

Observing observers: Using video to prompt and record reflections on teachers' pedagogies in four regions of Canada

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Abstract

Regional differences in performance in mathematics across Canada prompted us to conduct a comparative study of middle-school mathematics pedagogy in four regions. We built on the work of Tobin, using a theoretical framework derived from the work of Maturana. In this paper, we describe the use of video as part of the methodology used. We used videos of teaching activities as prompts for discussions among teachers and the video recordings of such discussions became the data sources for our comparative research. Our use of video revealed a number of advantages and disadvantages which influenced the research.

Keywords

comparative studies, mathematics, methodology, pedagogy, video

Introduction

We conducted a comparative study of middle-school mathematics pedagogy in four regions of Canada. In our research design video data are used in two ways: edited videos of classroom teaching are used as prompts for discussions among teachers; and videos of those discussions are used as data by members of the research team. In this paper we describe our use of video and offer a number of insights into the advantages and disadvantages of using video in the field of cross-cultural comparative research in education.

Background

Large-scale international and national assessments have revealed a considerably wide range of student achievement in mathematics across Canada. When compared to international results, some Canadian provinces, notably Québec, rank among the top countries, while other provinces, especially in the Atlantic region, fall significantly below the Canadian average. There are also some differences related to the language used in the schooling system. Students from the francophone system in Québec and the anglophone system in Ontario achieve a higher average than their peers in the same province (Brochu et al., 2013). These differences have been evident in international assessments since 2000 (Bussière et al., 2001) and in national assessments over a longer period (e.g. Council of Ministers of Education, Canada, 1997).

These differences have been attributed to a number of factors including: student gender, attitudes, beliefs, aspirations and time spent working outside school; parents' education, involvement and socio-economic status; and school curriculum and resources (see Anderson et al., 2006; Beaton and O'Dwyer, 2002; Schmidt et al., 2001; Wilkins et al., 2002). Teaching, which might be expected to have the most direct effect on student achievement, is less often considered. This led us to consider ways in which we might conduct a cross-Canada comparative study of the teaching of mathematics.

The nature of pedagogy

The teaching of mathematics, that is, the observable behaviours of teachers, varies considerably from teacher to teacher. Furthermore, the same teacher may teach different topics, or different groups of students, in distinctly different ways. This makes directly comparing teaching practice between regional or linguistic groups quite difficult. However, it is assumed that underlying a teacher's behaviours is a set of beliefs, tacit knowledge, customs and habits that guide practice while remaining largely implicit. This is referred to as the teacher's *pedagogy* and it is further assumed that teachers who interact regularly will evolve pedagogies that are similar.

This concept of pedagogy resembles what Tobin et al. (2009) call the “‘implicit cultural practices’” of teachers, [...] practices that though not taught explicitly in schools of education or written down in textbooks reflect an implicit cultural logic’ (19). As they note, these implicit practices are related to teachers’ ‘knowledge in practice’ (Anderson-Levitt, 2002: 109) and ‘embodied knowledge’ (Anderson-Levitt, 2002: 8). Such knowledge is related to Bruner’s (1996) concept of folk pedagogy, the ‘taken-for-granted practices that emerge from embedded cultural beliefs about how children learn and how teachers should “teach”’ (46). To investigate these implicit practices Tobin et al. (2009) focus not on behaviours, but on teachers’ comments on their own and other teachers’ behaviours recorded on video:

In our analyses, we give greatest emphasis not to what teachers in each culture do, but to how they think about what they are doing. Our focus is primarily not on teachers’ behaviors, but on their practice or *praxis*, which we define as action plus intention. The videotapes capture behaviors; it is only when we add the explanations of the teachers and directors that we can get at practice. (19)

For instance, for many mathematics teachers a typical behaviour might be to present only correct answers on the chalkboard. When they are confronted with a video showing a teacher intentionally leaving an *incorrect* student-generated answer on the board, their discussion of the video reveals their own implicit cultural practices. In the following, ‘pedagogy’ is used to refer to such implicit elements that influence teaching. Pedagogy could also be described as the ‘professional culture’ of mathematics teachers; however, the phrase ‘professional culture’ is used in another sense in the education literature (e.g. Lieberman, 1988) so use of the word ‘pedagogy’ is preferred.

Pedagogy is further theorized as being an *emotional orientation* to particular practices. Maturana (1988) uses his concept of ‘emotional orientation’ to explain science as a domain of explanation, that is, as a domain in which characteristic implicit criteria for making and accepting explanations apply. The same idea applies to teaching as a domain of practice. Maturana argues that the criteria for accepting an explanation in science must be implicit at some level, in order to escape an infinite regress. Explicit criteria at some level require an explanation that must be based on more fundamental criteria. Those more fundamental criteria, if they are explicit, necessitate the introduction of even more fundamental criteria. The only way to escape an infinite regress of more and more fundamental criteria is to have implicit criteria at some level that remain unexplained, and hence do not require more fundamental criteria for their explanation. Similarly, the criteria for teachers’ in-the-moment decision making about practice must also be implicit at some level. Explicit principles are both impractical to access in the ongoing flow of teaching (Brown and Reid, 2004, 2006), and, also, would be a part of the teacher’s explicit practice and so require deeper criteria. Later, how teachers’ watching of videos to reveal the implicit criteria underlying their teaching is used by researchers will be discussed.

