

Lesson Study: A Model of Professional Development for Teachers of Mathematics in Years 7 to 12

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Lesson Study is a model of professional development designed to assist teachers produce quality lesson plans and gain a better understanding of student learning in mathematics Years 7 to 12. The process involves a small group of teachers as a *Lesson Study* team, who meet regularly to plan, design, implement, evaluate and refine lessons for a unit of work that they had selected. In 2002 it was implemented in 36 NSW departmental secondary schools from across the state in Semester 1 and another 77 schools in Semester 2. This paper briefly describes the program and considers certain aspects of the evaluation, particularly in terms of teacher learning.

In 2001, the New South Wales Department of Education and Training initiated a trial project called *Lesson Study* in conjunction with the Quality Teaching Program (QTP). The *Lesson Study* program is a model of professional development designed to assist teachers produce quality lesson plans and gain a better understanding of student learning in mathematics across Years 7 to 12. The process involves a *Lesson Study* team, which is a small group of volunteer teachers under the coordination of a volunteer team leader. They meet regularly (1-2 periods per week) for a 6 month period to plan, design, implement, evaluate and refine lessons for a unit of work selected by the teachers. The schools volunteer to join via their Regional Mathematics Consultant, with the project coordinated by a departmental project officer. The process encourages classroom observation and collaborative work practices.

The project began in 2001, involving three secondary schools and 12 teachers. In 2002 during the first half of the year, the program was conducted in 36 secondary schools from across NSW, involving more than 150 teachers. During the second half of the year 2002 another 77 schools were included from across NSW, involving more than 250 teachers. In 2003 in the first half of the year another 76 secondary schools have been introduced to the project. An evaluation of the implementation of the program was carried out during 2002, by the authors of this paper.

The evaluation focussed on the five critical levels of professional development evaluation as proposed by Guskey (2000):

- participants' reactions;
- participants' learning;
- organizational support and change;
- participants' use of new knowledge and skills; and
- student learning outcomes. (p. 82)

In this paper, we will briefly cover all levels and concentrate and report in slightly greater depth upon the second level, that of teacher learning.

Background

One of the issues raised by the *Third International Mathematics and Science Study* (TIMSS) and the repeat study (TIMSS-R) was that student learning was not likely to improve markedly until teachers were given the opportunity and the support to further develop and increase the effectiveness of their skills (Lokan, Ford & Greenwood, 1996; Martin & Mullis, 2000; U.S. Department of Education, 2001). The *Lesson Study* program is a model of professional development that aims to address these and other issues.

The *Lesson Study* program belongs to a tradition of teacher professional development that concentrates upon an examination of practice either through direct observation by colleagues of each others' practice, through the examination of classroom artefacts, or case studies of teachers by teachers (Hollingsworth, 2002; Lampert & Ball, 1998; Rowley & Hart, 2000; Seidel, 1998; Stigler & Hiebert, 1999; Stigler, Gallimore & Hiebert, 2000). It is assumed that teacher learning and development will be more meaningful and effective if it is embedded in their everyday work, or that of their colleagues (Lieberman, 1996). Key principles of the program (Stigler & Hiebert, 1999) include the following.

- It is a process based on a long-term continuous improvement model, where change is incremental.
- It uses a local school context and maintains a constant focus upon student learning.
- There is a direct focus on the improvement of teaching and not upon the teacher.
- The process used is collaborative in nature where improvement is the work of the teacher.
- It builds teacher perceptions of contributing to the development of knowledge as well as their own professional development.
- The process builds a system that can learn from its own experience.

The Australian national mapping exercise of school teacher professional development up to the year 2000 (McCrae, Ainsworth, Groves, Rowland & Zbar, 2001, p. 160) identified trends over time that existed both nationally and overseas. They listed four discernible phases: training (in the 1950s and 60s); in-service education (1970s and early 80s); professional development usually involving pupil-free days (1980s and early 90s); and learning and development involving a learning culture approach (now and in the future) (see Hawley & Valli, 1999). The *Lesson Study* program appears to fit closely within the latter current phase and resonates strongly with Clarke's (1994, p. 38) list of key principles for effective professional development of mathematics teachers that arose from his review of the research literature.

Methodology

The *Lesson Study* evaluation reported here concentrates only on the 2002 participants. The following data collection techniques were employed in the overall evaluation of the program:

- team leaders of the Semester 1 cohort completed a survey before the program commenced;
- teacher questionnaires were conducted at the completion of the program by Semester 1 and 2 cohorts;
- follow up survey 6 months after completion for Semester 1 cohort;

- telephone interviews and follow-up interviews of teachers from both Semester 1 and 2 cohorts;
- case studies involving three schools from Semester 1 cohort.

