THE PROFESSION, THE PUBLIC, AND SCHOOL MATHEMATICS

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Shared meanings and constructions are necessary if purposes embedded in documents such as the National Statement on Mathematics are to be realised. One starting point is to establish where the profession and the public stand in relation to values and goals.

This paper builds on a previous study and reports on perceptions of the role and purpose of school mathematics as obtained respectively from samples of community members (N=662) and mathematics teachers (N=97). Viewpoints were sought by structured interview or questionnaire across the thematic areas of content, individual values, additudinal aspects, and folklore.

The data from the study suggest that public and professional views in relation to school mathematics have more in common with the competency movement than with the broader ideals of mathematics education.

BACKGROUND

The publication of the National Statement on Mathematics for Australian Schools, Australian Education Council (1991) provided guidelines for the learning and teaching of mathematics across a variety of content, emphases, and approaches.

Subsequent publication of The Finn Review (1991), Mayer Committee Report (1992), and the Carmichael Report (1992) has moved the national agenda firmly in the direction of competency based training. Intersections between the concepts of education in mathematics as training for vocational needs, and as a broad and rich intellectual enterprise carry inevitable tensions.

Three major players can be identified in the present climate. These are firstly government agencies which may be taken to include the concerns of business and industry in a current climate of economic rationalism.

Secondly there is the general public who provide the consumers of education in all its forms. Thirdly there is the education profession and in particular, in relation to this paper, the mathematics teaching fraternity.

One perpetual challenge to curriculum change is the move from rhetoric to implementation. The change literature is replete with examples of programs that have not achieved their goals. Reports are compiled and curricula written by highly committed professionals working from a superior knowledge base and vision. However recommendations must be realised in the real world - the world of the ordinary citizen and the average teacher; not the rarefied world of expert knowledge, total commitment, and high professional skill.

The knowledge, attitudes, and values of the community as employers, workers, parents, students, taxpayers, and consumers defines the context in which educational change is sought.

What values does the community have in regard to its expectations and perceptions of school mathematics? What perceptions do teachers of mathematics have regarding the public image of school mathematics and its role and purpose?

Answers to questions such as these are needed if a shared construction of the role and purpose of school mathematics is to be achieved. Without a shared construction initiatives for change, from whatever perspective, will have their energy dissipated.

Among the recent efforts to relate aims and achievements in mathematics education to societal contexts and national needs, factors such as gender differences, problems of motivation and attitude, the changing needs of the workforce, and the influence of government, receive continued attention.

The magnitude of the issues involved are inherent in the stimulating dialogue between Apple and Romberg (Apple, 1992 (a) and (b); Romberg, 1992). The substance of this paper addresses but one aspect of the challenge.

The aim of the study is to identify commonalities and differences between community perceptions of the role and purpose of school mathematics, and the corresponding perceptions of practising mathematics teachers.

METHODOLOGY

The paper extends an earlier study, Galbraith and Chant (1990). Further details of the rationale and an extensive literature base are included in that paper.

Influences identified and elaborated from the literature were classified into four areas according to the following criteria.

Content oriented items (C) either required a mathematical response, or involved a perception of what is important or typical about mathematics.

Value oriented items (V) sought views about what individuals believed concerning the role of mathematics, about desirable emphases in teaching, or about its importance.

Attitude oriented items (A) focussed on aspects actually experienced by individuals in their own learning of mathematics; these included perceptions of bias, personal attitudes within themselves, and related perceptions in respect of other students.

Folklore items (F) were chosen to sample popular beliefs that have typically appeared in the public media - both historical and emerging, and/or are a part of traditional views expressed about mathematics.

The items were presented in the form of a structured questionnaire which required a mix of likert type responses, open ended responses, and qualitative comment.

In all instances members of the community sample responded in terms of their own individual positions. For the teacher sample this was also the major form of response. However in some cases the teachers were asked for their perceptions of community knowledge or views. Such items are marked with an asterisk in Table 1.

Community Sample

As described in the earlier paper community responses were obtained from approximately 660 members of the public. The sample was representative, although not random, and was stratified by gender (females (334), males (326)); and by age (21-30 years (226), 31-45 years (222), above 45 years (212)). Maximum educational levels were represented respectively as (years 9-10 (272), years 11-12 (146), tertiary (240), unknown (2)). The main occupational categories were distributed as follows: (professional (145), technical/clerical (149), tradespeople/skilled workers (109), home duties (122), student (84), miscellaneous (54)).

The distribution of occupations identifies the sample as a representative urban Australian one, with a slight bias towards the professional category. If anything this may tend to increase the number valuing mathematics relative to the population as a whole.

