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The Use of Action Research for the Professionalisation of Beginning Women Teachers as They Learn about Inclusive Mathematics

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This paper reports on a project that aimed to assist the induction of three women teachers into the practice of mathematics teaching. In their first year of teaching the three teachers were located in schools at great distances from the normal support structures for the teachers. Further, the schools consisted of student populations with wide diverse cultural and ethnic backgrounds, not familiar to the teachers. The project had the following characteristics: Firstly, it employed the formation of an action research network. Secondly, it targeted the concern of the teachers on how to make mathematics more inclusive for children from a variety of backgrounds. Thirdly, it bridged the divide in jurisdiction between the responsibility of the university for preservice training and the responsibility of the school and the employment departments for induction and inservice professional learning. This paper discusses the procedures adopted in the project and the outcomes in teachers' learning and professionalisation.

The project reported here was concerned with the induction of beginning teachers into the practice of mathematics teaching. Three women who were in their first year of teaching are the subjects in the paper along with the authors who were the university teacher educators involved in the project. Characteristics of the project were as follows: (a) it involved the formation of an action research network; (b) it targeted the teachers' concern on how to make mathematics more inclusive for children from a variety of backgrounds; and (c), it bridged the divide between the responsibility of the university for pre-service training and the responsibility of the school system for in-service professional learning. Procedures adopted in the project and the outcomes in teachers' learning about inclusive curriculum and professionalisation are discussed along with limitations.

Professionalisation of Teachers

A recent report from the Commonwealth Department of Education, Science and Training (DEST, 2002) on the needs of commencing teachers and the principles of effective induction programs, claimed that the area is "a heavily researched area, yet frustration at the lack of constructive change is a consistent theme in the literature" (p. 8). The report went on to identify the "reality shock" experienced by many teachers during the initial stages of their practice as teaching, not the least of which is a sense of isolation and loneliness (Ganser, 1999). This feeling of isolation is made worse by the common practice in most states in Australia of appointing beginning teachers to schools in rural and provincial areas for a short period of

time, resulting in a very transient and inexperienced teacher population in those schools (DEST, 2002).

Several researchers on teachers' induction have identified stages of professional development during the first years in the classroom (Burden, 1980; Katz, 1972; Vonk, 1983). Common to all these models is the initial "survival stage" distinguished by self-interest and self-concern by the teacher, that is, getting through the day and planning for a short period of time. According to these models, teachers only develop their concern and attention to the individual needs of students at later stages of their development. A report from the Queensland Board of Teacher Registration (BTR, 1991) noted that many beginning teachers started "out with idealistic attitudes towards democratic classroom management, but ... (have) to abandon these in favour of the more custodial approach" (p. 9). Sullivan and Leder (1992) also reported beginning teachers tending towards authoritarian classroom control, and over directing classroom activities, including drill and practice activities.

There are many models of induction/support programs for beginning teachers (e.g., Clement, 2000; Feiman-Nemser, 2001; Miller, Morley, & Westwater, 2002; Wong, 2002), including provision of printed materials about employment conditions and school regulations; orientation visits to schools and the surrounding areas before taking up duty; release time; group meetings among beginning teachers for emotional support; consultations with experienced teachers; team teaching; and mentoring schemes. Many of these induction programs incorporate mentoring, where an experienced and competent teacher teams up with the beginning teacher. However, as Feiman-Nemser (2001) pointed out, that, unless induction programs are framed "around a vision of good teaching and compelling standards for student learning, we will end up with induction programs that reduce stress and address immediate problems without promoting teacher development and improving the quality of teaching and learning" (p. 1031).

Some induction programs have included university input, where university staff provided expertise, support and advice, and ran inservice courses (e.g., Cheney, Krajewski, & Combs, 1992; Dianda & Quartz, 1995; Reiman, McNair, McGee, & Hines, 1988). Some of these partnership programs have incorporated reflective practice or action research at both preservice (e.g., McLaughlin & Hanifin, 1994) and inservice levels. Bartell (1990) asserted that "beginning teachers need to develop not only the capacity for seeking out ideas and resources but a framework for making decisions about what is or what is not useful or effective in their own practice." The advantage of such an approach to induction is that the participants seek knowledge and make decisions for their own settings, thus increasing their sense of agency as professionals. Fuller (1969) argued that through the use of induction programs such as these teachers were able to demonstrate a concern about their students learning even at the so called "survival stage" described above.