The questionnaires were designed with a range of closed questions scored on a four or five point Likert scale and open-ended questions that invited a sentence response to cover each of the five critical levels of professional development proposed by Guskey (2000). Questions were framed around the responses from open-ended questions and were included in later instruments to determine the degree of consensus among the participants. Participants were encouraged to leave a blank response if the question was not applicable. The follow-up questionnaire was distributed in order to capture those insights that clarify as a result of delayed reflection by the teacher. The questions involved with teacher learning tended to be closely linked with the principles of the *Lesson Study* program (Guskey, 2000, p. 83). However, efforts were made to gather material outside the range defined by the principles. All questions were discussed with teachers before and after survey completion to address concerns of descriptive and interpretative validity “if we start from the same perspective, sharing a language and so on, we will tend to describe/interpret things in basically the same ways” (Denzin & Lincoln, 2000, p. 883).

At the completion of the *Lesson Study* cycle in July 2002 a total of 53 participants responded to the questionnaire from the 36 participating schools. The response rate was low for the follow-up survey in November 2002. It was expected that the rate would be lower than the earlier response rate due to a six month interval and the arrival of a QTP survey at the same time as the follow-up survey could have contributed to a further lowering of the response rate. Team leaders who comprised 72% of the respondents dominated the follow-up response sample. We postulated that perhaps they felt more obligation to respond and were more committed to the success of the project. Also at the completion of the *Lesson Study* cycle for the Semester 2 cohort in November 2002, a total of 64 teachers and team leaders from the 77 schools completed a questionnaire.

Telephone interviews, rather than face to face interviews, were conducted with teachers (7), team leaders (6) and Head Teachers of mathematics (6) because of convenience, given the geographic spread of teachers and schools and because of the demonstrated advantages of this approach in facilitating thought and reflection (see Dinham, 1994). The disadvantages were the lack of non-verbal cues and the problems of reviewing the data although it was sent to the teachers after the interview. The purposes of the interviews were to check the interpretative validity of the instruments, to discuss issues arising from the survey data, and to gather data not included in the surveys.

The methods used in the analysis of data used elements from grounded theory (Strauss & Corbin, 1990) and that of content analysis, although a full application of the techniques did not occur due to the exploratory nature of the evaluation. Both quantitative and qualitative analysis were used and were desirable because neither on its own yields as much information as they do together (Cant, 1997).

Results

The data are divided into two sections, as Cohort 1 completed the program in July and Cohort 2 in November.

Cohort 1

Responses to the “before commencement” survey for the team leaders indicated 27 out of 34 (79%) were confident that *Lesson Study* would enhance their teacher skills in planning, implementing and evaluating lessons. A total of 25 leaders (74%) indicated a high degree of confidence in the *Lesson Study* program enhancing the professional collegial bonds within their mathematics staff. The survey revealed that all the team leaders (100%) reported the *Lesson Study* program key principle of maintaining a constant focus upon student learning as the most important.

Before undergoing the program, the team leaders classified the degree of importance of the individual *Lesson Study* principles. The principle the teachers nominated as most important was the constant focus upon student learning. The next principles of importance referred to the collaborative process; the contribution to development of knowledge of teaching and learning; and the direct focus upon improvement of teaching. These were followed by the principles referring to being based on a long-term continuous incremental improvement model and contributing to staff professional development. The least important principles were the focus upon the local school context and the building of a system that can learn from its own experience.

At the completion of the program in July 2002 the teachers and team leaders (N = 53) were asked to respond to statements about their learning, and 79% agreed that the program had increased their understanding of student learning (see Table 1). When asked directly about the most important ideas gained from the *Lesson Study* project, working collaboratively and sharing ideas was very popular, which reflected the earlier responses to the “before commencement” survey. Sample responses were: “The realisation that collaborative team work is an outstanding professional development exercise. It certainly enhanced the teaching of the topic we focussed on and made for greater student engagement by engaging them more actively in their own learning”. Others teachers commented that they discovered “well planned lessons lead to greater levels of student learning. Lessons which engage the students are more effective and lead to enjoyment and understanding”.

