What Teachers See When Watching Others Teach

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This paper reports results from a study exploring classroom modelling as an approach to teacher education. In particular, it presents analysis of responses on an observation proforma completed by primary school teachers to indicate what teacher actions they observed when watching modelled lessons and which of those actions they intended to implement in their classrooms as a result of the observation. One hundred and sixty two teachers participated in observing at least one modelled lesson in a variety of classroom contexts over a period of twelve months. The results of the observation proformas revealed that teachers focussed on desirable pedagogies when observing modelled lessons, suggesting that classroom modelling may be a powerful form of teacher learning.

Classroom teaching that engages students in the active construction of knowledge is complex. As Ball and Forzani (2009) argued, the work of effective classroom teaching is unnatural in that it goes beyond showing and telling. Ball and Forzani argued that such teaching requires a suspension of self with an orientation toward others focused on enabling others to think, learn and do. Each episode of instruction requires many moves and decisions requiring high levels of coordination. Because of the intricate nature of such teaching, which is fundamentally connected to student thinking and learning, it seems that at least some professional learning for teachers may best be situated in classrooms. Certainly it cannot be expected that teachers will learn everything they need from their initial education. There is a need for ongoing professional learning. At least some of the learning should ideally be focused on the complexity of practice and at least some of this learning might involve observation of practice. Given the popularity of Japanese Lesson Study (Fernandez, 2005), it seems possible that classroom based professional learning may be manageable and productive. The notion of *lesson study* is centred on the examination of teaching practice and involves a group of teachers planning a lesson, one of them teaching the lesson and then all of them reviewing the lesson and planning the next cycle.

There have been suggestions that classroom based professional learning could include experienced practitioners observing less experienced teachers and giving feedback. For example, *The Australian Institute of School Leadership* (AITSL, 2012) mandates observation of teaching practice and feedback for each teacher as part of performance reviews. However in over eight years of working closely with teachers in initiating, planning and facilitating professional learning in mathematics, my experience is that many teachers are reluctant to be observed especially if there is an evaluative component. I have conducted a number of lesson observations as part of my teacher education role but teachers found the observations stressful. The observations seemed to alienate teachers rather than building a climate of trust, which was necessary to promote teacher learning. Sullivan (2011) argued that observation of teaching practice is counter to our Australian teaching culture where many teachers consider their classroom to be private.

As a consequence of teacher unwillingness to be observed and at their request, I began to model pedagogies in their classroom contexts with the object of building trust and working out the best way to support them. This modelling followed a request from teachers in which they nominated a specific mathematical and pedagogical focus for the modelled lesson. The sessions also included a pre-lesson briefing, a modelled lesson and then a post

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lesson debrief. The pre-brief involved outlining the planned lesson followed by the modelled lesson. During the lesson, observers had opportunities to make notes on anything of interest to them. This was followed by a post-lesson debrief, during which teachers were given the opportunity to discuss their observations and implications for future lessons.

The intent of the modelling process was to build on and extend teachers' views of pedagogical approaches that were possible and to encourage collaboration and reflection. This research reported here is focused on what teachers observed during the modelled lessons and the intended pedagogical change to their classroom practice as a result of the observation. The research question framing the research reported in this paper is:

> When given the opportunity to observe teachers modelling, which aspects of pedagogy and mathematics do teachers notice?

Of course the real test is that teachers transfer observed practices to classroom practice. But the first step is that they can "see" the practices. That is what this process is exploring.

The discussion starts with perspectives on know ledge for mathematics teaching and follows with viewpoints on modelled lessons from the literature.

