

Beyond the Ivory Tower: nurturing teachers at the chalkface

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Abstract

During 2001, as the writers spoke with teachers in several primary schools in the North and North West of NSW, it became apparent that there was a lack of professional development opportunities available to them, particularly in the area of innovative mathematics pedagogy. This has contributed to the persistence of traditional mathematics beliefs about the subject mathematics, how it is learnt and how it should be taught. The writers suggest that there is a role for the teacher education staff in the mathematics curriculum area as facilitators for pedagogically-based professional development programs. This paper describes four models of professional development that may provide ways of reconnecting research and practice in the field of primary mathematics and of revitalising teaching as a profession.

1. Introduction

Understandings of how children learn (and thus how best they may be taught) change as society changes and as research offers new insights. Practising teachers need to be informed of these changes and to adapt their practice so that they continue to engage children in learning appropriate for the time and place. They need also to be exemplars for beginning teachers. The content of the mathematics curriculum has changed little during the last decade. At the same time, the introduction of outcomes as content organisers, problem-solving methods and an emphasis on teaching for understanding has meant that teaching methods have needed to change. Because of the nature of the subject and beliefs held by teachers, students and parents about the subject, innovative teaching practices are still regarded sceptically by many.

As a consequence of the writers' visits to schools in the North and North West regions of NSW, it became apparent that there was a lack of access by primary school teachers to a range of professional development that focused on innovative mathematics pedagogies. Ideally, professional development goes beyond providing teachers with a set of classroom activities that meet curriculum outcomes and challenges their beliefs about the subject and the way children learn mathematics. As teachers are confronted by such changes, they need on-going support in order to lessen a sense of professional isolation. They need opportunities and time to reflect on their practice and to discuss their ideas with other teachers beyond their immediate colleagues. The problems of distance – time and costs of travel, accommodation, workshops and family commitments – exacerbate systemic and attitudinal impediments to teachers committing to such a professional development programs in rural and regional areas.

Coincidentally, two apposite reports have recently been released: *Quality Matters. Revitalising teaching: Critical times, critical choices*, written by Gregor Ramsay for the Minister for Education and Training, released in November 2000, and *PD Australia 2000*, commissioned by DETYA, compiled by National Curriculum Services, headed by David McRae and released in 2001. Both reports draw data from all education sectors – government, Catholic and Independent, primary and secondary.

The Ramsay Report is a review of teacher education in NSW. It examines pre-service teacher training, beginning teacher induction in schools as well as the continued

learning by practising teachers. The report suggests that there is a need for pre-service teachers to gain greater professional experience and for teacher educators to work more closely with schools and practising teachers. It also challenges assumptions underlying the current framework of the professional development of teachers in NSW and proposes new directions designed to create an environment that places greater value on the continued learning by teachers.

The latter report, *PD 2000 Australia*, focuses solely on the professional development of teachers across Australia. Professional development is taken, in the report, 'to mean deliberate processes designed for the purposes of teacher post-initial professionally related education and training'. It is this definition that the writers will adopt in this paper. *PD 2000 Australia* takes a more positive view than that expressed by Ramsay in *Quality Matters*, concluding that participation by teachers in professional development activities has risen during the last decade. This report also provides analyses by subject, so there is some indication of the emphasis given to mathematical issues within the overall context of professional development.

Despite the apparently contradictory perspectives taken by these two recent reports, there is, in the detail, considerable concert. The differences between that which is described nationally and that for the state, serve to highlight the inadequacies of teacher professional development in NSW noted by Ramsay and perceived by the writers of this paper. If professional development in general is found to be somewhat lacking, then that with a mathematical focus is even more so. For example, the NSW Association of Independent Schools (2001) publishes on its Web site an annual calendar of professional development activities – in Sydney and near environs. In the 17 pages of the 2001 program, there was only one one-day workshop specifically targeting mathematics (Years 5 – 10), one two-day conference (K-2) which may have addressed things mathematical and two other general workshops that could have some impact on mathematical curriculum and pedagogy.

