

Using Video-Stimulated Recall as a Tool for Reflecting on the Teaching of Mathematics

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This paper reports on the use of a reflective technique that incorporated video-stimulated recall to encourage reflection on practice. The author videotaped a series of mathematics lessons conducted by an experienced teacher, which were then collaboratively viewed and discussed, with the aim being to bring about changes in the teacher's practice. The findings indicated that the video footage was a powerful medium that stimulated deliberate reflection and led to changes in teaching approaches that were consistent with mathematical reform recommendations.

Recent research into effective teaching of mathematics has suggested that there are significant differences between teachers (Carroll, 2005), which invariably impact upon the quality of mathematics instruction offered to students. Professional learning has the potential to influence mathematics instruction, in that it can provide opportunities to influence teacher knowledge and beliefs and to expose them to practices that are consistent with the mathematical reform agenda. This agenda has an emphasis on written and verbal communication, working in co-operative groups, making connections between concepts and a focus on the process, rather than the answer (NCTM, 2000). While some mathematics teachers have embraced the mathematical reform, and emphasise conceptual understanding, thinking and problem solving, many students continue to experience mathematics that is dominated by memorisation and drill, without any meaningful context (Reys, 2002). While the reform agenda has influenced the nature of professional learning offered to teachers, evidence of sustained changes in teachers' practice has been limited. This may be partly attributable to the delivery of the process, such as employing a "top-down expert" approach, which often fails to engage teachers (Hargreaves & Fullan, 1992) and rarely leads to sustained changes in pedagogical practice. The study discussed in this paper describes the case of a personalised professional learning experience conducted with a practicing teacher, using video-stimulated recall of mathematics lessons. Specifically the research questions were:

In what ways, if any, does video-stimulated recall support reflection on one's mathematical practice?

What changes in practice (if any) occurred as a result of video-stimulated recall?

According to Day (1998), documentation of cases in which an external collaborator works with teachers over time is limited, and specific curriculum areas have been neglected in the reflection literature (Muir & Beswick, 2007). This paper adds to the limited research through providing details of an individual teacher's experience with a video-stimulated recall process that enabled him to reflect on his practice. In doing so, it also addresses the need for detailed descriptions of the process of teacher change (Clarke, 1997).



Theoretical Framework

Professional Learning and Change

Muir and Beswick (2007) identified that professional learning should be grounded in teachers' learning and reflection on classroom practice. Success is more likely to occur if this learning takes place as close to the teacher's own working environment as possible, provides opportunity for reflection and feedback, involves a conscious commitment by the teacher, and uses the services of a consultant and/or critical friend (Lovitt & Clarke, 1988).

Much of the mathematics professional learning documented in Australia at least, has focused the development of teachers' mathematical pedagogy through teachers' involvement in projects such as Count Me In Too (Bobis & Whitton, 1999) and the Early Years Numeracy Project (Clarke, Sullivan, Cheeseman & Clarke, 2000). Common features of these programs were that they were based around teachers' understanding of a particular intervention program or framework and involved facilitators working intensively with teachers to improve their practice and enhance student learning. Reports of such projects have detailed benefits to the participants and changes in teachers' practice, although it is often difficult to attribute improvements directly to the program, as other variables, such as leadership factors, may have resulted in the favourable outcomes observed.

The professional learning experience detailed in this paper differs from these approaches in that it was based on observation of teachers' current practices, and while aimed at developing appropriate pedagogical practices, did not advocate a prescribed program or framework. In common with other studies (e.g., Clarke, 1997; Day, 1998; Geiger & Goos, 2006; Olsen & Kirtley, 2005), a partnership was formed with a teacher educator who provided opportunity for professional dialogue to occur. Clarke (1997) for example, found that the role of the researcher in assisting to guide the teachers' reflections was a significant influence in bringing about changes in one teacher's practice. While the teacher in Olsen and Kirtley's (2005) study also found this to be beneficial, the critical factor in bringing about change was attributed to the opportunity to experience mathematics in a new way and continued engagement in professional learning.

Reflection and Video-Stimulated Recall

As both Clarke (1997) and Day (1998) found, the help of a critical friend was beneficial, and even essential, in enhancing reflection on practice. Research also indicates that video-stimulated recall has also been found to enhance reflection (e.g., Rosaen, Lundeberg, Cooper, Fritzen & Terpstra, 2008). Although also used with students (e.g., Tanner & Jones, 2007), in this context, the video stimulated process refers to a collaborative inquiry between the teacher and researcher, with the dialogue focused on thinking about aspects of practice (Powell, 2005). Powell (2005) found that video-stimulated reflective dialogues enabled teachers to articulate their thinking and feelings by defining a focus and context for inquiry into their professional practice. Both Day's (1998) and Powell's (2005) research involved the use of video footage to stimulate reflection by experienced teachers, but it appears the documentation of this process as it applies to practicing mathematics teaching is not extensive. Researchers such as Hennessy and Deaney (2009) have used video-stimulated recall to encourage teachers to articulate their pedagogy across a range of subject areas, while others such as Rosaen, et al. (2008) have used the technique with interns. Specifically, Rosaen et al.'s (2008) study examined the differences between what the pre-service teachers noticed when reflecting on lessons from