Women Teachers of Mathematics

Historically, the lack of content knowledge in mathematics among women teachers may be accounted for by the avoidance of higher levels of mathematics by many school girls after it ceases to be compulsory. The traditional perceptions of women as nurturers implied that they are more suited to primary and early childhood teaching and subjects such as English, home economics and biology. This perception has been detrimental to women wishing to enter such fields as the physical sciences and mathematics. Although policies for change have been initiated (e.g., Clark, 1990; Kenway & Willis, 1993), and despite encouraging indications that females have moved into mathematics (Willis, 1989), reports continue to note that many women preservice teachers remain weak in mathematics, and have little interest in teaching the subject (e.g., Cobbin, 1995).

Several researchers (e.g., Ai, 2002; Leder, 1992; Li, 1999) have noted a relationship between teachers' behaviours and attitudes and students', especially girls, behaviours and attitudes in mathematics. Others noted relationships between classroom factors (e.g., context of problems) and beliefs about learning mathematics, leading to less mathematics involvement by girls (e.g., Forgasz & Leder, 1996; Forgasz, Leder, & Taylor, 1996). If the teaching of mathematics in many primary and early childhood classrooms remains problematic because of these factors, we will continue to fail to address deficiencies in girls' education and access to non-traditional subjects, and continue to fail to teach mathematics satisfactorily in the primary and early childhood years.

Concerns about Inclusive Mathematics

During the past 25 years concerns about inclusive mathematics teaching and learning have progressed from localised interest of particular researchers and projects to a national policy issue. For example, the *National statement on mathematics for Australian schools* (Curriculum Corporation, 1991) argued that "access to and success in school mathematics should be independent of gender, social class or ethnicity" (p. 8). It went further to say that

> we are now beginning to understand some of our past curriculum practices in mathematics which have disadvantaged groups of students. For example, many of the contexts in which mathematical concepts were developed, applied and assessed were more likely to be central in the lives of boys than in the lives of girls. ... In a similar way the mathematics curriculum has tended to emphasise values and concerns which are more middle class, and to draw on experiences which are more relevant to children of Anglo-Celtic descent than those of Aboriginal descent or those from non-English speaking backgrounds. (p. 9)

This concern is reflected in the publication of the 1997 yearbook by the National Council of Teachers of Mathematics on *Multicultural and gender equity in mathematics classroom*. In that yearbook, Trentacosta and Kenny (1997) argued that

> in order to create an equitable learning environment among a growing diverse student population, it is important for teachers to understand the relationship between learning mathematics and the linguistic and cultural background of the

> students ...Teachers who understand the interrelatedness among topics of mathematics and acquire the facility to operate using different mathematical world views can help students develop their ability to understand mathematics and to build on their own mathematical world views. (p. 5)

Brock and Grady (1998) argued that inclusive teaching is being recognised as an important component of preservice teacher education. Thus, commencing teachers are faced with the challenge of finding ways in which their teaching can be more inclusive at a time when they are facing the multilevel adjustments to the reality of the profession.

The Project

Methodology

In designing this study we were interested in induction programs that are empowering for beginning teachers and that are based on the concept of teachers as professionals (Atweh & Arias, 2001). We believe that such programs would involve knowledge generation and knowledge application within the same program. Research has a negative connotation in the mind of many teachers – arguably more so for beginning teachers who are often quite critical of a perceived theoretical nature of their pre-service courses. Often, research questions are perceived by teachers as not relevant to their needs and concerns. Similarly, research findings are often reported in a language not accessible to teachers. We argue that emancipatory interests of teachers are served by teachers becoming active in the research process as well as in the application of the knowledge generated (Grundy, 1998). Such an involvement would ensure greater relevance of research questions and findings to the practice of teaching as well as demystify research for the teachers. This fusion of knowledge generation and application, of action and reflection, of theory and practice, lies at the heart of the action research paradigm (Kemmis & Wilkinson, 1998). Further, the use of action research as a means of professional learning of teachers has been argued by Crawford and Adler (1996) using a constructivist perspective which asserts that learners (in this case, teachers) develop their knowledge based upon previous knowledge and experience, and that this process is assisted by reflection and negotiation with others and not simply transmitted from expert to novice. Through action research, teachers become active participants in the generation of their own knowledge about teaching.

