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Video as a tool for focusing teacher self-reflection: supporting and provoking teacher learning

Hilary Hollingsworth[1] · David Clarke[2]

Abstract This article describes the research landscape related to the use of video for promoting teacher learning, drawing on a variety of research studies to illustrate the breadth of approaches that have been employed. One particular research study is reported in some detail since, it is argued, this represents a new level of devolution of agency to teachers to play a self-scaffolding role in their own professional education. The study involved the investigation of an approach to the provision of feedback to teachers about their practice that involved stimulating teacher self-reflection and juxtaposed structure and agency. An observation framework grounded in classroom practice research was developed, and teachers selected elements of that framework to serve as the focus for examining their practice and seeking feedback about that practice. Teachers and researchers examined video-recorded lessons focusing on the teachers' selected observation elements, and then engaged in feedback conversations about their observations and analyses, and the implications of these for future practice. The approach identified the video record as an artefact of the teacher's own practice and one which demanded a professional response from the teacher. The balance between structure and agency realised in the study, in combination with the use of video for observation and analysis of practice, facilitated teacher self-reflection and functioned to both support and provoke teacher learning.

Keywords Video · Teacher professional growth · Teacher self-reflection

✉ Hilary Hollingsworth
hilary.hollingsworth@acer.org

David Clarke
d.clarke@unimelb.edu.au

[1] Australian Council for Educational Research, 19 Prospect Hill Road, Camberwell, VIC 3124, Australia

[2] The University of Melbourne, Level 3, 234 Queensberry Street, Parkville, VIC 3010, Australia

Introduction

Education communities across the world prioritise efforts to raise teaching quality in order to improve student learning. Of particular interest to policymakers, teacher educators, school leaders and teachers themselves is ongoing or continuous teacher professional learning as a key to improving instruction.

A current focus of researchers and educators of all levels is to understand how teachers *best* learn to develop and refine their practice. This focus provides the frame for this article. We have studied teacher professional growth extensively over many years and have highlighted the complexity of the processes of teacher change and teacher growth (Clarke and Hollingsworth 2002). Our work has involved the use of video recordings of classroom practice to research mathematics teaching and learning, and to encourage and support mathematics teachers to research their own and others' teaching practices and consider the implications of that research. Accordingly, we have identified the merits of video as a tool for stimulating teacher self-reflection and we assert that video recordings of classroom practice can provide unique, rich and powerful opportunities for teacher learning and teacher professional growth.

The article is presented in three sections. The first section provides an overview of different approaches to using classroom video recordings for teacher education. After setting out the variety of existing practice, the second section elaborates a specific pro-gramme in which the informative value of video is optimised by a heightening of the teacher's responsibility for their own professional learning. The programme utilises key elements drawn from the different approaches outlined in section one. A key focus is the level of control accorded to the teacher to determine either what is recorded and/or what is the focus of reflection. The final section presents some possible future directions for work in this area.

The use of video for promoting teacher learning

Many of the practices of our most capable teachers have a subtlety that renders them effectively invisible to casual observation. Frequently, this will be because the teacher's actions carry a significance or meaning that is shared by teacher and class but not readily apparent to an outside observer. Videotape, which lends itself to re/view, can facilitate the sort of fine-grained "data-driven" discussion likely to reveal the nature and significance of such practices. Some of these practices are not even represented in our discourse. Our increasing use of video material to facilitate teacher reflection on classroom practice may (i) render visible, for the first time, some of the unnoticed practices of teachers and (ii) facilitate the development among the teaching community of a new vocabulary by which we might describe teaching practice. Both these developments are important.

Video as a research tool

Video can contribute to teacher learning through its role in research into teacher practice. By facilitating improved understanding of teacher knowledge and expertise through the recording and analysis of classroom practice, video can lead to recommendations for effective practice, sometimes supported by illustrative examples. Stigler and Hiebert (1999) and Hiebert et al. (2003) used video to study the classroom practice of mathematics

teachers in a combination of seven high-achieving countries. Employing a different design logic, Clarke and his colleagues in the Learner's Perspective Study (LPS) (Clarke et al. 2006a, b; Kaur et al. 2013) used video to document the activities of teachers and learners in over a dozen countries in the mathematics classrooms of teachers locally identified as competent. The complementary combination of survey and targeted case study approaches offered by these two projects has demonstrated the power of video to document classroom practice in ways that sustain powerful comparative analyses, generate significant insights into practice and lead to evidence-based instructional advocacy. Other researchers have also used video as an effective research tool (Klieme et al. 2009).

Of all data sources currently available to researchers in education, video data seem most amenable to multiple analyses. The richness and complexity of video records of social interactions provide opportunities for reinterpretation, recoding and representation of what is captured in the video records of social settings. Increasingly, research designs are anticipating multiple analyses of the complex data sets generated from educational settings (Clarke et al. 2009, 2012). Research studies with which we have been involved have collected and configured data in anticipation of the use of such multiple analyses to realise the potential of classroom video data. We suggest that it is through multiple analyses of the same educational settings that research can come closest to matching in its findings the complexity of the situations and practices in those settings. Video provides the essential tool for such multiple analyses.

