Co-Constructing New Classroom Practices: Professional Development Based upon the Principles of Lesson Study

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A challenge for educational employing authorities is the provision of high-quality, sustainable professional development opportunities that will lead to positive growth in teachers' pedagogical practices. The study reported here sought to devise and implement a model of teacher professional development that would result in such growth by increasing mathematics content knowledge and pedagogical content knowledge. While there were a number of components to the study, including the investigation of a relationship between teacher professional learning and improved student learning outcomes, this paper focuses upon the changes in teachers' beliefs and practices as reported by the teacher participants, their students, and observed by the researcher. A variety of qualitative methods for data collection were used in order to develop a complete picture of the nature of teacher growth.

The improvement of teachers' content knowledge and pedagogical content knowledge is one of the most important investments of time and funds which systems and levels of government can make in education (Holland, 2005). As Ingvarson (2003) pointed out in his paper "there are no short cuts to educational improvement" (p. 63). Policy makers and politicians can have quite unrealistic or simplistic expectations about the ease with which educational change can occur, not understanding that the most significant changes are those that build teacher capacity and professional culture, *not* structures or curriculum frameworks.

Teaching is a dynamic profession, and requires not only the development of a *professional identity* but the construction of professional knowledge and practice through continued professional learning (McCormack, Gore, & Thomas, 2006). As professionals, teachers are expected to maintain currency in content knowledge, pedagogical content knowledge, and pedagogical knowledge. As practising teachers, the opportunity to maintain this currency, and to have this maintenance documented, is by participating in school-, system- or state-organised professional development activities. The main focus of this study was the use of an effective model to support the teacher-participants in their professional development, and to scaffold them to incorporate solving mathematical word problems into their daily practice.

Lieberman (1996) argued that situating teachers' learning in their *everyday work* with their students in their classrooms, rather than one-off seminars or workshops, *increases* the likelihood that the learning will be meaningful and incorporated into practice. In addition to embedding teachers' learning in their everyday work, Fernandez (2005) identified a number of approaches to teacher professional development that also increased the likelihood of meaningful learning.
These included:

- critical examination of teacher practice, either directly (live or video-taped) or indirectly (through analysis of artefacts);
- working collaboratively with professional developers, teacher colleagues, or both; and

_ teachers' analysis of student demonstrations of learning collected during a course of instruction.

These approaches culminated in an interest in the Japanese form of professional development referred to as 'Lesson Study' (Fernandez, 2002; Fernandez, Cannon, & Chokshi, 2003; Lewis & Tsuchida, 1997). Lesson Study, the principles of which underpin the model of teacher professional development used in this study, reflects a rigorous and well-documented means of examining practice in which many Japanese teachers engage (Fernandez, Cannon, & Chokshi, 2003). Lesson Study refers to a process of pedagogical improvement of which the *research lesson* is the key component (Lewis, 2000). Research lessons are *authentic* classroom lessons that are: planned collaboratively, focused upon a particular pre-determined goal, observed by colleagues, recorded, reflected upon, and discussed.

The general theory of constructivism, with an emphasis on social constructivist ideals, provided a framework that supported the use of Lesson Study principles as the basis of the professional development model used in this study. A Model of Teacher Change (see Figure 1) was developed by the researcher to investigate changes to teacher practice from the perspectives of the participating teachers, the students, and the researcher. The Model of Teacher Change illustrates a theory that positive outcomes for teachers and students would affect the teachers' beliefs, further influencing their pedagogical practices.

Method

The study was conducted at a semi-rural P-12 ecumenical college, south-west of Brisbane (Queensland, Australia) over the 2007 school year. Five teachers of students in year levels 6 to 9 participated in the project, and the site coordinator was the Assistant Principal Curriculum. The study was *iterative* in nature with data collection points delineating the beginning and end of the iterations. Figure 2 illustrates the model of teacher professional development created for this study, and shows the structure of the cycles, described as 'iterations' within Phase One and Phase Two.

