Working Group Reports

Report of the mathematics education and the analysis of language working group

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In this report we present key points from the input and discussion at the working group meeting during the day conference in Bristol.

Keywords: language, analysis, Habermas, mathematics education.

Background to the working group

At the Bristol day conference, the Mathematics Education and the Analysis of Language Working Group met for the fourth time since re-forming in November 2011. The aim of the group is to offer participants an opportunity to dwell in the moment of interaction with language data. We share approaches to the analysis of transcripts of classroom talk and raise awareness of issues. In this session, we worked on a framework and some data provided by Geoffrey Kent.

Background to the data

The research that the data are from focused on the close examination of student interactions in classrooms in which teachers were in the process of adopting complex instruction practices. This research was done with teachers who were also participating in the first stage of the research, which eventually led to the Raising Expectations and Achievement Levels for all Mathematics Students (REALMS) research project (see http://www.sussex.ac.uk/circlets/projects/realms). Based on data collected at a workshop at the University of Sussex in the summer of 2008, the sites in the REALMS study were selected for their stated intention to eliminate setting in year seven, and to adopt complex instruction practices. I approached several teachers participating in the preliminary stages of the REALMS study to see if they would participate in additional research for my thesis and three teachers at three different sites agreed to participate.

Framework for analysis

Habermas (1985a) describes communicative action as a process of coordinating action by achieving mutual understanding of goals and means to achieve them. In this process of communication, utterances of the participants implicitly raise validity claims in each of three realms: normative; objective; subjective. It should be noted, perhaps, that Habermas would suggest that while one or the other of the validity realms might be thematically emphasised in an utterance, all utterances that are part of communication tacitly make claims in all three realms. Thus if we were working together on a mathematics problem and I said ‘Perhaps this problem is related to completing the square.’ in response to an insight or comment you had made about the

problem, I would be making three tacit claims: 1) that it is appropriate to make such a contribution in this situation; 2) that my comments make sense (or refer to) an epistemologically objective world (which we share access to); and 3) that I am being sincere. These three claims, which are mainly made tacitly (although I would suggest in this example that the reference to an epistemologically objective world of symbolic mathematics is thematically at the fore), are basis on which the collaboration entailed in communicative action takes place. In my analysis I used codes to identify what seems to be the thematically dominant claim or claims, and there was often some overlap and double coding.

In the course of coordinating goals and related actions, other participants can challenge validity claims and when this happens the participants enter into 'discourse' (Habermas 1985a, 42). This validity-discourse is one that is focused on explicitly re-establishing the tacit consensus that has broken down. The model is a cyclical interactive process with a number of steps or stages:

1. Participants coordinate action around determining goals
2. Participants coordinate around how to achieve goals
3. Participants engage in interactions aimed at achieving goals by reaching common understanding through consensus (tacit or explicit).
4. Any participant can challenge the utterances that constitute this consensus, and these challenges can be levelled at any one of the three types of validity claim.
5. According to Habermas (1985a), when an utterance is challenged, it must be supported, altered or abandoned in order to re-achieve the consensus that constitutes understanding in the group interaction.

The interaction cycles through steps 2 through 5 until the participants decide they have achieved their goal outlined in step 1 (see Figure 1). This model was developed by the researcher to attempt to make sense of the open coding and analysis being done in early stages of research. It attempts to make clear how the codes could meaningfully be related to each other and served as a constellation of analytical