Reports which specifically address issues in mathematics education and teaching have been published in England and the United States of America. Askew et al. (1997), in a study of teachers in three Local Education Authorities, identify characteristics of effective teachers of numeracy. One way in which teachers can obtain or enhance their skills in the teaching of numeracy is by Continuous Professional Development (CPD) focused on mathematics concepts and teaching methodologies (pp.74-75). In America, John Glenn chaired a formidable committee that compiled a Report to the Nation on the state of Mathematics and Science education. The report identifies reasons for America to have a citizenry that is well educated in mathematics and science, reasons that are equally applicable to Australia (pp.10-12). In order that this be achieved, changes need to be implemented and 'the most powerful instrument for change...lies...with teaching itself' (p.5). To change teaching practice requires, amongst other strategies, the institution of a professional development structure that empowers teachers to deliver high quality teaching (p.18).

This paper examines some aspects of professional development for primary school teachers in all education sectors. A brief overview of the findings of the reports mentioned above will be followed by a description of the study and the data collected. The writers identify some issues arising from the data and discuss consequent implications for professional development programs. Four models of professional development are described.

2. A Brief Overview of Professional Development in Australia and NSW

Although McRae et al. (2001) report that teachers are participating in more professional development than in the previous decade, little of it has a pedagogical basis. Many activities are focused on training teachers to implement systemic changes. Other professional development sessions provide training in behaviour management of children, school leadership or in compliance with mandated legal and Occupational Health and Safety aspects (McRae et al., 2001, p.32). Professional development included activities initiated by education authorities (state, commonwealth or regional) school administration, and school staff. Modes of delivery ranged from staff meetings with a professional development focus, school/program/curriculum planning and adjustment sessions to individual attendance at seminars, workshops and conferences.

Across the nation, there has been increasing devolution of responsibility for professional development to schools, although in their report, McRae et al. (2001, p.84) refer to it as 'dispersal'. The responsibility for professional development was devolved to schools so that activities relevant to the needs of a group of individual teachers, or a group of schools, could be locally organised and run, rather than be centrally controlled with a concomitant diminution of relevance. However, the worthy principles of devolution are often undermined when 'system initiatives [are] afforded priority over school and individual professional development demands where these are incompatible' (McRae et al., 2001, p.84, quoting part of Clause 25 of the EBA, WA government sector).

In NSW, two pupil-free days a year are set aside for mandatory professional development. Schools in the Catholic and Independent sector tend to follow a similar program. But, in many cases, such activities tend to be 'rudimentary and sometimes superficial in nature', and are 'frequently met with cynicism' (Ramsay, 2000, p.80).

Organisation of professional development in NSW has become more centralised because of cuts to discretionary funds available to schools (McRae et al., 2001, p.31). Funding for professional development in NSW, in this area, is currently quoted as: Government sector - \$40 per capita per annum; Catholic schools - \$115 per capita per annum. Whilst Independent schools set their own funding levels, the writers were advised that in 1999 a local Independent school allowed \$100 per capita per annum (Personal communications). These are defined allocations of discretionary funds per teacher and do not include professional development funding that may be accounted for in other budgetary items. McRae et al. report that across the nation 'In 17% of cases this spending [on professional development] was less than \$50 per staff member annually; in more than 65% of cases, this figure was \$100 or more (McRae et al., 2001, p.124). Coupled with these funding figures is the observation that teachers were generally unwilling to outlay large amounts on their own professional development. The reasons for this are many, some noted in the report, but the most salient is that the education systems do not reward time, effort or money spent (McRae et al., 2001, p.152; Ramsay, 2000, p.81).