Membership in a community is established on the basis of shared emotional orientations. This is a recursive process that evolves over time, so that individuals adjust their emotion orientations to fit the communities they find themselves in, and at the same time their emotional orientations contribute to the community’s standards of behaviour. Just as populations of animals become more distinct and eventually evolve into new species when isolated from contact with others, this recursive process of evolving emotional orientations means that communities become more distinct when isolated from contact with other communities. This is the theoretical basis for the assumption that in different regions of Canada different pedagogies will occur. In the next section, possible conditions for the evolution of regional pedagogies are described.

Regional variation in Canada

Canada has two official languages (French and English), that are not evenly distributed across the country. Québec is officially francophone (French speaking) and 80% of the population speaks French at home. New Brunswick is officially bilingual and 32% francophone. The other provinces are either officially anglophone (English speaking) or have no official language and have small francophone minorities. Canada also has a cold climate and is sparsely populated. The population is concentrated within the warmer regions: the so-called Québec–Windsor corridor along the St Lawrence River, Lake Ontario and Lake Erie; and the southern Prairies and the Pacific and Atlantic coasts. The physical, climactic and linguistic circumstances divide Canada into four regions: the mostly anglophone provinces on the Atlantic coast; francophone Québec; and mostly anglophone Ontario which is separated from the other anglophone provinces in western Canada by the sparsely populated area north of Lake Superior. Canada's size makes communication between these regions difficult. Toronto, the largest city in Ontario, is 2,700 km away from Calgary, the largest city in western Canada – farther than London is from Moscow. Hence, it is reasonable to consider communities in these regions as being isolated from one another.

Mathematics teachers are most likely to interact with other teachers within their schools and these interactions may influence their pedagogies in ways that are independent of the subjects they teach. Their interaction with other mathematics teachers is likely to occur at school district, provincial or regional professional development sessions and mathematics specific conferences. School districts in Canada are usually language-specific and so such interaction is likely to be with teachers who share the same language. Interaction with teachers from other provinces, especially from provinces in other regions of Canada, is unlikely due to the physical, climactic and linguistic circumstances described above. In addition, in Canada's federal system, each province sets its own standards for education, including teacher preparation and curriculum. This means that the officially constituted communities for education are provincial.

Methodology

The research methodology in this study evolved from an epistemological position, summarized in the observation that 'everything said is said by an observer' (Maturana, 1987). Maturana's work in the neuroscience of perception led him to conclude that he 'had to abandon the question, "how do I see that color?" and ask instead, "what happens in me when I say that I see such a color?"' (Maturana, 2002: 5); instead of asking questions about an external world, the focus shifts to asking questions about observers and the worlds they observe.

What does it mean to research pedagogy from this perspective? It means that it makes no sense to go into classrooms or to view video recordings of classroom teaching and attempt to reconstruct the pedagogy underlying the teaching observed. Such observations are productions of the observer, not a reflection of the teaching observed.

However, it seems likely that a teacher's pedagogy would not only guide her teaching but also guide her observations of teaching. This suggested the notion of putting teachers in the role of observers of their own or other teachers' teaching practice, and making their observations the basis for this research. Soon after this idea occurred Tobin's work was encountered, which starts out from a different theoretical position to the current study but pursues a similar approach.

Tobin was dissatisfied with both the traditions of positivist anthropology and reflexive approaches. Positivist 'cross-cultural research follows the form of Westerners studying non-Westerners, whites studying non-whites, and again, scholars studying practitioners [*sic*] and men writing about (or just as often, failing adequately to write about) the lives of other cultures' women and

children' (Tobin, 1989: 173). The power inequities in this model are clearly problematic and were Tobin's main concern, but from the current study's epistemological position they are also inadequate because all that is achieved is observers reporting their self-generated observations and pretending they are reflections of the worlds they observe.

According to Tobin:

Reflexivity generally involves a focus either on the limitations of the individual researcher including ethnocentrism, professional anxiety and ambition, and counter-transference reactions or on limitations of the discipline of anthropology including conservative, self-perpetuating conventions of discourse, intellectual elitism, and a tendency towards colonialism, sexism, and orientalism. ... we are bothered by the irony that reflexivity, while successfully undercutting the researcher's omnipotence, often also has the effect of centering the text even more dramatically on the figure of the researcher-author. (173-174, references removed)

In other words, reflexivity acknowledges that everything said is said by an observer, but reacts by making the observer the object of the research, thus neglecting the original object of the research.

Tobin refers to his method as 'populist post-structuralism' or 'multivocal ethnography'. Key principles are 'a belief in the ability of ordinary people to explain the meanings of their actions and to analyze the institutions of which they are a part' (174) and 'a rashomonian' telling and retelling of the same event from different perspectives; an ongoing dialogue between insiders and outsiders, between practitioners [*sic*] and researchers, and between people of different cultures' (176). Tobin continues:

Our approach begins with the making of videotapes in comparable settings in two or more cultures. For example, for our current research, we shot videotapes of typical days in preschools in Japan, China, and the United States. Next, we take edited versions of these tapes back to the settings where they were filmed and ask insiders to give their interpretations and explanations. For the third step in our method, we take videotapes shot in one culture to the other cultures in the study, asking, for example, Japanese and American preschool teachers to make judgments about a tape we made in a Chinese preschool. (176)

Tobin calls these three steps visual ethnography, auto-ethnography and ethno-ethnography. These terms will be adopted to describe the methods in the current study.