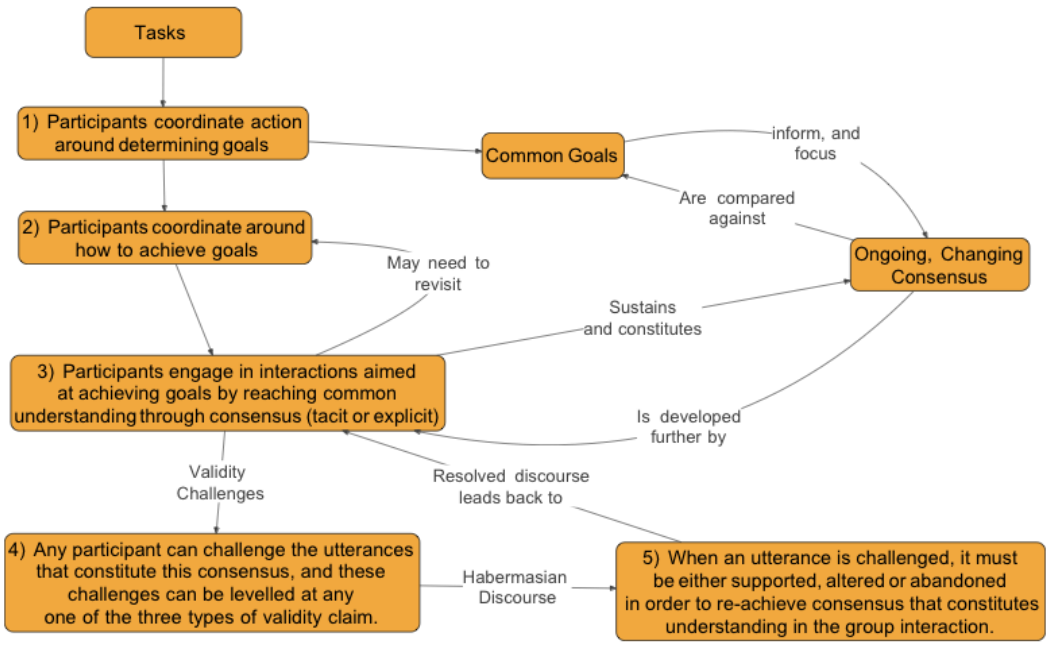

Figure 1 Initial Intersubjective Model of Student interaction

statements and/or hypotheses that were taken back to the data tested and refined in the course of ongoing analysis.

There are two main elements that are not part of these steps but which are shown in Figure 1. These pieces are again influenced by Habermas' theories, and were seen by the researcher as necessary in order for the interpretation from the perspective of communicative action to be meaningful and coherent. The first is the tacit or explicit common goal, and the second is the ongoing, fragile and temporal consensus entailed in the problem-solving discussion. Also missing in this model are the relationships between consensus and action, task completion and understanding. If the task is well designed it is possible achieving the goals set out in the task entails the understanding of certain mathematical concepts and/or knowledge. Thus by coordinating their actions to achieve the task, the students may have intersubjectively understood the content. For instance, step three could be amended: '…and then do the actions that correspond with that consensus which in aggregate will achieve the common goals (in this case the product of the task)'.

It is important to note that the term discourse is used in a much narrower sense in Habermas' work (Habermas 1985a, 42). This does not imply that Habermas ignores the other broader use of the term referring to these ideas in terms of particular cultural settings and/or contexts. Analytically, Habermas considers all participants in a communicative interaction to have equal rights and opportunities to participate. This is due to the presumption of an ideal speech situation. Communicatively, teachers have no recourse to authority except through their ability to bring to bear the 'unforced force of the better argument' (Habermas 1985a; 2002). This is again a

Figure 2 Initial Intersubjective Model of Student interaction

counter-factual idea conceived of abductively by Habermas as a prerequisite for communicative action. Abductive reasoning, is an attempt to generate explanatory hypotheses based on analysis of evidence such that what is abduced as a hypothesis would, if it were the case, make the nature of the evidence (as analysed), a matter of course. Thus for Habermas, if the preconditions are not assumed (or cannot be interpreted as being assumed) the interaction between participants could not be interpreted as communicative action, but would rather be 'distorted' (if it were pretending to be communicative when it was not) or strategic action.