In the minds of many people, action research consists of cycles of planning, action and reflection. However, Kemmis and Wilkinson (1998) identified five additional characteristics of action research. It is:

- Participatory: in that it involves the insiders of a practice in the whole process of research and action;
- Collaborative: in that it involves groups of participants from within and from outside the practice working together;

- Social: in that it posits the practice as part of a social context outside it and often has social justice concerns;
- Critical: in that it sets out to problematise assumptions and conventions and present alternatives to traditional ways of acting and knowing; and it is
- Emancipatory: in that it aims at empowerment of all participants to take control over the process of improving their practice and their knowledge about their practice.

The Participants

The three teachers working on the segment of the study reported here[1] were recent graduates from a four-year Bachelor of Education (Primary) course at a Queensland university. During their final year in their pre-service course, the three teachers were interviewed, regarding their life histories in studying mathematics and their teacher preparation course. Special attention was given to the perceptions of these teachers about their confidence in the content of mathematics and in their ability to teach it in the primary school. The participants were invited to commit themselves to collaborative work with each other and with staff from the university in action research projects within their schools in their first year of teaching. They joined the project in the belief that it might benefit their teaching and that the findings would also help them to apply the theory they received during their pre-service primary teacher education program. From time to time a retired teacher with extensive experience in Indigenous Eduction joined the group's discussion as a critical friend.

Data Collection and Analysis

Action research cell meetings. Regular meetings of the action research cells were conducted by telephone conferencing. These meetings were audiotaped and summarised by a research assistant who attended all cell meetings. These meetings allowed the participants to discuss their individual experiences, share ideas and suggestions, as well as plan the conduct of the action research cell.

Email. All participants had access to electronic email facilities, thus providing possible one-to-one and one-to-many channels of communication. All correspondences were archived for documentation of the study.

Reflective journals. Participants in the study were encouraged to maintain a weekly diary of their experiences in their first year of teaching. The participants were asked to record general comments on their teaching with specific attention given to issues of inclusive mathematics. The participating teachers found it

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[1] The group of teachers discussed here formed an action research cell within a wider network consisting of teacher cells working on various aspects of teaching mathematics and science in the primary schools (Ginns, Heirdsfield, Atweh, & Watters, 2001).

difficult to maintain these reflective journals. However, they engaged in reflective writing using the email facility as described above. In turn, the university team kept record of their involvement in the project and shared their notes with the participating teachers.

Data analysis. Two sources of data were used for the analysis presented in this paper. The first source was the teachers' own writings. These included the situational analysis, the contribution to a conference presentation at the end of the first year, and their responses to requests from the university staff to elaborate on aspects of their contribution. The second source of data was the reflections of the university staff on the project, based on all the documentation available, including records of teleconferences. The university team members undertook the analysis of the data reported here, using qualitative techniques based on the approach of Strauss and Corbin (1990).

Perhaps a word about authorship and voice is relevant here. It is our belief that papers/articles resulting from action research projects should be written collaboratively with the participants (Christensen & Atweh, 1998). The conference presentation was done in that spirit. While the teachers were happy to use their own names in writing the conference paper, in the context of this current paper, their names are substituted by pseudonyms since it was not possible to contact the teachers who have moved since the completion of the project[2]. Therefore, this particular paper represents the learning from the project by university facilitators, and was written independently of the teachers. We will attempt to represent the voices of the teachers but cannot claim to speak for them.

The Three Teachers

Lorraine. Lorraine's interest in primary teaching was perhaps chosen by a process of elimination rather than deliberate planning; she said that she "fell into" it and had not set out to be a teacher. Yet, at the end of her university course, she said that "now I love it". During her studies at high school and university, she was aware that mathematics always demanded more time for her to come to terms with than perhaps other students. Further, some perceived "bias" on the part of some university lecturers, and lack of care on the part of some previous male school teachers toward female students did not help.

