

DISCOURSES OF ASSESSMENT ACTIONS IN MATHEMATICS CLASSROOMS

Lisa Björklund Boistrup

Stockholm University

This paper presents some tentative results of a study on assessment actions in mathematics classrooms, as they appear in the interaction between teacher and student. The study has four research objectives and in this paper results concerning one objective, discourses of assessment in mathematics, are presented. The theoretical frame-work is an institutional/discursive perspective coordinated with a social semiotic perspective. For the analysis additional theories are included. When it comes to discourses of assessment and/or of mathematics education, a dichotomous picture is often described in literature. The results in this paper broaden this picture, including drawing attention to aspects concerning students' agency in assessment in mathematics.

This paper presents some preliminary results from an ongoing classroom study on assessment actions in mathematics classrooms. In this sense, this paper is an empirical paper. At the same time, the paper is an example of what a coordination into one theoretical framework of two theories, institutional/discursive (Foucault 1969/2002, 1971/1993) and social semiotics (Hodge & Kress 1988; van Leeuwen 2005), can contribute. In this sense, the paper can be considered as a theoretical one.

CLASSROOM ASSESSMENT IN MATHEMATICS

The concept of classroom assessment in this paper is taken to be a concept with broad boundaries. Obviously, assessment takes place explicitly when students are given their mathematics test results. But often, 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. 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 reasoning. My assumption is that both the explicit assessments and the implicit assessments in mathematics classrooms play a key role for students’ learning.

The purpose of the ongoing study is to describe and understand aspects of classroom assessment that have potential to afford possibilities and restrictions for students’ learning. Since at least Black & Wiliam (1998), there has been a call for classroom studies in depth in this area, and there still is a need (e.g. Hattie & Timperley, 2007).

I address four research objectives concerning: kinds of assessment actions; aspects of mathematical competence; roles of different communicational and representational modes; and institutional discourses of assessment in mathematics. The results presented in this paper are primarily related to the fourth research objective, but they are also connected to the first three,

In the ongoing study the interactions between teacher and students in five classrooms of 10-year olds (fourth grade in Sweden) are analysed. Two students in each class are (for ethical reasons) randomly chosen and the analysis is focused on the interaction between these two students and the teacher. The data material, from which the examples in this paper come, consists of video recordings and written material.

THEORETICAL AND ANALYTICAL FRAMEWORK

The two main perspectives are briefly described here and additional theoretical structures that are operationalised in the analysis are presented.

Institutional/discursive perspective

Drawing mainly on Foucault (1969/2002, 1971/1993), one of the two main perspectives in this paper is an institutional/discursive perspective. Assessment in mathematics education is taking place in school where there are institutional aspects present. Institutional aspects have both direct and indirect effects. Decisions may be made at different “levels” in the school system, which have a direct impact on the classroom work. There are also indirect aspects, such as classificatory systems, norms and dominant discourses (traditions) developed over time.

Discourse according to Foucault (e.g. 1969/2002, 1971/1993) is a broad notion which incorporates not only all ‘statements’ but also the rules that affect the formation of the possible statements in the discourse. By this, the discourse is more than everything that is communicated and the way it is communicated. The discourse is also present in what is not communicated, or what is communicated through gestures, attitudes, ways of being, patterns of actions, and the rooms and furniture. According to Foucault, discourses contain a limited numbers of ‘statements’, that is, discourses are finite. Other features are that they have a history, they have social distribution and they can be realised in different ways (Foucault, 1969/2002, 1971/1993; van Leeuwen, 2005). Discourses are materialised into discursive practices where the discourses are maintained by the ones that participate in the practice. My understanding of the term discourse is to be seen as being in line with a dynamic view, where “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). This dynamic view involves a stronger position for the individual, and *agency* is another concept that is operationalised in the analysis described in this paper (see also Mellin Olsen, 1993).

Social semiotic perspective

The other main theory in the used theoretical framework is a social semiotic perspective with a multimodal approach (Hodge & Kress, 1988; van Leeuwen, 2005). In a multimodal approach, all modes of communication are recognised and have to be taken into consideration for example in research on assessment in mathematics. In O'Halloran (2000) there is an interest in three semiotic resources/modes: mathematical symbolism, visual display and language, and the author addresses the impact that the multisemiotic nature of mathematics has on classroom discourse. In this paper, and in relation to assessment in mathematics, the range of possible modes is considered broader, including modes such as gestures and gazes, pictorial elements and moving images, sound. Modes according to e.g. van Leeuwen (2005) are seen as socially and culturally designed in different processes of meaning-making, so their meaning changes over time. Kress (2009) argue for the importance of understanding multimodal communication to be able to fully understand a phenomenon as assessment. Language, in the sense of communication, "may serve as a crucial window for researchers on to the process of teaching, learning and doing mathematics" (Morgan 2006, p 219).

