What are we looking at? Thinking about the 'visual' in video based classroom research

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Current interest in argumentation has promoted a particular version of reasoning in science developed from Toulmin's model, which is in line with traditional perspectives on reasoning as syllogistic and verbal in nature. These perspectives have driven discourse analyses of videotaped classroom dialogue to generate evidence of levels of reasoning in classrooms, and teacher support of reasoning. However, researchers have also been interested in non-formal reasoning as a critical aspect of idea generation in science, including model based and analogic reasoning, and reasoning through representation – construction. In this paper we will use video evidence from classrooms to argue the need for a multi-perspectival view of reasoning, to adequately describe the nature of quality learning and teaching in science. The paper also touches upon issues of the increasingly popular use of visual methods such as video and alerts researchers to take the methodological and representational issues of the visual seriously.

Introduction

The science group at Deakin have been involved in a number of research projects using video as a tool to explore teaching and learning in science in a number of contexts. In particular, we are drawing on the methods developed by Professor David Clarke from the University of Melbourne to generate data in three projects funded by the Australian Research Council:

- 'The role of representation in learning science', in which we worked with a small number of teachers to develop and evaluate an approach to teaching and learning based on representation construction

- The 'Equalprime' project, currently collecting data on competent primary teachers of science for cross cultural comparisons with Taiwan and Germany

- Investigating the representation construction pedagogy in an expanding number of schools in a project running from 2012 – 2014.

The research design includes the production of a comprehensive data set of complete science learning sequences, using two video cameras with radio

microphones – one focused on the teacher and the other on a selected group of students. Stimulus recall interviews capture elements of teacher planning, beliefs, and review, and students' perceptions of the learning process. Student artefacts such as workbooks, pre and post tests, are collected, and photographs of 3D artefacts. In these projects we draw on the video and other data to analyse a range of features of teaching and learning in science classrooms. In this paper we attempt to clarify the different ways the 'visual' features in the research, and the possibility of expanding our thinking, and our methods, into new areas.

A Taxonomy of Visual Methods used in Classroom Video Research

In the paper we identify four distinct ways in which the 'visual' contributes to the analyses, and speculate on the nature of the affordances and constraints with these, and the potential to expand our methods to make use of the visual. These ways are:

- Capturing data visually

- Using the visual record as a tool

- Relating the visual to the conceptual

- Analysing the visual per se.

We will describe the ways in which visual data operates in each case, including the methodological affordances, and constraints, below.

Capturing data visually

There are many, well-recognised affordances offered by such video data: the permanency of the record; the relative completeness especially if supported by other data such as teacher and student interviews, records of student artefacts, and testing; the ability to return to the video to re-analyse from different perspectives; the clarity it gives to the setting of natural language interactions through capturing gesture, emphasis, physical setting; the enabling of close analysis using different theoretical perspectives; and the capacity to act as a site for multiple readings, because of the richness of the record.

There are however constraints, or limitations to the video record: the selective nature of the image in that the camera is inevitably deliberately pointed at a particular aspect of the classroom; the 'window-like' aspect of the record that lacks the embodied sense of actually being there – the feeling for space, the movement around the camera, the broader aural environment, the lack of ability of the viewer to adjust the view to points of interest that may disappear of frame, and the lack of relational links with the actors in the drama of the classroom. There are also limitations because of the 'snapshot' nature of the record — the history of the teacher and students is out of frame, as is the sociological setting in which the teaching and learning is being played out.

In our research, the main purpose of the classroom video capture is to enable us to analyse conceptual transactions that take place between the teacher and students, in whole class, small group, and one-on-one interactions. For this, the video record enables us to track interactions between verbal and gestural exchanges, and physical

artefacts. Thus for instance we can capture two students describing their model of movement of an earthworm.

So we tested out by using blu-tac and a rubber band to see which one would represent better. So what we did with the blu-tac , we basically pull it one way [pulls the mechanical handle] this is how it moves.

The analysis thus enabled included in this case the way students' attention shifts back and forth between the physical model, writing and drawing, and verbal interactions. It also allows analysis of teacher interventions which include gesture, and use of artefacts and board-work, as well as verbal exchanges (see Hubber et al., 2010, for an example).

The major value for us, afforded by the video capture is to help make sense of the oral exchanges — the visual aspects are subsidiary and not analysed in their own right, although the ability in transcripts to describe the setting of utterances (to point out who the comment is directed to, and whether it is accompanied by gestures or pointing to physical artefacts) helps make sense of the verbal record. There is a real question raised, therefore, about the sense in which this type of research data capture and analysis can be called a 'visual methodology', since the visual is used as a record rather than a mode of interest in its own right.

Using the visual record as a tool

In our work we also use stimulated recall interviews to probe teacher and student interpretations of what is happening in the lesson. For the teacher the focus is on intentions, on moment-by-moment pedagogical decisions, and the beliefs that may underlie these. For the student it is on elucidation of their experience, on the points at which their learning advanced, and what aspects of the lesson impacted on their understandings. The video can be used as a deliberate stimulus focusing on particular events of interest to the researcher, or as a tool over which the interviewee has control in reconstructing their experience, or a combination of both.

The paper by Gail Chittleborough (2011) also in this symposium, is another example of the use of the video as a tool, in this case to stimulate pre-service teachers' analysis and reflection on their practice.

In these uses of video, the visual is not the object of investigation itself but acts as a stimulus – a provocation – to elicit personal accounts, interpretation and reflection on meaning.

Looking at the visual and its relation to the conceptual.