Using Bassey's (1999) concept of 'Theory Seeking' case studies the research design focused on the process of connecting research questions to empirical findings. The model of case study research used begins with research questions, and proceeds through the collection and storing of raw data as data items, to an iterative process wherein the analysis of the data items generates analytical statements. These analytical statements are then tested against the data items and refined. Once the analytical statements have been refined 'as much as possible' this iterative process is considered exhausted and the analytical statements are 're-expressed as empirical findings' (ibid). The research design for this study made extensive use of generating analytical statements at the different stages of the analysis and testing them and refining them in the service of developing theories to understand the interactions of participants. Thus below one can see the refined intersubjective model of student interaction.

The model is focused on participants (with a privileged position for the teacher) interacting in small groups around a mathematical task. The model seeks to articulate patterns of interactive utterances in small group interactions. Students begin by coordinating their action by emphasizing the establishment of shared goals. These initial interactions, as the students try to understand the task, what the expectations

are, and what the mathematical (and potentially other) content is, leads to either negotiation around goals (validity-discourse on goals), or to a relatively stable agreement about what they think they are supposed to do. In the latter case the students move onto 'working' on the tasks at hand. In this phase the students articulate ideas, opinions, and assertions of fact that contribute to a shared network of ideas that are oriented on the mathematical task and satisfying the goals related to the mathematical task.

During this phase of groupwork four things can happen: The students continue making constative statements that contribute to the constellation of ideas that is the 'product' of their coordinated speech acts; the students' consensus around constative utterances break down and need to be re-established through recourse to justification in validity-discourse around problem-solving; the students' consensus around goals breaks down and has to be re-established through justification based on normative expectations such that consensus around the coordination of action is re-established and the students move back to 'problem-solving'; Finally, students can reach a point were they decide that they have achieved their goals and are 'done'. Assuming the students get 'done' they will have some sort of product that they tacitly or explicitly believe addresses the goals of the mathematical task. If the process of interactive problem-solving is successful, this product will be a constellation of ideas, possibly including verbal, written, and/or graphical symbolic content whose meaning has been worked out through communication around the task.

This model represents an ideal carefully constructed from classroom observations, professional background knowledge, analysis of transcripts of episodes of utterances, interviews, reflective memos from participant observation, and theoretical insights from the theory of communicative action.

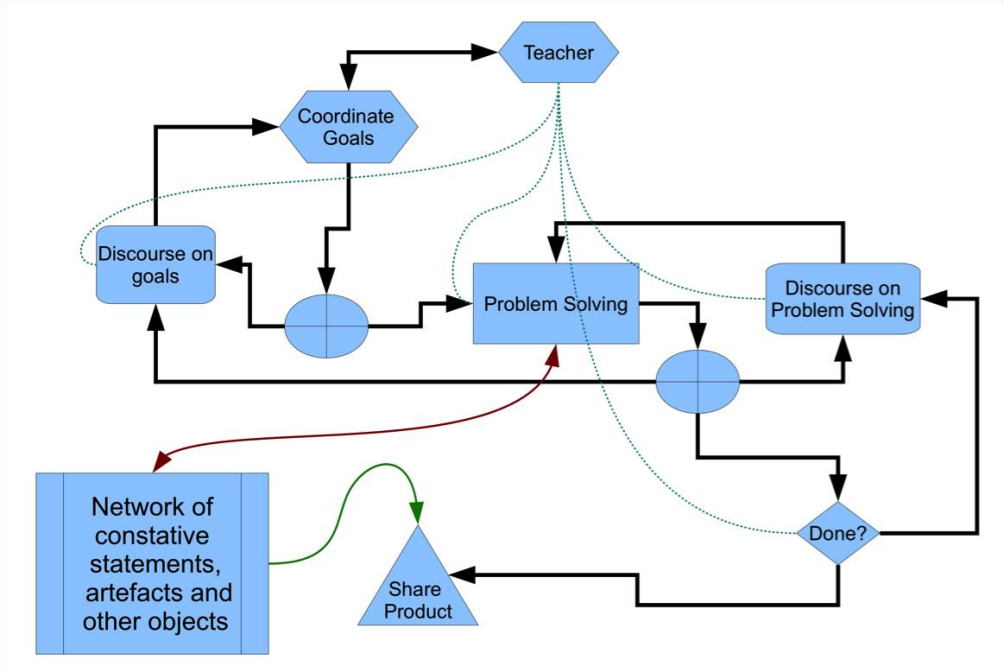

Figure 3 Refined intersubjective model of participant interaction

Analysing data

At the working group session, we offered participants a transcript of student interaction on a mathematics problem and invited them to try and code the talk using

the model above. The first task was to decide if the talk constituted one of the three realms of validity claims (normative; objective; subjective); whether the talk was focused on problem-solving; or, whether the talk was around co-ordinating. An example of an excerpt of coded data, codes and key are below.