Assessment of learning from this perspective is about acting on signs of learning, as shown by different communicative modes (see Kress 2009, see also Pettersson 2007). 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 2008).

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 the three meta-functions contribute to the focus of the construed discourses. 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). In this paper it concerns what kind of assessment in the form of feedback is taking place in the interaction between teacher and student. The *ideational* meta-function is related to human experience and representations of the world (Halliday 2004). In this paper it concerns what aspects of mathematical competence are represented and communicated in the assessment actions. 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), Here the focus is on what roles different modes play in assessment in mathematics classrooms as well as on how modes are accepted by teacher and students.

Discourses of assessment in mathematics education

When it comes to institutional aspects of Swedish mathematics education, a dichotomous picture is often noticed (e.g. Persson 2009). 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 emphasises a joint exploration in which, for example, students are invited to be active participants in problem-solving. These two discourses of mathematics education in Sweden are similar to the discourses described in the literature on assessment in general. For example Broadfoot and Pollard (2000), drawing on Bernstein, present two discourses of assessment: A ‘performance’ model and a ‘competence model’. The two discourses of assessment in mathematics that are a starting point for the analysis in this paper can be summarised in the following way:

“Traditional” discourse	“Active participant” discourse
The teacher is the only one who assesses,	The student is also part of the assessment
Focus on teacher’s guidance	Focus on the teacher promoting thinking
Focus on the correct answer, the product	Focus also on processes
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

Table 1: Assessment discourses, with inspiration from Lindström & Lindberg (2005)

In Björklund Boistrup & Selander (2009), we kept to these dichotomous discourses. In this paper, I broaden the scope of discourses in relation to the findings of the study. Another discourse that will be related to the results is Walkerdine’s (1988) test-discourse. In this discourse the teacher poses “unreal” questions, questions to which the teacher already knows the answer of.

Additional concepts used in the analysis

In the ongoing study, each of the three meta-functions, ideational, interpersonal and textual, is a base for a respective research objective (described in Björklund Boistrup & Selander, 2009). To make the description and construal of the discourses as “thick” and elaborated as possible the three meta-functions also serve as inspiration and structure here, in relation to the fourth institutional/discursive research objective. There are thus some additional concepts in use. These are briefly described here:

For the interpersonal meta-function three kinds of feedback (Hattie & Timperley, 2007) are operationalised: *feed-back* – what aspects of competence has the student shown?; *feed-up* – how can the aspects shown, and future learning and teaching, be related to stated goals?; and *feed-forward* – what aspects of competence might it be best to focus on in future teaching and learning? How to “go about it”? These three kinds of feedback can go in two directions, from teacher to student and vice versa. The latter can be the student giving feedback to the teacher or the teacher using the

students' shown learning in mathematics as feedback for the teaching. For the ideational meta-function, four kinds of possible focus for the assessment are operationalised: *self* – the student as a person, e.g. “You are (I am) good in mathematics.”; *task* – the product/result, e.g. the answer to the task or what the student should do (instead of learn); *process* – what is required e.g. to solve a task (there is a clear focus on the (shown) knowing and/or learning); and *self-regulating* – the student as the driving force of her/his learning. There are also aspects of mathematical competence (Skovsmose, 2005) in use here: *Mathematical knowing itself*; *Practical knowing* (knowing of how to use mathematical knowing); and *Reflective/critical knowing* (a meta-knowing for discussing the nature of mathematical constructions, applications and evaluations). For the textual meta-function the focus is on which *modes* and *artefacts* are used and what role they play. This includes e.g. to what extent there is an acknowledgement for the student to use any mode s/he wants and also when there is a restriction of modes, why this is the case. The *time*-mode has appeared to play an essential role for some of the discourses. These concepts along with the concepts derived from the main theoretical framework, especially *agency*, are present in the descriptions of the discourses that are found in the visited classrooms.

ANALYSIS AND RESULTS

Following a social semiotic perspective with a multimodal approach the transcription of the video material has been performed multimodally. The transcription along with the coding is done in the software Videograph. For all categories there are elaborated criteria. The categories are based on the concepts presented in the earlier section of this paper. A similar process is done with the written material. The process of construing the discourses has so far included these steps: (a) using the dichotomous discourses in an early attempt of interpreting discourses in the material; (b) broadening the first two discourses through capturing diversions from the two ‘starting-discourses’; (c) choosing the most solid ones among the first suggestions; and (d) elaborating on the discourses when using the meta-functions as a base as well as bringing in a few new features. Four preliminary discourses are construed (drawing on a method described in Foucault, 1969/2002, p36).