The lack of tangible support or rewards has also contributed to the fact that fewer post-graduate formal qualifications are now being sought than during the previous decade. When teachers do undertake further formal study they make a considerable

commitment in terms of time and costs (HECS, travel, texts etc). If the profession has no structure that attributes value or recognition to these pursuits, there is little incentive, other than personal satisfaction, to make that commitment. (McRae et al., 2001, pp.11, 91, 134; Ramsay, 2000, p.23). The irony is that, having furthered their understanding of pedagogical issues, or studied a particular subject in depth, if teachers wish to take advantage of promotional or salaried rewards that exist, they must move out of the classroom into administrative positions. A similar situation exists in the US (Glenn, 2000. p.26).

During the last decade, three-year trained teachers were expected to undertake formal study in order to attain the same level of qualification as more recently graduated teachers. Less experienced teachers had, therefore, access to a structured program that led to career options than would otherwise have been unavailable. This 'catch up' program has run its course. Now, less experienced teachers claim greater difficulty in gaining permission for professional development than those with more experience. The result is that participation in professional development activities of all types appears to be higher for experienced teachers and particularly for those in administrative positions (McRae et al., 2001, pp.154 -159).

Most professional development activities were delivered as one-off, face-to-face workshops with follow-up sessions in some cases. The variety of activities was found to diminish as the location became further removed from city centres (McRae et al., 2001, p.10): 'The problems generated by distance recur regardless of any other factor' (McRae et al., 2001, p.86) – problems mentioned in the introduction above. To resort to the use of Information and Communication Technologies (ICTs) is not, it would seem, to be a way of reaching a large number of teachers. Only 12.5% of male teachers and 8.3% of female teachers across all education sectors expressed a preference for learning via these media (McRae et al., 2001, p.12), and only 10.6% of female teachers expressed a preference for on-line learning, compared to 17.9% of men (McRae et al., 2001, p.149).

All sectors accessed Commonwealth funding for designated priority areas with the following percentages of respondent schools including the topics in their professional development programs: Teacher's ICT skills 89.3%, Literacy 88.6%, ICTs in classroom 76.8%; Numeracy 54%; Maths 34.1% (McRae et al., 2001, p.126). Later in the document there is an analysis of duration of activities longer than a day (p.141), and it is apparent that time spent on numeracy or maths is considerably less than that spent on literacy. The figures are the more difficult to interpret because respondents had trouble distinguishing the meanings of 'numeracy' and 'mathematics' (pp.141-143). Despite the reported increase in professional development activities, it is not apparent that there is any particular structure in place to encourage a program of teacher involvement with an ongoing critique of individual and systemic curriculum and pedagogy. Ramsay deplores a climate that fails to model the 'lifelong' learning that is necessary to and characterises other 'professions' (Ramsay, 2000, pp.80-81).

Of particular concern for teacher educators is the increasing lack of interest in mathematics in high school and beyond. One response to the decline in enrolments in mathematics and science faculties is to examine the quality of teaching in high school, and, perhaps most importantly, in primary schools, where many of the attitudes to learning and to particular subjects are formed and reinforced.

...the way to interest children in mathematics and science is through teachers who are not only enthusiastic about their subjects, but who are steeped in their disciplines and who have the professional training – as teachers – to teach those subjects well. Nor is this teacher training simply a matter of preparation; it depends just as much – or even more – on sustained, high quality professional development (Glenn, 2000, p.5).

The attitudes and beliefs of teachers about mathematics inform the way they teach the subject and, in turn, the attitudes and beliefs of their pupils.

3. The Study

There are two sections to the study. The first section examines data collected during discussions with practising teachers in schools. The second section looks at data derived from post-professional experience discussions with the pre-service teachers in lectures and workshops.

The schools visited were in or near rural towns in the North and North West of NSW. The size of the schools varied from more than 700 to approximately 35 students. No school was extremely isolated. The levels of funding and resources available to and accessed by the schools varied considerably, as did the experience and background of the teachers in those schools.

