

To Know And To Be Right: Studying The Classroom Negotiation Of Meaning

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Abstract

A specific research technique is outlined by which the nature of "coming to know" in classrooms might be put on a more empirical footing. In this research, an attempt is made to optimize the use of currently available technology through the synthesis of classroom videotape and interview data in an integrated video and text "document". The analysis of the resultant data is enhanced by the use of an indexing tool with the capability to undertake complex qualitative analyses of textual data in a replicable fashion. Some preliminary findings are reported which employ students' use of the term "right" to offer insight into the process of "coming to know" in science and mathematics classrooms.

Introduction

Recent attempts to study learning have taken two common forms: Clinical studies of one or two children in situations described as "Teaching Experiments" (for example, Schoenfeld, Smith & Arcavi, in press; Steffe, 1993); and descriptive studies of mathematics classrooms, in which videotapes of classroom interactions have provided data for later analysis (for example, Cobb, Wood & Yackel, in press). Such studies have as their focus the construction of a model of the process of learning mathematics. The work of Steffe, Cobb and their co-workers

presume a constructivist model of learning and seek to both validate and elaborate such a model through their research. Schoenfeld's approach seems more concerned with theory construction.

Steffe and Schoenfeld have restricted their study to the learning of individuals in quite tightly controlled situations involving few participants. The challenge confronted by Cobb and his colleagues and other such classroom-based research is the challenge presented by the complexity of the classroom as a research site; the interaction of social and personal variables in a setting over which the researcher can exert no control. While studies of the first type might be characterized as "experimental" or, at least, "clinical", studies of the second type have much in common with ethnographic studies of community behaviours. However, this second category of studies retains a focus on the learning of participant individuals, and depends to a large extent on inferences concerning cognitive process drawn from videotape data of overt social actions.

The research procedure which forms the focus of this paper was developed in an attempt to study learning in legitimate classroom settings, while minimizing the need for researcher inference regarding pupil thought processes and maximizing the richness of the research data base. The focus of the research stems from a perceived need to model empirically the process of learning in classrooms, and, in particular, the so-called "negotiation of meaning".

A Method Of Classroom Research

The perspective adopted here takes the distinction between the personal and the social as empirical rather than illusory, and attempts to devise a research procedure with the potential to reveal relationships between learning behaviours in the two domains. Essential to this methodology was the development of a viable technique for collecting the type of data which might represent the operationalization of constructs such as "the negotiation of meaning" in classroom settings. In his 1991 paper, "The structuring of the structures", Bauersfeld identified a need for theories by which situated, social knowing might be understood, and anticipated the replacement of the current concept of knowledge. It is the need for an empirical base for such a theory that motivated the research design outlined here.

Aim

The particular aim of the research discussed here is:

To elaborate a constructivist model of learning with specific regard to classroom negotiation and the construction of meanings by learners in mathematics and science classrooms.

The key to such an approach is to ground the student accounts in a videotape record of specific shared classroom events, and to supplement each student's account with an associated data base of other students' accounts, researcher field notes, and transcribed videotape records. By this approach, the research techniques of classroom videotape analysis and student clinical interview are combined to best effect in a manner designed to be reciprocally validating and illuminating.

Method

The challenge for this type of classroom research is to portray the learning process undergone by an individual embedded in a

highly complex social context. This learning process must integrate not just the obvious social events which might be recorded on a videotape, but also the individual's construal of those events, the memories invoked, and the constructions which arise as a consequence. The research procedure employed here was designed explicitly to achieve this integration.

Central to the research methods employed in this research design is the use of videotaped classroom lessons and video-stimulated recall techniques within an interview protocol that sought to obtain:

- 1 student perceptions of their own constructed meanings in the course of a lesson, and the associated memories and existing meanings employed in the constructive process;
- 2 students' sources of conviction for construction of their mathematical (or scientific) meanings;
- 3 the individuals, experiences, arguments or actions in which students felt mathematical or scientific (academic content) authority resided.

Since the concern is with the context of learning and descriptions of teachers' and learners' scientific and mathematical interpretations in classroom settings, qualitative research methods predominantly are employed.