Design

The design of the research for this study followed the structure outlined by Tobin. Video recordings of teachers in different regions of Canada, teaching in three contexts were planned to be made: a lesson the teacher would describe as typical of his/her teaching; a lesson the teacher considered exemplary in some way; and a lesson on the topic of fractions. These contexts were chosen in order to generate a variety of prompts to be used in the later stages and also as an early indication of what the teachers felt was typical and exemplary teaching. The lesson on fractions was included to ensure that at least some of the videos would involve similar content so that differences related to the content taught would not distract from other differences.

The regions were selected to include provinces, which had markedly different results in international assessments. At the time, regional groups had formed in western and Atlantic Canada that shared a common mathematics curriculum. Two provinces in western Canada, Alberta and Manitoba, which had above average and average results in assessments respectively, were included. In Atlantic Canada, all four provinces shared the same curriculum and had similar below average results in assessments. It was planned to form focus groups of teachers in Nova Scotia, the most

populous Atlantic province, but for logistical reasons a francophone group was formed in New Brunswick instead. Ontario and Québec were also included as they are Canada's most populous provinces and differ from each other in terms of curriculum, assessment results and the dominant language. It was further planned to form anglophone and francophone focus groups in all the provinces included, and in order to ensure good comprehension of the language of instruction francophone groups viewed francophone videos and anglophone groups viewed anglophone videos. In the section *Déroulement*, below, some changes to this plan related to video use are described.

In contrast to Tobin, this study did not make use of the videos of classroom teaching as part of its data, though his term 'visual ethnography' was used to refer to them. Descriptions of them are not included in the reporting of this work, nor have they been shown to a wide range of audiences as Tobin did. This reflected the current study's positioning of the teachers as observers and the researchers as observers of their observations. It also addressed a practical concern: that is that many school districts and university research ethics boards in Canada are wary of video recording in schools. In fact it was emphasized in the research design that only a clearly defined group of people, that is the researchers and the teachers in the focus groups, would be given access to the videos.

For the most part, the following procedure was followed. Each teacher collaborated with a researcher to select segments to be included in each video. An edited video of 20 minutes or less was produced by a research assistant for each lesson recorded per teacher. The edited videos presented the lesson in an accessible format, which included key episodes and omitted sequences (e.g. individual paper and pencil tasks) that are not usefully portrayed visually. Omitted sequences were marked with descriptive titles. The final edited video was shown to the teacher to check that it portrayed the lesson adequately.

In the next stage, corresponding to Tobin's 'auto-ethnographies', the teachers in each focus group viewed the edited videos featuring their classrooms and attempted to identify three videos to be shared with teachers in other regions. The recordings of these focus group discussions formed the first data set: as responses of observers within each regional and linguistic group of observers they provided an auto-ethnography of mathematics teaching in each region.

The three videos chosen for each region were shared with the corresponding linguistic groups in all the other regions. In Tobin's terms, they acted as stimuli for the ethno-ethnography phase. In this stage, encounters with other teachers' teaching were expected to offer the participants a way to reflect on their own familiar beliefs and practices in comparison with those held by others. The recordings of these focus group discussions formed the second data set. They were analysed to identify points of difference and similarity observed by the participants.

Reflection on the use of video in the research design

Tobin (1989) provides a number of reasons for using video in his research:

Our choice to rely heavily on video-tape rather than on written narratives at most stages of our research also serves our goal of reaching the widest possible audience for our work. Videotape is not more objective or less artificial or inherently more democratic than written texts, but it is generally much more accessible to audiences. Using video-tape allows us to gain the willing participation of parents, teachers, and administrators who would likely balk at the chore of reading and critiquing our written texts but are glad to watch and discuss our ethnographic films. (175)

The current study was not concerned with reaching a popular audience with its research results, but rather with providing prompts that would be accessible to the teachers who were participating in

the research. However, the same argument applies. Video has a number of advantages over live viewing of teaching behaviour and over transcripts of lessons. Unlike watching lessons in a classroom, watching them on video makes it possible to view episodes of interest several times and skip classroom activities, such as individual paper and pencil activities, that are not well captured on video. While video cannot be called more objective than a transcript, it does have a verisimilitude that written texts often lack. Even in this age of widespread manipulation of images, it is still felt that pictures show more. Video has some disadvantages that should not be forgotten, however. When watching lessons in classrooms there is an even stronger feeling of 'being there'. Watching lessons live allows the observers to choose a vantage point and change focus, for example by observing a single student closely during group or individual activities. Transcripts also have advantages over videos. Transcripts allow for a much easier comparison of episodes occurring at different times and, because transcribing requires greater attention to exact wording than comprehending spoken language, transcripts can help reveal details that are easily missed when watching a video. The main reason behind the decision to use video in this study was the researchers' familiarity with the advantages and disadvantages of working with video from their previous research.

An obvious shortcoming in the research design is not having anglophone groups react to francophone videos and vice versa. This would have been interesting data to include but it was believed that obtaining it would require the subtitling of the edited videos. There was a reluctance to do this not only because of the costs and the time involved but also because it was felt that watching a subtitled video does not give the same quality of prompt as watching a video in the researcher's own language. This last point is debatable and clearly an issue in comparative research using video across language groups.

