BUILDING PRESERVICE TEACHER CAPACITY FOR EFFECTIVE MATHEMATICS TEACHING THROUGH PARTNERSHIPS WITH TEACHER EDUCATORS AND PRIMARY SCHOOL COMMUNITIES

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Calls have been made for teacher educators to innovate upon well-established teacher education programs. During 2010, a project was initiated that sought to study the impact that a school-university partnership had on building preservice teacher capacity for effective teaching of mathematics. Early findings suggest that a range of factors including observation of lecturers teaching mathematics lessons, and participation with teacher educators in lesson planning, team-teaching, and post-lesson reflections can be helpful in building capacity for effective mathematics teaching.

Introduction

It is generally agreed among classroom teachers and researchers that teaching is complex. Indeed, the complexities that the teaching of mathematics poses may be challenging not only for novice teachers but also for the more experienced (Kazemi, Franke, & Lampert, 2009). As teacher education plays a key role in supporting novice teachers for situations they may face in the classroom, it is important to reflect upon the nature of preservice teacher education and the opportunities that preservice teachers (PSTs) are given to develop their abilities to teach.

A recent government report (Hartsuyker, 2007) from an inquiry into teacher education in Australia recommended a more collaborative approach to teacher education than existed at that time. Most particularly, in discussing practicum and partnerships, the need was identified for a stronger sense of shared responsibility between all stakeholders, that is, universities, schools and employing bodies, for preparing the next generation of teachers.

The research reported in this paper relates to a partnership based model being utilised to prepare primary school PSTs at Australian Catholic University (ACU) for their future work in schools. This partnership focused on building capacity for effective teaching of mathematics. The authors sought possibilities to innovate upon current teacher education practices that already existed at the university in relation to mathematics education. As stated by Kazemi et al. (2009),

> … the future viability of professional teacher preparation requires that we systematically pursue appropriate ways to develop, fine-tune and coach novice teachers' performance over a variety of settings. These activities must find their way into university coursework rather than be relegated to field placements. (p. 12)

Background

There is widespread concern for good teaching practice for mathematics learning (e.g., Australian Association of Mathematics Teachers, 2006; National Council of Teachers of Mathematics, 2000). Recent research has provided a range of insights into the practices of effective teachers. For example, Brown, Askew, Baker, Denvir, and Millett (1998) identified teaching that requires thought rather than practice, emphasis on establishing meanings and connections, collaborative problem solving, and autonomy for students to develop and discuss their own methods and ideas. Muir (2007) summarised characteristics of effective numeracy teachers as related to maintaining a focus on mathematical ideas, using a variety of teaching approaches to foster connections, encouraging purposeful discussion, and possessing knowledge and awareness of conceptual connections. The more detailed list of 25 characteristics of highly effective teachers of mathematics identified from case studies of six highly effective early years teachers (McDonough & Clarke, 2003), has commonalities with results from other studies but also offers insights into additional effective practices. A focus on such effective practices may provide an avenue for preservice teacher development, while at the same time further developing in beginning teachers an orientation to self-learning as called for by Sullivan (2002).

Goodlad (1991) defined a school-university partnership as a mutually beneficial inter-institutional relationship that is established through planned efforts. Goodlad purported that an essential aspect of school-university partnerships lies in drawing on the strengths of the parties involved in the partnership to advance the interests of the collaboration. Choice in participation is also an important aspect of establishing a school-university partnership (Stephens & Boldt, 2004).

All stakeholders involved in the school-university partnership have the opportunity to benefit from involvement through practices of sharing resources, expertise and facilities (Smedley, 2001; Smith & Lynch, 2002). Stronger school and university links, development of workplace capacity, and teacher and school renewal have been reported as benefits by those involved in successful school-university partnerships (Allen, Butler-Mader, & Smith, 2010). The sharing of knowledge and skills between the partnership sites (school classrooms and university campuses) is also possible, and this allows further opportunities to renew the sites during the partnership process (Stephens & Boldt, 2004).

Making the commitment to form a school-university partnership means that all parties involved in the collaboration also commit to learn together (Stephens & Boldt, 2004) through an on-going collaborative process of documentation, analysis and communication of successes and failures (Goodlad, 1991). However, there is no best way of organising school-university partnerships and debate about the most appropriate implementation approaches continues (Goodlad, 1991; Smedley, 2001).

