

EXPLORING A DISCURSIVE PERSPECTIVE ON MATHEMATICAL EXPLANATION

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The nature and role of explanation in mathematics classrooms has been investigated from a variety of different perspectives. In this paper, I consider a possible approach derived from discursive psychology. This approach sees explaining as a situated, discursive practice and seeks to understand how explanations are locally accomplished in interaction. Analysis seeks to uncover the structure of explanations from the participants' (rather than analysts') perspective. By working on an example of mathematics classroom interaction I explore how this perspective could be useful for research in this area.

INTRODUCTION

There has been quite a bit of research on explanations in mathematics classrooms, including work on argumentation, justification, reasoning and proof. Some of this work takes a broadly social, discursive perspective, e.g. Yackel (2001), Yackel and Cobb (1996), Krummheuer (1995) or Zack and Graves (2001). Nevertheless, the analytic focus is often on what the teacher does and on what the teacher can do to encourage students to offer more effective explanations for their mathematical ideas. A general assumption is that, following Vygotsky (1978), for students to explain their thinking is an important part of the learning process.

Explaining, however, is not an activity exclusive to mathematics classrooms. Indeed explaining is a basic feature of interaction in a wide range of settings (Sacks, 1992). Drawing on work in conversation analysis, research in discursive psychology has examined the structure of explanations in everyday talk, highlighting the underlying patterns through which they arise. In this paper, I consider the possible use of this perspective for the analysis of mathematics classroom interaction.

A DISCURSIVE PSYCHOLOGY PERSPECTIVE ON EXPLANATION

Discursive psychology (Edwards, 1997; Edwards and Potter, 1992) takes a non-cognitivist, relativist perspective on psychological processes. Rather than trying to work out what happens in individual minds, psychological activity, such as thinking, knowing, remembering, is seen as constituted through interaction. That is, an instance of remembering or knowing is seen as jointly produced by participants in some kind of interaction and as being organised (at least in part) by the particular concerns of the situation.

From the perspective of discursive psychology, explanations are not seen as straightforward representations of what is in an individual's mind. Rather, they are seen as situated in interaction and as organised in part by the structure of that interaction. This organisation includes the key structuring aspect of talk: turn-taking (see Silverman, 1998). Turn-taking is further structured around *adjacency pairs* or

two part sequences, such as question-answer, invitation-acceptance, blaming-denial. Adjacency pairs can be seen to have a *preference structure*, including patterns of expectable responses to the first part of an adjacency pair. The preferred response to an invitation, for example, is an acceptance. Dispreferred responses are marked in some way. Declining an invitation, for example, will often begin with a hesitation, an expression of pleasure at receiving the invitation, a refusal and an account for the refusal. e.g. 'Errm, well it's very kind of you to ask but I'm afraid that I can't come, since I have to go to a meeting at that time.' The initial pause and 'erm' are markers of dispreference.

EXPLANATION SLOTS

Conversation analysts and discursive psychologists refer to explanations as 'accounts' – utterances that account for something; often, for example, they account for dispreferred responses (e.g. in the above example, 'I have to go to a meeting'). Accounts occur at quite specific points in interaction, which Antaki (1994) refers to as 'explanation slots'. Antaki summarises the commonest patterns in which explanation slots appear in everyday talk, which he divides into two broad groups: slots set up by a speaker for someone else, and slots set up by a speaker for themselves.

Explanation slots set up for someone else

Noticings: commenting on something marks it as unusual or noticeable and an explanation is expectable (for transcription conventions used in the paper, see [1]):

- B: Hello::
A: HI::
B: Oh:hi:: 'ow are you Agne::s
A: Fine. Yer *line*'s been busy
B: Yeuh my fu(hh)-'hhh my father's wife called me

(from Pomerantz, 1980, quoted in Antaki, 1994, p. 77)

A's noticing that the 'line's been busy', is following by B's explanation that 'my father's wife called me'.

Problem setting: explicitly asking for an account of something noticeable, often marking it as problematic.

- N: What's doin' (.)
H: a-ah:, noth[in:
N: [Y'didn't go meet Grahame?
H: .pt .hhhhahh Well, I got ho::me=
N: = u-hu:h?
H: ayu::n:: .hh he hadn' called yet 'n there weren't any messages'r...

(from Button and Casey, 1985, pp. 29-30, quoted in Antaki, 1994, p. 79).

N sets up the problem ‘Y’ didn’t go meet Grahame?’ which is followed by H’s explanation of what happened.

Explanation slots set up by the speaker for themselves

Giving a dispreferred second part of an adjacency pair: e.g. turning down an invitation or request, disagreeing with an assessment of something, admitting to blame for something, giving an unexpected response to a question.

B: No it’s terribly...terribly cultural – in fact you can’t separate yourself from – natural free associations about each word [*unintelligible*]

A: Well I can because I’ve lived in two [s] very different countries

(Antaki, 1994, p. 82)

In this exchange, B makes an assessment about something. The preferred response to an assessment like this is an agreement, often in slightly stronger terms. A, however, disagrees, and since disagreement is dispreferred, an explanation follows.

Self-initiated requests, assessments etc.: explanations may be given as to why a request or assessment has been made if it may be interpreted as problematic for some reason. For example, an awkward request is often accompanied by an account of why it is necessary.