The design of the iterations explicitly supported the *operational principles* of Lesson Study namely: discussion of practice, co-planning specific lessons, implementing the lessons, observing the lessons, providing feedback, and undertaking reflection. The planning, observation, and provision of feedback for lessons occurred *between* the teacher-participants as well as with the researcher.

In Phase One the components of the iterations were: Week 1 – researcher models, teachers observe; Week 2 – joint lesson planning, researcher and teachers; Week 3 – teachers execute lesson, researcher and peers observe and provide feedback. In Phase Two the iterations became: Week 1 - joint lesson planning, researcher and teachers, and Week 2 – teachers execute lesson, researcher and peers observe and provide feedback.

Throughout the study data were collected using a range of methods: teacher questionnaires; student questionnaires; in-class observations of teacher practice; teacher interviews; and student focus-group interviews. The *Teacher Questionnaire Part 1* and *Teacher Questionnaire Part 2* were designed to: (i) facilitate teacher reflection on their beliefs about mathematics teaching and learning, and problem solving, and (ii) to provide information about each of the teachers' 'espoused' classroom practices.
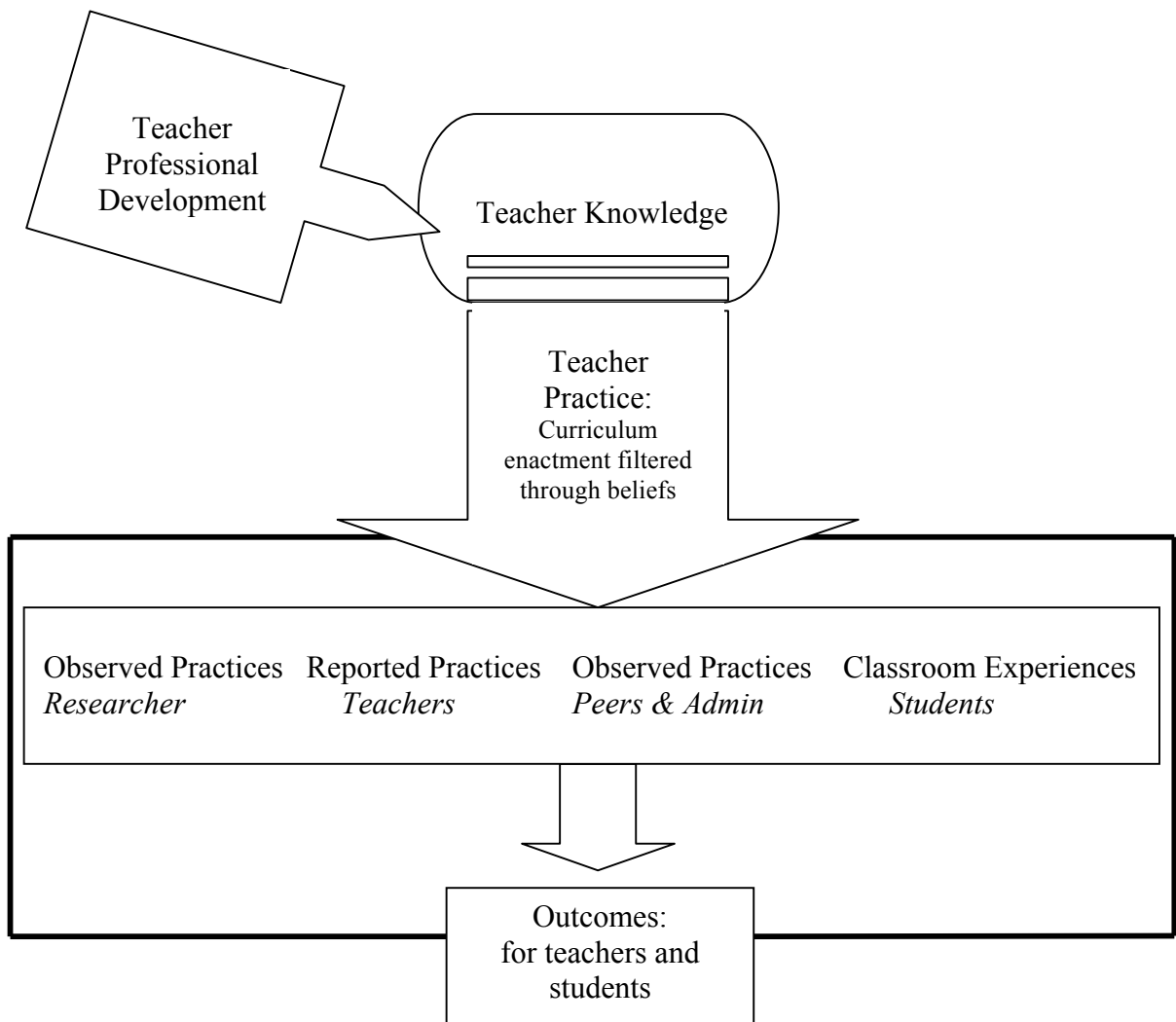
Figure 1. Model of teacher change

