Simon Says: Direction in Dialogue

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There has been a steady increase in the quantity of mathematics education research focusing on language, discourse and interaction. A wide variety of theoretical frameworks and methodological approaches have been taken including discursive psychology, commognition, and discourse analysis. This paper explores the use of a conversation analysis approach to analyzing interactions in mathematics classrooms. In particular what this approach can tell us about the structure of interactions and the use of *repair* in the negotiation of mathematical meanings.

Keywords: classroom discourse, conversation analysis, repair

Introduction and Background

Several authors have focused on language, discourse and communication in the mathematics education literature over the past twenty years. Some authors have explored the relationship between discourse and identity (Boaler, Wiliam and Zevenbergen 2000, Lee 2006), beliefs about mathematics and beliefs about teaching and learning. Others have focused on interactional strategies and the implications of these for the learning of mathematics (O'Connor and Michaels 1993). More recently, Sfard (2007) has proposed a theoretical framework which conceptualises learning mathematics as a transformation and extension of learner's discourse. This "commognitive" framework treats a learner's discourse as the object of learning and not just the means of learning, raising the importance of research on mathematics classroom discourse.

There are many methodological approaches available in the research on discourse: discourse analysis including systemic functional linguistics, critical discourse analysis, discursive psychology and conversation analysis to name a few. This paper explores the conversation analytic approach as a means of explicating the complexity of interaction in the classroom setting.

After outlining the conversation analysis methodology the notion of repair is explored in the context of two extracts taken from transcripts of whole-class interactions. Differences in the organisation of repair between the classroom contexts and everyday conversation are then examined and the implications these differences have on the learning of mathematics are discussed.

Conversation analysis

The origins of conversation analysis lie in the analysis of naturally occurring conversation but have been extended to include the analysis of institutional settings such as courtrooms and emergency help lines (see Drew and Heritage 1992 for more examples). McHoul (1990) used a conversation analysis approach in his study of geography classrooms and Seedhouse (1996) offers an in-depth analysis of second language classrooms.

Conversation analysis (CA) as a methodology assumes that interaction is structurally organised and the goal of CA is the exposition of this structure from the perspective of the participants themselves (Levinson 1983). Consequently, claims about the existence of

various structures of interactions need to be supported with evidence in the transcripts that the participants orient themselves to these structures. This is often referred to as the next-turn-proof-procedure and serves as an attempt to offer empirical proof and prevent the imposition of the researcher's preconceptions.

Of particular importance to the analysis of classroom discourse is the CA dynamic view of context. The well-known initiation-response-feedback (IRF) triad from a discourse analytic approach is proposed as a common feature of classrooms but this takes a static view of the context of the classroom. The CA approach examines why the IRF triad shapes the classroom context. In particular, each occurrence of an IRF sequence can only be understood within the sequential context of the interactions as they are affected by previous utterances and it influences those utterances that follow. Each part of the triad has multiple roles in relation to what has occurred before and in what is to follow. A response, for example is constrained by the nature of the initiation it follows but also constrains the feedback that is yet to come. The CA approach therefore offers a tool for explicating the fluidity of classroom interaction, in particular how the context (mathematical, task-based, management) can shift during and after individual turns. A CA approach provides an in-depth analysis of a specific context but also limits the generalisability of any analysis.

Talk in classrooms is usually goal oriented. The multidimensionality (Doyle 1990) of classrooms means there are multiple goals influencing interaction in the classroom. These include the pedagogic goals of the teacher and the wider goals associated with the behaviour, motivation and learning of the participants. CA examines interactions with reference to these goals, but the analysis seeks only to examine the interactional advantages and disadvantages and does not evaluate the effectiveness of these interactions from a pedagogical perspective. This could lead to a conflict between pedagogic goals and the interactional goals controlling the discourse.

The structures of *turn taking* and *repair* are particularly relevant to the classroom contexts and it is the latter that is the focus for this paper. There are three features of a repair: the trouble source; the initiation; and the outcome. Trouble has a broader definition than that of errors and mistakes, including difficulties in understanding, hearing or in the structure of the interaction itself. The repair initiation and outcome are sequential and can be performed by the speaker in which the trouble occurred (self) or other participants (other). Self-initiated self-repair is the preferred type of repair, occurring most often in everyday conversation, whilst other-initiated other-repair is very rare (Schegloff, Jefferson and Sacks 1977). In CA, the preference for self-initiated self-repair is not that the participants like or want to do this, but the act is socially affiliative. Preferred actions are normally bald and direct, without hesitation or delay, whilst dispreferred actions usually include hesitation, mitigation, and delay. There is some evidence that the preference organisation of repair is different in the classroom context (McHoul 1990) with other-initiated repairs occurring more frequently. This is perhaps unsurprising in many classrooms as it is often the teacher who not only has the expertise to identify the trouble source but also the authority to initiate a repair.