A: m Thank you very much indeed – do you know anywhere which does sort of...service flats for people ‘cos I’ve got, I...think I shall probably have to come up to town...and stay for a few weeks in October

(Antaki, 1994, p. 87)

A’s request is somewhat awkward, perhaps because A is asking a stranger for advice. The request is followed by an explanation of why it is necessary.

It should be noted that Antaki’s analysis focuses on the structures of interaction through which accounts or explanations arise and are interpreted by participants, not on the nature of the content of these explanations. It is evident from the examples, however, that the accounts are doing considerable social work, in terms of positioning the participants, for example. As Antaki says, ‘a speaker can call for an explanation, or can signal that she or he is about to give one; both cases are matters...of marking out shifting positions’ (p. 68). This level of analysis, however, has to be based on the social organisation of explanations, since interpretation of the content must be derived from its interactional purpose (i.e. an account for a refusal, or for not answering etc.).

EXPLANATION SLOTS IN MATHEMATICS CLASSROOMS

In the session at Lancaster, I invited participants to use the preceding ideas to examine various extracts of mathematics classroom interaction, mostly taken from my research. None of the extracts were collected specifically for this purpose. I will

discuss one of these extracts, which shows two Year 5 students working on the task of writing an arithmetic word problem together. The students, Verity and Tahira, have been asked to write a word problem involving division:

- 36 T I can think of times one
37 V mm
38 T if/[if there were um
39 V [y-
40 T if you had um/ twelve sweets
41 V twelve/ sweets/
42 T and you had um/
43 V you had/ how many people?/ six people
44 T six people
45 V yeah 'cause half of twelve is six/ if you/ had
46 T six people
47 V six people/ how many sweets/ how many sweets would they get each/
ac-
48 no/ actually/
49 T twelve divide six
50 V yeah twelve divided by six/
51 T do times
52 V no we're not allowed to do times/

Tahira & Verity, 5/12/00

Two or three explanations can be seen in this short exchange, in lines 45, 49 (repeated in line 50) and 52. The explanation shown in line 45 ('cause half of twelve is six') occurs in a slot set up for Verity by herself. She first asks a question, 'how many people?' (line 43). The expectable pattern following a question is that the other person would provide an answer of some kind, or else some account for why they are unable to answer. In this case, however, Verity answers her own question, 'six people'. To answer one's own question is unusual and positions the speaker as relatively powerful. Teachers, for example, often respond to their own questions, whilst students are less likely to, although it depends on the culture of the classroom. Verity deals with the interactional problem of answering her own question by following it up with an explanation (line 45).

The next explanation slot could be seen as being set up by Verity for Tahira (lines 47-49). Verity goes over the formulation of the question in their word problem, and then pauses and marks some kind of problem, 'no/ actually' (line 48). Tahira appears to hear this interruption as problematising the underlying mathematical structure of the problem, rather than the wording, since she supplies an explanation to again justify the choice of 12 and 6. This time, she uses the word 'divide', rather than Verity's earlier use of 'half'. An alternative account, however, is that Tahira's remark 'twelve divide six' (line 49) is an *assessment* of the problem that Verity has just read out: Tahira characterizes the problem as being about division. Verity provides the

preferred response to an assessment: she agrees with it, reformulating Tahira's assessment. This confirmation is followed by a problem setting from Tahira, 'do times' (line 51), that relates to her earlier comment 'I can think of times one' (line 36), as well as to the preceding assessment. In setting a problem (that the word problem is not about times), Tahira sets up an explanation slot for Verity. Verity provides an explanation that refers to the original instructions and that relies on an external authority (me) for the task (line 52).

In both these explanatory exchanges, Verity is positioned as more powerful than Tahira. In the first, Verity asks and then answers a question, providing a mathematical explanation to account for this unusual interactional course. In the second, Tahira attempts to critique the word problem, first establishing an agreed assessment of the word problem, which then allows her to set an interactional problem. Verity draws on an external authority to deal with Tahira's problem, ensuring that the status quo is maintained, and with it her own power.

DISCUSSION

The preceding brief analysis illustrates how mathematical explanation is organised at least in part by the social dimension of interaction. Although the above example involves mathematical explanations, in which the two students consider the mathematical structure of their word problem, the organisation of these explanations is shaped by the social structure of talk. The explanations serve to position Verity as slightly more powerful than Tahira within the exchange. This social dimension (managing local power relations) is therefore implicated in how the explanations are produced. Interestingly, the positioning of Verity as more powerful goes with the two explanation slots arising in her turns.

This analysis leads to questions about how explanations arise in mathematics classrooms. In much whole-class interaction the teacher is positioned as more powerful: does this positioning mean that most explanation slots arise for teachers rather than students? How do explanation slots arise for students in mathematics classrooms? Are the structures of interaction that lead to explanation slots in mathematics classrooms in any way similar to those of everyday talk? The discursive perspective on explanations outlined in this paper offers a framework within which such questions can be both raised and investigated.

NOTES

1. Transcription conventions: Italics indicates emphasis. / and (.) indicate short pauses. ? is for question intonation. [for concurrent speech. :: shows extended sounds. (hh) indicates laughter.

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