Professional development activities undertaken with a maths focus were categorised formal or informal. Formal in-service activities included: studying for a degree, further degree or diploma, or participation in organised workshops or conferences, either specifically on maths/numeracy, or on more general topics such as gifted and talented education, early-childhood learning, class management, text book evaluation, reading recovery, use of concrete materials, as well as staff meetings, either with a specific maths focus, or a specific maths time slot. Informal activities included: staff meetings or programming sessions where the development of staff was not a deliberate goal of the activity, individual teaching experience and ‘own reading’ as well as discussions with colleagues, family and friends.

Forty-five of the participating teachers had amassed 832 years of teaching between them. From these teachers were received 75 indications of participation in some formal professional development activity. Some of these activities involved several teachers from the one school, or from a group of nearby schools (eg. participation in a Count Me in Too (CMiT) workshop may have involved six of the respondents at the one time). Some teachers had undertaken more than one formal professional development activity during their teaching career. Most of the activities were no longer than two days. Only two teachers in our sample had undertaken further long-term study.

If we include school staff meetings and school or syllabus organisation days as examples of formal professional development, we have 89 indications of participation. Thus every one of these 45 teachers participates, on average, in some mathematics professional development every 9.3 years.

In my 28 years as a teacher I have seen seven curriculums measuring about 25 cm high grow to over two metres of syllabus and support documents of dense text. I’ve had no real teacher retraining except a scattering of after school curriculum development meetings and my own reading (Ramsay, 2000, p.81).

This quotation could have come, almost verbatim, from any one of a dozen or so conversations. When one considers that the flurry of mathematics professional development activity which occurred at the time of the introduction of the 'new' K–6 syllabus is likely to have been one of the 'scatterings' for this teacher - maybe 11 years ago - there is a distressingly long time between drinks at the fount of mathematical knowledge!

There were 42 responses identifying activities that could be classified as informal professional development activities. These included staff meetings and, most significantly, sessions devoted to the development of maths scope and sequence charts across the school. Teachers involved in these sessions remarked how much the exercise contributed to their understanding of the development of mathematical understanding in children. Other informal professional development, predominantly through 'colleagues' or 'other experienced and enthusiastic staff members', or 'a family member' accounted for 14 responses.

Many schools in the study had engaged staff in activities such as the development of 'scope and sequence' charts, or devoted some staff meeting time to mathematical issues, thus providing opportunities for staff to discuss content and teaching methods. However, 15 teachers expressed the need to talk with other teachers from other schools. They wished to find out how other schools implemented outcomes-based programs, developed problem solving in mathematics and how they managed within a prescribed timeframe. They also felt that they needed guidance and encouragement to reflect on their own beliefs and practices.

The writers of this paper observed that much 'good' teaching with a constructivist basis happens in the early stages of schooling (Years K – 3), but methods become increasingly traditional, relying on textbooks, note-taking and repetitive exercises, in the higher grades (also reported by Glenn, 2000, p.17 and Ramsay, 2000, p.23). The reasons for this may be many, but important ones noted are the need for teachers to complete a crowded curriculum that requires a considerable depth of mathematical understanding, the necessity to comply with mandated hours of teaching time for all KLAs and the pressure of external testing that occurs in Years 3, 5 and Year 7.

For pre-service teachers, the influence of what actually happens in the classroom of experienced teachers is profound. The models they emulate determine whether they continue past practice or implement innovative methods. Pre-service teachers when asked to describe lessons observed almost invariably describe lessons where textbooks or photocopied worksheets have dominated the activities. One student approached her lecturer for advice on how to meet her supervising teacher's demand that she use the class textbook and at the same time teach the mathematics the way she had been taught at university, and the way in which she wished to teach. Other students responded that they had not been allowed to develop their own maths lessons whilst on professional experience in schools – they have been presented with the text, or a series of worksheets with strict instructions to teach to these exactly as their supervising teacher required. In addition, they have not been permitted to include further explicit mathematics in any other subject area. Many of these requirements are in direct conflict with what pre-service teachers are taught about how children learn and how best to teach.