Procedure: In the classroom

Two video cameras are used: one focussed consistently upon the teacher, and the other on a selected group of about four students. This approach does not assume that the students will be working in collaborative groups, only that they are seated sufficiently adjacent for the entire group to be simultaneously in view and for a single microphone to be used to record the conversations of all four students. The teacher's conversation is recorded through a radio microphone. The dual video images of teacher and pupils are combined into a single image through a compact

audiovisual mixing board situated at the rear of the classroom. This image can be viewed on a small portable monitor and the composite image structured so that the students occupy most of the viewing screen with the teacher included as a small insert in one corner of the screen. The same mixing device will combine the audio input from both microphones. The relative volume of teacher and student conversations can be adjusted.

The combined image is recorded onto video-8 tape using a very compact videorecorder. This videorecorder is linked to a laptop computer. Using headphones, the researcher is able to listen simultaneously to both the students' conversations and to teacher utterances. Using the "CVideo" software (Rochelle, 1992), the researcher is able to record field-notes onto a word processing document on the computer. These field notes can be "time-tagged" to the corresponding events in the video record. Typical field notes might resemble these (numbers refer to hours:minutes:seconds elapsed on the video tape):

00:33:40 to 00:34:03 A asks something of G (PURSUE THIS)

00:34:08 to 00:34:40 T: Open your books and correct it, time is up

00:34:44 to 00:35:12 G: I got this wrong, A: oh, my god

00:35:14 to 00:36:01 A looks up and back, G: I got that all right

00:36:03 to 00:36:42 A: does spelling matter? C: I got seven

00:36:44 to 00:36:59 T: stick sheet in book

Such field notes serve two purposes: First, as a record of the researcher's immediate impressions of significant social interactions and learning events; and, second, as reference markers for the subsequent interviewing of the student subjects.

To summarize: If our purpose is the study of learning in classrooms, the analysis of videotapes of classroom events is inadequate if the meaning of students' actions and utterances is

inferred only from the video record. The video data must be supplemented by the student's immediate account of the classroom events, their personal significance, and the constructions which followed. The synthesis of videotape and interview optimizes the value of both techniques. As will be discussed, both videotape and interview record can be subjected to later analysis, separately and in combination as forms of related text.

Procedure: The Interview

At the end of the lesson, the researcher interviews the target students individually, using the video record as stimulus. For the interview stage, the researcher requires only the video recorder, video monitor, the laptop computer, and a compact audiorecorder so that the interview can be recorded on audio tape.

A typical interview protocol might commence in this fashion:

- I: What do you think that lesson was about?
- S: Oh, linear functions and how you graph them.
- I: Was that something that you understood before the lesson started?
- S: Not really. I mean I knew about linear functions, and we had done a bit of stuff on graphing, but I couldn't say I really understood it.
- I: Would you say that you understand it now, after the lesson?
- S: Yes, I think so.
- I: At what point in the lesson would you say that you came to "understand" about graphing linear functions?
- S: I'm not sure. Probably after I had tried a few of the problems in the book, and they seemed to be coming out o.k.
- I: Was there something that happened in the lesson that really helped you to understand?
- S: Maybe. I'm not sure.

- I: It seemed to me that you spent a lot of time talking to Simone at one point, what was all that about?
- S: Really. I don't remember. I suppose it was something to do with the problems. Yeah. She asked me about the first one, and then we started talking about how to do them.
- I: Let's look at that bit now, and you can tell me what you were thinking.

The use of the *CVideo* software enables the researcher to locate within the field notes reference to actions of the student which seemed to be of significance either to the researcher or to the student. Having found this point in the word document, the software can be used to find the corresponding moment on the video record. This can then be played back and discussed.

The audio record of the interview can then be transcribed onto the relevant section of the word document and time-tagged to the corresponding video incident. The resultant video record plus word document incorporates student and teacher actions and utterances throughout the lesson, together with the researcher's field notes augmented by the student's interpretations and explanations of significant events. This integrated data source is then available for analysis. One example of such an integrated word document is given below (**bold** = field notes; plain text = transcript from videotape; *italics* = transcript from interview). In the following document, a graphing problem had been set from the textbook and the issue being discussed by the students concerned which of two variables should be located on the vertical or horizontal axes of the graph.

