School-University Partnerships and the Enhancement of Mathematics at all Levels of Education

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This paper describes a study in which a collaborative relationship between two tertiary mathematics educators and a small group of classroom teachers not only enhanced the professional development of the teachers and mathematics educators directly involved, but has implications for the enhancement of mathematics teaching and learning at all levels of education.

Inservice training and development for professional educators...has as its purpose the improvement of the educational enterprise, particularly the quality of teaching, and, in the final analysis, better outcomes for students. (Schools Council, 1990, p.91)

While the ultimate objective of any professional development program is the enhancement of student learning, it has usually been interpreted in extremely narrow terms to refer only to the immediate context. However, 'excellence in education depends upon what is done by teachers who work at all levels' (Eltis, 1994, p.54). While the aim of the study referred to in this paper was to establish a school-university partnership for the purpose of teacher professional development, it soon became obvious to the researchers that, due to the nature of the relationship, the venture had potential implications for mathematics teaching and learning at all levels of education. This paper draws upon interview and observational data from the professional development study to explicate the wider implications of such partnerships.

In essence, a collaborative relationship was established between two tertiary mathematics educators and three classroom teachers from a suburban primary school. The context of the relationship was established through mathematics, namely, the intention to foster the sustained use of calculators by the three classroom teachers. The project was conducted over a period of one school year and consisted of three major phases: an investigation and development phase (term 1); an implementation phase (term 2 and 3); and an evaluation and follow-up phase (term 4). Rather than imposing an externally validated model of professional development, the researchers sought to observe the evolution of teacher change. (A similar approach is described by Hopkins (1994) when he talks about school improvement as a 'journey' in which he offered support and intervention, researching the journey as it occurred.) However, a theoretical and practical framework was derived by listing conditions and areas of concern identified by the researchers during the initial investigation stage of the project. Broadly speaking, the resultant framework was indicative of an integrated model of professional development - one that espoused elements deemed necessary for success in other models of professional development, but included only if preliminary investigations identified them as important obstacles to the likely success of the project in question. Such conditions and areas of concern included many of the impediments to professional development already identified in the literature (see Clarke (1994) for a summary). While it

is not possible, given the limits of the present paper, nor is it the intention of this paper, to outline how each of these conditions and concerns were specifically targeted by the researchers, many will inadvertently be treated as the ensuing discussion focusses on the wider implications for promoting excellence in mathematics education.

Establishing a school-university partnership

Phase One - Investigation and development

Goodlad (in Fullan, 1991, p. 322) makes the point that 'schools and universities are markedly different cultural entities', but undeniably depend on each other to be most effective. Furthermore, he suggests that the best partnerships integrate teacher development and school development through the 'creation of exemplary sites in which future teachers are educated' and where site-based staff development activities foster continual school renewal through the continuous infusion of knowledge 'in schools and in programs preparing educators'. On this basis, the school in the present project was chosen due to its proximity to the mathematics educators, its willingness to accept regularly preservice teachers from the university for practicum experiences, its reputation for accepting professional advice from other university staff members and the willingness of the staff and administration to participate in the collaborative project. The three teachers, two third grade and one third/fourth grade teacher (referred to by fictitious names hereafter), were chosen on the basis of their desire to undertake professional development of the nature being suggested by the researchers.

During the investigation and development phase, background information was gathered via interviews with the administration, parents and the teachers directly involved in the project. A questionnaire and three focus discussion groups involving parents were also conducted. The data gathered during this initial phase allowed the researchers to gain a better understanding of the school's specific context in which professional development might take place. For example, interviews with the teachers established that Debbie was new to the school and although she expressed a desire to work more closely with her colleagues, had not as yet had the opportunity to do so. Amy and Julie, however, had already been engaged in considerable sharing of ideas and resources and had, on occasions, team taught. It was therefore considered that the basis of a collegial group had already been established and that it was now possible to extend it to include the third teacher and the two tertiary educators. Collegiality in the workplace, among other factors, is well supported in the literature to increase the likelihood of successful professional development (Little, 1990; Fullan, 1991). Unfortunately, it is also well documented that the norms of isolation and autonomy in many schools can undermine attempts of collegiality among teachers (Hyde, Ormiston, Hyde, 1994). On the basis of this information, it was negotiated with the teachers and the school administration that a collaborative relationship similar to what Little (1990) labelled 'joint work' be established. Such a relationship involved team teaching, mutual planning, observation, action research and mentoring - hence, professional development activities centred around events in the classroom. It was agreed that during phase two of the project one of the mathematics educators would visit each classroom for about an hour each week and either conduct demonstration lessons, team teach with the classroom teacher or act as an aid and be allocated a task by the teacher. It was also decided that regular sessions would be held when teachers and the tertiary educators could discuss mutual progress and when concerns could be raised and dealt with. These sessions were often

held during a recess or lunch break immediately prior to or after work done in the classroom.