Mathematical Knowledge for Teaching

One of the key underpinnings of this research is a perspective on kn owledge for mathematics teaching, which builds on Shulman's (1986) well known notion of Pedagogical Content Knowledge (PCK). Ball, Thames, and Phelps (2008) proposed a model of Mathematical Knowledge for Teaching (MKT) in which they described two categories: subject matter knowledge (SMK) and pedagogical content knowledge (PCK). Within the category of (SMK) there are three subsets: common content knowledge (CCK), knowledge at the horizon and specialised content knowledge (SCK).The first subset CCK was defined as the mathematical knowledge used in teaching and other professions. The second subset SCK was defined as mathematical knowledge, which was exclusive to teaching. Finally Ball et al. (2008) described a third subset of subject matter knowledge as Knowledge at the Horizon, which involves understanding of how mathematical concepts are related and connected across the curriculum.

Within the category of PCK there are also three subsets: knowledge of content and students (KCS), knowledge of content and teaching (KCT) and knowledge of curriculum. KCS is focused on t eachers' understanding of how children think about and learn mathematical concepts. Knowledge of common preconceptions, partial conceptions and misconceptions related to mathematical concepts is central to KCS. Effective teachers can foresee what students are likely to think and have the skill to modify mathematical tasks or questions often "on the fly" to scaffold learning. This demands knowledge at the intersection of content and students (Ball et al., 2008). Teachers cannot effectively cater for the diverse range of students in their classes without this knowledge. Hill, Ball, and Schilling (2008) noted that the domain of KCS remained under-conceptualised and what constituted such knowledge was not yet clear and needed further development. They stressed the importance of classroom based research contributing ideas and measures of good teaching practice to this field of study. Teacher observations of the subtleties of teaching practice in this study may be a useful way to contribute to this research.

KCT is the combined knowledge of effective teaching pedagogies and mathematics. This includes choice of representational models, sequence of tasks and choice of questions to ask students in order to probe learning. For example, knowing when to pause for clarification, take the lesson off on a different path due to a student's remark or pose a new task to further students learning. Each decision made “requires coordination between the mathematics at stake and the instructional options or purposes at play” (Ball et al., p. 401).

The Ball et al. (2008) classification of MKT provides a useful theoretical framework on which to base this research as it offers increased levels of understanding of what PCK entails. An increased understanding may make it easier for teachers to establish agreed and specific foci for their observations and specify the actions of effective teachers as they teach. This process may support teachers in integrating these actions into their classroom practice.

Perspectives on Modelled Lessons from the Literature

A modelled lesson is a professional learning strategy designed to support teachers to improve instructional practice and outcomes for diverse learners. Teachers gather together to observe instructional practice, which is usually modelled by a more experienced teacher and situated within a real classroom. The aim is to make new knowledge, skills and pedagogy explicit to teachers and manageable within their practice contexts. The focus of the observation may include lesson structure, pedagogy, teacher actions and student learning (Bruce Ross, Flynn, & McPherson, 2009).

The literature focussing on modelled lessons is limited. Few studies have been described and the body of literature that exists seems to focus on di sciplines other than mathematics. However, a small number of recent international studies have suggested modelled lessons support teachers to visualise new practices and see how effective teachers enact particular teaching actions and principles (e.g., Higgins & Parsons; 2011). Casey (2011) argued that as teachers try out new pedagogical approaches to teaching, they crave modelled lessons so that they can see the contextualised approach in action and how their student’s might respond. Some studies (see Bruce et al. 2009; Grierson & Gallagher, 2009) have suggested this contextualised experience for teachers is a catalyst to enable them to reflect upon their own practice and make changes.

It seems that modelling can be effective at least in certain circumstances. Grierson and Gallagher (2009), for example, investigated the effects of a demonstration classroom initiative which sought to meet teachers’ differentiated learning needs and promote curriculum reform in literacy. The qualitative case study involved eight teachers, a demonstration teacher and a consultant teacher external to the school. The methods included interviews, observations and field notes. The demonstration teacher was selected on the basis of her exemplary classroom practice and coaching skills. The consultant teacher acted as a peer coach for the demonstrating teacher by assisting her to further refine her exemplary teaching practices.