As noted above, school districts and university research ethics boards are sometimes wary of video recording in schools. This concern is not uniform across Canada, but it did influence the research design. The limits set on the use of the videos, and the decision to edit them, were both guided by concern over obtaining approval to conduct the research. The editing process not only allowed for the shortening of the recordings, thus reducing the time required for the focus groups to view them, but it also meant research ethics boards, school districts, school administrators and parents could be assured that no students would be recognizable in the edited videos, either because episodes showing students would be edited out or because faces would be blurred. The limiting of the audience for the videos to the researchers and participating teachers was also intended to ensure the privacy of the teachers and students involved. This contrasts strongly with Tobin's use of video which was to make his research more accessible to a wide audience. In this study a design was chosen that would better the chances to be allowed to actually conduct the research at the cost of limiting the ways in which results could be communicated.

One decision we made in for the research design in this study was to use videos recorded in the classrooms of the participating teachers instead of adopting the Chazan and Herbst's design (Chazan and Herbst, 2011; Chazan et al., 2011; Herbst and Chazan, 2006, 2011). They created animations of teaching episodes to use as prompts in teacher professional development. The animations often include sequences Chazan and Herbst consider 'breaches' of normal practice. They have identified a number of advantages related to using hypothetical animations of classroom interaction rather than actual videos of live classroom activities. They perceive the verisimilitude of live video as being a disadvantage in their work, 'in that video can too forcefully narrate one story, address one context, and thus obliterate any need to [relay] alternative stories that should have happened instead or could have happened in another context' (Herbst and Chazan, 2006 216). For the current research, however, no disadvantages to using live video are envisaged. In fact, because alternative stories of what could have happened to come from the teachers' different pedagogies are expected, it is important that the videos offer authentic

portrayals of teaching. Moreover, unlike Chazan and Herbst, the current study does not want to predetermine what practices will provoke reactions. It is not known what teachers in one region will see as significant when watching a video of a teaching activity in another region. What they do find significant will in part reveal their pedagogy. In the next section, some comments from the teachers that illustrate this are included.

Déroutement

As with all but the simplest of research designs, what actually happened differed in many ways from what had been planned. A number of these differences relate to the use of video in the current work and these differences will be focused on here.

Formation of the focus groups

The first change to the design was in the formation of the focus groups. Only in Québec was it possible to form both anglophone and francophone focus groups. In Ontario the number of francophone teachers is limited and, although there was strong support from the school district, not enough teachers volunteered to make a focus group possible. It is hypothesized that a reluctance to be video recorded while teaching was a factor in some teachers' decision not to participate, and so it is now planned to form a francophone focus group that will only watch videos from other regions and not make their own. In Alberta there are even fewer francophone teachers and no francophone focus group was formed. In Nova Scotia a number of changes were being made in the mathematics curriculum at the time this study was attempting to form the focus groups for its research, and the school boards refused permission for their teachers to participate as they feared that this research would distract teachers from implementing the curriculum changes. Based on previous experience with conducting research using video in Nova Scotia, it is also suspected that concerns over classroom video recording may have been a factor. In contrast, this study was able to form an unplanned francophone focus group in New Brunswick composed of teachers who were quite comfortable with being videoed. In the end, classroom videos were made by anglophone teachers in Alberta, Ontario and Québec and by francophone teachers in Québec and New Brunswick. The focus groups in Manitoba had to be dropped because the Manitoba research team member had to leave the study.

Another change was the addition of cross-language viewings. The Québec francophone teachers themselves asked if it were possible to view the videos from the anglophone Québec teachers:

Teacher J: Même si ce sont des vidéos en Anglais, on aimerait bien savoir ce qu'ils font eux. [Even if the videos are in English, we would like to know what they are doing.]

Teacher C: Oui tu sais, dans le fond, on a peut-être les mêmes programmes ici au Québec. Mais on a aucune idée de ce que les enseignants anglophones font. J'aimerais bien connaître leurs idées à eux aussi. On pourrais-tu voir aussi les vidéos des anglophones, surtout de notre province? Ou devons-nous juste voir ceux des francophones des autres provinces? [Yes, you know, in the end, we may have the same curriculum here in Québec. But we have no idea what anglophone teachers are doing. I'd like to know their ideas, too. Could we see the videos of anglophones, especially in our province? Or do we just see those of francophones in other provinces?]

The francophone groups in Québec and New Brunswick and the anglophone group in Québec felt sufficiently confident in their understanding of the other language to view videos from the other language group. The researchers reconsidered subtitling and offered to do it if it would make

viewing videos in the other language easier for the teachers, but they indicated that it would not be necessary.