Developing the partnership
Phase Two - Implementation

An aim of the second phase was to gradually strengthen relationships among all members of the group via the classroom support and discussion sessions. No formal interviews were conducted during this time, but informal discussions with teachers, students, parents and administrative staff and anecdotal evidence collected during classroom visits was recorded via reflective journals kept by the teachers and the tertiary educators. Hence, a description of this phase of the project is confined to actual events and insights gained by the researchers from such data.

In addition to regular discussion sessions and classroom visits a number of workshops were conducted with parents during this phase. Parent and student groups can be very influential in the change process and their significance has often been underestimated by those trying to initiate change at the classroom level (Fullan and Stiegelbaur, 1991). A communication network was established with newsletters informing parents of developments from a teacher's perspective and letters written by the students informing them of what and how the children felt they were learning. The importance of establishing such a network when attempting to initiate change was recognised by the teachers and considered essential to the nature of the developing school-university relationship. As Amy commented: '...that was good and the parents liked it...quite a few parents gave me feedback saying that was lovely...'. Hence, not only was communication enhanced between the children and their parents via their 'letters', but it encouraged communication between the parents and the classroom teachers.

Three events during this phase were considered helpful in strengthening the school-university partnership: the practicum; math activities organised by Julie and Amy for the rest of the school; and a guest lecture by teachers from the school to preservice teachers at the university. The presence of student teachers from the university in the school, one of whom was assigned to Amy's class, increased the number of university staff and school staff having direct contact with each other. The student teacher on Amy's class remarked that it was the first time that a 'classroom teacher on prac. has shown confidence in my ability to teach maths the way I'd like, rather than forcing me to follow a text book'.

Ten weeks into the project, Julie arranged for Amy's class to participate in an activity where her students instructed Amy's students in games they had invented with the use of a calculator. Fifteen weeks into the project, Amy had appointed groups of her students to rotate amongst groups of grade 4, 5 and 6 students to instruct them in mental strategies for multiplying two digit numbers by one digit numbers during a mathematics fun day. These independently arranged activities were perceived by both the school administration and the tertiary educators as indications that both Amy and Julie were taking more risks with their teaching of mathematics and were establishing more control over the use of calculators in their classrooms and in the school in general.

Towards the end of the implementation phase, teachers from the school were invited to address final year preservice teachers at the university. Both the school's principal and Amy accepted the invitation with Amy focusing on the significance of her own professional development. While originally unintended, the partnership has provided the university with a network of teachers enthusiastic to spread their 'wisdom of practice' (Shulman, 1987). Amy later accepted another invitation, this time to discuss

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student outcomes of the project with teachers from other schools involved in the university's practicum for final year students.

Further evidence that the relationship was strengthening and that Amy and Julie were becoming more autonomous was their concern for the tertiary educators' interests in the project. Reflective journal entries made by Amy indicated a concern that she was 'getting more out of the project' than her university partners. Debbie, on the other hand, made her feelings quite clear from the beginning that 'If this (the project) gave me an overload, I wouldn't be that interested in it...'. Such statements are indicative of Goodlad's (in Fullan, 1991, p. 322) suggestion that for school-university partnerships to work there must be mutual satisfaction of self-interests and 'sufficient selflessness on the part of each member to assure the satisfaction of self-interest on the part of all members'. It was evident very early in the implementation phase that Amy and Julie shared similar self-interests for the project to those of the tertiary educators, but that Debbie's interests fell short of these and that she was actually becoming more isolated. Visits to Debbie's room were cancelled due to minor disruptions to the timetable and she stopped making herself available for discussions with either the tertiary educators or with the other two teachers involved in the project. There was also a high degree of absenteeism on her part. A little over half-way into the second phase of the project Debbie resigned from teaching.

