USING REDIRECTING, PROGRESSING AND FOCUSING ACTIONS TO CHARACTERIZE TEACHERS' PRACTICE

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'Redirecting, progressing and focusing actions' is a framework for describing how teachers use students' comments to work with mathematics. In this article, the framework is presented using examples from two teachers' practices. Then the article demonstrates how this framework can be used to characterize the two practices and differences between them.

Keywords: Communication – Teachers role – Orchestrating discourse

INTRODUCTION

There is a need for more detailed understanding of communication in practice generally, and how teachers' use or not use students' comments to work with mathematics. This article presents an example of how the framework of 'redirecting, progressing and focusing actions' (Drageset, 2012) can be used to characterize teachers' practice. This is done by looking into the amount of different types of teacher comments in two teachers' practices and exemplifies how this might be interpreted.

COMMUNICATION

Researchers often finds that classroom discourses are dominated by teacher talk, in a discourse pattern where the teacher initiates the questions, the students respond to them, and the teacher evaluates the responses (Franke, Kazemi, & Battey, 2007). This pattern is often labeled as IRE (initiation-response-evaluation). Cazden (2001) describes IRE as 'the default option – doing what the system is set to do 'naturally' unless someone makes a deliberate change' (Cazden, 2001, p. 31). In this pattern, the students are normally engaged in a procedure-bound discourse, such as calculating answers and memorizing procedures, and with little emphasis on 'students explaining their thinking, working publicly through an incorrect idea, making a conjecture, or coming to consensus about a mathematical idea' (Franke et al., 2007, p. 231).

During what Stein, Engle, Smith and Hughes (2008) call the first generation with respect to mathematical discussions in the classroom, focus was on the use of cognitively demanding tasks, encouragement of productive interactions, and letting the students feel that their contributions were listened to and valued. Little attention was directed towards how teachers can guide the class towards worthwhile mathematics, and many teachers had the impression that guidance should be avoided (Stein et al., 2008). The result could be that the students took turns sharing their solution strategies without any filtering or highlighting.

However, even though an increased level of discourse is positively related to student learning we know that just getting students to talk is not enough (Franke et al., 2007). Merely making your thinking available to others is insufficient because too much is normally unsaid. The manner in which we make our thoughts available seems to be crucial (Kieran, 2002). Consequently, details matter, or in the words of (Franke et al., 2007, p. 232): 'One of the most powerful pedagogical moves a teacher can make is one that supports making detail explicit in mathematical talk, in both explanations given and questions asked'

The second generation practice 're-asserts the critical role of the teacher in guiding mathematical discussions' (Stein et al., 2008, p. 320). The hallmark is that the teacher actively uses students' ideas and work to lead them toward more powerful, efficient and accurate mathematical thinking. Ball uses the term 'show and tell' as an example of the same:

> 'For the lesson to be more than a drawn out "show and tell" of the different methods requires the composition of a mathematical discussion that takes up and uses the individual contributions … making available one child's thinking for the rest of the class to work on.' (Ball, 2001, p. 20)

Ball here emphasizes an active use of students' contributions. However, even though there is increasing agreement that students' contributions must play an important role in classroom communication there is a need to understand how this can be achieved. Carpenter, Fennema, Franke, Levi and Empson (1999) suggest using a careful selection and sequencing of student strategies. Stein et al (2008) suggest a similar strategy as part of a model that specifies five key practices in order for a teacher to use student responses more effectively in discussions; anticipating likely student responses, monitoring, selecting responses to be presented, sequencing the presentation, and making connections.

This model may move attention away from learning mathematical content independently of student thinking. Instead, attention is directed towards how students' thinking about mathematical content can be used to create reflection and learning. Such a strategy will also give the teacher regular access to students' ideas and the details that support them. This is essential knowledge for teaching and learning in mathematics (Franke et al., 2007).

Fraivillig, Murphy and Fuson (1999) and Cengiz, Kline and Grant (2011) report studies of how teachers actively use the students' ideas to lead them towards more powerful, efficient and accurate mathematical thinking and in which situations this occurs. Fraivillig et al (1999) present a framework called 'Advancing children's thinking' (ACT) based on an in-depth analysis of one skilful first grade teacher. The framework has three components: eliciting children's solution methods, supporting children's conceptual understanding, and extending children's mathematical thinking. While the eliciting and supporting components focus on the assessment and facilitation of mathematics with which the students are familiar, the extending

component is focused on the further development of the students' thinking. Each of these components is defined by several categories of instructional techniques, for example 'encourage elaboration', 'remind student of conceptually similar situations' and 'demonstrate teacher-selected solution methods'.

Alrø and Skovsmose (2002) introduce the notion of inquiry co-operation as a particular form of student-teacher interaction when exploring a landscape of investigation. As part of the inquiry-cooperation model they identify eight communicative features: Getting in contact, locating, identifying, advocating, thinking aloud, reformulating, challenging and evaluating. These features were present both in the student-student interaction and in the teacher-student interaction.