Selection of the lessons to be recorded

The selection of the lessons to be recorded also did not go exactly as planned. The intent was to allow enough time for teachers to choose from a range of lessons they wished to record. It was hoped to as much as possible avoid disrupting the teachers' normal activities. However, in one case in Alberta the process of obtaining permission to video record in classrooms and negotiating times for video recording delayed the timing of the recording to the last month of classes before the summer break. The teacher, wanting to participate in the study, agreed to do review lessons to fit the three lesson types that were planned to be recorded. In the other classrooms, the fraction lessons were done to fit the recording schedule not as part of the normal sequence of teaching. In this sense, at least five out of the nine lessons, which were recorded, could be viewed as staged lessons. Two of the teachers gave a lesson on fractions in spite of it being dropped from their yearly plan. The third teacher, however, chose to focus on a problem that required rational number thinking because she felt that a lesson on fractions, 'was out of synch with my year plan [...] and I wasn't at a point I could even review, it would have seemed crazy'. One of the other teachers seemed surprised by her colleague's concern since that teacher's students 'wanted to keep going with reviewing fractions'. The limited number of days for recording lessons also meant that some lessons were atypical in other ways. One teacher commented that 'Well, it was a weird day, because a big chunk of them were gone on a band trip and they [the remaining students] were afraid to talk in front of the camera. Normally they are not afraid to talk'.

Recording of the classroom videos

In most cases the video recording was done by a research assistant as had been planned. In Ontario both a researcher and a research assistant were present and they set up two video cameras, usually at the back of the room, so that they captured two different angles and had a back-up if one recording was faulty. One video recorded sound through a clip-on microphone that the teacher wore and the other video picked up the general sound in the room (student discussion, etc.). In Alberta a single video camera was used. This was set up by the research assistant at the back of the room where images of students would be kept at a minimum. In New Brunswick the teachers recorded their lessons themselves with the help of a student from the class or a teaching assistant. Two of the teachers were at schools in remote locations. The researchers did offer to have the research assistant travel to the schools to record the lessons, but the teachers felt confident that they were able to handle the task themselves.

The process of editing the videos also varied from place to place. In Ontario the researchers provided each teacher with a USB key with the recorded lesson, and then scheduled a follow-up meeting to work with the teachers so that the teachers could inform the research assistant how to edit the 45–60 minute video of the lesson to a 20 minute video to share with the other three teachers. The teachers took this step very seriously and would often have detailed notes about where to stop and start the edits. The researchers watched the entire lesson with each teacher, and as the teachers identified the edit points they would talk about why they were making that particular edit, for instance to focus on a critical question that a student had asked, to follow a particular group throughout the lesson or to demonstrate the variety of ways in which students approached a problem. These discussions were unexpectedly rich and seen by the teachers as an opportunity to reflect on their teaching, but unfortunately they were not recorded. In Alberta, the research assistant edited

out the parts which showed the students working individually at their desks before the teachers reviewed the videos. This was done to save the teachers' time but, as it turned out, this created some problems. When the teachers were presented with the edited videos they were disturbed by the absence of student desk-work. They were also reluctant to select a single video as 'typical' since they all taught differently. They asked if they could create a single video that demonstrated the teaching style of all three teachers. The research team agreed to this. In Québec and New Brunswick the researchers offered to meet with the teachers to involve them in editing the video, but the teachers did not wish to get involved so a research assistant edited the videos. In New Brunswick one teacher suggested that the research assistant keep one part of her lesson in the edited version. The teachers were also invited to review the edited videos before they were shown to the focus groups. Only one teacher, in Québec, took up the invitation. In that case the lesson had been recorded with a difficult group of students and the teacher was concerned that the problematic behaviour of some students would not be shown on the video.

Teachers' observations on the videos

For the purposes of this research the most important observations made by the teachers were those that revealed their pedagogies and give one example is given here. The main focus in this paper, however, is on the use of video in this research and so teachers' observations that address the study's use of video will be concentrated on.

Explicit and implicit: what teachers found significant

As the Alberta teachers ('Andrea', 'Brenda' and 'Maryanne') watched a lesson from the anglo-phone Québec teachers, they took note of the interactive 'SMARTboard' activity the teacher was using, which Andrea suggested might have come from the SMART exchange web site. Brenda checked this out:

Brenda: I went on the SMART Exchange and I typed in integers and that was the first thing that came up, was her lesson.

Researcher: Her lesson?

Maryanne: Well, that lesson.

Brenda: Yup, yup.

Andrea: Does it say grades it's suited for?

Brenda: It says seven, eight, nine.

The question about grade level reflects an earlier discussion on where integers feature in the written curricula of the two provinces.

The use of a pre-packaged lesson led to a discussion of the Alberta teachers' own use of resources. Brenda described how she used resources provided with a textbook:

Brenda: I use the textbook stuff in Math Links, the Adapted Programme. Just to guide the lesson. Because it has, you know, it's chunked really nicely, it's got a little bit – it's got an example that we do together, and it's a Show You Know, and then another example, and a Show You Know.

Brenda later elaborated on how she used these resources in her lessons.

Brenda: Yup, yup. So there's an example that we do together. And then there's a, they call it Show You Know, which is a similar sort of thing. And then there's usually two or three of them. And then we do an activity, which aren't in the text, those aren't in the textbook.

Researcher: So, the activity would not be in the – not in...

Maryanne: Yeah, whereas mine, I mean, it would be similar like I – I have my little presentation or whatever, and I start with the outcomes, and then I do all the keywords.

Researcher: Okay.

Maryanne: And then I, like, usually are, kind of like are tying in the review that ties into our new concept. And then I'll do examples. And again, I pull a lot of my examples from the textbook because it's PDFs, I can copy and paste pictures or whatever I want to do.

Brenda: Yeah, so you're taking bits of it and putting it into the SMARTboard.

Andrea: Are you using Math Links, too?