Table 1

Frequency Distribution of Teacher Perceptions of the Impact of the Lesson Study Project Upon Their Knowledge. (N = 53)

Being involved in the Lesson Study Project has improved my:	Strongly Agree	Agree	Disagree	Strongly Disagree
Use of collaborative work practices to design lessons that engage students with their learning	15 (28%)	35 (66%)	3 (6%)	0
Understanding of student learning	9 (17%)	33 (62%)	11 (21%)	0

The participants were also asked what new skills they had acquired that would improve their ability to help students learn and again the breadth of comments indicated the program was a rich experience for most of the participants. A typical type of response was

“I have a greater understanding of how the steps involved in learning a new concept can be simplified and scaffolding can be provided for the students”

A follow-up survey was conducted in November 2002, six months after the completion of the project and asked teachers to respond to statements about their learning made by other *Lesson Study* colleagues. All the teachers and team leaders (100%) agreed that it was valuable to co-teach, because it showed them how other teachers dealt with the topic as well as disruptions to tasks. A total of 27 (84%) reported that they learnt a better way to teach the topic, and 27 (84%) agreed they had a deeper understanding of the content. A total of 26 (81%) reported they had a deeper understanding of how students learn the mathematics in the lessons (see Table 2).

Table 2

Frequency Distribution of Teacher Perceptions of Their Learning. (N = 32)

Respondents asked to respond to the following statements:	Blank	Strongly agree	Agree	Dis-agree	Strongly disagree
It was valuable to co-teach, because it showed me how other teachers dealt with the topic as well as disruptions to tasks	0	14 (44%)	18 (56%)	0	0
I learnt a better way to teach the topic	0	10 (31%)	17 (53%)	5 (16%)	0
I have a deeper understanding of the content now	0	6 (19%)	21 (66%)	5 (16%)	0
I have a deeper understanding of how students learn the mathematics in the lessons	0	2 (6%)	24 (75%)	4 (13%)	2 (6%)

Cohort 2

At the completion of the project in November 2002, the participants in the second semester cohort were asked to respond to statements about their learning made by other *Lesson Study* colleagues.

A total of 56 in the second semester cohort (87%) reported how valuable it was to co-teach, because it showed how other teachers dealt with the topic as well as disruptions to tasks. While 55 (86%) agreed that they had learnt a better way to teach the topic, only 24 (34%) agreed they had a deeper understanding of the content.

This result (which one?) was lower than the responses to the same question in the follow-up survey for cohort one (see Figure 1). Lastly, a total of 37 (58%) agreed that they had a deeper understanding of how students learn the mathematics in the lessons (Table 3).

Table 3

Frequency Distribution of Teacher Perceptions of Their Learning. (N = 64)

Respondents asked to respond to the	Blank	Strongly	Agree	Dis-	Strongly
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following statements:		agree	agree	disagree
It was valuable to co-teach, because it showed me how other teachers dealt with the topic as well as disruptions to tasks	4 (6%)	25 (39%)	31 (48%)	4 (6%)
I learnt a better way to teach the topic	2 (3%)	17 (27%)	38 (59%)	6 (9%)
I have a deeper understanding of the content now	3 (5%)	6 (9%)	16 (25%)	35 (55%)
I have a deeper understanding of how students learn mathematics in the lessons	2 (3%)	5 (8%)	32 (50%)	23 (36%)

An interesting issue arose from the interviewing process about the availability of good mathematics programs for teachers. Teachers reported that the *Lesson Study* program provided the motivation to engage with programs that have been available but not used. “We have had the MCTP in our store room for years. We knew if had some good ideas but we didn’t get the time to use it. With *Lesson Study* we were searching for good ideas and were amazed at how good the MCTP was. So it has been dusted off and we are now using other lessons from it. I guess it is just having the time and motivation”.