The challenge confronting classroom researchers has always been to make confident connection between classroom activities and learning outcomes in order to optimise classroom learning environments and promote learning. We believe that serious research addressing this issue cannot be restricted to a single analytical frame, but must take a programmatic approach, where a well-equipped research team, combining a range of methodological and theoretical expertise, undertakes careful parallel analyses of high-quality, complex data. Advances in technology and particularly the growing sophistication in the research use of video bring us ever closer to the realisation of this vision.

Video viewing and teacher education

Video has been used extensively as a resource in teacher education and teacher professional development. Gaudin and Chaliès (2015) conducted a review of the literature related to "video viewing" for the purpose of teacher education. The structure of their report usefully examines "video viewing" from the perspectives of the nature of the activity, its purpose, the focus of the video record and the consequences of video viewing. The report also demonstrates the contemporary breadth of use of video in teacher education, reporting studies conducted in 26 countries and across a wide range of subject and pedagogical foci. The Gaudin and Chaliès report coheres around the activity of video viewing. This provides a very practical focus to the article, around which the more nuanced questions of who, what, how and why can be explored.

Video cases

By viewing a given video excerpt as constituting a "video case", we are able to explore the use of video in teacher education and professional development from the perspective of the sort of work for which cases are employed in professions such as medicine, law and psychology. This logic of cases, characterised by Shulman (1992) as a signature pedagogy

for several professions and elaborated by Barnett (1999), provides a structure through which to explore the possible uses of video to promote teacher learning.

Video can stimulate teacher learning by providing candid, dramatic, accessible representations of teaching events or series of events in the form of video cases. Most people would have some idea of the function served by "cases" in such professions as law, medicine and social work. Teaching has now adopted the strategy of case-based professional development (Barnett 1991, 1999; Louden and Wallace 1996; Merseth 1991; Wasserman 1993). Whether we are dealing with the professional development of practicing teachers or pre-service teachers, cases offer identifiable benefits. In particular, a case-based approach should be contrasted with a principles-based approach. Barnett (1999) has provided a practical introduction to narrative-based cases. Sherin and Van Es have also published widely on the use of video in teacher professional development, specifically to promote teachers' "professional vision" (Sherin and Van Es 2005; Van Es and Sherin 2008). Clarke and Hollingsworth (2000) have discussed the relative merits of narrative and video-based cases in the promotion of teacher professional development. Clarke et al. (2013) contrasted case-based and principles-based professional development programmes, suggesting that every profession has principles of good practice, but questioning the value of any professional development programme based solely on the communication of such principles.

In the case of novices, "principles alone" tend to confirm the beginner's already oversimplified notion of what teaching is all about. In the case of more experienced practitioners, an in-service programme restricted to the communication of principles implicitly disregards the expertise of the practising teacher, offering little opportunity for the teacher or the group to benefit from the accumulation of practical wisdom present in any gathering of professionals. By contrast, cases connect teachers to professional practice. It is a key feature of cases that they offer a common point of reference for practitioner collegial reflection, and video is the ideal vehicle for this. Asking practitioners to reflect on specific instances of professional practice, captured visually through the use of videos, ensures that the resultant discussion will be firmly grounded in a shared familiarity with a particular incident in a particular educational setting. A key virtue of such case discussions is that the situation being discussed is held in common by the group. Since the case is held jointly rather than by one individual, discussion is unrestrained by any identification with one particular group member.

The use of video cases has taken many forms:

a.   Cross-cultural video cases

When teachers view videotapes of classrooms, the familiarity of the classroom setting can reduce the power of the video clip to catalyse teacher reflection. However, if the video-taped lessons are taken from a very different culture, the teacher's assumptions about accepted and expected practice no longer apply. In this situation, teachers are more inclined to interrogate the videotape and, by implication, their own practice. The unfamiliarity of what they are viewing challenges their assumptions about what is acceptable, competent teaching practice. In our experience, experienced teachers, in particular, find video clips of lessons in other countries both interesting and challenging.

b.   Examples of practice

In one Californian programme, American teachers are guided through a discussion of video recordings of American mathematics classrooms (each recording representing, typically, the greater part of a lesson). Familiarity with the sociocultural context of the lessons

enables the discussion groups to undertake fine-grained interpretation of the teacher's and students' actions. Teacher interaction with the video material will be mediated by the teachers' construal of the video-recorded practice as either exemplary or problematic, both of which can be not conducive to constructive discussion. In the hands of a good case discussion facilitator, teachers will be guided to focus on "what could have been done?" rather than "what should have been done?" and the video clip can stimulate group participants to share their own teaching practices and beliefs and relate these to those evident in the video clip and those of the other group members.

c. Structured illustration

Collated video examples of different teaching approaches are in widespread use in pre-service and in-service teacher education programmes. In one resource produced for the Victorian Department of Education and Training, short video clips were organised into categories of activity types and distributed to schools to illustrate different approaches to the teaching of algebra and fractions. In another initiative, video resources were developed to support the education of pre-service teachers at the University of Melbourne. The material was presented as an interactive DVD, and prospective teachers were guided through structured interactions with video clips of elementary and high school classrooms and videotaped interviews with teachers and students. Electronic notebook facilities were provided within the programme environment, and an audit trail was built into the programme so that a student's interactive pathway through the material could be reviewed by students and lecturers.