The data discussed in this paper is taken from the transcript of a lesson with 12-13 year old students, considered to be high achievers in relation to their peers, focusing on measures of central tendency, and is chosen to exemplify the features of repair outlined above. The students have been asked to calculate the missing value if the mean is 70 and the other values are 72, 43, 85 and 71. The extracts are taken from the whole-class interactions that occurred after the students had been given some time to work on the problem individually.

Extract 1

1	Sam:	I added them all up
2	Simon:	you added them all up

Sam has been nominated by the teacher (Simon) to explain what he did. His answer is incorrect and Simon initiates a repair in line 2. Immediately we can see the importance of knowing the interactions that preceded this interaction in order to identify Sam's utterance as causing trouble. However, these two utterances do not themselves offer evidence that this is in fact an other-initiated repair. We need to look at the utterances that follow for that:

Extract 2

3	Sam:	yeah
4	Simon:	so you did (0.9) what that (0.6) plus that (0.5) plus that, did you add that one on as well.
5	Sam:	u:m: no
6	Simon:	okay
7	Sam:	and then (0.6)I: (1.5) divided that by five (0.7) to get the how much she needed (0.7) in the last (0.3) um: (.) test.
8	Simon:	so you added up the four numbers, (0.8) you added up four numbers (0.3) and then you divided by five? (1.8) is that it?
9	Sam:	yeah

In line 3, Sam's affirmative response indicates that Simon's repetition of his answer in line 1 has been understood by Sam as a check that Simon has heard and understood Sam correctly. In lines 4 and 8, it becomes clear that Simon in fact meant his repeat as a repair initiation by repeating, expanding and recasting Sam's initial response further and emphasising the words four and five in line 8, locating the source of the trouble. The repair itself is not performed in the entire episode but the dispreference for other-repair is clear from Simon's final utterance:

Extract 3

18	Simon:	Sam added them up. okay (1.2) Sam added them up shhshh shh shh. Sam added them up, (0.7) they added up to two hundred and seventy one, that is a useful bit of information (1.0) bu:t that thing about dividing by five. that seemed to me, I don't know, a little bit nonsensical cause you've only got four

numbers, dividing by five I'm not sure. Phillip.

Here Simon is now addressing the class as a whole. He starts by repeating Sam's response and follows it with a positive evaluation. Then he pauses before locating the trouble again. This second half of the response is hesitant and mitigated with vague phrasing "that thing about" and hedged comments "seemed to me", "I don't know", "I'm not sure". Simon is avoiding making the repair, and in this example, the repair is not directly made until the next student speaks and offers the expected answer:

Extract 4

19	Phillip:	um you need, if yo-, you can find th- like all the numbers, the end mark, the end percentage means that there's like three hundred and fifty percent altogether divided by five it comes up to seventy.
20	Simon:	right hold on a sec. (0.5) three hundred and fifty percent,(.) er I suppose, can you add percentage together and then get three hundred and fifty per[cent I suppose so]ok (0.9)
21	Phillip:	[no what we]
22	Simon:	so you're saying that if you've got five numbers (0.4) and you want to get a mean (.) of seventy

In this example, Phillip is searching for the words he needs to explain what he did. In line 2, Simon initiates a repair focused around the trouble associated with whether you can have three hundred and fifty percent or not. There is no indication in the interaction as to whether this is Simon's interpretation of Phillip's trouble (in which case it is an other-initated repair) or a new trouble source which is Simon's himself (in which case it is a self-initiated repair). Phillip's interruption indicates that this was not the source of trouble for Phillip; Simon recasts Phillip's answer in line 4, consequently performing the repair.

Each of the two repairs in extract 4 is clearly different in nature. The first is a difficulty in communication revealed by Phillip's word search, whilst the second is mathematical (can you have three hundred and fifty percent?). The latter appears to be repaired in the same turn as the trouble (line 2) yet in line 4, Simon's recasting uses the word number instead of percent, indicating that a repair of meaning has not actually been performed. It is interesting to note that the trouble in the first extract was also mathematical and in both cases, the repair was to some extent not performed.

In conclusion, a conversation analytic approach offers an effective tool for exploring and exposing the structure and complexity of mathematics classrooms. In particular, the preference organisation of repair explicates the roles adopted by the participants of teacher and students. The more frequent prevalence of other-initiated repair defines the teacher as expert and in a position of authority, similar to adult-child interactions in other contexts. The dispreference for other-initiated other-repair remains evident in the extracts discussed above.

Future work will include the analysis of a broader data set to examine the structure of repair in the secondary mathematics classroom. This includes exploring the similarities and differences between the nature of the trouble source, the participants in the repair and the repair trajectory. The implications of each of these on the learning of mathematics are of

particular interest. For example, the relationship between the dispreference of other-initiated other-repair and the role of errors and mistakes in the learning of mathematics.

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