

Teaching Primary Maths What's Important? Says Who ?

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Assumptions are made about what primary school teachers need to make them better mathematics teachers. Professional development courses and conferences are held based on these assumptions? Who decides what teachers need? What do teachers want for professional development in teaching primary mathematics? Do they know what's good for them? This paper presents preliminary results of a study of primary school teachers' views of what's important in teaching maths and outlines the inherent difficulties. Teachers views of the influences on their teaching and their ideas of the perfect professional development for maths teaching are also included.

The Mathematics Curriculum and Standards Framework (1995) takes the guesswork out of deciding what's important in teaching mathematics for teachers in Victorian schools. The Mathematics Curriculum and Standards Framework's (CSF's) list of desirable features in mathematics teaching includes things such as teaching from a base of concrete experience, recognising mathematics as concrete and general and using a variety of modes of classroom activity. Teachers are urged to incorporate approaches that ensure equity and equal opportunity for all students regardless of gender, ethnicity or socioeconomic factors. The CSF recognises that individual differences between children should be appreciated and catered for and urges teachers to allow children time to develop the capacity to link mathematical ideas together, to see connections and to use ideas (CSF, p 11-14). The importance of language, integration of mathematics with other subject areas and problem solving in mathematics is reinforced by the fact that almost an entire strand, tools and procedures, is devoted to them. The CSF reflects views that are reinforced in teacher training institutions, professional development courses and conferences, that changes in mathematics teaching are unavoidable with the advent of calculators and computer software. These have forced a major re-evaluation of school mathematics curricula in terms of content and strategies for teaching and learning mathematics.' (CSF, p.14).

Victorian teachers are currently coming to grips with the prescriptives of the mathematics CSF. While some aspects of the CSF are contentious, many mathematics educators would agree with the list of characteristics of a successful mathematics program. Examination of the CSF provides an indication of what is generally agreed to be important in teaching mathematics.

What do primary school teachers think is important in teaching mathematics? What do they find difficult? How would they design professional development when given the opportunity? This paper is a preliminary analysis of research that asks primary school teachers for their views of what is important in teaching primary mathematics, what are the difficulties in teaching mathematics to primary school children and what helps in professional development? The research also asks teachers how they feel about themselves and addresses ideas of change in teachers' views by asking them about significant agents of change in their teaching. This research is part of a larger study.

Method

One hundred and eight teachers working in primary schools were surveyed. The sample included 88 teachers working at 13 suburban schools in Melbourne and a group of 20 teachers who were enrolled in graduate diplomas in Education at Royal Melbourne Institute of Technology (RMIT). The teachers' experience ranged from first year out to

thirty five years teaching with an average of fourteen years in the classroom. [The RMIT sample was included after the first 88 surveys were returned as they represented a much younger, less experienced group, while many of the teachers at suburban schools had been teaching for many years, and it was felt that the younger teachers were not well represented in the original sample.]

The survey included ten questions of a biographical nature, seven written response questions and thirty questions requiring responses on a five point Likert-type scale. The research reported on in this paper is an analysis of the written responses to the following five survey questions:

What do you consider to be most important when teaching maths to primary school children?

What is the most difficult aspect of teaching maths in primary school for you?

How do you feel about yourself as a teacher of mathematics?

Which things, people or events have been most influential in your teaching of mathematics?

If you could design the perfect professional development for teaching mathematics in primary school, what would it be like?

The data were analysed by compiling all the responses to each question. These were then analysed to reveal patterns or themes in the data, using Nudist (1994). This method of analysis has been derived from the approach described by Marton (1993) in which the data is treated as a whole and patterns identified.

To provide an indication of the strengths of themes in the data percentages have often been used in the results. The percentages represent the proportion of the one hundred and eight teachers who mentioned a particular theme in their response. As any one response may contain references to a number of themes, the total percentage of respondents to any one question is often much greater than one hundred. For example, respondent one's responses to the question 'what do you consider to be most important when teaching maths to primary school children' were as follows: 'use of concrete materials, allowing children to solve problems in their own way, discussion and explanations in small groups after to clarify their thinking, real life experiences'. This response referred to four different ideas; concrete materials, solving problems, using language and real life experiences that would be sorted into four different categories.

Results

What Do You Consider To Be Most Important When Teaching Maths To Primary School Children?

The most important factors in teaching mathematics were developing knowledge and understanding of mathematical skills and concepts, generating enthusiasm for and confidence in mathematics by making maths fun and enjoyable, using concrete materials, and making mathematics meaningful for children. Other aspects that were important were solving problems, the use of language and providing adequate individual attention.

Knowledge And Understanding Of Skills And Concepts: Sixty percent of the teachers used the words 'knowledge' or 'understanding' when answering this question. They stated that it was important for children to have 'appropriate', 'sound', 'basic', 'clear', understanding and knowledge. Two thirds of the sample referred to the importance of skills and concepts, for example, 'a good understanding of the four operations', 'firm foundations in all areas of maths' and 'tables and automatic responses are extremely important'. Knowledge and understanding were also said to be important for teachers, who need an understanding and knowledge of the whole primary course, the strand they are teaching, of individual differences in children, of how children learn and of where children are at.