00:31:10 to 00:32:12

Uncertainty by Alice - Potential conflict with teacher authority (PURSUE)

Alice:(asking Carl)

So what goes down the side and what goes down the top?

Carl: (inaudible)

- Ellen: Mr. Lawrence, what's?
- Alice: So which goes down the side Ell? Hey Ell, do you put this on the top? Or down the side?
- Ellen: You put it on the bottom. O.K. Right? That one goes on the bottom.
- Alice: Really? It'd be easier to do it the other way 'round.
- Ellen: I know.
- Alice: That's dumb.

Interviewer (I):

Alright. Now, tell me what's going on here? This is almost my favourite bit in the whole lesson. So?

Alice (A): Oh, I wanted to know what was, cause there was this other one that had all these - I can't remember - I don't know what it was about, but it had all the -

I: What you had out on the blackboard at this moment was a thing set out like, I don't know, zero and -

A: Oh yeah, yeah. It was ah, cause there was all these different numbers again. And I didn't know which ones to - like one number was from zero to nine.

I: Yes.

A: From zero negative one to negative nine. And then along the top it had like 623 all the way up - not each separate number but in between numbers - all the way up to 1072.

I: Right.

A: And I wanted to know which ones went on the side and which ones went on the bottom.

I: Right. Now, you go on and have a conversation with Carl about it. [on the video tape]

Carl: You gotta do that one, as well

Alice (to Carl):

How do ...? You gotta do this one. You don't do that one. That's on the bottom, right?

Carl: Why? Why is that one on the bottom?

Alice: I know. 'Cause Mr Lawrence said we have to do it that way. It's easier to do it the other way, isn't it?

How do you go up by this much? (inaudible) That's heaps isn't it?

Carl: More than that.

Alice: Because you've got to go up by ...

Carl: So what do you go up by here?

I: Oh, I see what you mean. [video tape is playing]

So, what's the big dilemma?

A: No one knew which went on the side or which went on the bottom.

In combination, the researcher's field notes, the recorded classroom interactions, and the student's explanations augment the video record to provide a rich data base for subsequent analysis.

Analysis: Finding Structure In Diversity

The analytic framework for the analysis of videotape and interview data was derived from earlier work on classroom consensus processes (Clarke, 1986), on sources of conviction (Frid, 1992), and on existing theories derived from constructivist models of learning. In particular, the analytic framework employs the interrelated set of metaphors (constructs) discussed in Clarke (1993).

Text analysis can identify points at which the student's state of knowing demonstrably changes from uncertainty to comparative certainty or conviction. It may be that a student recounts a situation in which they came to "know" or to "understand" something related to the topic dealt with in the observed lesson. These accounts are also taken to constitute

data regarding the process of coming to know.

In particular, any student use of the verbs, "know", "understand" or "learn" can be analysed in detail with regard to the subject and object of each verb's use. That is, what sort of things can be "known", "understood" or "learned"; what sort of experiences, events, images, or people appear to be associated with "learning", "understanding" or "coming to know"; and, who is it that "knows", "understands" or "learns" things? In this analysis, the software package *NUD•IST* (QSR, 1994) is employed to undertake a textual analysis of the frequency of association of terms such as those above in student classroom discourse and in student discussion of video-recorded classroom situations.

NUD•IST is fundamentally an indexing tool, which allows the cross referencing of particular terms or phrases. Central to its use in this type of research is the capability of *NUD•IST* to reveal clusters of related terms: related by common situation (textual or social situation), or by association with a common key term or referent. In addition, relationships can be identified between clusters of terms. *NUD•IST* facilitates the identification of the sort of "grounded key" discussed by Glaser and Strauss (1967). Within this research design, video transcripts and transcripts of student interviews can be combined for the purpose of textual analysis. The search for the associations between textual elements, which appear to structure the process of coming to know, is a form of exploratory content analysis. The use of an indexing tool such as *NUD•IST* offers a form of replicability not previously associated with conventional content analysis.