Maryanne: No, but I use – I have both books, so I use both books. We use Math Makes Sense, but I use both to draw from, for examples. So then I usually do, we do examples together and then it's the You Try. So then they do stuff, then kind of back and forth, right?

Brenda: Yeah, the Math Links textbook is too difficult for those students. So that's why you see adapted materials. But, um, I have, like, maybe a third of my classroom working out of the textbook, and the rest of them are doing adapted materials, so...

These discussions are about the explicit behaviours of the teachers and their use of various resources, but they also reveal implicit elements of their practice. Their pedagogy includes an assumption that part of teaching is assembling and organizing lessons as opposed to using lessons composed by others. The teachers in Alberta may not be aware that this is an assumption they make, as it may seem natural to them, and so if they were to be directly asked about their teaching methods they might not mention it. Confronted, however, with a teacher who seems to use resources differently, they reveal this implicit assumption and give us an insight into their pedagogy.

During the focus group discussions the teachers made comments that touched on the way video was used in the study. They mentioned ways they saw things differently when watching the video than when reading written descriptions of the lessons, and ways they felt the videos did not represent their teaching methods. They also reflected on how seeing each other and other teachers in the videos might affect their practice.

Video versus written descriptions

In the 'auto-ethnography' phase, when the anglophone Québec group reviewed their edited videos to select the ones to be shared with other regions, they were given a supporting document in which each lesson was divided into episodes and described. This was intended to help them follow the videos, but they noted that these also gave them a different impression of what actually went on:

Teacher K: She said that the way that, I, but I see. I wasn't sure if that, if it was the way you typed it.

Researcher T: No, I typed it the right way, but when I looked at it, I said that's not actually what she was doing.

Teacher K: What happened is, this was solved out of order and then the one half was forgotten.

Researcher T: And it was the same thing on this side too. She didn't copy the one sixth.

Teacher C: That's right.

Teacher K: That actually when I, when you first handed this, I'm having trouble following the work here. I can't figure out where this comes from.

The written version of the equation shown in the video was accurate but did not reflect the dynamics of how it was written, illustrating an important advantage of video recording in researching mathematics teaching. Written representations of mathematical expressions and diagrams are static, but the process of their creation is dynamic and encodes important information (Netz, 1998).

(Mis)Representations in videos

The edited video recordings of classroom teaching were far from perfect representations. Reducing lessons to 15–20 minute long edited recordings required leaving out a great deal and the teachers in Alberta commented on this when they viewed their own recorded lessons during the auto-ethnography phase.

Teacher B: You had a very specific activity the kids were doing and that got chopped out right? I'm thinking even my little checks for understanding [...] and A's [...] personal solutions.

Teacher A: Yeah, I was going to say, student input.

Teacher B: Yeah, student input for solutions.

Teacher A: For me it is the whole idea that it's about what the students are bringing, so that the idea that they're contributing which I think we don't see a lot in the videos because that is more their work time [which was cut out of the clip].

Another thing missing from the edited videos are the internal reflections a teacher makes on the decisions, imagined and actualized in her teaching. In a video the teacher doing one thing or another may be observed but reflection on her teaching choices cannot be seen. As one teacher in Alberta commented, 'I wonder though, when I'm teaching if it's just that it's what I'm bringing to it [...] if I don't have this whole bag of tricks about fractions, then we just really don't do anything different with fractions because I don't know what to do'.

The Alberta teachers were also concerned about the fact that the videos did not show students working at the tasks the teachers offered in the class:

'I am thinking we're doing it together. There's a huge chunk of time that was cut out there, so I must have been walking around, working with the pairs'.

'I still think, for whatever the reason, the lessons that I have here that I taught more than, I was at the front more than I usually am'.

These comments reflect upon this study's use of edited videos. They suggest that looking at their own teaching practice in an edited form already made the process strange enough to reveal an aspect of the teachers' pedagogy: a focus on student participation.

The Ontario teachers made decisions when editing the videos that resulted in edited videos that included both whole class discussion and the teacher interacting with small groups as they worked on problems. All the teachers felt that how they interact with individuals and groups of students was an important component of teaching. Here again, the process of editing the videos revealed an aspect of the teachers' pedagogy in a way that was not anticipated.

How watching videos might affect practice

The teachers commented on the value of watching videos of other teachers teaching, both from their own group and from other groups. As was mentioned above, the Québec francophone teachers wanted to watch the videos of the anglophone groups. Teachers also sought to use their own videos in existing professional reflection exercises. In Ontario, one teacher asked if she could use one of her recorded lessons as part of her Teacher Appraisal, and she chose to watch the lesson with her principal when discussing her teaching.

One teacher in the Québec francophone group commented that such activities, which they are familiar with from initial teacher education, should be a standard part of their ongoing practice:

C – Pour moi c'est tant. Oui je retiens des choses qu'on a vu, tu sais des détails de leçons typiques, et tout ça. Mais la démarche qu'on fait là, de se faire filmer, de se regarder enseigner et de recevoir des commentaires et d'en donner, moi je trouve que ça c'est vraiment très très très riche et qui nous pousse à se mettre à réfléchir. Oui quand notre termine notre période, on va souvent se faire une rétroaction dans notre tête. Mais des fois elle va s'arrêter là. Mais de se faire filmer et de se regarder et recevoir des rétroactions des autres, ça c'est quelque chose qui devrait se faire. Je pense qu'on devrait avoir des groupes comme ça régulièrement. Ça ne devrait pas juste être un projet de recherche. Ça devrait faire partie de la pratique. [For me it's both. Yes, I remember the things we saw, you know the details of typical lessons and stuff. But the approach we doing here, to be filmed, to look at teaching and receive feedback and to give, I think it is really very very very rich and compels us to reflect. When we finish our class period, we often have reflections in mind. But sometimes it will stop there. But to be filmed and to watch and receive feedback from others, that's something that should be done. I think we should have groups like this regularly. It should not just be a research project. It should be part of practice.]