d. Structured investigation

MILE (Multimedia Interactive Learning Environment) is a highly structured, interactive learning programme implemented at the Freudenthal Institute in the Netherlands, whereby pre-service (or in-service) teachers are assisted to utilise classroom video recordings to undertake guided investigations related to issues of pedagogy and learning. Within MILE, prospective teachers can view and review fragments of lessons. The full MILE database consists of more than three thousand five hundred video clips or lesson fragments. Prospective teachers can carry out full text retrieval searches of the class dialogue (transcribed) and of synopses of the lessons and lesson fragments. In addition, some preparatory coding has already been carried out on the lesson fragments and prospective teachers can search the lesson fragments using these codes. The intention is that the video material provides a vehicle for prospective teacher investigation of professional activity and thereby stimulates their reflection on the nature and optimisation of that activity.

e. Problematic cases

Scripted videos could be used to illustrate either exemplary practice or problematic situations. Scripted videos of problematic cases have the virtue of not contravening good ethical practice since the competence of neither teacher nor students is in question. In contrast, the use in professional development programmes of actual video clips of problematic classroom situations runs the risk of showing either the teacher or the student(s) in a bad light, with possible negative consequences for reputation and career.

Video cases allow participants to construct their own interpretations of the classroom depicted and to attend to those aspects they consider important. While this holds the potential for greater participant interest, it also holds the threat of a discordant, unfocussed discussion in which a variety of personal agendas compete for discussion time. The role of a case discussion facilitator in framing the group's discussion assumes new significance as the variety of possible themes for discussion expands. As noted earlier, the distinction

between "should" and "could" is particularly useful, and we paraphrase this approach as: "Focus on what the teacher *could* have done, not what they *should* have done". It seems to us that this distinction is at the heart of a productive case discussion.

Video as a catalyst to facilitate teachers' reflection

In conventional models of professional development, the university academic is positioned as "outside expert" with the role of sharing knowledge and expertise with the community of teachers who are consequently positioned as "needy", lacking the academic's knowledge or expertise. In the last decade, research on professional development focused on bringing together science and classroom practice, for example, with a focus on professional communities (Lachance and Confrey 2003) or communities of practice (Krainer 2003; Zaslavsky and Leikin 2004). These efforts of fusing teacher education and research are mostly intervention research, that is, the same people responsible for the intervention do the research. In neither situation, in-service professional development or research, can the relationship between academic and teacher be described as a partnership.

Recently developed programmes in several countries have contested this positioning and constructed programmes in which significant agency resides with the participating teachers. In the next section of this article, we explore the possibilities for teacher professional growth through academic-teacher collaboration using video case data generated in the classes of the participating teachers. Video case studies capture the "visual, nonverbal, physical, tactile and verbal elements of teaching", and "bring together both teaching action and space for reflection" (Harris et al. 2005). Further, such records of everyday teaching practice, when used skilfully by collaborative teams of teachers and academics, afford the possibility of building theory and couching such theory in the language of teacher learning and everyday classroom practice (Shulman 1992; Shulman and Shulman 2004).

Stimulating teacher self-reflection to inform instructional improvement

This section reports a research study that investigated the provision of feedback to teachers about their practice through a process of structured stimulation of teacher reflection. Of particular interest were the opportunities for teacher learning provided through this process. The question of agency is central. A teacher may select from among a collection of pre-existing video excerpts or, alternatively, actively decide what should be filmed. But, in both of these cases the responsibility for determining the focus of discussion remains a matter for negotiation or active teacher choice.

Video as a resource for teacher learning can be thought of as a collection of artefacts or as an integral component of a process. In every instance, the question of teacher agency is paramount. What level of control might the teacher be given to determine either what is recorded and/or what is the focus of reflection?

Teachers were invited to use a theoretically grounded observation framework to select foci for their own professional learning and then used these foci to observe, analyse and reflect on video recordings of their mathematics teaching practice. They then engaged in feedback conversations with a researcher about their observations and analyses and the implications of these for their practice. The purpose of the study was to investigate the efficacy of the structured stimulated reflection process and in particular to determine those

elements of the process that function to provoke and support teachers as they engage in reflection and learning focussed on instructional improvement. Details of the theoretical framework, research questions, methodology, study design and selected results follow.

Theoretical framework, research questions and methodology

The approach used in this study drew on the Interconnected Model of Teacher Professional Growth (Clarke and Hollingsworth 2002) (Fig. 1). This model represents professional growth as an inevitable and continuing process of learning and incorporates key features of contemporary learning theory. The model suggests that change occurs through the mediating processes of reflection and enactment in four domains that encompass the teacher's world: the personal domain (teacher knowledge, beliefs and attitudes), the domain of practice (classroom experimentation), the domain of consequence (salient outcomes) and the external domain (sources of information, stimuli or support). The model recognises the complexity of professional growth through the identification of multiple growth pathways between the domains that occur through the mediating processes of reflection and enaction (represented in the model as arrows linking the domains).