In her first year of teaching, Lorraine was appointed to a remote Aboriginal community about 300 kilometres northeast of Katherine. The community was isolated by road for a good part of the rainy season, causing students to miss a large portion of the school year because families moved toward the out-stations in the dry season. Kriol was the spoken language outside school by all students. However, at the community's request, English was the language used in school. Lorraine taught a multi-age group consisting of Years 3 and 4, covering a wide range of educational achievement levels.

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[2] We will break from the usual convention of providing the full reference to the conference paper here to guard the anonymity of the teachers.

Georgina. Like Lorraine, Georgina also "fell into" general primary school teaching, with her initial preference being for special education. She had a physical impairment that affected her studies at primary school. She contended that that was the reason she was advised to study "lower-level" mathematics at Year 9 in the secondary school. At Year 10, she was noticed by a non-mathematics teacher as capable of higher performance which boosted her self-image considerably. However, at the start of Year 11 she attempted the higher mathematics classes, but due to lack of teacher support in providing additional attention, she was forced to go back to the lower level.

In her first year of teaching, Georgina was appointed to a regional primary school about 500 kilometres north of Alice Springs. The school of 420 students had a mixed student population, consisting of significant minorities of Asian, European and Aboriginal students. She taught a combined class of Years 4 and 5. However, in mathematics, she only taught Year 5 students. Students were streamed in mathematics classes based on ability. There were no Aboriginal students in her upper stream mathematics class.

Judy. Judy worked full time for three years before commencing a teaching career. Her decision to change was primarily motivated by an interest in child education and for her own self-satisfaction. Of the three teachers, Judy was the only one who studied Mathematics I (a medium level mathematics course in Queensland) at senior high school. Like Georgina and Lorraine, Judy was also disillusioned by the lack of support from her mathematics teachers who seemed to devote more attention to the high achieving students.

In her first year of teaching, Judy was appointed to an independent school in Sydney emphasising "Islamic culture, values and beliefs", which catered for students, the majority of whom were from non-English speaking backgrounds. Its enrolment included students from Kindergarten to Year 10, but the school was expected to expand to all levels within two years. She taught Year 5 for first term and Year 1 for the rest of the school year.

Learning from the Project

Over the period of this project, the teachers communicated with each other, the university academics, and at times another expert, using teleconferences and email. Along with their reflections at the end of the year, these communications were evidence of learning and development on the parts of all the teachers. These learnings appeared to fall into two main categories: Learning about inclusive curriculum and learning about professionalism and teaching. These findings are now discussed in turn.

Learning about Inclusive Curriculum

All three teachers were well aware of a clash between their cultural background and that of the particular school that they found themselves in during their first year of teaching. All three teachers found it a challenge to make mathematics more meaningful to the students from the diverse backgrounds and

to find a pedagogy that was culturally appropriate. The discussions at the teleconferences often expressed these concerns. Did the project assist them in dealing with these concerns?

At the initial stages of the project, their comments often reflected what is generally referred to in the literature as the "deficit model" of disadvantage. For example, Lorraine saw her Aboriginal students as "culturally do not have a mathematical background rich in language", and as "lacking the experiences necessary to understand certain concepts in the set curriculum". She added:

> Making mathematics relevant to Aboriginal children was [a] problem, as mathematics usage was usually only necessary [in their context] for purchasing goods at the store. … Usually mental computation of adding or subtracting money was a strong point [with many of these students].

Similarly, Georgina described her students as having the attitude that "near enough is good enough". She added, "There is very little parent interest and support in the classroom. … There doesn't seem to be much encouragement from home as to the importance of mathematics."

Perhaps more than the other two teachers, Judy described the social background of her students and the social context of the school in terms of a deficit model.

> [These] children cannot work independently, and I am struggling to keep them under control. One of the major challenges I encountered was that my classes consisted of students with dramatically different mathematical ability. Many of my students had regularly changed schools, and the lack of continuity in their education and lack of support from at home, contributed to their failure to master even the most fundamental concepts. … Unfortunately, support is difficult to provide if the parents themselves also have trouble with both the language and terminology.

The nature of their comments changed significantly by the end of the project. For example, Lorraine questioned whether the problem, rather than being with her students, was with the curriculum itself in being inappropriate for the needs of the students and not taking their prior learning into consideration.

