COORDINATING MULTIMODAL SOCIAL SEMIOTICS AND AN INSTITUTIONAL PERSPECTIVE IN STUDYING ASSESSMENT ACTIONS IN MATHEMATICS CLASSROOMS

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What can a multimodal social semiotic perspective in coordination with an institutional perspective make visible? In this paper we describe how we coordinate these two perspectives in order to look at the same empirical material with different focuses. The research interest is assessment actions in mathematics classrooms, an interest that also affects research objectives and possible results. When coordinating the different perspectives, we have chosen, for the analytical frame-work, to develop the social semiotic meta-functions by adding a new, fourth, meta-function: the institutional. For the detailed analysis, we connect to these four meta-functions other compatible concepts to create an analytical framework.

BACKGROUND

The focus of this paper is to describe how we coordinate two theoretical perspectives, multimodal social semiotics and an institutional perspective, in order to create a structured and nurturing analytical framework for the analysis of assessments during lessons in mathematics. We will start out by describing some of our central notions of assessment.

Assessment – a broad concept

Both in cases where some people realise that they actually are "capable" in mathematics, and in other cases where people think that they will never come to terms with it, we can notice "hidden" stories about assessment. Obviously, assessment explicitly takes place when students are given their mathematics test results. But often enough, assessment is implicit during teacher-student interaction in learning sequences. One example is the following: a student asks the teacher about a certain mathematical "rule" and wonders where it comes from. The teacher's answer, by way of different communicational modes, shows that this particular student does not have to bother about such a question. S/he is just asked to follow the rule. But when another student asks the same question, the teacher engages in a discussion about the historical development of this particular rule. The first student in this example learns, through this implicit assessment, that the teacher does not consider her/him capable enough to understand this kind of question. Our assumption is that both the explicit assessments and the implicit assessments in mathematics classrooms play a key role for students' learning. The empirical examples we use in this paper focus on implicit assessment actions.

COORDINATING TWO THEORETICAL PERSPECTIVES

As stated above, we hold that we are coordinating two different theories. Prediger et.al. (2008) make a distinction between *coordinating* and *combining* theories. They define "coordinating" as a term for bringing theories together that contain assumptions that are compatible, whereas "combining" is when the theories are only juxtaposed.

A multimodal social semiotic perspective

In a multimodal approach, all modes of communication are recognised (Kress et.al. 2001). Communication in a multimodal perspective is not understood in the same way as communication in a narrow linguistic perspective, focussing on verbal interaction only. Rather, all kinds of modes have to be taken into consideration, such as gestures, and gazes, pictorial elements and moving images, sound and the like. Relevant modes in (most) mathematics education are, for example, speech, writing, gestures and gazes as well as graphs, diagrams, physical objects, symbols, pictures and virtual animations. Modes are socially and culturally designed in different processes of meaning-making, so their meaning changes over time. It is also the case that one "content" in one kind of configuration (for example as speech), will not necessarily be the "same" content in another configuration (for example as illustration). Different representations of the world are not the "same" in terms of content. Rather, different aspects are foregrounded. In verbal texts we read linearly, within a time frame, whilst a drawing will be read within a space frame. And a graph does not represent a knowledge domain in the same way as numbers does. The modes that are "chosen" in a specific situation reflect the interest of the sign maker, and they are therefore not arbitrary. We argue for the importance of understanding multimodal communication to be able to fully understand a phenomenon as assessment. Language, in a broad sense, "may serve as a crucial window for researchers on to the process of teaching, learning and doing mathematics" (Morgan 2006, p 219).

We also argue that the assessment of learning (in a deeper sense) is about understanding *signs of learning*, as shown by different communicative modes (see Kress 2009, Pettersson 2007, Selander 2008b). This perspective is based on an understanding of learning as an increased engagement in the world, and as an increased capacity to use signs, modes and artefacts for meaningful communication and actions (Selander 2008a).