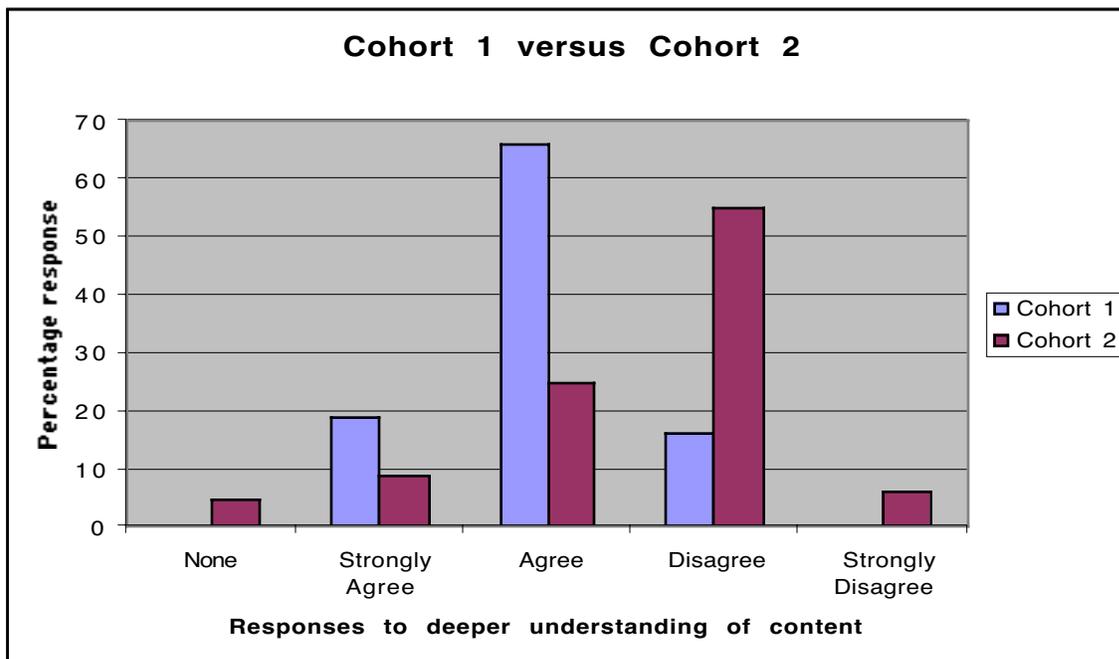


Figure 1. Percentage comparison of teacher responses from the Semester 1 and two cohorts to the statement that the *Lesson Study* program had increased their knowledge of the content.

It appears that the problem lies not with a low supply of good mathematics teaching resources and programs but with other factors. Interviews revealed some factors as lack of planning time, lack of familiarity and confidence with materials, lack of understanding over implementation of some programs.

Discussion

Both groups indicated that the program contributed substantially to their own learning and in particular to their understanding of student learning. When asked to give specific examples, the breadth of comments indicated the program had been a rich experience for most participants. However, just because the *Lesson Study* program was a systematic process, doesn't guarantee that teachers would develop a disposition towards learning. The role of the team leader was to stress the grounded vision of teaching as a site for learning where the teacher was in charge of their ongoing learning.

After completing the project, the placing of the principles in terms of importance had changed. For all groups and across all the surveys, teachers continually highlighted and commented upon the use of collaborative work, working on common goals, sharing of ideas, team teaching and co-operation among staff as major benefits of the program. For some teachers, they reported that the program was their first real experience of collaborative planning and teaching. The discourse in the staff rooms changed with the focus being directed to a greater extent on issues of teaching and learning with an increase in the willingness of colleagues to share ideas. Disagreements could be explored and settled experimentally via the focus lessons in the classroom.

Associated with the collaboration was the appreciation of the opportunity for classroom observation. All groups reported that *Lesson Study* provided a non-threatening context for lesson visits. These observations were rich experiences for teachers. Of course, this was an opportunity for a good deal of incidental learning. However, the data showed that in some classrooms the observer acted as another set of hands in the classroom and turned the lesson into a team teaching situation. While this was a rich learning experience for the teacher it obviously made it difficult to examine the true effects of the lesson. It would have been harder to pinpoint the effects of poor instructions or confusing explanations when the other teacher is providing compensatory explanations. Teachers expressed in varying ways the fact that "teachers getting together and working on a common goal is very satisfying especially when their efforts can later be shared".

Nearly as strong a response and linked to the comments above were those attesting to improved learning and different ways to teach a topic together with an increased depth of understanding of the content and structure of the lesson. Comments of the following type were common, "the process certainly makes you evaluate your teaching and content both prior to delivery and after".

Conclusion

In summary the *Lesson Study* program was experienced by teachers as a powerful process for guiding them towards new practices and dispositions. The program united an examination of practice with commonly accepted features of quality teaching and learning to create a well-defined and structured process. The core of the *Lesson Study* program involved working on focus lessons, a process that was natural, useful and easily sustainable by teachers. The program provided a comfortable forum for teachers to challenge ideas about their practice and the content that they taught and for the system to learn from its own experience. However, due to the limited evidence as a result of poor response rates, more research is needed before more general conclusions are possible.

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