memory compared to when they viewed video footage of their lessons. They found that when using videotape, more specific observations were made, the statements were focused on instruction rather than classroom management, and the focus moved away from self and onto the children. Davies and Walker (2005) also provide an example of video footage being used to examine teachers' mathematical content knowledge and to document teachers' abilities to 'notice' significant mathematical instances. Their findings also support the recommendations of the use of a 'significant other' in that the teachers in their study, even with the use of video footage, needed guidance in order to learn to notice these moments and to respond appropriately.

Methodology

The study reported on in this paper was part of a larger study, which involved two main phases. The first involved the observation and videotaping of a sequence of mathematics lessons involving three upper primary teachers, while the second used an action research approach to engage the teachers in a process termed Supportive Classroom Reflection (SCR). The concept of SCR involved combining professional learning with enacted classroom practice and was designed to encourage the teachers to interpret, reflect on, and enhance their teaching of mathematics (for details of the SCR process, see Muir & Beswick, 2007). The teachers were not required to attend workshops or meetings off-site and collaborative viewing of the video footage occurred at the teachers' respective schools.

Jim, the teacher who is the focus of this paper, had been teaching for approximately 10 years. At the time of the study he was currently teaching in a Grade 5/6 class in a small primary school. A total of five of Jim's numeracy lessons were observed and parts of the lessons involving teacher led discussions were videotaped and transcribed within hours of observation. Field notes were also used to document aspects of the lessons, which were not captured on videotape. Following each lesson, the video footage was viewed by the researcher and Jim; discussions related to viewing the footage were audio-taped and promptly transcribed. A private room was used for the viewing of the video footage with Jim, prior to which he was asked to make any comments about the lesson he had just conducted and whether or not there were any incidents that particularly stood out. The aim of this was to contrast these comments with the comments made during and after the video footage, both in terms of which aspects he chose to reflect on and also to determine whether or not the video footage helped to increase the depth of reflections, as Rosaen et al. (2008) found. During the viewing of the footage, Jim (and the other teachers) was encouraged to make comments and/or pause the video at any time. The researcher also paused the video at certain points, mainly to clarify the teachers' intentions or to discuss a 'teachable moment' (Muir, 2008) or critical incident. Examples of these incidents, as they occurred for Jim, are provided later in this paper.

Each week the researcher visited Jim's classroom, videotaped an arranged mathematics lesson and viewed and discussed the lesson observed. This formed part of an action research cycle (Hopkins, 1993) that allowed for the possibility of providing evaluative feedback within and between the cycles of action and monitoring phases, enabling the next step to be influenced by the results of the intermediate analysis of the data from the previous stage. Specifically, the action research cycle involved the following steps:

1. Observe/gather information (collaborative viewing of video footage of lesson by researcher and teacher)
2. Analysis and interpretation (collaborative discussion of what happened in the lesson)

3. Formulation of plan (what will happen in the next lesson?)
4. Act/experiment (teach the lesson)

This cycle was repeated for each of the lessons observed. Each teacher was also asked to identify a focus area to work on; Jim chose to focus on teaching for conceptual understanding so weekly discussions occurred around this.

Data analysis commenced during the data collection process and units of analysis were created through ascribing codes to the data (Miles & Huberman, 1984). Data analysis for the SCR process was responsive, with categories derived from the teachers' responses, including the nature of reflective responses (self, practice, students) and the levels of reflection (technical, deliberate, critical; for a more detailed description of these levels see Muir & Beswick, 2007). Classroom observation data were also analysed according to categories and these were often referred to in subsequent discussions with the teachers. For example, quantitative counts were kept on the types of questions asked by teachers and the results of these counts were discussed with the teachers in the week following the lesson. The results and discussion that follow particularly look at the impact that viewing the video footage had on Jim's practice and the nature of his reflective comments that occurred as a result of viewing the footage and engaging in professional dialogue with the researcher.