Teacher Sample

The teacher sample was drawn from practice teaching schools used in the Diploma in Education program. Eleven state high schools (62 teachers), and nine independent schools (35 teachers), participated in the study. The sample was chosen to be representative with respect to gender (females (45), males (52)); responsibility (subject head/supervising teacher (54), neither (38), undefined (5)); and teaching experience (0-5 years (15), 6-10 years (15), 11-20 years (43), above 20 years (24)).

RESULTS

Selections from the responses are summarised and compared in Table 1. They have been selected as representative of the four thematic areas and chosen for their interest in relation to the purpose of the study.

TABLE 1

Percentage Distribution of 'Content' oriented items

C1.*	What meaning do the following statements have for you?		Correct	Incorrect/ Don't know			
	(a) pi	P	50.94	49.06			
	$\chi^2 = 25.34$ (n = 432, df = 1, p < .001)	T	30.56	69.44			
	(b) triangle with two equal sides	P	47.61	52.39			
	$\chi^2 = 15.36$ (n = 377, df = 1, p < .001)	T	47.22	52.78			
	(c) ½ x base x altitude	P	44.49	55.51			
	$\chi^2 = 6.10$ (n = 450, df = 1, p = .01)	T	72.22	27.78			
	(d) opposite over adjacent	P	17.05	82.95			
	$\chi^2 = 45.64$ (n = 228, df = 1, p < .001)	T	2.78	97.22			
C2.	It was enough to get the right answer at school; you didn't have to understand why.		SA	A	N	D	SD
		P	8.11	30.35	4.16	32.85	24.53
	$\chi^2 = 51.26$ (df = 4, p < .001)	T	0.00	0.00	5.56	37.50	56.94
C3.*	What math do you use in your daily life? (multiple responses accepted)		Arithmetic	Algebra	Geometry	Computing/ statistics	Other
			70.65	5.92	7.63	10.68	5.12
			88.26	0.76	1.89	3.03	6.06
C4.	What math should all pupils be able to do on leaving school? (multiple responses accepted)		Arithmetic	Algebra	Geometry	Computing/ statistics	Other
		P	59.16	9.98	9.66	15.51	5.69
		T	77.51	4.07	7.32	4.88	6.23

Percentage Distribution of 'Values' oriented items

V1	It is more important to be able to solve problems than to do routine calculations. $\chi^2 = 17.27$ (df = 4, p = .002)		SA	A	N	D	SD
		P	20.58	39.09	10.19	24.74	5.41
		T	9.72	38.89	25.00	25.00	1.39
V2	All mathematics subjects taught at school should be useful to students in their lives. $\chi^2 = 34.94$ (df = 4, p < .001)		SA	A	N	D	SD
		P	29.52	33.26	3.95	28.69	4.57
		T	6.94	20.83	8.33	51.39	12.50
V3	Industry is entitled to expect school leavers to be able to do job calculations. $\chi^2 = 15.46$ (df = 4, p = .004)		SA	A	N	D	SD
		P	41.37	45.32	4.16	8.52	0.62
		T	19.44	59.72	9.72	11.11	0.00
V4	It is more important for boys to go on in mathematics than it is for girls. $\chi^2 = 19.10$ (df = 4, p = .001)		SA	A	N	D	SD
		P	2.29	10.81	7.28	35.76	43.87
		T	0.00	1.39	5.56	23.61	69.44
V5	People use school mathematics marks to decide how smart someone is. $\chi^2 = 13.44$ (df = 4, p = .01)		SA	A	N	D	SD
		P	14.97	54.68	7.48	17.88	4.99
		T	4.17	75.00	8.33	11.11	1.39

Percentage Distribution of 'Attitude' oriented items

A1	Do you recall sex bias being shown by your teachers during mathematics lessons? $\chi^2 = 1.08$ (df = 2, p = .58)		Yes	No	Inapplicable
		P	17.26	53.64	29.11
		T	22.22	51.39	26.39
A2	Do you recall bias shown in maths lessons for or against pupils of different abilities? $\chi^2 = 3.41$ (df = 1, p = .07)		Yes	No	
		P	55.09	44.91	
		T	66.67	33.33	
A3*	What feelings come to mind when you recall school mathematics *lessons*? (multiple responses)		Positive	Negative	
		P	42.71	57.29	
		T	18.10	81.90	

A4*	What feelings come to mind when you recall school mathematics *teachers*? (multiple responses)		Positive	Negative			
		P	50.83	49.17			
		T	35.93	64.07			
A5	It is important that students enjoy mathematics. $\chi^2 = 4.60$ (df = 4, p = .33)		SA	A	N	D	SD
		P	38.88	46.78	7.90	5.61	0.83
		T	30.56	59.72	5.56	4.17	0.00