Several scholars have described a phenomenon where the teacher dominates the solution process and in different ways reduces the complexity for the students. Brousseau (1997) describes that teachers sometimes provides more and more information to help students when they fail repeatedly. The result is that the teacher gradually takes responsibility for the essential part of the work. When the target knowledge disappears completely, Brousseau (1997) describes it as the Topaze effect. A similar way for teachers to reduce complexity for students is described by Lithner (2008) using the term guided algorithmic reasoning. In guided algorithmic reasoning 'all strategy choices that are problematic for the reasoner are made by a guide, who provides no predictive argumentation' (Lithner, 2008, p. 264) and the remaining routine transformations are executed without verificative argumentation. Predictive arguments are related to why the chosen strategy will solve the task, while verificative arguments are related to why the strategy solved the task. A third concept for this phenomenon is funneling (Wood, 1998). A teacher's questions funnel the conversation when the teacher does most of the intellectual work and 'the student's thinking is focused on trying to figure out the response the teacher wants instead of thinking mathematically himself' (Wood, 1998, p. 172).

Several studies have developed tools for characterizing teaching practices, such as Wood's (1998) funneling and focusing and Brendefur and Frykholm's (2000) four levels of communication. While these concepts have explanatory power in the study of entire practices, the limitation lies in the lack of detail. Other studies, such as 'Advancing children's thinking' (Fraivillig et al., 1999), its further development by Cengiz et al (2011), the inquiry co-operation model described by Alrø and Skovsmose (2002) are different, as these studies characterize elements found in teaching without describing an entire practice. These are concepts that enable us to describe single teacher comments at a level of detail which is not possible using more general concepts such as funneling and focusing. Detailed descriptions are critical for researchers to be able to describe and analyze teachers' communication in more detail. It is also crucial for professional development as teachers have little use for general advice. Further development of detailed frameworks is needed in order to create concepts to describe and understand how single comments might contribute to the mathematical discourse.

PURPOSE OF THE ARTICLE

The purpose of this article is to illustrate how the framework of redirecting, progressing and focusing actions can be used to characterize and interpret teachers' communication in practice.

REDIRECTING, PROGRESSING AND FOCUSING ACTIONS

The redirecting, progressing and focusing actions framework was developed through several stages. The data comes from five teachers practices at upper primary (grade 5-7, students aged 10-13). All their mathematics teaching for one week was filmed from the start of the topic of fractions, typically four or five lessons. The five teachers participated in a larger survey (Drageset, 2009, 2010) and were selected for further study based on a selection of diverse profiles from the survey. Altogether this meant that the data was approximately 2000 teacher comments. In this case a teacher comment is defined to be a response to a student comment.

In the first step of the development, each teacher comment of several excerpts from five teachers was characterized with respect to how teachers use or not use student comments to work with mathematics. Similar comments were collected in groups that formed initial categories with a preliminary definition. The definitions were inspected with each comment added and adjusted whenever necessary, and categories were sometimes divided or merged as a result of this. When the categories seemed to have stabilized, all the rest of the data were coded. During this coding the definitions were adjusted whenever necessary, and also at this stage some new were created, some were merged and others divided. During the end of this work the categories were organized in three superordinate groups, the redirecting, progressing and focusing actions. This method has similarities with grounded theory (Charmaz, 2006; Glaser, 1978; Glaser & Strauss, 1967). However, this is done without following the original emphasis on discovery, detachment of theory, and the step-by-step procedure. For further information about the development, see Drageset (2012).

TWO CASES COMPARED

This article will use the practices of Anne and Linda, two of the original five teachers, as an example. During the filming of Anne and Linda, their practices were considered to be quite different. Their practices were described in several ways, both intuitively and using existing concepts and coding schemes. For example, concepts from 'The knowledge quartet' (Rowland & Turner, 2009; Rowland, Turner, Thwaites, & Huckstep, 2009) and the 'Content knowledge for teaching' framework (Ball, Thames, & Phelps, 2008) and the coding scheme for measuring the quality of mathematics in instruction (LMT, 2006) were used. But all these failed to have any explanatory power related to the perceived differences. When these initial attempts were unsuccessful, it was decided to instead try the approach of characterizing single comments and creating categories of similar comments. This turned out to be a more productive approach, resulting in the framework of 'Redirecting, progressing and focusing actions' (Drageset, 2012).

ACTION	CATEGORY	ANNE	LINDA
Redirecting		**6 %**	**22 %**
	Put aside	2 %	8 %
	Advising a new strategy	2 %	5 %
	Correcting question	2 %	9 %
Progressing		**58 %**	**53 %**
	Demonstration	3 %	7 %
	Simplification	4 %	17 %
	Closed progress details	45 %	26 %
	Open progress initiatives	5 %	2 %
Focusing		**36 %**	**25 %**
	Enlighten detail	10 %	7 %
	Justification	2 %	1 %
	Apply on similar problems	0 %	0 %
	Requesting assessment from other students	2 %	0 %
	Notice	20 %	13 %
	Recap	3 %	4 %

Figure 1: Amount of each category and summarized for each action. The percentages are based on number of comments. When 'Put aside' is 2% for Anne it means that 2% of all of Anne's comments were of this type.