Results and Discussion

Lesson One Observation and Reflection

The first lesson that was observed and videotaped followed a didactic approach in that the teacher modelled a particular process for students to follow. The students had previously been working on short division problems using single-digit divisors and the aim of this lesson was to build on this and introduce division with two-digit divisors. Students were seated on the floor in front of the whiteboard and the lesson began with a discussion on how to divide \$15 between four people. The division algorithm was modelled with contributions from the class, along with the process used to obtain an answer with a decimal remainder. The example of 764 divided by 15 was then written on the board using the standard division algorithm. This was again worked through as a class, with the emphasis being on following the same process used for single-digit divisors. Students were then given three problems to solve individually and were encouraged to use 'scrap paper' to record their guesses at how many multiples of the number (divisor) would be required to reach, or almost reach, the number. After students spent about twenty minutes working on the problems, the class gathered again in front of the whiteboard and strategies students used to multiply the divisor were shared. The lesson concluded with a discussion on how students felt about completing the problems.

Prior to watching the video footage, Jim indicated that he was quite pleased with how the lesson went. He was critical about his lack of confidence in using specific mathematical terms (e.g., divisor, dividend) as the following excerpt shows:

I think personally it's really poor on my part not being confident enough to use the specific mathematical terms, which I know is really important um cause we're trying to get the mathematical language through that um so that's not an oversight, but probably lack of planning on my part um and knowledge about using the recurring [decimals] and so it's something that I need to brush up or rebrush up on make sure I know it for next time, so they've got those answers there which they're genuinely interested about ...

During the viewing of the video footage, Jim made comments about himself, his practice and the students. He made personal reflections about his failure to model the

correct mathematical terminology and stated that he “was quite embarrassed about that”. Further on in the session, Jim’s personal comments indicated that he was quite critical of himself and sought reassurance from the researcher:

With regard to planning, I know what I want to achieve, but as far as that – should I be doing that more? [I] tend to rely on what’s happened in the past.

Several reflective comments were made about his practice, often in response to the researcher’s questioning:

R: Was there anything you particularly noticed from the video footage that you didn’t reflect on immediately following the lesson?

J: Questioning – some of the kids were taking the questions a bit further – you have to have a balance between the information you just hand out – sometimes I asked the question and gave the answer too quickly ... there were 5 or 6 main characters (involved in the discussions) – maybe I could try a strategy of talk to the person next to you – or small groups would be better ... time factor – it was a pretty big block of time – that was more obvious from the video – not an appropriate length of time to have them sitting there

Jim recognised that the discussion around decimals and recurring decimals was problematic:

... because you see that ‘recurring’ – that was almost a flippant comment when we first started, and now they’ve picked up on it, so probably shouldn’t even have introduced it until a later stage.

This last comment provided the opportunity for professional conversation to occur, and partly led to Jim selecting a focus on conceptual understanding as a goal to work on throughout the SCR process.

The researcher also encouraged Jim to make observations about individual students:

R: Are there any concerns with individuals – that you don’t think you cater for?

J: Um, I think there’s 2 or 3 real weakies ... that was probably above them – out of their reach um, so I mean from time to time, what I should be doing is taking them back to the simple division and those processes and going right back yeah, but as I say, in small groups that can happen – but no, I think I cater for those kids that are up there and there’s extension and teach the middle and try and bring them up – so I hope I’ve got them covered – but I know it’s different from somebody on the outside looking in.

In summary, the video footage provided a mechanism for deliberate reflection (Muir & Beswick, 2007) to occur in that Jim and/or the researcher identified ‘critical incidents’ and an explanation or rationale was offered. Jim also reflected critically, when he stated that the whole group discussion was limited to a few participants and offered an alternative approach. Jim was primarily critical about his demonstrated lack of knowledge in regard to using the correct terminology, providing the opportunity for more students to participate actively in the discussion and maintaining a focus on conceptual understanding. The following description of the second lesson observed for Jim and his subsequent reflective comments illustrate how he changed his teaching approach in the next week to address the concerns he raised.

Lesson Two Observation and Reflection

The second lesson observed for Jim represented a distinct contrast to the one observed the previous week. As before, students were seated on the floor in front of the whiteboard, but Jim began the lesson by introducing students to a scenario that had the effect of totally engaging and motivating the students as the following excerpt illustrates:

Now I have a little problem that I want you to help me with. The parents and friends association are on my back – they’re nasty, nasty people – and I know some of your parents are involved in it – but they’re still on my back – and they want to know what this class is going to do for the fair in November – and I have an idea and hopefully it’ll get the parents and friends off my back so this is the idea that I’ve got. The idea is that we move out all the bookshelves and desks out of the classroom – we move them all out and we seal off the computer room and we fill the classroom right up to the top with jelly.

Jim’s goal for the lesson was for students to develop an understanding of the concept of volume, but rather than adopt a didactic approach as he did in the first lesson, he instead presented the scenario and invited students to investigate how they would work out how much jelly would be required to fill the classroom. The children were immediately captivated by the task and enthusiastic about working in small groups to formulate a plan to carry out their investigation, including finding the volume of the classroom (although the term ‘volume’ was not actually used). The lesson concluded with the groups sharing some of their preliminary findings with the whole class.

