording Methods.*

REC. METH.	Prim female	Prim male	Sec female	Sec male
Anecdotal	93.0	86.0	34.0	28.0
Criteria sheet	54.0	54.0	74.0	67.0
Mark sheet	78.0	87.0	95.0	94.0
Spreadsheet	11.0	15.0	30.0	38.0
Checklist	96.0	90.0	59.0	52.0

Table 11 *Confidence Using Reporting Methods.*

REP METH	Prim female	Prim male	Sec female	Sec male
Letter grades	59.0	76.0	93.0	91.0
Profiles	57.0	49.0	81.0	76.0
Certificates	41.0	30.0	53.0	51.0
Par-tch interv	91.0	90.0	84.0	74.0

Analysis of variance of the summary data in Tables 9 to 11 revealed that significant differences exist between primary and secondary level teachers in the extent of use of the following assessment instruments: timed tests, projects, investigations, practical work, and oral testing (not homework). There were no significant differences in the extent of use of the assessment instruments between male and female teachers.

In relation to levels of confidence with these instruments, the only significant difference existed between primary and secondary teachers for oral testing. There were no differences in the levels of confidence with the assessment instruments between male and female teachers.

Discussion and Conclusions

The demographic results showed that most teachers at both the Primary and Secondary level were in the 26 - 45 year old age bracket and that the majority of the teachers in the survey had been teaching for between 6 and 20 years. The demography of the primary schools indicated that most of the male teachers were in the upper years with the female teachers concentrated more in the lower years. Similarly, the demography of the secondary schools indicated that the male teachers were more prevalent in the year 11 and 12 classroom.

With regard to education, the demographic results showed that the secondary male mathematics teachers

had attained the highest level of education and completed more mathematical courses at a Tertiary level. However, the results also indicated that most secondary male teachers attended these courses more than 10 years ago. Finally, the demographic results showed that the majority of teachers had attended more than 3 inservice courses; and that, for the secondary male teachers, most of these inservice courses had been specifically in mathematics.

For assessment instruments, the survey responses showed that female teachers used the assessment strategies of practical work, investigations, oral testing, interviews, and analysis of work more frequently than their male counterparts; whereas male teachers used timed tests more frequently than the females. The results indicated that both male and female teachers seldom used the strategies of student self evaluation, supported teacher assessment and parent input. The results showed that primary teachers used the assessment strategies of homework, practical work, oral testing, informal interviews, peer evaluation, support teacher assessment and parent input more frequently than their secondary counterparts; whereas secondary teachers used timed tests and summative assessment more frequently. However, while there are gender differences in the extent of use of the various assessment instruments, when gender and school level are considered simultaneously, the variance for all instruments (except howework) can be attributed to differences in school level.

With regard to recording techniques, the Mann-Whitney U tests revealed that female teachers made significantly less use of the recording strategies of spreadsheets than males did, but made more use of anecdotal records. Further analysis showed that these differences were attributable to school level.

For reporting techniques, the results revealed that secondary teachers were more confident in using letter grades, profiles and certificates, whereas primary teachers were more confident with parent-teacher interviews. Further analysis showed that the difference concerning profiles was attributable to school level.

The results were conclusive in one area. With regard to use of traditional and non-traditional assessment instruments, there were significant differences between females and males and primary and secondary teachers. Primary female teachers were very different to secondary male teachers in use of all assessment techniques other than homework. The survey responses showed that primary female teachers used non-traditional forms of assessment significantly more than secondary male teachers. The survey has indicated that there are significantly more primary female teachers than secondary male teachers who are confident in using anecdotal records and parent teacher interviews, and there are significantly more secondary male teachers than primary female teachers who are confident in using spreadsheets, letter grade marks and profiles.

However when considering the two variables, gender and school level, the one which is the most significant is school level. Mathematics teachers in secondary schools make less frequent use of newer forms of assessment along with recording and reporting methods. This result has important implications in terms of the differences in teacher culture between primary and secondary schools and the feasibility of implementing alternative forms of assessment in secondary mathematics.

These issues are important because non-traditional forms of assessment increase in importance within an SPS framework, and training in these non-traditional assessment forms is a major component of teacher professional development associated with SPS. This means that the implementation of SPS in Queensland is relying on training mathematics

teachers in assessment techniques that a large proportion do not now use or have not the confidence that they will be able to use. It seems evident from the survey responses that a large number of secondary teachers will have to significantly broaden their range of assessment techniques if they are to fully implement SPS. Further, SPS professional development will also have to overcome low confidence levels and high resistance in teachers with some techniques to implement a number of the recording and reporting procedures recommended for SPS.

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