Institutional perspective

Within social semiotics, there are acknowledgements of institutional aspects, even though they are not always as clearly outlined as in the following:

> Detailed studies of the use of a given semiotic resource are interesting in their own right, but they also demonstrate a theoretical point. They show how the semiotic potential of framing is inflected on the basis of the interests and needs of a historical period, a given

> type of social institution, or a specific kind of participant in a social institution (van Leeuwen 2005, p 23, see also Morgan 2006)

Institutions are often taken for granted by the researcher who "knows" the situation. But without some idea of the communicative situation, it is very difficult to draw conclusions from, for example, a conversation. Here, we will go one step further in addressing "the institution" in its historical context. We understand that the interactions between teacher and student are situated in a context characterized by dominant mathematics education discourses, the use of artefacts developed over time, framings in terms of specific resources for learning, division of labour and time, established routines, classroom structure and authority.

Douglas (1986) argues that institutions (rituals, norms and classifications, what counts as centre or periphery etc.) affect the decisions made by individuals, for example the way they classify "phenomena" and "things". Existing classification systems are often taken for granted. In this paper, we take the stance that classifications are products of social and cultural negotiations (Bowker & Star 1999). Wertsch and Toma (1995) emphasise that powerful institutional parameters constrain classroom discourse (see also Bartolini Bussi 1998, Lerman 1996). Our understanding of thee term institution is also to be seen as being in line with a dynamic view:

> Importantly, however, the thinking and meaning-making of individuals is not simply set within a social context but actually arises through social involvement in exchanging meanings (Morgan 2006, p 221).

Institutional framings have both direct and indirect effects. Decisions may be made on different "levels" in the school system, which have a direct impact on the classroom work. However, in this paper we will try to outline the indirect aspects, such as classificatory systems, norms and traditions developed over time. We will also use the institutional aspect already in the creation of analytical categories, not only as an overall umbrella-tool for reflecting over the results (see Björklund Boistrup 2007).

AN INSTITUTIONAL PERSPECTIVE IN RELATION TO META-FUNCTIONS

Inspired by Halliday (2004), social semioticians usually talk about three communicative meta-functions: the ideational, the inter-personal and the textual. In Morgan (2006), these functions are used with a focus on the construction of the nature of school mathematics activity. In this paper, we start out with the meta-functions as used by Kress et.al. (2001), focussing on assessment in mathematics.

As we see it, the three meta-functions are strong concepts for discussing situated communication and learning. However, two different kinds of restraints need to be noted. The first concerns the fact that not *all* possible communicative aspects can be

captured by the three concepts. For example, expressive modes are not well captured (van Leeuwen 2005). Secondly, to be able to fully address institutional discourses in the situated communication and learning (as in this study), a wider notion of institutional framing (norms, institutional practices, classifications of good or bad performance etc.) seems to be needed. Communication in a classroom has different characteristics than communication in court or in a medical consultation. We add a fourth, *institutional* meta-function (proposed by Selander 2008c).

META-FUNCTIONS AND RESEARCH OBJECTIVES

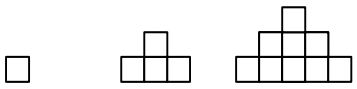
In this paragraph, we describe the four meta-functions and relate them to the research objectives of an ongoing research project on assessment actions in mathematics classrooms in grade 4 (10-year-olds). Even if all four meta-functions are present in all cases, in each and everyone of them, one function is in the foreground and the others are in the background. Thus, the division into four meta-functions related to four research objectives is meant to be seen as an *analytical* framework.

The ideational meta-function – aspects of mathematical competence

The *ideational* meta-function is related to human experience and representations of the world (Halliday 2004). When using this meta-function and aligning it with the *research interest* of assessment, the aim for the research project is to investigate what aspects of mathematical competence that are represented and communicated in the assessment actions.

In order to find a structure which can serve as part of the analytical framework for the more fine-grained analysis, we draw on a structure presented by Skovsmose (1990). He discusses mathematics education and the possibilities for mathematics to serve as a tool of democratisation in both school and society. He presents a structure of three aspects of mathematical competence:

- Mathematical knowledge itself
- Practical knowledge. Knowledge about how to use mathematical knowledge.
- Reflective knowledge. A meta-knowledge for discussing the nature of mathematical constructions, applications and evaluations.



First three figures in pattern.