Results suggested the demonstration classroom was successful in enhancing teacher abilities to modify their practices, with specific factors noted as being critical to the success of the study. These included the “the provision of ‘believable’ vicarious experiences in a l ocal school context” (Grierson & Gallagher, 2009, p. 567), the organisation of the program, the exemplary teaching, interpersonal and mentoring skills of the demonstrating teacher and ongoing support for teachers beyond the experience.

A significant finding of Grierson and Gallagher’s (2009) study was that modelling the use of evidence based differentiated literacy strategies within the context of a classroom enhanced teachers’ perceptions of the feasibility of implementing such practices in their own classrooms. It seems this was because observing teachers could see how the strategies worked with students within the context of a real time classroom. This suggests modelling pedagogies to cater for diversity in other learning areas may yield the same result.

An alternate approach that has been used in various places involves modelled lessons conducted by expert teachers, coaches or mathematics teacher educators not from the school, which may or may not be followed by observation of implementation. For example, in the New Zealand Numeracy Development Project (NDP) (Higgins & Parsons, 2011), eight facilitators modelled complex pedagogies and then observed teachers as they attempted to enact what they had seen. The facilitators who also provided feedback were part of a case study examining the effectiveness of classroom based professional development. Data were gathered from transcripts of face-to-face interviews with the facilitators at the end of the initial phase of the project's implementation. Their responses drew upon their experiences of up to four years working with teachers in the NDP. The facilitators were interviewed about what they did when modelling and observing in teachers' classrooms and the challenges they faced when modelling. Facilitators reported that putting modelling first before observation was an important step in building trust which was necessary to encourage teacher improvement.

A focus on students' thinking through open ended questioning supported teachers to shift their pedagogical practices from teaching procedures to teaching for understanding. Secondly, a focus on teaching strategies that were part of the NDP was useful to provide a focus for the modelling. Thirdly, facilitator modelling and subsequent observation of teachers enabled a focus on classroom discourse. The modelling by facilitators showed teachers what their students were capable of when using pedagogies promoted in the NDP (Higgins & Parsons, 2011). These findings suggest there may be advantages in having expert teachers model teaching practice. It seems experts can support teachers to make knowledge, skills and pedagogies meaningful and accessible within their contexts and develop their capacity to inquire into their practice to inform next steps in teaching.

Higgins and Parsons (2011) argued that engaging experts to work with teachers to interpret practice for enactment in classrooms is critical. They asserted the role of experts is pivotal in education reform that "seeks to influence the *difficult to reach* dimensions of teacher practice and improve outcomes for the diversity of students in classrooms" (Higgins & Parsons, 2011, p. 71). These dimensions include a focus on student thinking of the task at hand within the context of a real time classroom and the classroom discourse associated with that.

The above summary of literature suggests modelled lessons may have the potential to support teachers to learn some MKT in a non threatening way by seeing how the demonstrating teacher responds in flexible ways to diverse student learning needs.

Method

This section explains my professional background, the process of the modelling and observation and discusses the data collection methods.

I work for Catholic Education Tasmania as Numeracy Education Officer with state-wide responsibilities. Prior to taking on this role 8 years ago, I was a classroom teacher in Tasmania's state sector for 18 years.

Modelling and Observation Processes

The processes for enactment of the classroom modelling associated with the data collection were as follows. One or more teachers in a school context initiated the process by contacting me and inviting me to model a lesson in their school. Following this I emailed them a proforma to complete and send back. The proforma contained the following questions:

1. What would you like the mathematical focus of the lesson to be? (Please feel free to use content descriptors from the Australian Mathematics Curriculum)
2. What would you like me to focus on with respect to pedagogy? (For example, questioning, differentiation, open ended tasks, structure of the lesson, materials used)
3. What would you like to observe during the lesson with regard to student learning?