Semester One 2007   Semester Two 2007
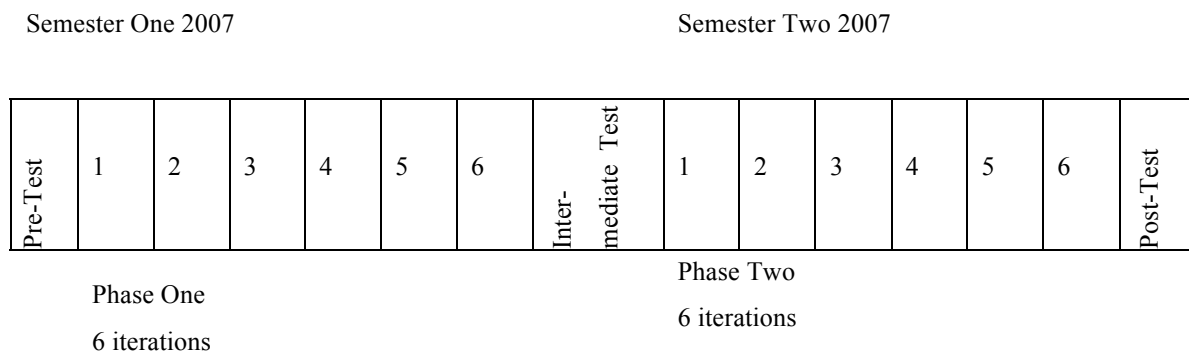

Phase One

6 iterations

Phase Two

6 iterations

Figure 2. The Model of Teacher Professional Development Used in this Study.

The *Student* was used at the beginning of the study to determine teacher practice as experienced in classrooms and *reported* by the students before the commencement of Lesson Study-principled model of professional development. The statements used for the *Student Questionnaire* closely reflected the statements used for the *Teacher Questionnaire Part 1* and *Part 2,* serving to provide consistency and related contexts so that self-reported teacher practice could be compared with the reported practices from the students' perspectives.

The in-class observations of teacher practice by the professional development facilitator (the researcher) formed part of the Lesson Study-principled process and were annotated on the *Lesson Planning Proforma* used by each teacher-participant. The in-class lesson observations made and annotated by the researcher were varied in nature, ranging from a focus on the fluency with which the teachers executed the stages of the co-planned lessons, to the degree of student engagement in the learning experiences facilitated by the teachers. Generally the annotations of what was observed by the researcher incorporated these components:

- the confidence of the teacher while executing the lessons, as indicated by speech patterns and body language;
- the cohesiveness of the delivery of the sequenced teaching episodes, as indicated by referring to relevant mathematical concepts, revisiting prior components of the problem-solving strategy, and linking student input to the planned sequence; and
- the degree to which the students engaged with the lessons, as indicated by colluding to follow the procedures facilitated by the teacher, volunteering suggestions and opinions related to the problem being addressed, and attaining solutions and posing extension questions.