The Interconnected Model takes teacher change to be a learning process and suggests the possible mechanisms by which this learning might occur. Its nonlinear structure recognises the situated and personal nature of both teacher practice and teacher growth, which comprises an individual amalgam of practice, meanings and context. Clarke et al. (2013) report:

> Our support for the process of teacher growth must offer teachers every opportunity to learn in a fashion that each teacher finds most useful. If our professional development programs are to recognize the individuality of every teacher's learning and practice, then we must employ a model of teacher growth that does not constrain teacher learning by characterizing it in a prescriptive, linear fashion, but anticipates the possibility of multiple change sequences and a variety of possible teacher growth networks. Professional development programs that prioritise teacher agency are needed. Such programs require tools that inform teacher action and facilitate teacher reflection on that action. We suggest that video is such a tool. (p. 99)

This study sought to investigate the learning opportunities provided in a feedback process for teachers that juxtaposed structure and agency, and made use of video as a tool for stimulating and informing teacher reflection and action. The study acknowledged that pivotal to the growth process are those salient outcomes to which teachers themselves attach value, and the approach included design elements that provided teachers with increased agency in regard to focusing their learning, observing and analysing their practice, reflecting on their practice, and planning actions to improve instruction. Video was key to the design, as each video record was identified as an artefact of the teacher's own practice and one which demanded a professional response from the teacher. Also key to the design was a deliberate focus on investigating the kinds of feedback about classroom practice that can support and provoke teacher learning and teachers' efforts related to instructional improvement. Much attention has been given to the significance of feedback to student learning in the research literature. For example, Hattie and Timperley (2007) provided a deep explanation of the power of feedback, and in his meta-analyses Hattie (2009) reported, "feedback was among the most powerful influences on [student] achievement" (p. 173). In this study, it was anticipated that parallels would exist with respect to the role and importance of feedback in teacher learning. The view of feedback
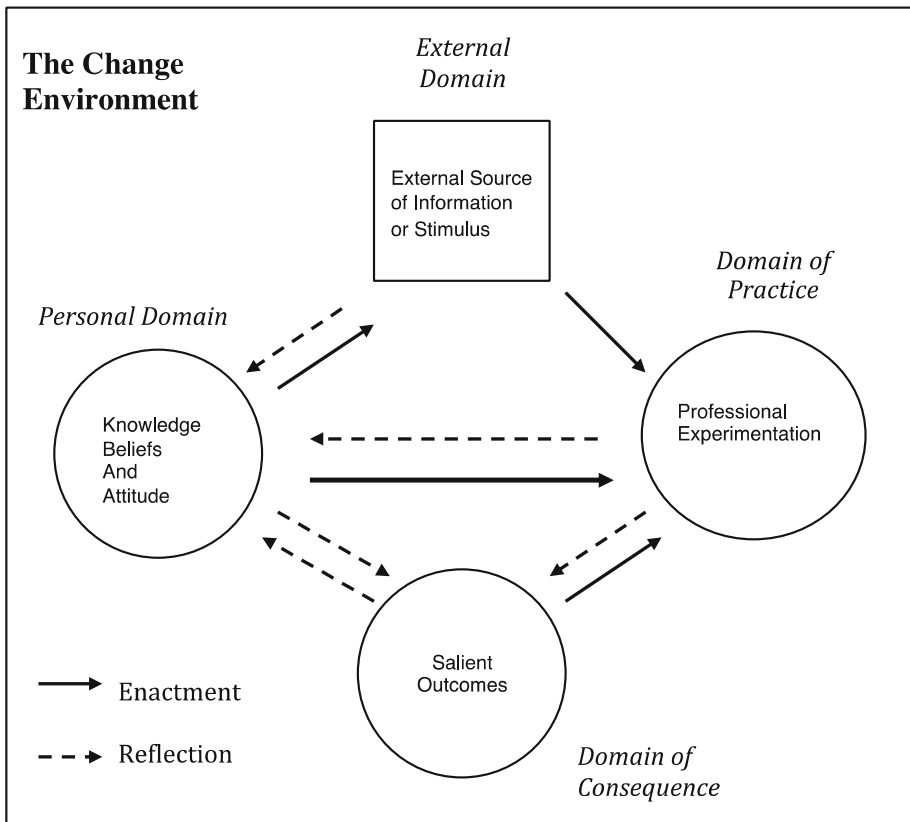
Fig. 1 The Interconnected Model of Teacher Professional Growth (Clarke and Hollingsworth 2002)

adopted was akin to Winnie and Butler's claim that "feedback is information with which a learner can confirm, add to, overwrite, tune, or restructure information in memory, whether that information is domain knowledge, meta-cognitive knowledge, beliefs about self and tasks, or cognitive tactics and strategies" (1994, p. 5740).

Two research questions framed the investigation in the study:

(i) What kinds of feedback about classroom practice can be provided in a timely fashion to usefully inform instructional improvement?
(ii) How can video enable the efficient analysis of classroom practice and the prompt provision of useful feedback to teachers?

In selecting methods appropriate to the investigation of these questions, an important consideration was the need to select a research approach that would enable the study of process—specifically the process of professional growth. Qualitative data collection and analysis methods were chosen as they would allow the complex process of professional growth to be explored with the "depth, detail and individual meaning" (Patton 1990) desired. The Interconnected Model of Teacher Professional Growth (Clarke and Hollingsworth 2002) informed the design of protocols used in the data collection and assisted the analysis through providing a way to represent the growth processes in which teachers engaged.

The study was staged in five phases. A description of each of these phases, including details of the data collected and the data analysis techniques employed, is provided next.