Based on teacher responses to the questions above, I planned a lesson. This aimed to provide teachers with an exemplar from which they could see how the lesson objectives and tasks connected with the Australian mathematics curriculum. There was usually a space of two to seven days between receiving teacher responses and the modelled lesson. I met with observing teachers for a 30-minute pre brief prior to the lesson on that day. During the pre brief, observing teachers were given a copy of the lesson plan and it was discussed. Initially I explained how the lesson connected to the request from the class teacher. I attached a copy of the lesson request proforma to the lesson plan. I outlined the tasks I had planned, enabling prompts and extending prompts (see Sullivan, Zevenbergen, & Mousley, 2006), connections to the Australian Mathematics curriculum and questions I intended to ask the students. During this meeting I handed teachers an observation proforma, which I invited them to complete either during or after the lesson. The observation proforma was designed in an attempt to evaluate the experience of the observation. The observation proforma contained the following prompt:

> What teacher action/s did you observe today that are different from what you usually do that you will try to implement in your classroom?

I taught each lesson observed by between two to ten school based personnel. Observing teachers included the teacher of the class where the modelling was taking place and teachers of similar grades. For example, if the lesson was in grade four, observing teachers tended to be teaching grades three, four or five. Other observers sometimes included the principal, teacher assistants and relief teachers.

After the lesson, all observing teachers and I met for a thirty-minute de brief. The first ten minutes was set-aside for observers to complete their observation proforma. During the next 20 minutes we discussed their responses, with observers having the opportunity to share anything that was pertinent to the discussion.

Analysis of responses

The Ball et al. (2008) classification of MKT guided the data analysis and interpretation of responses. First, written responses were read and grouped into categories. The majority of teachers wrote more than one response, hence the breakdown of the responses is greater than 100 per cent. Next, the responses were inspected and the initial coding revised. The teacher responses were sorted into the categories of the Ball et al. (2008) MKT framework. Finally, the grouped responses were sorted into sub categories.

For example, the three sub categories listed below under KCS are examples of teacher actions associated with responding to student learning needs in the moment (see Table 1). In order to modify questions to probe learning, it is assumed that teachers need to be familiar with common preconceptions, partial conceptions and misconceptions and the ways children learn mathematics. This is to enable teachers to probe at the opportune time and to scaffold or provoke thinking and understanding.

Similarly, some responses were grouped in the KCT category because they were examples of effective teaching pedagogies and mathematics (see Table 1). T he final category was common content knowledge (CCK).

Results and discussion

The categories emerging from the data analysis of the teacher responses in each observation proforma are presented in Table 1. The categories are presented in order of decreasing frequency. Some representative teacher responses are presented as illustrative examples of each sub category. They are direct quotes from teacher responses.

Table 1
Categories of responses with illustrative examples of teacher responses

Category	Sub category	% of teachers (n = 162)	Illustrative examples of teacher responses
KCS	Opportunities for students to justify thinking and explain mathematical reasoning	41	"Prove it as opposed to explain" "Allow the students to explain in their own words" "Reasoning and thinking questions". "Tell me about…" "Convince me", "More talk" "More student interaction" "Really encourage math thinking and exploration" "Children share strategies" "I have learned to support and encourage questioning by students" "Keep thinking" rather than "no" "No wrong answers" "By the end of the lesson, I saw four weaker students putting up their hand to explain" "Positive referral to mathematics and mathematicians and students being thinkers"
	Allowing the children to struggle and allow time for them to come up with solutions	37	"Letting the children struggle more and allow more time for them to come up with solutions". "Giving time for processing allows all children to experience success" "Thinking time". "Lots of time for all students to think and find solutions". "Opportunities for students to modify their thinking, even when they seem to have no idea". "The not telling stance" "By leaving the students to work through the problems, they came to the solutions themselves" "Making mistakes and retrying" "Don't ever imagine the low attainers can't enter the task…they can" "Encourage persistence" "Differentiation is not something we're used to with our streamed maths classes"
	Modification of probing questions to scaffold or challenge thinking	19	"Layered questions" "Very much involve the low attaining children. Using their existing knowledge to build higher order thinking" "Probing questions scaffolded learning and thinking. "Inquiry rather than telling"
KCT	Lesson structure and features	39	"Different starting numbers" "enabling prompts" "Use of "cliff-hanger" to challenge students".