In our research project 'The role of representation in learning science', we worked with teachers over 3 years to develop and explore an approach to teaching and learning based on representation construction. The approach is grounded in a

pragmatist, semiotic perspective on learning (Lemke, 2004) and views learning science in terms of induction into disciplinary literacies (Moje, 2007). In this classroom work on multiple representations we have been struck by the pervasiveness of visual representations and their importance in reasoning and learning in science has become increasingly apparent. We have argued for instance for greater attention to be paid to active drawing by students as a key aspect of pedagogy in science (Ainsworth, Prain & Tytler, 2011).

In science itself, visual reasoning and visual communication are becoming more and more important with the advent of digital power over multiple forms of visual analysis and communication (Elkins, 2011). Drawing and visual representations are central to idea generation in science (Nersessian, 2008; Gooding, 2004) In our research we analyse the coordination of the visual and verbal and argue this coordination is key to what we mean by understanding. Thus, in our research, the visual record is central to our analysis, and this is generated using scanning and photographing of student artefacts (models, drawings, graphs and tables) and video capture of verbal and of gestural interactions. The analysis involves tracing the way these various modes interact during the teaching and reasoning and learning process.

An issue for us in relation to the visual concerns the possibility of judging learning through tracing visual artefacts. Does the visual convey conceptual meaning on its own. We think this is the case, but in reliably pinning down understanding we believe the coordination of verbal and visual and other representations are necessary. The problem remains for us, however — how do we find ways of judging the visual, as conceptual?

Analysing the visual

Visual methods and images have played an important role in the development and understanding of the social construction of reality and social science research more broadly. The rapidly developing field of visual culture is an important source of understanding of the social world. Visual methods as with any research method have inherent epistemological orientations, strengths and weaknesses. Visual researchers use a range of social science protocols and formats. As Schirato and Webb (2004) state 'visual culture is most profitably understood as all those visual artefacts, natural forms and ways of thinking that make up perception in our everyday life, as well as interdisciplinary technologies of analysis that can be applied to make sense of them' (Schirato and Webb 2004, p. 6). Marcus Banks (2007) offers a more succinct definition when he defines visual research as the production, organisation and the interpretation of images. Today, visual research is located in a wide range of fields such as media studies, cultural studies, psychology and cultural geography.

Drawing from the developments in qualitative inquiry, the field has grown rapidly. These influences include:

- the contribution of narrative and narrative theory, also known as the 'narrative paradigm' (Zeller and Farmer 1999, p. 15);

- the reconceptualisation of visual sociology, now known as visual culture; and

- influences of globalisation, 'technoliteracy' (Lankshear, Green and Snyder, 2001) and 'the material–semiotic systems of technoscience' (Haraway 2004, p. 326.)

- The use of visual mediums which has been described as image-based research (Prosser, 1998) visual ethnography (Pink, 2001), visual methodologies (Rose, 2001) and visual methods (Banks, 2001).

The emergence of visual methods and approaches taken up in education appear in the now considered seminal book, *Image based research: a source book for qualitative researchers,* by Jon Prosser (1998). In the 21st video based accounts of classrooms and digitised archives generated by classroom researchers are used more common. At one level the new forms of research and curriculum inquiry are impressive. The lived experience of classroom life, moving documentary photographs of children's understandings of the world of schooling and their lives, and semiotics that feature images, graphics and colour; communicate an apparent sophistication of new knowledge.

The analytic dimensions of working with visual data however are more commonly reliant on approaches that reproduce the accepted forms of research production. Fischman (2001), supporting this argument, states '(t)he reliance on words and numbers among educational researchers and the general tendency of dismissing images is generalised across academic traditions, theoretical traditions, and research methods' (p. 28). Equally forms of visual data production may constrain researchers. The struggle to interpret the voluminous proportions of newly created pixelated, powerful and highly seductive imagery, that is the product of these methods, is often realised late in the program of research and has not been considered from the range of possibilities that exist outside of education.

Fundamental to understanding the visual is that images of any kind represent a social story. Visual representations of classroom and curriculum have likewise changed over time and will continue to do so. Social anthropology reminds us that the meanings of images do change over time and that the images are going to read by audiences differently. Classroom researchers and the subsequent viewer are likely to read these data from different perspectives through multiple interpretations.

Marcus Banks (2007) provides some useful insights for setting up our analytic practices. He urges researchers first to consider whether you are working from interpretivist or naturalistic paradigms. These words are similar to the often quoted words of Patti Lather (1991) who suggests that research can be constructed as a *realist tale*, a *critical tale* or a d*econstructivist tale*. Finally Banks (2007) cautions researchers to be explicit about their theoretical orientations, **before** they get behind the lens of the camera.

Conclusion

Through this analysis of the various ways in which the visual appears in this classroom video capture research, we have come to realise the untapped potential, in our case, of the video analysis, and the need to develop, alongside our current approaches, more subtle and flexible ways of approach the variety of visual data in our research on its own terms.

In conclusion it might well be useful also to note what Gillian Rose (2001), a cultural geographer states that using the visual requires a disposition which:

- *'takes images seriously…* it is very necessary to look carefully at visual images, and it is necessary to do so because they are not only reducible to their context. Visual representations have their own effects.

- *thinks about social conditions and effects of visual objects…*Cultural practices like visual representations both depend on and produce social exclusions and exclusions, and a critical account needs to address both these practices and their cultural meanings.

- *considers your own way of looking at images.* If ways of seeing are historically, geographically, culturally and socially specific, then how you or I look is not natural or innocent' (pp. 15, 16).

Finally, there is increasing emphasis on visual images as central to the knowledge building practices of science (Elkins, 2011), and the development of visual languages has become an important part of scientific practice. Classroom practices in science therefore need to place greater emphasis on representation construction, and as researchers we need ways to conceptualize and analyze these.

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