The observations, undertaken by the researcher and, as often as possible, by other teacher-participants, constituted part of the *critical feedback* to the teacher-participants about their lessons to inform further planning, and also were analysed to determine changes to 'reported' teacher practice, that is, practice observed by others such as students, parents, administration or others, over the time of the study. Other observations and notes made by the researcher were made during the co-construction of the research lessons and during the reflection and feedback sessions. On these occasions the researcher focus was on the following aspects:

- the confidence of the teacher to contribute to the construction of research lessons, as indicated by the amount of input volunteered and a willingness to undertake new or different methods or approaches;
- the professional sensibility of the teacher to provide critical feedback to colleagues, as indicated by the acknowledgement of 'successes' as well as areas for improvement; and
- the ability to critically reflect upon lesson execution and articulate this reflection to their colleagues and the researcher, as indicated by comparing perceptions of what occurred during the lesson what was intended and planned for.

The *Teacher Interviews* and *Student Focus-Group Interviews* were conducted at the end of Phase Two of the study (that is, the end of Semester Two, 2007), using predetermined questions to encourage teacher-participant reflection on the professional development intervention and representative student reflection. Questions for both were drawn from Guskey's (2005) *Five Levels of Professional Development Evaluation*.

The five levels are organised under these headings:

1. participants' reactions;
2. participants' learning;
3. organisation support and change;
4. participants' use of new knowledge and skills; and
5. student learning outcomes.

Researcher field notes, lesson observations, and teacher-participant interview transcripts were used to portray each teacher-participant at the beginning of Phase One and then again at the end of Phase Two, and were analysed from a qualitative perspective. From a social constructivist viewpoint, the teacher-participants' successes or failures were described by the interplay between self and behaviour, that is, cognitive growth (or learning) as evidenced in behaviour recognised as teacher practice.

Findings

The definitions of 'traditional' and 'contemporary' pedagogical practices in this study were similar to those of Anderson, Sullivan, and White (2005). Traditional practices include: the rehearsal of routine questions, a reliance on textbooks and worksheets, and presenting problem solving to students after they have mastered basic skills and facts. Contemporary practices include: use of co-operative group work, use of non-routine questions that promote mathematical thinking, and the development of problem-solving skills for all students. A descriptor of 'mixed' pedagogical practices was assigned to teachers who evidenced elements of both traditional and contemporary. Table 1 shows the alignment between the teacher-participant reflections, their students' reported classroom experiences, and the researcher's in-class observations of the teacher-participants at the commencement of the study.

The teacher-participant interviews conducted at the end of the study resulted in the following when the comments were related to Guskey's (2005) *Five Levels of Professional Development Evaluation*:

- *all* teacher-participants were satisfied with the professional development model in terms of enjoyment and time well-spent;
- *all* teacher-participants declared and were able to describe their new learnings (knowledge and skills);
- *all* teacher-participants recognised and described positive impacts upon the college resulting from the study;
- teacher-participants identified differing levels of support from the college leadership team, and all indentified the lack of recognition and encouragement from the college leadership team;
- *all* teacher-participants described their progress, changes in practice, and commitment to continue using the problem-solving strategy; and
- although the teacher-participants recognised and described positive changes in student outcomes, some were cognisant of differing student ability as being consistent (i.e., all students had value-added learning but the outcomes of the cohort were still differential due to the baseline ability of the students).

Table 1

Summary of Teacher Beliefs and Practices, Student Classroom Experiences, and Researcher Observed Practices

TEACHER	BELIEFS	PRACTICES	STUDENT EXPERIENCE	RESEARCHER OBSERVED PHASE 1
GA	Contemporary	Traditional	Traditional	Contemporary
BS	Contemporary	Contemporary	Traditional	Contemporary
MB	Contemporary	Traditional	Traditional	Contemporary (Yr 7) Traditional (Yr 9)
KB	Traditional	Mixed	Mixed	Traditional
JP	Contemporary	Mixed	Traditional	Traditional (both classes)

Teacher-participant self-reflection and researcher observations at the end of Phase 2 (as shown in Table 2) of the study clearly match and show that all participants (except for BS) had altered their practices. Interestingly, BS commented extensively on her increased content knowledge and confidence in teaching mathematics, and attributed this to her participation in the study. When the student focus-group interview comments were related to Guskey's (2005) *Five Levels of Professional Development Evaluation*, the following findings became evident:

- *all* students in the focus group recognised and described changes (which they considered to be improvements) in the way their teachers taught problem solving compared with the beginning of the school year;
- *all* students in the focus group stated that they felt *confident* in their use of the problem-solving strategy and more confident in problem solving in general;
- *all* students in the focus group identified that their teachers were now more willing to allow them to solve problems in their own way instead of controlling the solutions;
- students representing *lower year levels* were more confident about their peers performing better on the post-tests than were the older students; and
- the Year 9 students, in particular, were most resistant to using the problem-solving strategy, and made the suggestion that it be taught in much earlier year levels.

It appears that the comments from the focus group indicated that at least these students recognised *positive changes* in their teacher's practice as previously voiced by the teachers themselves. Teacher-participant interviews took place in the Post-intervention Phase, June 2008. The purpose of these interviews was to determine if, and to what extent, the application of skills and practices learned during Phase One and Phase Two had continued into the new school year *without* the same level of support from the professional development facilitator or the APA experienced during the study. Unfortunately, only two teachers had remained at the college in 2008: KB and MB. Both teachers declared that

Table 2
Summary of Teacher Practices and Researcher Observed Practices from Phase One to Phase Two (note: JP not represented due to absence in Term 4)

TEACHER	PRACTICES PHASE 1	RESEARCHER OBSERVED PHASE 1	PRACTICES PHASE 2	RESEARCHER OBSERVED PHASE 2
GA	Traditional	Contemporary	Mixed	Mixed
BS	Contemporary	Contemporary	Contemporary	Contemporary
MB	Traditional	Contemporary (Yr 7) Traditional (Yr 9)	Mixed	Mixed (both classes)
KB	Mixed	Traditional	Mixed	Mixed

problem solving should: (i) be a part of every lesson, and (ii) relate directly to current work and experiences that are relevant to the students. This is contrary to beliefs espoused at the outset of this study by these teachers, particularly by KB, who had stated that problem solving was only for the more able students, and could only be pursued when basic facts had been consolidated.

KB described his 2008 classroom practices as incorporating problem solving into every lesson, rather than separate lessons, and that the problems he created were directly linked to the concepts being taught. When asked if this was a change to his teaching practice, KB remarked that it was quite different to what he had done in the past, which was when (and if) problem solving was taught, it was treated as an isolated event. When asked if the problem-solving strategy was being used to any extent, and if so, how, KB described his use of the strategy as *frequent*, both during explicit teaching and prior to assessment tasks. Teacher MB described his use of the strategy as *extensive*, including: focused use in class for mathematics word problems, as part of National Numeracy and Literacy test preparation (for both Year 7 and 9 students), and in other subject areas, such as, science. An additional comment made by MB indicated that his awareness of the strategy encouraged him to include higher-order science questions in his everyday teaching as well as assessment tasks.

Conclusion

Multiple sources of evidence suggest that the teacher-participants:

- found that the focussed and sustained work resulted in increased content knowledge and pedagogical content knowledge;
- experienced an increase in their professional confidence; and
- valued critical feedback and peer collaboration.

Positive consequences of the implementation of this model of professional development based included:

- the teacher-participants' informed scrutiny of other professional development events on offer;

- the opportunity for the teacher-participants to develop their critical lenses for examining their practice;
- the active engagement of the teacher-participants in professional dialogues with the researcher and each other;
- the positive professional growth of the teacher-participants, the interest shown by staff of the college not directly involved in the study;
- the refinement of the strategy for problem solving; and
- the teachers' and students' involvement with problem solving at a meta-cognitive level.

The significant benefit of this model of professional development was the *positive teacher growth* resulting from participation in the activity for an extended period of time that is, the academic school year. As concluded by Desimone, Porter, Birman, Garet, and Yoon (2002) this kind of professional development is more likely to result in positive teacher growth than participation in event professional development such as one-day seminars or workshops. These findings have direct bearing upon all kinds of future professional development of teachers.

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