Study design

The design of the study, including its scope and duration, was determined within the limits of available funding. The study was staged in five phases across a period of 12 months. Phase 1 involved the design, testing and refinement of a custom classroom observation framework for use in the study. Phases 2–4 involved the collection and initial analysis of data from teacher participants, and Phase 5 involved further data analysis, interpretation and reporting.

Phase 1: Development of the observation framework

The first phase involved the development of a classroom observation framework. The framework was intended to provide teachers with a theoretical and practical structure for considering different elements of their instructional practice, and teachers used it to select foci for their own professional learning.

Work in this phase involved a research director and a research assistant [hereafter, "the researchers"] undertaking: (i) a review of the relevant research literature related to classroom observation instruments, teaching standards frameworks, video study coding schemes and effective mathematics instruction and (ii) consideration of the ways in which elements of existing instruments, frameworks and coding schemes might be adopted or adapted.

While a complete discussion related to the development of the observation framework is beyond the scope of this article, examples of instruments, frameworks and video coding schemes examined include: A Framework for Teaching (Danielson 2007); Classroom Assessment Scoring System—CLASS (Pianta et al. 2008); Australian Professional Standards for Teachers (AITSL 2011); AAMT Standards for Excellence in Teaching Mathematics in Australian Schools (AAMT 2006); TIMSS 1999 Video Study (Hiebert et al. 2003); and Teaching for Growth: Effective Teaching of Literacy and Numeracy (Louden et al. 2008).

With the focus of the study on teachers observing, analysing and reflecting on their instructional practice, the framework that was developed included only elements of practice that are observable during classroom lessons and not other areas of teachers' professional work (such as planning and preparation for lessons, involvement in professional learning activities, or communication with parents and the wider community).

The framework developed included five dimensions of instructional practice. Each dimension included a number of elements that teachers could nominate to focus on with respect to their instructional practice. These elements were described in observable terms (similar to code definitions), so that teachers and researchers had a frame of reference to observe, analyse and discuss practice. The five dimensions and the elements that were included in each one are displayed in Table 1. An example of an element description for each dimension is included as "Appendix".

Preliminary testing of the observation framework dimensions and element descriptions to determine their efficacy and applicability was undertaken using two processes. The first involved the researchers coding available classroom video data from the Third International Mathematics and Science Study (TIMSS) 1999 Video Study and the Learners' Perspective Study, checking with one another for shared understanding and consistent code

Table 1 Observation framework: dimensions and elements

Dimensions	Elements
1. Communicating expectations for mathematics learning	Learning goals High-quality performance Responsibility for learning
2. Questions and discussions for mathematics learning	Instructional dialogue Question types and levels Use of mathematics questions and ideas Levels of participation
3. Tasks for mathematics learning	Alignment with lesson goals Task complexity Depth of mathematics ideas, concepts and processes
4. Building understanding for mathematics learning	Meaning making Connections between ideas and concepts Explanations about mathematics ideas and concepts
5. Using assessment for mathematics learning	Eliciting evidence of understanding Provision of feedback Using assessment in instruction Assessing student learning using established criteria

application, and refining element descriptions as needed. The second process involved a focus group of 16 teachers working through a structured activity where they individually documented, and then together discussed, their interpretations of the dimensions and elements. The focus group comprised a mix of primary and secondary teachers from an independent school in Victoria, Australia. All of the teachers were teaching mathematics classes at the time of the study. Following the focus group activity, the researchers examined the teachers' documented notes, considered the points raised in the discussion and made refinements to improve the clarity of some element descriptions.

Phase 2: Identification of study participants and selection of the observation foci

In this phase, study participants were identified and then involved in the process of selecting particular elements from the observation framework to use as the focus for their professional learning.

Two teacher participants were identified for the study. They had been part of the focus group in Phase 1 and had become familiar with the classroom observation framework dimensions and elements through this work. One teacher, Teacher 1, self-nominated to participate in the study. At the time of the study, Teacher 1 was teaching a class of Year 6 primary students. The other teacher, Teacher 2, was asked to participate by a senior staff member of the school where both teachers were based. Teacher 2 is a secondary school teacher, and for the study she was recorded teaching a Year 8 mathematics class.

Each teacher identified dimensions and elements they were interested in developing with respect to their own professional learning, and then selected two of these as foci for their lesson observations and analyses in the study. The teachers nominated a date and time

for recording their lessons and then planned ways to focus on the elements chosen in their lessons.

Phase 3: Video recording of lessons; observation, analysis and coding of lessons; and teacher-led analysis and reflection feedback conversations

In Phase 3, each teacher was video-recorded teaching their nominated mathematics lesson using two cameras to capture the lesson activity—one that tracked the teacher and another that captured a wider view of the entire classroom. Lesson recordings were provided to the teachers and researchers on USB immediately following the lessons, with the two camera views presented as "Two-Up" displays as shown in Fig. 2.

The teachers and researchers viewed the recordings over a one-week period, coding and analysing them according to the teachers' selected dimension and element foci. Teachers kept detailed notes of their observations, analyses and reflections, referencing specific points in the video, so that they could refer to these in the planned feedback conversations. Researchers used a sophisticated software platform, *Studiocode*, to code instances of classroom activity relevant to the teachers' selected foci. The platform enables customised coding and intelligent searching across lesson timelines, databases and transcripts. The researchers coded the teachers' lessons using Studiocode and compared code inputs to ensure reliable coding of the teachers' selected foci.