			"Encouraging feedback to build climate of trust" "Flexible groupings" "Relate lessons to real life experiences" "Ending the lesson with an open ended question to take the learning from the lesson further". "Keep it simple" "Allowing the lesson to flow when it's all connected" "one task, multiple entry points" "Find out what they know. Don't make assumptions about what they know based on previous work" "Videoing children's explanations for future sharing" "Combined many concepts into one lesson" "Highlighting connections with other areas of maths, prompted by student contribution"
	Tasks	16	A reminder not to give students neat problems. "I will work on developing problem solving skills" "Division with remainders task stretched their thinking and allowed for clarification of misconceptions" "Made them really think" "Children learned so much by being challenged"
	Materials and representations	18	"Making maths come alive through props, e.g. Taking a map and recreating it as a real life model, where the children can physically put themselves in it and solve problems" "The number line made it very clear to students how the numbers were connected" "Connect ideas to visual models" "Teaching multiplication and division though arrays is much easier for them to grasp" "The story engaged the children" "Use of a book to stimulate a mathematical problem".
	Explicit use of mathematical language	15	"Very explicit reiteration of the children's strategies", "Repetition of keys words, e.g. dividing and sharing" "Extends their (students) vocabulary" "Clarifying terminology, clarifying understandings"
CCK	Knowledge of mathematics	2	"The task even helped me to understand area and perimeter"

Recognising that there is some overlap between the sub categories, results in the KCS category showed that 47% of teachers observed opportunities for students to justify thinking and explain mathematical reasoning; 37% observed opportunities for thinking time and 19% observed modification of probing questions. This suggested that significant number of teachers, unprompted, actually saw the very aspects of practice that it was hoped they would.

In the KCT category 39% of teachers observed lesson structure and features; 16% tasks; 18% materials and representations and 15% explicit use of mathematical language. These are also important aspects of teaching that have been noted by the observers.

Interestingly, only 2% of teachers observed aspects of CCK. It is possible that their focus was on the pedagogies rather than the content, but this suggests that teachers may need specific prompts if part of the goal in the observations is to see specific aspects of mathematical content. This might include structured questions with a narrow focus.

From the results it appears that the participating teachers who observed modelled lessons noticed important aspects of pedagogical content knowledge, namely KCS and KCT. This finding is important in that it builds on the research of Hill et al. (2008) by showing that under certain conditions, KCS can be conceptualised and articulated by teachers. Although Hill et al. (2008) argued that KCS remained under-conceptualised, this classroom based research has indicated that modelled lessons might be a useful tool in assisting teachers to see the subtleties of classroom practice.

The results of this study support the findings of previous studies in other learning areas (e.g., Grierson & Gallagher, 2009) in that observing teachers could identify important pedagogies and how they catered for students within the context of a real time classroom.

In relation to the design of modelled lessons, Higgins and Parsons (2011) argued that the role of experts is critical in supporting teachers to change their practice. In this study, the modelling of pedagogies by an experienced teacher did seem to focus the teachers' attention onto the pedagogies incorporated into the lesson.

Conclusion

This study sought to answer the question 'When given the opportunity to observe teachers modelling, which aspects of pedagogy and mathematics do teachers notice?' The results indicate that when given the opportunity to observe modelled lessons, teachers noticed important aspects of *Mathematical Knowledge for Teaching*. These were predominantly pedagogies associated with *Knowledge of Content and Students* and *Knowledge of Content and Teaching*. This suggests that modelled lessons may be a productive form of teacher learning. However, further research needs to be undertaken to determine to what extent these observed actions translate into classroom practice.

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