“Do it right and do it quick” (1):

In this discourse *feedback* is mostly from teacher to student. Questions posed by the teacher are “unreal” questions (Walkerdine, 1988) and there are rarely follow-up questions. *Feed-forward* concerns what to *do* next (as opposed to what to learn). There is not much *feed-up*. The focus is on *task/product* and mainly whether an answer is right or wrong. The focus can also be on doing instead of learning when the teacher emphasises practical issues. Occasionally there is a focus on student’s *self*. The used *modes* and *artefacts* are the ones that are stated by the text-book. When it comes to *time*-aspects, both teacher and student talk in short sentences and there are rarely longer silences. The main agent in this discourse is the teacher and the

student's possibility for active *agency* in the discourse is not high. One exception might be a student who takes on the teacher's role.

“Anything goes” (2):

There is not so much articulated *feedback* in this discourse, apart for a lot of *approval*. Also here the feedback is mainly from teacher to student, but the student is encouraged to contribute to the discussion. Both real and “un-real” questions are posed. There are few critical discussions about students' solutions, and wrong answers can be left unquestioned. Focus is mainly on *task*, but there is also some focus on *process*. Both *mathematical knowing* and *practical knowing* are focused. Different *modes* and *artefacts* are welcomed, and *additional* modes and artefacts, e.g. manipulatives, apart from those mentioned in e.g. the textbook, are introduced occasionally by the teacher and/or the student. Modes are never excluded. Teacher and students use short sentences and there is not often silence. Also in this discourse, the teacher is the most active agent. There seems to be a high possibility for the student to also take part as an active agent, since there is so much “positive” approval going on. My interpretation is that this is, in fact, not the case. When the teacher values the student's performances so often, the teacher simultaneously takes the role as the main agent, “the one that is judging”.

“Anything can be up for a discussion” (3):

There is a lot of feedback (*feed-back* and *feed-forward*, and sometimes *feed-up*) going on in this discourse, both in direction from teacher to student and the other way around. Mostly real questions are asked, and teacher and student often show interest in each other's reasoning. The focus is mostly on *process* and *self-regulation* and on *mathematical knowing* and *practical knowing*. “Wrong” answers are also starting-points for discussion, but there is always, in the end, clarity about what can be counted as mathematically correct. Different modes are acknowledged. Sometimes the teacher *restricts* the use of some *modes*, and this seems to be for promoting a process. There is not much silence. Teacher and students communicate in longer utterances (e.g. sentences), but not more than a few utterances at each time. In this discourse the possibility for the student to take active agency seems quite high. This is especially clear when there is feed-up as a “neutral” comparison between the students shown knowing and stated goals.

“Reasoning takes time” (4):

Also in this discourse the *three kinds of feedback* are present and in *both directions* between teacher and student. Sometimes the feedback is shown by *silence*. The posed questions are real ones, and there are signs of interest, sometimes mutual, between teacher and student. The focus is mainly on *process* and *self-regulation*. All three aspects of *mathematical competence* can be present including *reflective/critical* knowing. Different *modes* and *artefacts* are acknowledged and the use of modes/artefacts can also be restricted, when promoting a certain process. In this discourse *silence* is common and the possibility (for both teacher and student) to be

silent seems to promote mathematical reasoning. Teacher and student can both be active for a *longer time-period*. The possibility for the student to take active agency again seems high. The possibility to be quiet and think for a while seems to promote this possible agency along with the extent to which there is a “neutral” comparison between students’ shown knowing and stated goals

Examples of two of the four discourses

In relation to the first discourse, *Do it right and do it quick*, the example is from a lesson where the students are working by themselves in the textbook. The student Catrin is waiting for Cecilia, the teacher, to come and check her finished diagnosis. 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. Cecilia comes to Catrin’s desk and both look at her work:

SS:		B	Time
TS:	"1. Which angles are straight?"A and	Yes, good.	
SG:			
TG:	In one hand red pencil, ready to write in notebook. Other hand pointing at task in text-book.	Writes R in Catrin's notebook.	
SB:	Looks at notebook and text.-book back and forth	Looks at angles in text-book.	
TB:	Turns to Catrin. Looks at notebook and text.-book back and forth Is standing behind Catrin leaning over her head.		

The same pattern continues for two more questions: Cecilia reads the question and Catrin answers the same as she has written in her notebook. Cecilia marks *R* with her red pencil. Suddenly Cecilia addresses how Catrin is writing in her notebook: *What big numbers you have done!* Cecilia writes the number of the task in the margin of the page and tells Catrin to do the same in the future. During the sequence there are no longer silences and the utterances are short.