A video-stimulated feedback conversation was conducted one week after the lesson recordings. The design protocol for these conversations was based on five key factors: teacher's voice (teacher owned and led); professional conversation (discussion/dialogue between the teacher and researcher); focus (centred on teacher-selected observation framework elements); evidence-base (use of lesson video record to examine teaching); and direction (a focus on teachers' reflections *and* implications of these for practice). Specifically, the feedback conversation involved teachers using the video records of their lessons and their viewing notes to lead a conversation about their observations, analyses and reflections related to their selected framework foci. The researchers provided an initial framing for the conversation by asking two questions, "*What did you see?*" and "*What are your thoughts about what you saw?*" The teachers then led the conversation focusing mostly on their selected foci, but taking the opportunity to note additional observations.

Fig. 2 Sample "Two-Up" display

The researchers prompted teachers at times to elaborate their thinking and to contemplate the implications of their observations and analyses for their future teaching practice. Towards the later part of the conversation, the researchers shared and discussed with the teachers details of the Studiocode analysis they had completed, including a printed display of the coded instances of the teachers' selected foci that they had observed across the lesson. This provided an opportunity for teachers and researchers to compare their observations of the lesson.

The feedback conversations were audio-recorded but not video-recorded (due to limited funding). Transcripts of the audio records were prepared for analysis.

Phase 4: Interviews about the structured stimulation of reflection process

The final data collection phase of the study involved interviewing the teachers to seek information about the stimulated reflection and feedback process that they had worked through. Questions included in the interview focussed on two main areas. The first set of questions focussed on the design and structure of the stimulated reflection process. Teachers were asked to comment on the use of the observation framework for selecting their own observation and analysis foci, the use of video for analysing and reflecting on their practice, the protocol used in the reflective phase of the feedback process (where they led the feedback conversation) and the overall timing of the feedback process (one-week turn around time). The second set of questions sought teachers' views about whether their engagement in the stimulated reflection process informed their efforts to improve their mathematics instruction. Teachers were asked in what ways the process had informed their practice and to provide examples of these. The interview questions were provided to the teachers prior to having the interview conversations, and the teachers recorded notes related to each question. These notes supplemented the interview conversation data.

Phase 5: Data analysis, interpretation and reporting

The data that were collected in the study included: written notes from teacher focus group members; teacher notes related to observation foci; video data of classroom lessons; teacher notes of lesson observations and analyses; audio records of analysis and reflection conversations; teacher notes related to interview questions; and researcher notes related to interviews with teachers.

All of the data collected and stored as text during the study were coded and sorted into categories according to emergent themes, and tables were used to display data systematically to support interpretation (Miles and Huberman 1994). The categories developed as the study proceeded and related closely to the two research questions and to the specific observation framework foci selected by the teachers. In this way, the data analysis overlapped the earlier data collection phases.

The analysis enabled rich descriptions of the structured reflection and feedback process experienced by the teachers and factors associated with the process that they perceived influenced their professional learning related to their instructional practice. As noted earlier, the Interconnected Model of Teacher Professional Growth (Clarke and Hollingsworth 2002) was used to interpret and represent the growth processes in which teachers engaged.

A brief report about the study process and findings was prepared, and local and international presentations were made to share the results of the study. A discussion of results is presented next.

Results

This section presents a discussion of selected results framed around three components of the structured stimulation of reflection process identified as pivotal to supporting and provoking teachers' reflection and learning and a summary of features that appear key to the efficacy of the process.

The selection of observation foci

The teachers reported that the observation framework dimensions and elements helped to frame their consideration of possible areas of practice they wanted to improve and they wanted feedback about.

Both teachers reported that they had not previously received feedback focussed on specific areas of practice.

> I've had peer feedback from classroom swaps. It's generally been verbal, only some has been written. And there's been no specific focus. [Teacher 1, Focus Group Notes]

> During teaching placements [when training to be a teacher] I had some feedback about questioning during discussions with my supervisor, but nothing specific. [Teacher 2, Focus Group Notes]

The teachers each selected two framework elements as foci for their observations and analyses. Teacher 1 selected *Question types and levels* (Dimension 2) and *Provision of feedback* (Dimension 5), and Teacher 2 chose *Levels of participation* and *Question types and levels* (both Dimension 2).

During feedback conversations and interviews, the teachers noted ways that the selection of observation foci had guided and supported their reflections.

> It enabled me to select areas that were either of particular interest to me or that were potential areas that I had identified as needing improving. [Teacher 1, Interview]

> Initially I found it quite difficult to watch the video with the sole purpose of focussing on the selected dimensions and elements. There were so many other aspects of the lesson that I found myself drawn to from a positive and negative perspective. After that first 5–10 min of watching myself I was able to step back and review the teaching taking place. I found that I needed to focus on one element at a time, therefore needing to watch the video more than once. [Teacher 1, Interview]

> I was watching it and thinking about the dot points [framework element descriptions], and I really saw how I should have been responding to involve students more. Sometimes I just moved on thinking they've all got the right answer, and I didn't even see if they understand. [Teacher 2, Feedback Conversation]

> It made the process of reviewing the lesson much more targeted and specific. [Teacher 1, Interview]

Two aspects of the process of selecting observation foci appeared particularly important. First, consideration of the entire observation framework provided opportunity for the teachers to reflect on and identify particular areas of instructional practice they wanted to focus on. And second, selecting only two framework elements enabled the teachers to sharply focus their attention on those targeted areas.