In the following sequence, the students in the class are working in pairs on patterns. A boy (B) and a girl (G) are working together. Before the teacher approaches, these two students are discussing whether they need to count the squares one by one in order to find how many they are, or if they can use the pattern from an earlier task (1, 4, 9...). The excerpt shows what takes place when the teacher approaches the group. In the first line of the transcript, the students' speech (SS) and the teacher's speech (TS) are noted. In the next line, we find the students' and teacher's gestures (SG and TG), and in the bottom line the students' and teacher's body movements and gazes (SB and

TB). The actions that occur simultaneously are written above each other. The teacher starts by asking how things are going.

SS: G: *25* *Yes, it's going great!*

B*: This was strangely difficult.*

TS: *Are things going well?* *Why is it strange?*

SG: G is writing.

B stops writing.

TG:

SB: G is looking at her work and at T.

B looks at T and at his work. B looks at T.

TB: Approaches. Looks at G's paper. Moves close to G's desk. Looks at B's work. Moves closer to B's desk. Leans forward.

Time

We suggest that, during this lesson, the students get to show "Mathematical knowledge itself" related to patterns. The girl's comment that things are going great might be a sign that she feels that she has been able to handle the patterns well so far. The boy seems to have a different opinion. The teacher asks him and it becomes clear that this comment is mainly related to the aspect of mathematical competence focused on structuring one's notes. He has run into problems when drawing the figures:

SS: B: *You add this, but then it does not show that this one is this and that this one is this.*

TS: *No they are close now, but you can still see it I think. You'll have to leave more space between them.*

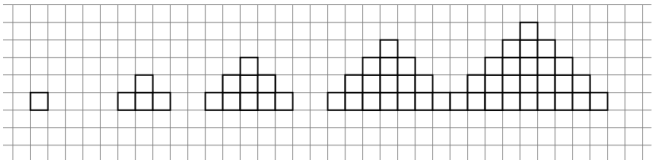
SG: B points at the figures on his paper.

TG:

SB: B looks at his work. B looks at T and down.

TB: Looks at B's work.

What he explains and shows by pointing is that two of his figures are drawn too close together on his paper, like this:



The teacher's comment is related to this "note-structuring" since she suggests that he should try to leave more space between the figures.

The interpersonal meta-function – feed-back, feed-up and feed-forward

The *interpersonal* meta-function is about how language (used in a broad sense in this paper) enacts "our personal and social relationships with the other people around us" (Halliday 2004, p 29). Morgan (2006) connects interpersonal aspects with assessment in an analysis of a classroom sequence. This is compatible with the way we use the interpersonal meta-function in this paper. Our *research interest* in relation to this is to find out what kind of assessment in the form of feedback and self-assessment is taking place in the interaction between teacher and student.

The structure for the detailed analysis is inspired by Hattie (2007). He suggests three kinds of feedback:

- feed-back – what aspects of competence has the student shown?
- feed-up – how can the aspects shown be related to stated goals?
- feed-forward – what aspects of competence might it be best to focus on in the future teaching and learning?

Using the same example as earlier, we find that the signs of assessment are shown both through the students' self-assessment and through the teacher's responses. Both the girl's and the boy's comments are within the category feed-back. The teacher's responses are connected both to feed-back and to feed-forward. We consider them as feed-back when the teacher communicates to the boy that his way of drawing the figures is acceptable; "No, they are close now, but you can still see it, I think". At the same time, she addresses a way of handling the very same issue during his continuing work, which we regard as feed-forward: "You will have to leave more space between them".

The textual metafunction – different communicative modes

The *textual* meta-function is related to the construction of a "text", and this refers to the formation of whole entities which are communicatively meaningful (Halliday 2004), in this case to other kinds of existing assessment systems and procedures. Teacher and students communicate in mathematics education with speech, gestures, gaze, pictures, symbols, writing and so on. According to this meta-function and our *research interest*, the objective is to investigate how different communicative modes (Kress et.al. 2001) are used and accepted by the teacher and the students. The boy shows his self-assessment on "note-structuring" by way of speech, gestures and drawings. The teacher listens and looks at the boy's work. Both the student and the teacher seem to accept different modes.