Percentage Distribution of 'Folklore' items

F1	Mathematics is a subject that you can either do or you can't. $\chi^2 = 11.13$ (df = 4, p = .03)		SA	A	N	D	SD
		P	13.51	32.85	6.65	36.80	10.19
		T	4.17	29.17	15.28	41.67	9.72
F2	Mathematics should be compulsory because it is good training for the mind. $\chi^2 = 4.33$ (df = 4, p = .36)		SA	A	N	D	SD
		P	20.58	41.58	11.85	22.45	3.53
		T	13.89	40.28	19.44	22.22	4.17
F3	Do you think that the mathematics of school leavers is better today than it was in the past? $\chi^2 = 18.56$ (df = 4, p = .001)		A lot better	Better	The Same	Worse	A Lot Worse
		P	5.82	29.11	28.07	26.61	10.40
		T	0.00	23.61	44.44	31.94	0.00
F4	Allowing the use of electronic calculators will lead to students becoming poorer at mathematics. $\chi^2 = 63.14$ (df = 4, p < .001)		SA	A	N	D	SD
		P	22.45	36.17	11.23	23.70	6.44
		T	2.78	13.89	6.94	52.78	23.61
F5	The use of computers means that mathematics as we know it will disappear. $\chi^2 = 73.73$ (df = 4, p < .001)		SA	A	N	D	SD
		P	8.73	29.11	13.10	34.10	14.97
		T	0.00	1.39	0.00	51.39	47.22

Discussion

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DISCUSSION

Responses to the *content* items suggest that basic results, several at the level of general knowledge, are not well remembered by members of the public. It is also interesting that teachers do not expect them to be. Does this mean that much of the material taught at school is not seen as relevant to ordinary citizens, even when it falls within the scope of what may reasonably be called basic mathematical knowledge?

Both the community and the teachers have an overwhelming view of mathematics for the majority as arithmetic, with this view more evident in the profession than among the public sample.

The *value* items provide interesting response patterns across the groups. There is a higher valuing of problem solving among the community members than among the teacher respondents, the former group strongly values utilitarian aspects of content where teachers do not, both groups agree that school mathematics should prepare students for the workforce, that mathematics is important for the prospects of both females and males, and that mathematics performance is used as a proxy for general intelligence.

With respect to the *attitude* items, the perceptions of bias based on ability is much more evident among the public respondents than bias based on gender. The teachers also agree that ability bias is the more prevalent. While the public is somewhat negative in their recollection of school mathematics lessons they are equally balanced in relation to their teachers. By contrast the teacher group is very negative in their perception of public views in relation to themselves and their subject. The self image appears decidedly low. However both groups of respondents agree that mathematics should be an enjoyable subject.

Finally the *folklore* items focus attention upon some persistent beliefs. There is substantial fatalism in the community that mathematics is a subject that a person can either do or not do. The teacher group is less strongly inclined although one third subscribe to this belief.

Support for the concept of mental discipline lingers on with over sixty percent of the community, and more than fifty percent of the teachers, believing in compulsory mathematics as training for the mind. The community and the profession are both divided as to whether current school leavers are better equipped mathematically than in the past, but the teacher group has a more positive expectation of technology in relation to the learning of mathematics than the general public.

In relation to future intentions and potential developments as promulgated in publications such as the National Statement and the Finn, Mayer, and Carmichael reports, the following observations may be made.

There is an overwhelming propensity among both the public and the teaching profession to view school mathematics primarily as arithmetic, both in terms of what is learned and what is useful. This appears to present a fertile environment for the advance of a competency based emphasis, less so for the higher ideals embedded in the National Statement.

Further, if the teacher sample can indeed be generalised, the profession as a whole has a low self image. It does not expect its students to remember what has been taught, nor to harbour positive feelings about the subject or their teachers.

A substantial amount of fatalism resides both in the community and with the teachers. Mathematics is still viewed as a subject beyond the reach of many, and as a proxy means of labelling ability rather than as an enriching study. There is, however, a positive view among mathematics teachers that educational technology has a productive future in enhancing the teaching and learning of the subject.

This paper set out to explore an aspect of the context of school mathematics believed to be an important component in the future of curriculum and attitude change. Based on the restricted samples in this study it would be risky to forecast unbridled joy for those with a vision of a future nirvana for school mathematics. The evidence we have obtained, suggests levels of understanding and value in the community, and in the profession, that have more in common with the competency reviews than with the higher ideals of the National Statement.

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