Conclusions

In this research, video data are used in two ways: edited videos of classroom teaching are used as prompts for discussions by teachers; videos of those discussions are used as data sources by members of the research team. This paper focused on the first use of video as it offers a number of insights into the use of video in the field of cross-cultural comparative research in education.

It is concluded that there are a number of advantages and disadvantages to using video for such research, including some pragmatic ones that were obvious from the start and others that only became apparent as this research progressed.

Videos offer the pragmatic possibility of sharing teaching practices across geographically, linguistically and culturally different contexts which can foster conversation, promote critique of others and of oneself, and hopefully enhance practice. They permit the representation of visual and concrete elements of teaching, as well as sound intensity, tone of voice, facial expression, chalkboard inscriptions and bodily gestures. In mathematics teaching, specifically, the use of visual and concrete representations of mathematics concepts is increasing and teachers' use of such representations are better captured by video than by other means.

However, using video meant that only small samples of teaching practice were available for review. Only a few lessons were recorded, so the teaching practice that came before the lesson and which followed after was omitted. Large chunks of the lessons were also omitted in the editing of the recordings to bring them down to a manageable length. The use of only one or two cameras meant that there was a limited view of the classroom, primarily of the front of the room, so most of the students' faces and their activities were not visible. The lessons recorded were also affected in several ways by the fact that they were being recorded. Some lessons were 'staged' by teachers to meet the inclusion criteria of the study. In at least one classroom the normal complement of

students was not present because students who did not bring in permission slips were sent to another classroom during the recording. Also, some teachers commented that students who were not normally afraid to speak in class did not do so on the days when the lesson was being videoed. Video recording in classrooms is neither a neutral nor a passive activity; it is intrusive, selective and formative. However, as the goal of this study was not to use the videos to observe the pedagogy but rather to stimulate conversations among teachers, the pragmatic advantages of using video far outweighed the disadvantages.

Videos are especially useful for this research because they provide the researchers, as observers, with another layer of data to work with in addition to transcripts, written lesson summaries and classroom observations. For this research, given its basic assumption that everything said is said by an observer, this layered data collection technique is significant. It allows for 'multiple consensual contradictory perspectives' (Reid, 1996: 207) in which different observers and different data offer alternative interpretations that extend what can be learned. Of course, with each layer some interpretive possibilities are destroyed and others are created. The fact that the edited videos of classroom teaching were imperfect representations was not a large concern in this study because it was intended to use them only as prompts in the teachers' discussions, which constituted the data of interest for this study. In a selective clip from a video of a teaching episode, the teacher responding to a question, posing a question, soliciting an explanation or observation, and so forth might or might not be observed. This says little about their pedagogy, unlike having the teachers commenting on their own teaching in that clip and questioning how their value of making space for 'student input' is reflected in the video-clip.

One criticism that could be made of this study's use of video, and of video based case studies in general, is that they are not representative or generalizable. Tobin et al. (1989) address this issue:

Clearly, one preschool cannot be assumed to represent the preschools of a nation. ... To address the problem of typicality and to give a sense of the great range of preschool practices and beliefs to be found in each country, we showed our videotapes to audiences associated with other preschools in the same country, in other cities. ... In each city we asked preschool parents and staff, and students and faculty at university early child education programs, to tell us in what ways the preschools we videotaped were typical or atypical of others in their country. ... These responses to our videotapes provide a third voice in our book, a narrative strain that contextualizes both our videotapes and the insiders' explanations of the tapes. (8)

In this research, the analogous process was the selection of videos by teachers from one region to share with teachers from the other regions. Except for the anglophone Québec teachers, who were all from one school, the teachers in the focus groups taught in different schools and had rarely or never met before the focus group sessions. Hence the videos which they selected, while still not definitively typical (after all, there may be no such thing), were probably not extremely atypical. In any case, for the purposes of this research the main concern was with the teachers' reactions to the videos not the representativeness of the videos themselves.

In summary, for the purposes of this research videos play an important role as prompts for reflection on teaching, revealing underlying pedagogies. Many advantages of using video have been experienced and most of the disadvantages of videos are not significant because of the design of this study. The video recordings of classroom teaching are used primarily as prompts for reflection and hence the main properties they must have are accessibility and verisimilitude, not accuracy or representativeness. The video recordings of the focus group sessions have not been discussed here, but a similar principle applies to them. The multiple perspectives of the research team help to ensure that the videos also act as prompts for this study's reflection on pedagogy

rather than objective records. From this study's perspective, video itself is a neutral source of data, which can be misused by researchers taking an objectivist position or used well by researchers who acknowledge the interactive nature of interpretation.