Some teachers have been very much involved in professional development activities, but it became clear that, in this corner of the state, meaningful and continuing

professional development with a focus on mathematics and with associated structures that acknowledge, value and encourage teachers to be lifelong learners was missing in all school sectors.

Much of the evidence gathered at this stage is derived from discussion with teachers and pre-service teachers in education courses at UNE. There needs to be more careful data gathering from deeper questioning of a wider sample. The research instruments used by Askew et al. (1997) in their study suggest a suitable framework. (Appendix 2.1, p.109).

4. Issues

The overriding issue is the lack of professional development opportunities in mathematics curriculum and teaching for both beginning teachers and experienced teachers. Beginning teachers need support as they encounter the successes and tribulations of the early years of teaching to retain their enthusiasm for the job and continue to grow in understanding and expertise. Experienced teachers need to have the chance critically to appraise their work so that they continue creative practices and use their expertise to promote better educational outcomes, for their pupils and colleagues.

When pre-service teachers and practicing teachers have been asked about their views on the nature of mathematics, the predominant response is that mathematics is about number, computation and is 'useful, if you know the rules'. It is these beliefs which influence how mathematics is taught, how the curriculum package is actually implemented. In the context of rural and regional schools, traditional conservative methods of teaching mathematics prevail as many schools are staffed either by those whose longevity of tenure is well over 10 years or by neophytes who look to the more experienced teachers as role models and mentors – which often produces conflict with their recently acquired university learning.

More specifically, the writers have identified eight issues emerging from the study. They are:

1. Negative responses by experienced teachers to non-traditional mathematics teaching practices and their rejection of university learning by 'forget all that' responses to ideas from new or pre-service teachers.
2. Negative responses to non-traditional mathematics teaching practices by parents and students.
3. Reliance by teachers, students, parents on textbooks as authoritative interpretations of the mathematics syllabus.
4. Lack of established discourse that encourages informed, professional analysis of curricula or methodologies. Instead, professional isolation is present in all education sectors and, in the country regions, it is exacerbated by geographical isolation.
5. Little time and few structures that enable teachers to engage in meaningful reflection about their practice and to research and incorporate new methods into their teaching.
6. The tendency for current professional development programs to direct available resources to meet 'central office' priorities, linked to commonwealth priorities, curriculum change or a regional initiative. Devolution of professional development responsibilities to schools has occurred without a framework and so the pedagogical needs of teachers and the system are met in

an *ad hoc* manner, and often by means of a 'deficit' model of professional development.

7. A renewal of emphasis on external basic skill testing has reinforced the traditional beliefs held by teachers, students and parents about mathematics, what it consists of and how it is to be taught. These views are unsophisticated, often reductionist, equating intelligence in maths with speed and accuracy of computation and understanding with an ability accurately to process complex problems (Cooney, 1994, p.12).
8. Where there has been poor preparation of teachers to teach maths, there is a lack of deep conceptual knowledge and of rich perceptual connections. Such teachers do not have a conceptual basis for analysing students' responses and lack confidence when dealing with change (Hyde et al., 1994, p.51), which has been, in the case of mathematics pedagogy, necessitated by the findings of research over the last forty years.

These are issues arising from a change in the understandings of mathematics pedagogy held by researchers and teacher educators that have not been successfully communicated to the much wider community of teachers at the 'chalkface'. Successful communication of these ideas involves a rather longer process than a mere 'telling' of teachers in the hope that the changes in understanding can be quickly and efficaciously 'transferred'. Askew et al. (1997), as noted previously, report the effectiveness of teachers having engaged in long term CPD in mathematics compared with the effectiveness of those teachers who have engaged in other CPD or none at all. (p. 74-75).

5. Implications

The Ramsay Report makes much of the need for staff in education faculties to be in greater contact with schools. Given the 'crisis' in mathematics in schools, there is an even more compelling need for educators in this field of pedagogy and curriculum to work more closely with schools and teachers than they have done in the recent past. Professional development programs initiated by or facilitated by teacher education staff are one way of achieving this liaison, and may provide cooperative research bases. This will require suitable funding for universities to do this and recognition by prestigious journals that the research findings are valuable and worth publishing.