Preliminary Findings

In applying *NUD•IST* in the analysis of the text document which is the primary product of the data collection process, our immediate goal was to identify a key term or phrase which appeared to signify

that a student's claim to "know" something. Our preliminary analyses revealed some interesting associations of terms, many of which warrant further investigation as we generate a larger data set. For example, it appeared that for some students the terms "know" and "remember" were interchangeable. Other terms which we employed in our analyses included: sure, clear, confused, agree, understand, know, learn. Our selection of terms derived from our focus on terms likely to be employed in asserting or justifying a claim "to know", or likely to be associated with the resolution of uncertainty, which we took to be a characteristic of the process of negotiation.

A major finding at this stage of the study is the significance of students' use of the word "right". The use of this term is discussed in some detail below as an illustration of the type of findings arising from this research.

It appears that there are two ways that things are labelled "right" by students: The teacher may say that something is right. The group may agree that something is right. The use of right is related to what it means to know something in and out of the classroom. It remains to be determined whether these uses of "right" occur with different frequencies in relation to science and mathematics.

I (Interviewer)

So why were you so sure you were right?

Karen: Because we all got the same answer and we were all working it out separately, weren't working it out together.

Another student working in the same group, in discussing the same event, justified her claim to know differently.

I: Why did you think it was right?

Helen: 'Cause if Mrs Burton thinks it's right, it probably is.

I: But did you think it was right before she came around?

Helen: Yeah.

In the interview excerpt below, Karen explains how she decides whether something she is working on is right. Both agreeing with her peers (in this example, Helen) and asking the teacher are important. But the teacher is not necessarily believed.

I: OK, and how do you decide when it's right?

Karen Well, I sort of go over it a couple of times, and then check it with someone else. And she'd just help me there. Or if I'm not wrong, Helen will point out that she's wrong, 'cause she'll know straight away that she's wrong, if my answer looks right and hers doesn't. But that doesn't happen very often. Yeah, ... I just sort of check it with Helen and if it's wrong then we just go through it and try to make it right.

I: And how do you decide between the two of you how something is right?

Karen: We work it out together again, and we just, if it looks right, we just keep it, and ask Mrs Burton if it's right, but as you can probably see, Mrs Burton kept on trying to correct us and she had the wrong answers.

I: Yeah, that was really interesting ... You and Helen were pretty sure?

Karen: And Helen would say, "And I've got this" and I would say, "I've got this" and Chris would say, "And I've got this", and we'd go "We're right, you're wrong, go back and check your own answers." She'd take it off the girls in the front row I think.

The analysis of our growing body of text has suggested several different uses of the term "right" as a key element in the claim "to know". These include: Knowing because of repeated success; knowing because of consistent outcome; knowing because the teacher ratified the correctness; knowing because the peer group agreed with you. Our research will continue to document uses of the term "right" and to relate these to a student's claim to "know." Other related terms will also be identified. The corpus of text elements which employ these terms can then be systematically associated with particular types of classroom activity and with the particular types of knowing about which a student can be "right." It is anticipated that other terms will emerge which offer similar insight.

Conclusion

Inextricably linked to the methodology employed for the study of classroom learning is the analytical framework applied to the data which emerge. These analytical frameworks are characterized by particular constructs which guide the research design, the data collection, and the consequent analysis. Cobb, for instance, attends specifically to the "obligations" and "expectations" of both the teacher and the students in a classroom (Cobb, 1994, private communication). In the research outlined in this paper, emphasis has been placed at the level of data upon student use of the terms "know", "understand" and "learn", and at the level of theoretical construct upon "agreement", "conviction", and "attribution of authority". The adequacy of these analytical frameworks and the associated theories must be judged by the coherence rather than the accuracy of their portrayal, and, most particularly, by their viability as instruments to advance our modelling of the process of coming to know.

In this research, an attempt is made to optimize the use of currently available technology through the synthesis of classroom videotape and interview data

in an integrated video and text "document". The analysis of the resultant data is enhanced by the use of an indexing tool with the capability to undertake complex qualitative analyses of textual data in a replicable fashion. Some preliminary findings are reported which employ students' use of the term "right" to offer insight into the process of "coming to know" in science and mathematics classrooms. The research procedure described in this paper appears to offer an approach to the investigation of classroom learning at least as potentially fruitful as any other currently available.

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