The high level of efficacy in regard to teachers selecting their own foci can be noted in this comment:

I think the ability to choose your own dimension as a focus is crucial in making it a positive experience. [Teacher 1, Feedback Conversation]

The use of video for analysing practice

The teachers identified a number of ways in which the use of video added value to the analysis and feedback process used in the study.

The teachers regarded the video records of their lessons as "evidence" of their practice.

It has helped me think about the ways in which I use questioning and feedback in the class. Not through reflection and remembering, but by actually seeing it. The ability to pause, rewind etc. means that you can really evaluate those targeted areas. I think there is a lot of merit in the process of being able to review a lesson, despite teaching thousands of lessons previously you never get that chance to see how it all unfolded. [Teacher 1, Interview]

When you can watch it, you can actually see—okay I'm not even interacting with those students over there. Or, someone asked me a question and I'm standing at the board and I'm not even really talking to them. You can just see it rather than being told, and I think that helps. [Teacher 2, Feedback Conversation]

They noted they could examine their lessons with a much higher level of detail than would be possible without video.

I watched it in two parts. I watched it looking for questions and question types and levels, and then I watched again to concentrate on the feedback I was providing which was one of the other dimensions. [Teacher 1, Feedback Conversation]

I looked at it and thought I hardly got them involved compared to what I wanted them to be. I wanted them to participate and see links between the different [revision] areas we were looking at but quite often there were just a couple of students involved... In the lesson I wasn't really observing the class and how they were interacting with me. I wasn't aware. [Teacher 2, Feedback Conversation]

I think video's very useful…. If I sat back after a lesson and tried to go through it, I wouldn't have come up with half the stuff here that I came up with a couple of days later when I was able to go back and review it and be able to pause and rewind. I think it's extremely effective. [Teacher 1, Feedback Conversation]

There were definitely numerous times that I noticed things on the video that I would never normally have noticed, or perhaps remembered, post-lesson. [Teacher 1, Interview]

They also suggested that the video provoked them to think of ways they might do things differently in the future.

I kind of realised that it was mainly the two boys and one girl participating. But, I didn't make the connection that the others were so separate—like on both sides there was no involvement. I didn't like the way the room was set up. It wasn't very good. I'd change that for this kind of lesson [in future]. Rather than just getting one of the

boys to answer, I'd try and get them to discuss it together, sit them in blocks and ask them to discuss with one another. [Teacher 2, Feedback Conversation]

In one activity I used things like "nice work" and "good job" which are kind of empty phrases, whereas I could have said "that was great work because …" saying why I thought it was great work. I could have done that more in the lesson, focusing my feedback on why it was good work. [Teacher 1, Feedback Conversation]

The teachers' reports suggest that video both supported and provoked reflection and learning, and that it usefully informed their efforts towards instructional improvement.

The nature of the "feedback"

As noted earlier, the protocol used in the video-stimulated feedback conversations involved increased agency for teachers, with them leading the discussion about their observations, analyses and reflections related to their selected framework foci. The teachers reported this made them feel a sense of ownership and responsibility with respect to their professional learning, which they valued.

I could give my own analysis as well as hear feedback and analysis from other people. And I think watching yourself is just as valuable as having someone else watch you as well. [Teacher 2, Feedback Conversation]

I felt that it gave me more ownership of the feedback process and at the same time made me more accountable for reviewing the video in a critical way. [Teacher 1, Interview]

The protocol deliberately included the use of the term "conversation", to signal that feedback was not intended to be "given to teachers", but instead was seen as an opportunity for the teachers and researchers to discuss observations, analyses and reflections. The teachers noted value in this approach.

I definitely wanted it to be a discussion between the two of us, rather than just a self-analysis or someone just throwing information at me, because there might have been areas that either of us felt needed addressing that could be missed. [Teacher 1, Interview]

If I just sat down with you after it [the lesson], I'd probably feel a bit like oh no she's getting into me about something I didn't even realise I'd done… sometimes you take the feedback a bit personal… but when you can see it rather than being told it can help, and you asked me "What did I see?", that helped. [Teacher 2, Feedback Conversation]

Two other aspects of the protocol that seemed to be valued by the teachers related to the timing of the conversations and the opportunity for teachers to consider implications of their analyses and reflections for future practice.

I certainly needed a whole week to adequately review my video. I couldn't have completed my reflection any quicker. I think the feedback [conversation] needs to be soon enough after so that the lesson is still prominent in your mind. One week was fine, anything longer than 2–3 weeks might not be as meaningful. [Teacher 1, Interview]

I got a lot out of it. I watched the video several times and kept seeing other things. It made me think about why I did some things, and what worked and didn't work. I kept thinking how I would do things later because I just saw things that need to be different. [Teacher 2, Feedback Conversation]

Features and future directions

The structured stimulation of reflection process investigated in the study supported and provoked reflection and learning for the teachers involved. Features that appear key to the efficacy of the process include: a focus on teacher professional growth; a balance between structure and agency; and the unique and powerful affordances of video for focusing teacher self-reflection.