The institutional meta-function – tradition versus active participation

When it comes to institutional aspects of Swedish mathematics education, a dichotomous picture is often noticed (e.g. Palmer 2005, Persson 2006). On the one hand, the discourse of mathematics education is seen as "traditional", whereby students are expected to spend a good deal of time solely on solving all the problems

in a textbook. On the other hand, the "wanted" discourse of mathematics education which emphasises a joint exploration in which, for example, students are invited to be active participants in problem-solving. These two discourses of assessment are similar to the discourses described in the literature on assessment in general (see Gipps 1994, Lindström & Lindberg 2005). The two discourses of assessment in mathematics can be summarised in the following way:

"Traditional" discourse	**"Active participant" discourse**
Focus on the correct answer	Focus also on processes
Focus on teacher's guidance	Focus on the teacher promoting thinking
Focus on the number of finished tasks in the textbook in mathematics	Focus on the quality of the mathematical accomplishments
Focus only on the aspects of mathematical competence the student shows on her/his own	Focus also on the aspects of mathematical competence the student shows when working with peers
Focus only on written tests in mathematics	Focus also on documentation of the learning in mathematics
The teacher is the only one who assesses	The student is also part of the assessment

With inspiration from Lindström & Lindberg (2005).

In the following example, we keep to these dichotomous discourses. However, during the full analysis we will broaden the scope of discourses in relation to the findings. We will now go further on in the sequence from the classroom. We start out with the girl asking the teacher if it is possible for her to read what she has written and drawn on her paper. The teacher asks if the student understands it herself. The girl answers yes and the teacher says that she also understand the notes. Then the girl makes this comment:

SS: G: *Just so that you don't mark it wrong "here you are wrong"*

TS: "laughs" *Is that what I usually do?*

SG: B & G are writing.

TG:

SB: B & G look at own work. G smiles.

TB: Looks at G's work. Looks at B's work.

As we see it, the girl's comment refers to the traditional discourse of assessment in mathematics, since she proposes that the teacher might regard her notes as either wrong or right. The teacher engages in the discussion and asks if that is what the girl assumes that she as a teacher normally does. The girl answers no to this question and

suggests that the teacher sometimes asks about notes that she does not understand. The teacher acknowledges this and the girl continues:

SS: G: *It is actually quite good to ask if you don't know what the children have done*			*Yes..*
TS:	*Well, that is the only way to get to know.*	*Mm*	

SG: G & B are drawing.	G stops drawing.		
TG:			

SB: G & B look at their work.	G looks at T		
TB: Looks at B's work.	Looks at G.	Nods.	

Here, the other discourse is present, and by (finally) looking at each other, they seem to agree on this. To be able to assess the students' notes, the teacher might have to ask for clarification. The implicit assessment in this described activity is not just a matter of what is right or wrong. It is a matter of active participation by the student as well.

REFLECTIONS ON THE COORDINATION OF THEORETICAL FRAMEWORKS

We argue that the three meta-functions need to be understood in the light of institutional framings (also see Morgan 2006). The fourth meta-function is a way to both *understand* and *describe* institutional discourses as situated in history, and to address what it is that is at stake in conflicts and negotiations of assessment procedures and standards.

We find the theoretical perspectives described in this paper fruitful with regard to several aspects of the research process. We understand assessment as an act of meaning-making through a multimodal use of language. When defining the research objectives, the four meta-functions provide means to focus on different aspects of assessment actions.

In the short examples in this paper, we have shown how the aspects of mathematical competence that are present (the ideational meta-function) at first seem to be in patterns. But through the boy's speech, gestures and drawings, our understanding shifts to the structuring of notes. When it comes to the interpersonal meta-function. we find that both teacher and students show signs of feedback, and in the end the teacher also gives feed-forward. The textual meta-function gives us clues as to how the teacher and students use, and show acceptance of, different modes of assessments. Finally, the institutional meta-function makes it possible to describe the discourse as related to a strong tradition in mathematics education, but also in the ways in which new ideas can be ideationally, interpersonally and textually meaningful. In relation to this issue, we have described a situation in which the girl positions the teacher in a "traditional" discourse of assessment in mathematics (right-

wrong). When analyzing what the teacher's gaze is focused on, we can notice that she initially looks at the boy's work when she is talking to the girl. But finally, when she turns towards the girl, they look at each other and the gazes reveal an "active participant" discourse.

This coordination of perspectives, including an analytical framework, seems to be a fruitful (and sufficient) basis for the full analysis of the empirical material in the project, in order to be able to describe, understand and discuss assessment in the mathematical classroom in a way that has not earlier been done (in Sweden).

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