Concrete Materials: Concrete materials and hands on activity were said to be important, by 40% of participants, in practical work at all levels and for developing a good understanding of skills and concepts by providing a bridge from the real to abstract.

The teachers indicated that lots of hands on experience was required to introduce new concepts, for modelling mathematical ideas and for reinforcement.

Enjoyment and Enthusiasm: Affective factors, like keeping children interested, fostering enthusiasm and enjoyment of maths by offering challenges to keep children interested and using fun activities were included in responses to this question. Thirty seven percent of responses referred to the importance of things like developing a love of mathematics and confidence in children about their ability to do mathematics..

Real Life Maths: Making mathematics relevant to children was a part of the responses of thirty six percent of participants, who agreed that linking mathematics with real concepts and children's everyday lives was a way of making mathematics meaningful to children.

Other Factors: Only seven percent of teachers mentioned the importance of problem solving and most of those don't discuss what makes problem solving important although one teacher suggested that it extends children's abilities. Language was mentioned in only 6% of the responses as a way of clarifying ideas, explaining strategies and linking with other language activities. Catering for individual differences arose in 7% of the responses.

What Is The Most Difficult Aspect Of Teaching Maths In Primary School For You?

These teachers found it difficult to cater for the range of abilities of the children in their classes. This was made more complex by composite classes and multiage teaching. Difficulties presented by lack of materials and resources for teaching were mentioned by many teachers as a major problem for them. However the most significant difficulty identified by the teachers, because it impinges upon all of the other difficulties mentioned, was a lack of time.

Time: By far the most frequently mentioned difficulty for the teachers was finding the time to cover the content and scope of mathematics thoroughly, finding the time to organise practical activities, time to teach as effectively as they would like, time to assist individuals and time to enable children to work at their own pace. Thirty eight percent of the teachers referred to a lack of time as the most difficult aspect of teaching maths in primary school. They needed more time to plan, to teach and to try new ideas.

Catering For Individual Differences: Although only 7% of the sample nominated catering for individuals in their most important list, the difficulties associated with catering for individual children in the classroom were referred to by 30% of the sample. Concerns ranged from children at lower levels who hadn't covered the course to extending gifted children. Teachers were challenged by planning programs to cater for the wide range of abilities to be found in classrooms.

Resources And Concrete Materials: Twenty percent of the participants stated that resources and materials presented difficulties. The problems included availability of interesting materials, lack of and access to equipment, organising and storing equipment.

Other Difficulties: Other difficulties mentioned were problems associated with large classes (9%) and attitude factors (6%) such as negative attitudes, hostility towards the subject, and making maths enjoyable .

How Do You Feel About Yourself As A Teacher Of Mathematics?

The responses to this question were sorted into five groups. It can be seen from Table 1 that the majority of respondents (52%) are in the first two categories; 'good' and 'good but...'. All of these teachers used terms like good, confident, comfortable or enjoy to describe their feelings about themselves as teachers of mathematics. Forty one percent of the teachers seemed to be content with themselves as teachers of mathematics. The category 'good but...' arose because a subgroup of the teachers (11%) who considered themselves to be 'good' teachers of mathematics also added a qualification to their statements with the use of words like '...but (I) get frustrated sometimes', '...but I adopt a fairly traditional approach that suits me' and '...but there's always room for improvement through PD'. These qualifications were significant because they indicated

that these people were not content just to be good. They were continually evaluating themselves and seeking improvements in their teaching.

Good or enjoy	41.6%
Good but...	11.1%
Feeling better - Improving	19.4%
Adequate	2.8%
Could be better	10.2%

Table 1: Responses to *How do you feel about yourself as a teacher of mathematics?*

Nineteen percent of the teachers described themselves as feeling better or *improving* as maths teachers. Many of them spoke of improving in confidence over time. Some mentioned the influence of new programs, books and inservice programs. Only 3% of people felt they just managed or were just adequate as maths teachers while 10% felt that they could be better teachers of mathematics. Their comments included:

...I would certainly be inadequate if I had to teach maths above grade 4 level...

...I feel it is not my strength but I enjoy integrating maths into my unit and making it meaningful. I am worried how my knowledge will be if I have to take a senior school class...

...I believe that I don't address the maths need of the each child in the group equally. There are too many invisible children who do things to an average or minimalist level. I need to motivate myself and the children to think more mathematically...

Which Things, People Or Events Have Been Most Influential In Your Teaching Of Mathematics?

Planned professional development courses and conferences were most influential in improvement for these teachers. Colleagues - teachers working together - sharing and learning from each other, also rated as significant influences. Teachers' histories, arose also, in the descriptions of influences. Almost one third of the teachers mentioned their own school experiences were important, while a quarter of the sample referred to teacher training experiences.