Implications of the Partnership

Phase Three: Evaluation and Follow-up

During the final phase of the project little direct classroom contact was made between the classroom teachers and the mathematics educators but Amy was again involved with the same student teacher on practicum. Towards the end of term 4 interviews were conducted with Amy, Julie, the principal and the deputy principal. Important themes that emerged from the interview data included: classroom support; the collaborative nature of the relationship; the long-term perspective; and the impact on teacher efficacy.

It is well acknowledged that when professional development is isolated from the classroom that significant effect on either teaching practice or students' learning is unlikely (Clarke, 1994). From the outset, the classroom was the focus of all professional development activities. This characteristic was identified as a major contributing factor to the project's success by the school's administration and by the teachers directly involved. Julie commented that the 'close involvement with the specialist maths person and access and support to a professionally interested person to discuss and bounce ideas off' had been most beneficial especially when it came to the discussion of 'philosophies and strategies for teaching'. Amy, on the other hand, found that 'having someone with more content knowledge' in the classroom 'helped my development and my understanding' of math concepts. She also commented that it had been beneficial because I've seen it in practice and that's where I guess you learn where you see the work happening. So that puts it far above the kind of learning experience you have in an inservice course where you are sitting and being talked at...to actually talk through and observe the children working is definitely invaluable.

The success of the project in Julie and Amy's classrooms can be partly attributed to their selflessness and willingness to adopt increasingly more of the responsibilities for directing the learning as the project progressed. As mentioned earlier, both Amy and Julie voiced concern that they wanted to help the tertiary educators achieve their interest in the project. Both the principal and the deputy noted that 'a fine rapport has been established' with the principal attributing 'the nature of the

relationship' with keeping 'the teachers enthusiastic, interested, and motivated to try new things'.

Few would contend the notion that significant change is a gradual process and that a long-term perspective to professional development needs to be adopted (Fullan, 1990; Hopkins, 1994). Evidence from this study reaffirms this position. Amy succinctly summarised opinions expressed by Julie and the administration when she noted:

I learned more by having watched the children's development than had it been maybe a one-off or two-off visit. ...The secret was the longevity of it...I had time to reflect on what was happening.

It has been argued by others that teacher change and teacher development is very much linked with the development of the total person and that 'you cannot change the teacher in fundamental ways, without changing the person the teacher is (Fullan & Hargreaves, 1992, p. 36). During interviews with Amy, the principal and deputy it was revealed that they had all noticed a marked improvement in Julie's self-efficacy. Being a relatively shy person by nature it was considered a major achievement by the principal that 'there has been a great effect on the professional development' of Julie 'and has greatly increased her self-esteem. She now has confidence to tackle new and different things, to take risks...'. The deputy principal also commented that Julie had made several requests to be kept informed of department initiatives in mathematics.

Conclusion

Undeniably, school-university partnerships are difficult and 'complex social experiments' (Sirotnik & Goodlad in Fullan, 1991, p. 322). Many times at the start of the project the tertiary educators felt under pressure to become more directive and to offer more specific advice with teachers wanting ready-made solutions to problems of teaching and learning mathematics in their classrooms.

While tempting to respond in the desired way in order to establish instant credibility in the partnership, it was recognised that such a response could not lead to the autonomous professional development of teachers. Such relationships require a long-term perspective if significant and sustained change is desired.

Perhaps it is due to this complexity that school-university partnerships have not gained full recognition for their potential benefits either in the literature or by the general education system. While the original aim and primary focus of the partnership in question was the professional development of classroom teachers, this paper has highlighted the wider implications such relationships can have for all those involved. There were implications for the classroom teachers directly involved in the project, for teachers not directly involved, for the tertiary educators, preservice teachers, and most importantly, the children. For instance, classroom teachers found the availability of expert mathematical knowledge invaluable to their teaching and student outcomes; the tertiary educators were provided with recent classroom anecdotes and samples of children's work that could enhance their teaching of preservice teachers, and preservice teachers were able to encounter teachers and a school environment that was not only 'moving' (Rosenholtz, 1989), but was open to new ideas provided by the student teachers themselves. The partnership that has been forged between the two institutions therefore has not only had positive learning implications for the teachers and their pupils, but will ultimately benefit mathematics teaching and learning at all levels of education.

Despite such close links having been established and maintained for so relatively short a time, the two teachers are particularly keen to continue their learning in mathematics. While the mathematics educators' direct and

regular involvement in the school has concluded, the partnership is continuing in other key learning areas.

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