The type of mathematics professional development programs the writers suggest would incorporate several aspects.

They would provide support to newly-graduated teachers either by providing continuing direct access to university staff via ICTs, through organised discussion groups, or by supporting the development of mentors in schools where new teachers are placed. Such programs should give to new teachers strategies by which non-traditional methods can be used to teach mathematics effectively. These strategies could help them evolve their practice (and maybe the practice of others in the school), as well as maintain the learning skills they acquired during four years at university. The programs should provide a forum for newly-graduated teachers to express their fears, frustrations, and successes in a constructively critical way so that their teaching develops more systematically than by 'trial and error'. Such programs imply that the staff of the training institution see their responsibility as going beyond the 'hallowed halls', not as 'professional know-it-all' but as mentor, advisor, joint researcher to include teachers as an integral part of a community of scholars engaged in lifelong learning.

The programs would also provide professional development to experienced teachers that would revitalise and renew their enthusiasm, continue their professional growth and understanding and lessen their professional isolation. The programs would also provide a basis for experienced teachers to understand and support new teachers trying non-traditional methods as 'critical friends' and mentors.

Professional development programs do need to address 'big issues' in the context of classroom practice. Professional development needs to provide strategies that teachers can implement in the classroom, ways in which they can reflect upon the effectiveness of those strategies, and a time and place to discuss these reflections with others in terms of the mechanisms as well as the underlying pedagogical philosophies. McRae et al. (2001, p.136) note that 50% of primary teachers (and 40.8% of secondary teachers) are interested in current trends. During visits to schools, teachers in more than half of them remarked on the benefits of being able to think about their practice in the light of new research and theories and being able to discuss those thoughts with colleagues as well as 'outsiders' who understood their profession.

Activities that challenge beliefs and build confidence in content and pedagogical knowledge followed up by reflective, evaluative, debriefing sessions will ensure that changes instituted by teachers have a substantive base. The program ought also to acknowledge that teachers are adult learners with considerable expertise, experience and well-developed thinking skills (Jones et al., 1994, p.24). Such teachers are, consequently, more likely to engage with a program that uses a developmental paradigm rather than a 'deficit' model. Ramsay (2000, p.23) acknowledges the 'deep well of the teacher's professionalism' that must be valued and the skills of experienced teachers drawn on in the exercise of raising the overall standards of teaching and learning.

Some professional development programs need also to involve parents. Joint participation can inform parents in a meaningful way about changes in teaching, and change their beliefs so that they can support at home, by their attitude, what goes on in the classroom. By providing a professional development program that includes all stakeholders in education, the universities would also be demystifying themselves as institutions, making themselves accessible to the public, rather than to a select few.

One of the seemingly intractable problems is providing teachers with the time needed for lesson preparation, individual study, peer contact or joint lesson planning or for them to engage in 'challenging educational experiences of their own' (Glenn, 2000, p.19). He continues to state that, 'many people erroneously believe that teachers are not working unless they are standing in front of a classroom'. Perhaps taking some professional development to the community, would go some way to changing this misconception as well as demonstrate that learning/teaching is not divorced from real life, but is integral to it.

6. Possible models

Four models the writers have seen used are outlined. In various ways, they address the issues and implications outlined above.

Staff Meetings

During weekly staff meetings, time is allocated for discussion of a maths topic (McRae et al., 2000, p.166) which may be short and sweet, a piece of unusual or provocative information, some innovative teaching that met with success. This time is designed to encourage interest in the subject amongst teachers, to provoke them to research maths and to discuss their ideas with colleagues. This model has the advantage of drawing on and encouraging sharing of expertise and interest, developing a collegial, learning atmosphere in the school and using staff meetings for more valuable ends than routine housekeeping. It does not, however, provide staff of an individual school with the contact with staff from other institutions.