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Note

1. This word refers to the 1950 Kurosawa film *Rashomon* in which several characters provide distinct and contradictory versions of the same incident.

References

- Anderson-Levitt KM (2002) *Teaching Cultures: Knowledge for Teaching First Grade in France and the United States*. Cresskill, NJ: Hampton Press.
- Anderson J, Rogers T, Klinger D, Ungerleider C, Glickman V and Anderson B (2006) Student and school correlates of mathematics achievement: Models of school performance based on pan-Canadian student assessment. *Canadian Journal of Education* 29(3): 706–730.
- Beaton AE and O'Dwyer LM (2002) Separating school, classroom and student variances and their relationship to socioeconomic status. In: Robitaille DF and Beaton AE (eds) *Secondary Analysis of the TIMSS Data*. Boston, MA: Kluwer, pp. 211–231.
- Brochu P, Deussing M-A, Houme K and Chuy M (2013) *Measuring Up: Canadian Results of the OECD PISA Study*. Ottawa: Council of Ministers of Education, Canada (CMEC).
- Brown L and Reid D (2004) *Emotional orientations and somatic markers: Implications for mathematics education*. In: Høines MJ and Fuglestad AB (eds) *Proceedings of the Twenty Eighth Conference of the International Group for the Psychology of Mathematics Education, Volume 1*. Bergen: PME, pp. 123–126.
- Brown L and Reid D (2006) Embodied cognition: Somatic markers, purposes and emotional orientations. *Educational Studies in Mathematics* 63(2): 179–192.
- Bruner J (1996) *The Culture of Education*. Cambridge, MA: Harvard University Press.
- Bussi re E, Cartwright F, Crocker R, et al. (2001) *Measuring Up: The Performance of Canada's Youth in Reading, Mathematics and Science: OECD PISA Study-First Results for Canadians Aged 15*. Ottawa: Human Resources Development Canada, Council of Ministers of Education Canada and Statistics Canada.
- Chazan D and Herbst P (2011) Challenges of particularity and generality in depicting and discussing teaching. *For the Learning of Mathematics* 33(1): 9–13.
- Chazan D, Herbst P and Sela H (2011) Instructional alternatives via a virtual setting: Rich media supports for teacher development. In: Zaslavsky O and Sullivan P (eds) *Constructing Knowledge for Teaching Secondary Mathematics: Tasks to Enhance Prospective and Practicing Teacher Learning*. New York: Springer, pp. 23–37.
- Council of Ministers of Education, Canada (1997) SAIP 1997 Mathematics Assessment. Available at: <http://www.cmec.ca/Publications/Lists/Publications/Attachments/138/saip1997.en.pdf> (accessed 13 April 2015).
- Herbst P and Chazan D (2006) Producing a viable story of geometry instruction: What kind of representation calls forth teachers' practical rationality? In: Alatorre S, Cortina JL, S ız M and M endez A (eds) *Proceedings of the Twenty Eighth Annual Meeting of the North American Chapter of the International*

- Group for the Psychology of Mathematics Education, Volume 2.* Mérida, Yucatán, México: Universidad Pedagógica Nacional, pp. 213–220.
- Herbst P and Chazan D (2011) On creating and using representations of mathematics teaching in research and teacher development: Introduction to this issue. *ZDM—The International Journal of Mathematics Education* 43(1): 1–6.
- Lieberman A (1988) *Building a Professional Culture in Schools.* New York: Teachers College Press.
- Maturana H (1987) Everything said is said by an observer. In: Thompson W (ed) *Gaia: A Way of Knowing.* Hudson, NY: Lindisfarne Press, pp. 65–82.
- Maturana H (1988) Reality: The search for objectivity or the quest for a compelling argument. *The Irish Journal of Psychology* 9(1): 25–82.
- Maturana H (2002) Autopoiesis, structural coupling and cognition: A history of these and other notions in the biology of cognition. *Cybernetics & Human Knowing* 9(3/4): 5–34.
- Netz R (1998) Greek mathematical diagrams: Their use and their meaning. *For the Learning of Mathematics* 18(3): 33–39.
- Reid D (1996) Enactivism as a methodology. In: Puig L and Gutiérrez A (eds) *Proceedings of the Twentieth Annual Conference of the International Group for the Psychology of Mathematics Education, Volume 4.* Valencia, Spain: PME, pp. 203–210.
- Schmidt WH, McKnight CC, Houang RT, et al. (2001) *Why Schools Matter: A Cross-National Comparison of Curriculum and Learning.* San Francisco, CA: Jossey-Bass.
- Tobin J (1989) Visual Anthropology and multivocal ethnography: A dialogical approach to Japanese pre-school class size. *Dialectical Anthropology* 13(2): 173–187.
- Tobin J, Hsueh Y and Karasawa M (2009) *Preschool in Three Cultures Revisited: China, Japan, and the United States.* Chicago: University of Chicago Press.
- Tobin J, Wu D and Davidson D (1989) *Preschool in Three Cultures: Japan, China, and the United States.* New Haven: Yale University Press.
- Wilkins JLM, Zembylas M and Travers KJ (2002) Investigating correlates of mathematics and science literacy in the final year of secondary school. In: Robitaille DF and Beaton AE (eds) *Secondary Analysis of the TIMSS Data.* Boston, MA: Kluwer, pp. 291–316.

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