The reasons why this is considered to be an example of the first discourse are: (a) The only feedback is in the direction from teacher to student; (b) There is a focus on the correct answers to the tasks (signalled already at the beginning of the sequence by the red pencil) and there are no follow-up questions. Later, the focus is not on mathematics, but on the correct way to write and draw in the notebook; (c) The only modes are the ones used in the text-book and there are few silences and short utterances; (d) Possibilities for the student to take active agency seem few.

For the third discourse, *Anything can be up for a discussion*, written material may serve as example. In this case it is a document from the school used for parent/teacher/student meetings. The same structure is used for all these meetings in all classes at this school. First there are two pages where the student is asked questions. These are expected to be answered before the meeting. The student Ali has

answered yes to the question whether it is *important to gain knowledge at school* and no to the question whether he *takes own responsibility*. One can read that he thinks that *I am good at a few things in mathematics* and that *I want to get better at a few things*. Then there are pages for the teacher to fill in before the meeting. One can see that for mathematics Anna, the teacher, considers *the knowledge status* for Ali to be “G?”. G is explained as Good in relation to the goals. When it comes to *Working concentrated and goal oriented* Anna has marked “G–“ (minus) and when it comes to *Exercising and accounting for home-work and assignments* she has marked “MbI” (Must be improved). The final document is filled in during the meeting itself. There are spaces for comments on both short-term and long-term goals. For long-term goals we can read this:

Content	School’s contribution	Student’s contr.	The home’s contr.
<i>Strengthen your math knowledge.</i>	<i>Provide assignments suitable for Ali.</i>	<i>Work good. Concentrate</i>	<i>Help Ali with home-work and remind him.</i>

The reasons why this document is considered to be an example of the third discourse are: (a) There are possibilities also for feed-up. Feed-forward concerns student’s as well as teacher’s courses of action; (b) There is a focus on the learning process and the student’s self-regulating; (c) There are several possibilities for the student to take active agency.

DISCUSSION

These institutional discourses can be seen as part of “traditions” developed over time. I mean that each of the four discourses have similarities with (at least) one of the discourses in the dichotomous picture described earlier in this paper, and thus, I argue that they have a *history* (van Leeuwen, 2005, referring to Foucault). All four discourses are found in several of the visited classrooms, which mean that they seem to have a *social distribution* (*ibid*). It is also clear that the discourses are *realised in different ways* (*ibid*) in the interaction between teacher and student, e.g. in different kinds of educational situations, in the video material as well as in written material. All these aspects can be viewed as indirect, but nevertheless they seem quite clear. Institutions are present in these indirect aspects, on one hand since they take place in the institution of school, and on the other hand since the institutional facts (Foucault, 1969/2002) in the discourse can be perceived to be as concrete for the people involved as other, more easily observed and experienced, “facts”. The presence of the institutions is considered more direct when it comes to “frames” such as e.g. documents from the municipalities or schools. In these documents it is possible to find one or more of the presented discourses. Since the participants are expected to follow these documents during a parent/teacher/student meeting these discourses have direct impact at least during this meeting.

Students’ and teachers’ interactions are part of different discourses and this is really obvious in the visited classrooms. As I see it a student (or teacher) always takes

agency in some discourses, sometimes in an “assessment in mathematics education discourse” and sometimes in totally different discourses (Mellin-Olsen 1993). This means that a discourse is steering the individual regarding what is considered “good” and who has the authority to act and so on. The individual, on the other hand, has the possibility to take part in another discourse instead. This dynamic view offers possibilities for teachers and students to take active part in the teaching and learning through participation in possibly alternative discourses. The student’s possibilities to take active agency in one of the discourses presented in this paper are to a high extent dependent on the discourse itself. However, it is also a matter of the interplay of discourses in the classroom. For example, if the discourse of “Anything goes”, with a lot of approval, is common in one particular classroom the student might not be empowered to take active agency when the discourse of “Reasoning takes time” is suddenly introduced by the teacher. The student may be in one discourse, “Anything goes”, while the teacher is in another.

CONCLUSIONS

In this paper, some preliminary findings concerning assessment in mathematics classrooms are presented. The combination of an institutional/discursive perspective coordinated with social semiotics has proven to be fruitful. Drawing on the three meta-functions for the construal of the discourses has contributed to more elaborated and focused descriptions than would be the case without them. Moreover, the multimodal approach has shed light on the role of different modes. Here the mode of time is especially mentioned. Silence, and absence of silence, play an essential role in several of the discourses, as does the length of utterances. When adding a focus on agency as well, the roles of teacher and students have been emphasised.

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