The Count Me In Too Project

This numeracy program, together with associated programs that have developed from it, is a regional initiative addressing what is perceived to be a problem or deficiency in the teaching of early numeracy. An advisor trains one or a number of teachers in the administration and interpretation of the initial diagnostic tool and in the subsequent grouping of students and creation, provision and use of the activities designed to teach the skills of early numeracy. Video support and information is also provided. Parental involvement is absolutely necessary in the production of the teaching materials and assessment tools. Teachers have commented on the way the diagnostic tests have enabled them to better choose activities that meet the needs of individual children and how much the children enjoy the hands-on approach. This model is designed to change teaching practice as well as enhance learning by the children. It is well-organised with clear goals and gives teachers a range of activities to use in the classroom with various identified groups. Some teachers adapt the ideas, acting 'on their best professional knowledge' (Castle et al, 1994, p.4). Others adopt the program, seeing it as a ready-made, successful model of instruction so that all they need to do is to implement it for successful outcomes to be achieved. This latter approach does not always lead to the enriched lessons that the study suggests are necessary.

Australian Association of Mathematics Teachers (AAMT) Workshops

This model closely fits the description by Cooney (1994, p.16) of an idealised teacher-education program:

- Teachers develop a knowledge of mathematics that allows it to be taught from a constructivist perspective
- Teachers reflect on their own learning experiences
- Teachers experience situations where they can develop expertise in identifying and analysing constraints they face in their teaching and how these may be dealt with
- Teachers gain experience in assessing students' understandings
- Teachers are given opportunities to translate their knowledge into viable teaching strategies.

This model consists of 'strand'- or 'topic'-based workshops running over several weeks, two hours a week after school. Facilitated by university staff, using prepared notes and booklets from AAMT, it is cost effective, so several staff members from various schools might attend. The workshop integrates mathematical theory, pedagogy and activities, challenging teachers to think about the concepts embodied in

the activity, how they would use the activity in a classroom, and encouraging teachers to try activities and return to subsequent workshops for discussion. The workshops provide a forum (for all sorts of issues), address curriculum changes, introduce new teaching/assessment strategies and present participants with a booklet of notes and further information - and a certificate of participation. The program also serves as a basis for more detailed school-based in-service programs to be developed by teachers and university staff.

Local Associations of Mathematics Teachers

One example is the New England Mathematics Association (NEMA), a local association between mathematics teachers and university mathematics educators. The invitation to join is extended to primary school teachers and others interested in maths/maths teaching. Fortnightly meetings between representatives of the various schools are held to discuss educational issues and to organise activities such as guest speakers at evening meetings, school days and conferences that involve a wider group. It is the on-going forum for discussion between teachers about current educational issues and the occasional talks that are valuable in terms of professional development. There are the usual problems that all organisations encounter, but it is a model worth considering that may meet local needs and provide a geographically accessible meeting place and time. NEMA also runs conferences. Conferences fall into the category of the 'one off', are fairly expensive (especially in rural and regional terms), and require a commitment from teachers of school, weekend or holiday time, but they do provide a unique environment for the exchange of ideas. There has been a considerable falling off of numbers attending conferences over the years, especially when the train-the-trainer compliance levy was abandoned.

In each of the models, discussion between teachers plays an important (if not integral) part in the professional growth of the participants. The models

recognise that changes in teachers' beliefs about teaching and learning are derived largely from classroom practice; ...[and] allow time and opportunities for planning, reflection and feed back in order to report success and failures to the group, the share the 'wisdom of practice' and to discuss problems and solutions....(Clarke, 1994, p.44).

7. Conclusion

Teachers need the opportunity to talk to others on their immediate staff, in different schools and in different strata of the system so that their understandings, by being articulated, are rendered more precise (Clarke, 1994, p.44). If discussion between our pupils is deemed to be vital to their learning, so must it be for the learning of teachers.

Teachers, at all stages of teaching, need to model that which they espouse and to induct their pupils into the community of scholars to which they also belong.

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