In response to calls for re-thinking preservice teacher education, and the literature related to partnerships and effective teaching of mathematics, new possibilities for supporting PSTs for their future work as teachers of mathematics were pondered. Inspired by the work of Kazemi et al. (2009), the opportunity of developing school-university partnerships within the *Contemporary Teaching and Learning of*

Mathematics (CTLM) project[1] was identified by the authors of this paper. The CTLM project is a professional learning initiative conducted in partnership between the Catholic Education Office Melbourne (CEOM) and ACU. Professional learning, aimed at developing teacher pedagogical content knowledge of mathematics, took place through professional development sessions (including workshops, professional reading and discussions) and via in-school classroom visits by the ACU mathematics education lecturers who modelled mathematics lessons (Roche & Clarke, 2009).

In 2010, the CTLM project provided the opportunity to innovate upon mathematics education practices at ACU through the development of the *University Partnerships for Teaching and Learning Mathematics* (UPTLM) project. This partnership model is triadic in its nature involving CTLM schools, ACU PSTs (completing their final year of a Bachelor of Education) and ACU mathematics education lecturers.

The research question for the aspect of the study discussed in this paper was:

> What aspects of University Partnerships for Teaching and Learning Mathematics (UPTLM) did the preservice teachers perceive as most helpful in building capacity to be more effective teachers of mathematics?

Method

In 2010, the study involved 12 volunteer Bachelor of Education PSTs, undertaking a university project unit (taught by the authors). Within tutorials, these PSTs chose a pedagogical focus, selected from research findings on effective teachers of mathematics (McDonough & Clarke, 2003), that acted like a personal goal for further developing their mathematics teaching. Examples of pedagogical foci selected by the PSTs were

- hold back from telling children everything;
- structure purposeful tasks that enable different possibilities, strategies and products to emerge; and
- draw out key mathematical ideas during and/or towards the end of the lesson.

Following our partnership theme, during the first half of 2010, the PSTs visited CTLM schools where they observed ACU lecturers teach mathematics lessons. During the observations, the PSTs recorded evidence of their selected pedagogical focus in practice. Following these experiences, the PSTs engaged in focused lesson debriefings with CTLM teachers and ACU lecturers. Other UPTLM project practices included the planning and team-teaching of mathematics lessons with ACU lecturers in CTLM schools. Working with a fellow PST, they went on to "buddy-teach" a number of lessons in a CTLM classroom. The CTLM teachers in these classrooms volunteered their time and expertise to host the PSTs in their classrooms. The buddy-teaching experiences in CTLM schools provided further opportunity to give attention to the pedagogical focus and to offer and receive feedback within a collaborative and supportive relationship with each other and the CTLM classroom teacher. Tutorials at university also provided opportunities for members of the group to share, challenge, and support each other.

In November 2010, data regarding the PSTs' perceptions of UPTLM were gathered. Data were collected through individual written responses and a separate focus group semi-structured interview. In reporting data from the study, the authors draw on the

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written responses and on results from a focus group ordering task. During this task, the PSTs were each invited to write what they perceived as a component of UPTLM on a card individually. These cards were then placed on a continuum from *most helpful* to *least helpful*. The PSTs involved in this ordering exercise were asked to share their insights with the group, identifying similarities and differences, and to develop consensus as a group as much as this was possible.

Results and discussion

The ordering task allowed access to some important insights into perceptions held by the PSTs about practices related to the UPTLM project. These practices are reported and discussed below, in order of their perceived helpfulness as expressed by the group overall. The two most helpful practices involved opportunities to work with ACU lecturers through mathematics lesson planning sessions and opportunities to debrief about lessons conducted in CTLM schools. The focused observation of lessons taught by ACU staff members was also believed to be a highly helpful practice.

The theme of partnerships featured as the next most helpful aspect of the UPTLM project. Aspects of the partnerships highlighted by the PSTs included the CTLM school communities, specifically opportunities to work with students who attended these schools. The PSTs also valued partnerships that developed between themselves and the ACU lecturers with whom they worked in primary mathematics classrooms. The PSTs saw the "buddy-teaching" experiences as another element of the partnerships forged through the project.

Team-teaching experiences with ACU lecturers were also reported to be a helpful practice. PSTs mentioned that the focused feedback on performance was valuable. Deemed as equally helpful by the PSTs were the UPTLM meetings that were conducted on campus during the year. It was articulated that opportunities for group reflection on UPTLM experiences were helpful in developing deeper understandings of effective teaching of mathematics. Feedback from parties involved in the partnerships (ACU lecturers, CTLM school teachers and the PSTs themselves) provided an *external voice* that supported critical reflection which was used to challenge current ideas and practices related to effective mathematics teaching (Muir & Beswick, 2007).