Professional Development Courses And Conferences: Professional development programs, inservice courses and Maths Association of Victoria conferences were said to be influential in the teaching of mathematics for 43% of respondents. In this question 23% of the sample referred specifically to the EMIC programs (an ongoing professional development package that involved reading research papers, discussing current approaches, sharing of good ideas by teachers and the trialing of material in classrooms) that were conducted in Victorian schools in the early 1990's. Twenty two prominent presenters of professional development were named as being particularly influential.

School Experiences: Personal experiences as school students were mentioned by 32% of the teachers as being most influential. Of these 51% recounted positive experiences at school, while 31.3% recalled negative school experiences. The rest of the participants (17.4%) described experiences that were either both positive and negative ('I was good at primary school but fair in secondary' or it was not possible to tell ('secondary maths teacher').

Those whose recollections of school experiences were positive spoke of their own enjoyment and love of learning maths in school and of teachers who allowed them to explore first, developed their understanding and who showed patience. Recollections of negative school experiences were of feelings of inadequacy, fear of being thought 'dumb' and low self esteem.

Colleagues: Working with colleagues in various ways was said to be influential for 29% of the participants. This category includes teaching colleagues who passed on hints, shared ideas and were involved in team planning. Some teachers mentioned colleagues who had provided them with effective modelling of good practice and others spoke of the

benefits of working with experienced teachers and the positive effect of encouragement from other teachers.

Teacher Training Experiences: One quarter of respondents mentioned teacher training experiences as being influential in their teaching. Three people felt their teacher training had a negative influence, while the majority in this group stated that their teacher training had influenced their teaching in positive ways such as development of understanding of concepts that previously had been learned by rote. Many teachers referred to a particular lecturer who had made a difference.

Curriculum Materials: Text book series like Eureka, Young Australia Maths, Rigby, MacMillan and other books which provided information and activities involving current approaches, as well as curriculum support materials and the Curriculum and Standards Framework were regarded as influential by 19% of the teachers

Other Influences: Learning from children, about how they think and learn, was an important influence for 9% of the teachers. Seven percent named professional reading as most significant for them and four percent wrote of the importance of their fathers as positive influences on their maths learning. Others described the influence of experimenting with various teaching techniques and being involved with the calculator project.

If You Could Design The Perfect Professional Development For Teaching Mathematics In Primary School, What Would It Be Like?

Given the emphasis that these teachers have put on planned professional development (PD) courses and conferences as influences, their views on the perfect professional development will be relevant when planning for future change. These teachers, for whom time is of the essence wanted practical, relevant PD that is ongoing and provides them with activities and ideas that they can readily use. They wanted help with planning and programming, particularly concerning catering for children's individual needs and are interested in trying out ideas that have worked for other teachers.

Activities And Ideas: Thirty seven percent of the teachers mentioned that professional development for teaching maths in primary school needed to provide maths activities and ideas. Many (21%) used the words practical or relevant in answering this question. These words were usually coupled with fun, interesting, activities or ideas. Activities in the ideal professional development course should be hands on, previously trialed by teachers and readily implemented.

Programming And Planning: Programming, sequential planning that ensures 'proper' development of all aspects of mathematics and assessment, with support from other teachers working at the same level would be included in the perfect PD program designed by 25% of these teachers. The ideal PD would be ongoing, for 13% of the respondents, rather than one off sessions. An ongoing program, like EMIC, they felt, provides opportunities to trial ideas, share resources and keep teachers in touch with current issues.

Other Approaches: Twelve percent of the teachers wanted PD to provide them with information on what to teach and how to teach it based on current research on how children learn. Sharing 'what works for me' between teachers was mentioned in 9% of the responses as being a worthwhile aspect of professional development, while seven of the teachers (6%) thought that observing other teachers who were highly skilled would be of use in professional development.

Discussion

How do the teachers' views of teaching mathematics in primary schools compare with the view presented by curriculum developers, in the mathematics CSF? Thirty seven percent of the teachers involved in this research felt that affective factors like enjoyment, enthusiasm and confidence were important yet these are overlooked in the CSF. The issue of 'time' is addressed in the CSF in the context of allowing time for the growth of

mathematical ideas in children. There is almost a plea emerging from the teachers' data for more time, for this, and so many other aspects of the teachers' work.

While teachers were concerned that mathematics should be made relevant to the children, issues of integration of mathematics with other subject areas were not a concern for them. There is quite a difference in the importance placed upon the roles of problem solving and language when comparing the teachers' view with the perspective of the CSF. Only 7% of the teachers felt problem solving was important, and only 6% of the teachers mentioned the importance of language. By comparison these things are stressed quite heavily in the Mathematics CSF. Gender equity, equal opportunity and the use of calculators and computer software do not arise as important for these teachers.

There are obviously differences in the issues that are important to the teachers involved in this research and those who determine curriculum for primary schools. Do these differences constitute the basis for further professional development for these teachers or should the areas of difficulty like catering for individual differences and organising and using concrete materials, which were identified by the teachers, determine their professional development? Who should decide what teachers need for professional development? While debate over what teachers need should continue, serious consideration must be given to professional development that is ongoing, practical and includes peer support programs. Solving the problems associated with the shortage of time could take a little longer!

References

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