The promising outcomes of this study have prompted a second, expanded pilot to be designed and staged. The second study, currently underway, includes: an updated and refined observation instrument; enhanced video capture of classroom events made possible through using three cameras (presented as "Three-Up" displays); enhanced teacher documentation for analysis and reflection conversations through the provision of recording templates; enhanced capture of the analysis and reflection conversations through the use of software to record the teacher's conversation about their lesson together with the lesson images they refer to during the conversation; and the application of the structured stimulation of teacher reflection process in other subject domains.

Conclusions

Video is a unique and potentially powerful tool for focusing teacher self-reflection and supporting and provoking teacher learning. Classroom video can capture both the subtleties and the complexities of classroom activities providing opportunities to examine those activities in great detail, attending to those things the teacher considers most salient to their practice, and using different analytical frames.

Depending on how they are used, video recordings of teachers' own classrooms and recordings of other classrooms can provide opportunities to see and consider teaching practices in different ways. Clarke (2012) offered three possible conceptions of the mediating role of video in classroom research: video as a window through which to see the classroom, video as a lens through which to focus on selected aspects of classroom activity and video as a distorting mirror through which the researcher sees a reflection of their own values and perspectives. Similar conceptions might be considered to describe the experience of teachers viewing video of their own and others' classrooms: video as a mirror for teachers providing a visible record of activity in their own classrooms; video as a lens providing opportunity to re/view video records to consider different levels of detail or different perspectives; and video as a window into other classrooms revealing alternate methods and possibilities.

Viewing classroom video has the potential to engage teachers in self-reflection about classroom activities—whether they affirm, surprise, confront or concern. However, as Gaudin and Chaliès (2015) report:

… simply viewing video does not ensure teacher learning. An important issue concerns how to facilitate substantive analysis of teaching practice with video so that it becomes a productive learning tool for teachers. (p. 59)

The pilot research study reported in detail in this article identifies a promising process for facilitating such substantive analysis of teaching practice with video. Teachers involved in the study reported that the process they engaged in to observe, analyse and reflect on their teaching provided them with opportunities to consider their practice in ways not previously possible. They regarded the video as a catalyst for their professional learning as it both provided insight into their teaching practice and demanded a response from them (evidence was before their eyes). And, they signalled their preparedness and enthusiasm for adopting the process as part of their routine professional practice.

Distinguishing features of this process of structured stimulation of reflection included: the negotiated observational focus located within a theoretically and empirically grounded observation framework; the privileging of teacher agency in recognition of the personal nature and critical importance of salience to any learning; and the use of video to focus teacher self-reflection and support and provoke teacher learning. Given the encouraging outcomes reported by teachers, these distinguishing features warrant further investigation. Gaudin and Chaliès (2015) report that the results of their literature review related to video viewing highlight the potential of video to "generate a collaborative space for teacher education and professional development, a space in which the traditional hierarchies and boundaries between actors (trainee, trainer and researchers) and knowledge (academic, professional and practical) are disrupted" (p. 59). It is possible that the process reported here might well provide a form of constructive disruption suited to supporting and provoking teacher learning.

Appendix

Observation instrument: example elements and descriptions

Dimension 1	Communicating expectations for mathematics learning
Element: Responsibility for learning	*Description*: *Responsibilities associated with the mathematics learning process are explicated during the lesson* Responsibilities might: - Relate to elements associated with academic aspects of learning tasks (e.g. selection of methods or processes, thinking and reasoning, evaluation of solutions and methods) - Relate to levels of participation or engagement with learning tasks - Relate to elements associated with organisational aspects of learning tasks (e.g. allocation of time, use of resources) - Be explicated by the teacher or students
Dimension 2	Questions and discussions for mathematics learning
Element: Instructional dialogue	*Description*: *Instructional dialogue engaged in during the lesson includes some that extends and promotes higher levels of mathematics thinking* Instructional dialogue might: - Relate to mathematics ideas, concepts or processes (procedures, problem solving, reasoning) - Be initiated by the teachers and/or students - Be sustained or elaborated by the teacher and/or students

Dimension 3	Tasks for mathematics learning
Element: In-depth investigations of mathematics	*Description:* *Learning activities and tasks that are worked on in the lesson include some that involve in-depth investigations of mathematics ideas, concepts or processes* In-depth investigations might: - Relate to mathematics ideas, concepts or processes (procedures, problem solving, reasoning) - Take place over extended periods of time (for example, 15 min or more) - Be sustained or elaborated by the teacher and/or students
Dimension 4	Building understanding for mathematics learning
Element: Meaning making	*Description:* *Learning activities and tasks that are worked on in the lesson include some that focus on the meaning of mathematics ideas or concepts* Meaning making might involve: - Demonstrating, articulating or elaborating mathematics ideas or concepts - Summarising answers to questions or solutions to mathematics problems - Linking mathematics ideas or concepts to other related ideas or concepts - Identifying patterns, theories or generalisations - Formulating further questions about a mathematics topic - The teacher and/or students
Dimension 5	Using assessment for mathematics learning
Element: Eliciting evidence of understanding	*Description:* *The teacher makes verbal or written statements to elicit evidence of students' mathematics understandings* To elicit evidence teachers might: - *Question* students about their mathematics understandings - *Prompt or encourage* students to demonstrate, articulate or elaborate their mathematics understandings - *Assign* specific tasks that require students to demonstrate, articulate or elaborate their mathematics understandings

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