The final most helpful aspect of the UPTLM project, as perceived by the PSTs, was the pedagogical focus. This self-selected focus provided opportunities for the PSTs to reflect on current practices and it also provided focus for the lesson observations in CTLM schools. The role that the pedagogical focus played was also highlighted in the written responses by the PSTs.

Not surprisingly, time constraints were the least helpful aspect of the UPTLM project. The PSTs agreed that there was a greater need for more time and opportunities to participate in the UPTLM project, spending more time in the partnership schools. When asked to describe the opportunities in which they would engage if they had more time, the PSTs identified lesson observation and team-teaching experiences with ACU lecturers were deemed as valuable uses of time by the focus group of PSTs.

The following brief discussion provides further insights into how the helpful UPTLM aspects developed the PSTs' capacity for effective teaching of mathematics. As discussed earlier, the notion of partnerships was central to UPTLM. One PST expressed the value of partnership, not only in relation to her attitudes to mathematics

teaching, but also for the contribution to the school in which she undertook her "buddy teaching":

> Being part of [UPTLM] made me a more confident and prepared preservice teacher for my placement. My teacher was impressed and appreciated the ideas I could bring to her class. (McDonough, Sexton, Miller, Mitchell, & Watson, 2010, p. 4)

Another school contacted the authors stating how impressed they were with the contribution by the two PSTs who were buddy teaching at their school. Indeed, they asked the PSTs to share their taught lessons with other teachers in the school as they felt this could be a valuable learning opportunity for staff. This suggests that UPTLM allowed the parties in partnership to draw on each others' strengths (Goodlad, 1991) and share expertise (Smedley, 2001; Smith & Lynch, 2002).

Other PSTs also expressed the value in terms of the influence on attitudes to teaching mathematics, for example,

> I have become a lot more confident in my teaching of Mathematics, not just in my content knowledge, but in my knowledge of what it takes to be an effective practitioner. I have also become a lot more enthusiastic about teaching maths. It is a great way to feel about a subject I will be teaching every day. (McDonough et al., 2010, p. 5)

The above quote also indicates the influence on content knowledge, a key focus of the CTLM project in which the teachers in the partnership schools were involved, and a focus of the preservice mathematics education units at ACU.

For these PSTs, having selected a specific pedagogical focus gave direction for a range of the UPTLM activities. This is expressed, for example, in the following:

> UPTLM has taught me the importance of focusing one aspect of your teaching. Having a pedagogical focus allowed me to really focus on one thing I needed to improve. I found this was more beneficial than trying to improve all areas of my teaching practice. … I can now effectively draw out the key mathematical understandings towards/at the end of a lesson. (McDonough et al., 2010, p. 5)

The PSTs also saw that by concentrating on one aspect of teaching, links with other effective teaching practices (e.g., McDonough & Clarke, 2003) could be seen. They also expressed the value of UPTLM experiences for an 8-week extended practicum that occurred in the second half of the 2010 academic year.

Conclusion

The UPTLM project has provided some insights into possible ways of establishing school-university partnerships. Throughout the project, there were opportunities for the participants in the partnerships to learn (Stephens & Boldt, 2004), including the authors who learned more about their work as teacher educators. The authors have come to understand more about ways of building PST capacities for more effective teaching of mathematics and exploring these practices in renewed, innovative, and collaborative ways (Hartsuyker, 2007; Kazemi et al., 2009; Stephens & Boldt, 2004). The authors also believe that they have challenged a model of teaching and teacher education that is referred to by Lampert and Graziani (2009) as "closing the classroom door" (p. 491), where individual learning is valued but the collective accumulation of knowledge is disregarded.

It is acknowledged that, in this project, the authors worked with a small number of PSTs and had the advantage of drawing on a professional learning project where lecturers were teaching in schools. Such opportunities may not be available presently to our colleagues in all tertiary institutions. However, the project has allowed a re-thinking of preservice teacher education and the value of partnerships in developing capacity for effective teaching of mathematics. Whilst respecting traditions, the authors see the possibility for this research to stimulate and contribute to dialogue that responds to calls for new practices in teacher education including partnership based models and approaches.

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