Jim was quite critical of what occurred in last week’s lesson and his initial comments revealed that he further reflected on this lesson following the first SCR session:

Well I wasn’t happy with last week’s performance, um, and I wanted something I guess to build my confidence, and just having a look through the elements of effectiveness, I just thought that one of the areas that I wanted to develop in was getting the kids trying to explain ... their responses through the investigation um, and I know that’s where you’re coming from and we should have these open investigations and um, I just thought I’d give that a go, because it’s not probably how I would normally operate and I’m trying to I guess improve my effectiveness as a teacher so I’m looking for ways to develop ... I was depressed after last week - no but it’s good because I got to see how I interact with the kids, ... and I wasn’t happy with it and I just thought what sort of rubbish am I handing out to these kids? But at the same time, at the end of the year, they’re still achieving, they’re still getting results, but I think that we can do that in better ways ... I thought it was – seeing it – if I was sitting there and watching a teacher teach that, I would have thought oh gees, and there were a few times, like lemon juice in a wound, sort of thing [cringes] ... I think that as a professional, working through that and seeing areas of deficiency and trying to work on them is really important, so that’s where I’m coming from at the moment

The above comments demonstrate critical reflection and indicate that watching the video footage was a significant stimulus in enabling Jim to view his teaching objectively. Furthermore, he implies that in the past he tended to evaluate his teaching effectiveness on ‘getting results’ and that were other elements that should be considered:

I thought I was reasonably good at teaching maths and yeah, looking back the results are there of the kids’ achievement but as I said there are different ways to go about it and perhaps, instead of the chalk and talk, the um, getting the kids to come at the answers probably gets more meaning behind it

As previously mentioned, Jim’s approach to his second lesson was a stark contrast to the first one observed and was more in line with mathematical reform practices, such as teaching for understanding, with an emphasis on thinking and problem solving. This was a deliberate decision on Jim’s behalf as the following comment shows:

... having the materials there for them to work with, having the concrete aids, which were one of the other things there [referring to effective characteristics] which you know, I think I said last week, I tend not to use the concrete aids as much – it’s been more number sort of oriented, it’s been grade 5/6 – that sort of thing – which I want to change because um, I think I was just lazy in the class, because I don’t believe it.

Jim also indicated that while he perceived volume to be “easier than number to investigate”, he anticipated that “by seeing how far I can come along here will change my

other teaching, whereas division is probably more difficult to teach that way”. Jim also indicated in this session that he had “gone away and read up on” mathematical concepts such as volume in order to address the lack of mathematical content knowledge that he felt occurred in the previous week’s lesson.

Summary

Jim’s reaction to the initial video footage and the subsequent viewing sessions showed that like Rosaen et al. (2008), he found it to be a powerful medium in revealing aspects of his practice that he had not previously considered. During the course of the study the video footage enabled him to gain a realistic picture of the experiences he was offering to the students and he regularly deliberately reflected on his mathematics lessons and made appropriate changes in subsequent lessons. In a post-study interview conducted a month after the observations ceased, Jim acknowledged that the video footage was instrumental in enabling him to reflect and change aspects of his practice:

Well for me I mean I was forced to reflect because I was sitting there looking at it, thinking oh my God this is you know, this has to change, and now you know when I’m teaching it’s in the back of my mind, it’s oh, what if [researcher] was here watching this, would this be what I want to see on the video ... and I’m thinking is this a teachable moment or is this something that we can come back to later, and if it’s detracting from what we’re focusing on, so I’m thinking about those sorts of things.

Jim’s reference to the researcher also acknowledges the role of the ‘significant other’ and supports the findings from other researchers (e.g., Clarke, 1997; Davies & Walker, 2005; Day, 1998) that this role is crucial in encouraging critical reflection. Not unlike the teacher in Olsen and Kirtley’s (2005) study, Jim was motivated to change after he experienced the teaching of mathematics in a new way and identified that this was beneficial to the students. Similarly, he acknowledged that his lack of mathematical knowledge in some areas was of a concern and needed to be addressed.

In summary then, while acknowledging that the results discussed here represent the case of only one teacher, they do indicate that for the duration of the study at least, and in the presence of the researcher, Jim did adapt his mathematical practice to be more aligned with mathematical reform recommendations, including an increased emphasis on teaching for conceptual understanding. Furthermore, his comments throughout the reflective viewing sessions and in a follow-up interview validate the influence of the video footage on bringing about these changes. It is hoped that the case reported here will encourage other researchers to engage in similar personalised professional learning opportunities and document their experiences accordingly.

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