Lorraine also had the experience to "look at other alternative maths programs and trialling them in [my] classroom". She took a critical view in reflecting on the appropriateness of these programs judging them to be "too basic" and "underestimate the knowledge that the students had". Other self-developed resources were trialled and found to be more appropriate and relevant for the students. Rather than constructing the worldview of her students in deficit terms she identified difficulties in terms of differences. Commenting on the teaching of measurement, time and space for Aboriginal students, she noted that "the teacher is confronted continually with an Aboriginal world view of these concepts which are vastly different from and more complex than non-Aboriginal concepts of time, measurement and space." She concluded "learning the cultural context within the school and background of your students is the first and vital step".

Lorraine demonstrated considerable learning about the meaning of an inclusive curriculum and how to achieve it. She concluded, "The process of making

maths more inclusive is not an easy task." It went beyond simply changing pedagogy in the classroom. "[It] is necessary to build trust and acceptance within the school and the community". She noted that towards the third school term she began to be accepted both by the school community and the children themselves. This was a topic of discussion during one of the teleconferences conducted in the project. She added,

> ... [t]he process of making mathematics more relevant/inclusive has helped me to identify and acknowledge that culture is a key indicator in different processes of learning and understanding. As teachers we fall into the trap of placing our own cultural and social expectation on other cultures that have a unique worldview different from our own. … I [now] tend to have more enthusiasm and positive responses from the students when introducing a new concept. Students are able to experience success.

However, the changes in teacher understanding of and practices in inclusive mathematics education were not reflected the same way with Judy. In her extensive writing in the project she did not mention the term once. All through her analysis she constructed her students in terms of ESL students, rather than in terms of disadvantage, equity and inclusivity. The strategies she used were ESL strategies and strategies that depended on the use of concrete materials. There was no discussion of attempts at overcoming language problems in connecting school with the home of the students, cultural sensitivity of the curriculum or its relevance to students' backgrounds.

Learning about Professionalism in Teaching

An evaluation of whether or not the particular pre-service course that these teachers had completed prior to their induction was adequate to prepare them for teaching such a diverse student population is beyond the scope of this paper. However, these teachers faced high levels of anxiety, and perceived that they had inadequate practical knowledge as beginning teachers in what they regarded as difficult conditions. Did this project allow them to make this transition a little easier? Here we will discuss the comments from the participating teachers under three topics: The contribution of the project to the development of their self-confidence in mathematics teaching, their development of reflective practice, and the development of supportive professional networks.

Developing self-confidence in mathematics teaching. Confidence was a topic that was discussed by all teachers in several contexts in their involvement in this project. All three teachers expressed a certain lack of confidence prior to commencement of their teaching. At times this lack of confidence was in their understanding of the content itself. Other times they reflected concerns about the use of mathematics in their own personal life. Some were concerned that inappropriate teaching might influence the long-term achievement and attitudes of students in mathematics. Some expressed lack of confidence in translating official curriculum documents into classroom programs and activities.

Similarly, all three teachers commented on the contribution of the project to an increase in self-confidence in their professional life as teachers of mathematics. In her reflection at the end of the project, Lorraine, reflecting on her feeling of isolation as a first year teacher in a remote and culturally diverse school, talked about how her involvement in the project enabled her "to gain more confidence in discussing problems with other professionals within the [action research] group and within the Department [of Education]". Similarly, she talked about her students developing confidence in their learning of mathematics. She developed teaching techniques that improved her students' confidence.

> I developed and implemented some maths operation cards that were sequenced developmentally. … This proved to be successful as it helped develop routine. Some of the children developed more confidence in their own ability in maths operations. Once they had finished one card they felt they had achieved something. Moving up the cards meant that they could see success instantly for themselves and also see their own process of learning clearly.

Similarly, Georgina, in her reflection on the project and her teaching over the whole year, said that "[t]hrough the project I was able to reflect on my own methods of teaching, understanding of specific mathematics concepts, and my own confidence with math[ematics]". She added, "The project assisted in developing my confidence in mathematics teaching and raised my awareness of the curriculum and suitable inclusive teaching methods."