Harry goes on reading the task card until 3:11

Harry: ok does everyone understand? [Question: others' understanding] [QD; QC]

Thomas: we understand- now we want to move on [Statement of understanding] [SD/SC]

Harry: ok you understand [pointing at Thomas]; do you understand [pointing at Charlotte], Charlotte– off in a different world [Checking understanding; accusation of non-participation] [QD/SC]

Charlotte: no I'm not [Response to accusation: Objection] [RC]

Harry: ok Daniel do you understand? [Question: others' understanding] [QD; QC]

Daniel : yes I do [enthusiastically] [Response to question: affirmative] [RD; RC]

Thomas: I reckon we should divide into two so some people work on this and some people work on the other question [Statement: suggestion for division of labor] [SC]

Harry: This is a bit embarrassing Dan - ok I need a pen – ok you're sure – ok investigate the number of factors different kinds of numbers have – ok so Rafael [Orientation Statement] [SC]

Thomas: You and Daniel are going to fill out this [holding up the factor chart] and try and get as far as you can; it's very simple does everyone understand what a factor is? [Taking control of process: Division of labor; Statement: denigrating task difficulty; Question: others' understanding] [AA; QD; QC]

Charlotte: numbers that go into [Response to understanding check] [RD; RC]

Thomas: no it's numbers that multiply together to ; so one… let's just do the first ten [Statement: denigrating response; taking control of process] [SVCh; AA]

Harry: ok [SC]

Figure 4 Transcript Excerpt Divisor Counting

Communicative Utterance Codes			
	Statements	Questions	Responses
Validity-Discourse	SV, SVCh, TD	QD, TD	RD
Constative and/or Problem-solving	SPS	QPS	RPS
Coordinating	SC, TC	QC, TC	RC

KEY:

Code	Description
SV	Validity Statement
SVCh	Validity Challenge
TD	Teacher Validity- Discourse Modelling
QD	Validity-Discourse Question
RD	Validity-Discourse Response
SPS	Problem-solving (constative) Statement

QPS	Problem-solving (constative) Question
RPS	Problem-solving (constative) Response
SC	Coordinating Statement
TC	Coordinating Teacher Move
QC	Coordinating Question
RC	Coordinating Response

Discussion

Several important and interesting issues were raised in discussion, which we can only give a flavour of in this report and which we raise in the form of questions:

- Do you try to code each sentence? each utterance? or a longer section of talk?
- How do participants' roles influence their interaction?
- How do the cycles of validity/problem-solving/co-ordination discourse interact and influence each other (e.g., possibly simultaneously)?
- The framework seems largely cognitive, but what about the social?
- Do we need to consider the *function* of speech?
- Do we use the transcript as the data to analyse, or the recordings themselves?

One fascinating insight that arose from the group concerned the issue of when, in the transcript, there seemed to be a switch from one cycle to a different cycle. One participant attempted the analysis using her own framework, derived from the work of Mercer. Although the categories are entirely different, her framework identified a shift in discourse at the precise line where others in the group had identified a shift using the framework from Habermas. There is perhaps a link here to the notion of networking theories, i.e., that something interesting can occur when we bring different conceptual lenses to bear on the same data and look at the similarities and differences in analysis.

Thank you to Geoffrey, for bringing such rich data to the group. If you would like to be kept in touch with the work of this group, please email alf.coles@bris.ac.uk, for example, if you have some data you would like to bring to a future meeting.

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