One area that concerned Georgina at the start of her teaching career was the fact that she realised, in spite of four years' preparation for teaching, her pedagogy in the classroom was more influenced by her own experience in her schooling than the content experienced in her university course. Her teaching was more "teacher directed and prescriptive". She added, "I feel that I understand how mathematics should be taught but because my [own] schooling is so embedded in my way of thinking, I find it difficult to change." However at the end of the project she wrote, "I had to come to terms with … trying to develop my own methods of teaching rather than drawing on my own school experiences, and developing my confidence in mathematics".

Even Judy who was the most confident of the three teachers at the beginning of the project found her "participation in the discussion sessions in the project to be useful in gaining confidence in my ability as the suggestions given in the meetings were ones I had already thought of and trialled". That discussion allowed reflections on her own teaching and provided an affirmation of her practices.

Developing reflective practice. All three teachers seemed to have benefited from developing a sense of critical reflection on their practices. The project involved several opportunities for the teachers to write down their experiences of school and classroom for the benefit of others. These involved the situational analyses and the final reflections on the project. In addition, during the teleconferences they had a chance to raise their own concerns as well as listen to the experiences of others. These experiences proved helpful to these teachers in developing a critical reflective practice. Lorraine indicated,

> This project has enabled me to be more critical in my teaching practices. Such as: Do the students understand this concept? How do I make this concept relevant and easy for them to understand? If it does not work I have learnt not to be negative and "throw the towel in", but to learn from my mistakes and try it again but in a different way. I believe this is developing good teaching practices.

We saw evidence of developing ability in critical reflection in the above section when Lorraine rejected some curriculum material because it was too "basic" for the students.

Arguably, developing a reflective practice is not an easy task for teachers, let alone beginning teachers. Undoubtedly, teachers do reflect on their experiences in an ad hoc manner. The demands of the job are such that it allows little time for more systematic reflection. This is best illustrated by Georgina's reflection on her first year.

> Coming to terms with the daily organisation and demands of teaching is something that I have had to grapple with all year: time or a seeming lack of it. … I was overwhelmed with meetings, in-service and in merely planning for units of work. There never ever seemed enough time to reflect on my teaching and/or get new content areas in mathematics set in my mind before teaching them.

However, at the end of the project, she asserted, "through the project I was able to reflect on my own methods of teaching, understanding of specific mathematics concepts, and my own confidence with math" and "[f]or the most part, the project ensured I was thinking critically about my methods of teaching when planning specific lessons or units of work". Similarly, Judy commented that the "[t]elephone conversations [in the project] … enabled me to reflect on my teaching and I was given a few ideas to trial".

Developing supportive professional networks. For many teachers, teaching can be an isolating experience. The closed door of a classroom can provide a shelter for the teacher, yet it also can provide a sense of isolation. It is not surprising that the theme of isolation came up a few times in the teachers' writings and discussions in the project.

Some schools have better support for their new teachers than others. Lorraine described how "within the Northern Territory there is a great deal of support for bush teachers and new teachers within the department". Other teachers talked about informal support from more experienced teachers and some available professional development seminars. However, Lorraine identified two limitations of school-based support. Firstly, since that support is seen to be from colleagues who are more experienced, sometimes the new teachers feel insecure to share their failures. Lorraine described her interaction with other teachers as "a matter of 'bluffing' and stating that your teaching practices are working successfully, even if it may not be the case". New teachers often feel that their performance during the first year is under assessment, and that this might affect their chance of promotion or transfer into better schools. Hence, the new teachers feel uncomfortable seeking assistance, when they feel they could be judged as incompetent by peers. Lorraine added, "The positive aspect that this project offers is that it allows the teacher to share with other professionals some of their faults and difficulties without being

persecuted or seen as incompetent." The second limitation of some induction programs is that new teachers do not often have the chance to discuss their own successes and failures. Lorraine indicated that "other professional development courses come across as 'every man for himself', a situation whereby teachers hear information … the teacher never has the opportunity to talk about what successful programs are running in their classrooms and what is unsuccessful".

In the words of Judy, "the project has been beneficial in that it has brought together a peer network in which I can discuss ideas and problems that I have encountered during my teachings … It was good to be able to talk about my difficulties with my peers to realise that many of my problems were not only unique to my own experiences, and I was able to learn new strategies to counter these problems". Finally, it is worth mentioning that the benefit of network formation extended beyond the limits of this project. Lorraine talked about how she "was able to share aspects of the project with other colleagues. It has enabled me to see that teaching is teamwork."

Discussion and Conclusions

Undoubtedly the process of transition from a university pre-service course into the practice of teaching can be a traumatic experience to many teachers of mathematics. Arguably, at that, so called "survival stage" of professional development of teachers, the techniques of classroom management and organisation take a priority over concerns of developing principles of equity and inclusion. However, as demonstrated here, beginning teachers can challenge their own views about their students in ways that can improve their effectiveness with diverse student populations.

Problems of transition into teaching mathematics can be more acute for some women teachers who have developed a certain apprehension towards mathematics and its teaching as a result of their learning of the subjects in their school years and at university (e.g., Atweh & Burnett, 1997; Cobbin, 1995). Faced with their lack of confidence in the subject and its teaching, they tended to resort to teaching methods with which they had been taught. Arguably, this is both detrimental towards the professional development of the teachers themselves and to their students, especially the girls, who may have as role models women teachers who are insecure about mathematics and try to avoid it whenever possible (e.g., Ai, 2002; Forgasz & Leder, 1996; Leder, 1992; Li, 199). The experiences in this project demonstrated that a group of female commencing teachers working together could provide the support they needed to face some of these problems and to increase their confidence in the teaching of the subject.

In many Western countries there is a sharp demarcation between pre-service training and induction of teachers, where the second task is seen as the responsibility of the employing agencies rather than the training institutions. Hence, a vital link between theory and practice, between pre-service and in-service professional development is often missed. The project discussed here incorporated university input, where the staff provided support and advice (c.f., Cheney, Krajewski, & Combs, 1992; Dianda & Quartz, 1995). This project went further, in

that this project incorporated beginning teachers doing action research on their own practice (c.f., McLaughlin & Hanifin, 1994).

In spite of its successes, this project was not without its limitations. The teachers did not appear to experience the critical and emancipatory attributes of action research, with their concerns continuing to focus on the technical aspects of teaching, rather than taking control over their actions and thinking. Perhaps this can be attributed to two factors: The preoccupations of the teachers in the first year with mastery of the routine aspects of teaching, and to the short time span of the project. However, as the teachers started to reflect on their practice, some professional growth towards the integration of theoretical knowledge and practice was noted. Further, the increase in their confidence both in teaching and in participating in decision making in the project was significant.

References

Ai, X. (2002). Gender differences in growth in mathematics achievement: Three-level longitudinal and multilevel analyses of individual, home, and school influences. *Mathematical Thinking and Learning, 4*(1), 1-22.

Atweh, B., & Arias. M. (2001). Continuous in-service professional development of teachers and school change: Lessons from Mexico. In B. Atweh, H. Forgasz, & B. Nebres (Eds.), *Socio-cultural research on mathematics education: An international perspective* (pp. 167-184). Mahwah, USA: Lawrence Erlbaum.

Atweh, B., & Burnett, L. (1997). The construction of personal theory on gender and mathematics: Nine case studies of women primary school teacher trainees. In F. Biddulph & K. Carr (Eds.), *People in mathematics education: Proceedings of the twentieth annual conference of the Mathematics Education Research Group of Australasia* (pp. 65-71). Rotoroa, New Zealand: Mathematics Education Research Group of Australasia.

Bartell, C. (1990). Action research: Cases of effective teaching practices. *Teacher Education Quarterly,* 79-91.

Board of Teacher Registration, Queensland. (1991). *Welcoming new teachers: Report of the working party on the induction of provisionally registered teachers*. Toowong, Queensland: BTR.

Brock, B. L., & Grady, M. L. (1998). Beginning teacher induction programs: The role of the principal. *The Clearing House, 71*(3), 179-183.

Burden, P. (1980). Teachers' perceptions of the characteristics and influences of their personal and professional development. *Dissertation Abstracts International,* no. 40, 5404A.

Cheney, C., Krajewski, J., & Combs, M. (1992). Understanding the first year teacher: Implications for induction programs. *Teacher Education and Special Education, 15*(1), 18-24.

Christensen, C., & Atweh, B. (1998). Collaborative writing in participatory action research. In B. Atweh, S. Kemmis, & P. Weeks (Eds.), *Action research in practice: Partnerships for social justice in education* (pp. 329-337). London: Routledge.

Clark, M. (1990). *Great divide: Gender in the primary school*. Melbourne: Curriculum Development Corporation.

Clement, M. (2000). Making time for teacher induction: A lesson from the New Zealand model. *The Clearing house, July/August*, 329-333.

Cobbin, D. (1995). *Women's participation in non-traditional fields of study*. Canberra: DEET, Investigation and Evaluations Program Report.

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Crawford, K., & Adler, J. (1996). Teachers as researchers in mathematics education. In A. J. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook for mathematics education* (pp. 1187-1206). Dordrecht: Kluwer.

Curriculum Corporation. (1991). *A national statement on mathematics for Australian schools.* Carlton, VIC: Curriculum Corporation.

Department of Education, Science and Training (2002). *An ethic of care: Effective programs for beginning teachers*. Canberra: DEST.

Dianda, M., & Quartz, K. (1995). Promising new teacher support strategies and their costs. *Teacher Education Quarterly,* 45-62.

Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record, 103*(6), 1013-1055.

Forgasz, H. J., & Leder, G. C. (1996). Mathematics classrooms, gender and affect. *Mathematics Education Research Journal, 8*, 153-173.

Forgasz, H. J., Leder, G. C., & Taylor, L. (1996, April). *Mathematics and language studies: A cross-national comparison.* Paper presented at the annual meeting of the American Educational Research Association, New York.

Fuller, F. (1969). Concerns of teachers: A developmental conceptualisation. *American Educational Research Journal, 6*(2), 207-226.

Ganser, T. (1999). *Reconsidering the relevance of Veenman's (1984) meta-analysis of the perceived problems of beginning teachers.* ERIC Document Reproduction Service No. ED 429 964.

Ginns, I., Heirdsfield, A., Atweh, B., & Watters, J. (2001). Beginning teachers becoming professionals through action research. *Educational Action Research, 9*(1), 111-133.

Grundy, S. (1998). Research partnerships: Principles and possibilities. In B. Atweh, S. Kemmis, & P. Weeks (Eds.), *Action research in practice: Partnerships for social justice in education* (pp. 37-46). London: Routledge.

Katz, L. (1972). Developmental stages of preschool teachers. *Elementary School Journal, 73*(1), 50-54.

Kemmis, S., & Wilkinson, M. (1998). Participatory action research and the study of practice. In B. Atweh, S. Kemmis, & P. Weeks (Eds.), *Action research in practice: Partnerships for social justice in education* (pp. 21-36). London: Routledge.

Kenway, J., & Willis, S. (1993). *Telling tales: Girls and schools changing their ways.* Canberra: DEET.

Leder, G. (1992). Mathematics and gender: Changing perspectives. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 597-622). New York: Macmillan.

Li, Q. (1999). Teachers' beliefs and gender differences in mathematics: A review. *Educational Research, 41*(1), 63-77.

McLaughlin, D., & Hanifin, P. (1994, July). *Empowering the novice.* Paper presented at the 24th Annual Conference of the Australian Teacher Education Association, Brisbane, QLD.

Miller, J. B., Morley, V. S., & Westwater, B. (2002). The beginning educator support and training program in Connecticut. *Journal of Physical Education, Recreation and Dance, 73*(4), 24-27.

Reiman, A., McNair, V., McGee, N., & Hines, J. (1988). Linking staff development and teacher induction. *Journal of Staff Development, 9*(4), 52-58.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research.* Newbury Park, CA: Sage.

Sullivan, P., & Leder, G. (1992). Students' influence on novice Australian teachers' thoughts and actions regarding mathematics teaching: Two case studies. *The Elementary School Journal, 92*(5), 621-642.

Trentacosta, J., & Kenny, M. (1997). *Multicultural and gender equity in mathematics classrooms: The gift of diversity*. Reston, Va.: National Council of Teachers of Mathematics.

Vonk, J. (1983). Problems of the beginning teacher. *European Journal of Teacher Education, 6*(2), 133-150.

Willis, S. (1989). *Real girls don't do maths: Gender and the construction of privilege.* Geelong: Deakin University.

Wong, H. K. (2002). Induction: The best form of professional development. *Educational Leadership, March*, 52-54.

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