The three redirecting actions of 'put aside', 'advising a new strategy' and 'correcting questions' are all comments with the common feature of trying to change the students approach. Linda uses redirecting actions far more than Anne (see figure 1). In fact, more than one fifth of all Linda's comments were about changing the students approach without trying to understand the reasons behind the answers given. Especially the categories of 'correcting questions' and 'put aside' are used far more by Linda than by Anne. This is consistent with the intuitive observation that this teacher gives fast, direct and sometimes harsh feedback to the students. One example of Linda's direct feedback is this one:

> Teacher: No, but we are not talking about pizza now, we are talking about… pure calculation with numbers, what is it that really happens?

This comment works redirecting because the student approach is rejected and a new direction is suggested. It is also fairly direct, not giving any form of support to the student's suggestion. And even with less direct feedbacks like 'I think you answer on

something different than I ask for' (Linda) such a large amount of redirecting actions will necessarily characterize the practice.

Anne seemed to avoid such confrontations by rarely using redirecting actions. Instead, Anne used focusing actions considerably more than Linda. By using focusing actions instead of redirecting actions, she appreciates the student's approach and might also understand more of the reasons behind it. However, the dominating type of focusing actions in Anne's practice is 'notice'. This is comments that stops or even interrupts the students and points out what the teacher finds important. It is a teacher-led focusing action, as this example from Anne's practice illustrates (the teacher just asked what the student did to expand the fraction):

Student: Expanded by four

Teacher: You expanded by four, so that you could have a common denominator. Yes.

The core of 'notice' is that the teacher points out and emphasizes some information that occurs during a dialogue. Sometimes 'notice' comments acts supporting for the student, and sometimes it is a way to add information necessary for the rest of the students to understand.

While Anne's practice has a considerably larger amount of focusing actions than Linda's practice, they are similar in that 'notice' is the dominating type of focusing actions and that the other major type is 'enlighten details'. One example of the use of 'enlighten details' from Linda's practice is this one (the task is to find out how many fifths nine of fifteen chips are):

Student: The answer is three

Teacher: The answer is three. Explain to me. Here are three. Here are three fifteenths… no fifths, is it? Three, six, nine, twelve, fifteen, there are fifteen chips. What are three fifths then?

In this example the teacher is not satisfied with only an oral answer but requests the student to find three fifths of the chips also. This is about enlightening the reasons behind the answer and to make the thinking explicit. According to Franke et al. (2007), making detail explicit is one of the most powerful pedagogical moves a teacher can make. It is worth mentioning that in both practices comments requesting students to enlighten details are almost only used as a response to correct answers.

Progressing actions are dominating both practices, but there are differences on which type of actions are used most frequently. The dominating type of progressing actions in Anne's practice is 'closed progress details'. This category is formed by comments where the teacher asks for one detail at a time, moving along one step at a time. Instead of asking about the final answer, the teacher splits it up into several smaller tasks and asks for answers to each of these. One aim of this strategy might be to ensure that every student is able to follow the line of thought by following them through every important step. The result is that the teacher takes control of the process and probably reduces the complexity of the task for the students, as that they

do not need to see the whole picture. These questions typically have only one correct or desired response, which is quite often easy to find. This type of comments is dominating the entire practice as 45 % of all Anne's comments are 'closed progress details'. This illustrates Anne's tendency to split up tasks, control the process and request the students to answer rather simple step-by-step questions. The following example of 'closed progress details' above is from Anne's practice. The task is to add 1/2, 2/5 and 1/10. The teacher writes '1/2+2/5+1/10=', and then this follows:

Teacher: What is the common denominator?

Student: Ten

Teacher: Ten. And then you did what here? (points out 1/2)

Student: Multiplied by five

Teacher: Multiplied by five, above and below. And here? (points out 2/5)

Student: Two

Teacher: Multiplied by two, above and below. And here? (points at 1/10)

Student: Nothing.

Teacher: Nothing. Okay, and then you got?

'Closed progress details' are also the most frequent category in Linda's practice, but the use is much less frequent. On the other hand, Linda uses simplification considerably more than Anne. The comments that form the simplification category are typically comments where the teacher simplifies the task by adding information, changing the task, giving hints or telling the student how to solve the task. And it is characteristic for Linda's practice that she adds information or changes tasks in order to make the student give the wanted response. One striking example comes when the teacher asks how much two fifths and three fifths are. There are ten orbs at the blackboard, and the teacher has told that two orbs is one fifth.

Student: Ten.

Teacher: *Two* fifths and *three* fifths, how many fifths is that? (emphasizes *two* and *three*)

Student: Ten.

Teacher: If you have two fifths here (holds up two fingers) and three fifths there (holds up three fingers on the other hand), how many fingers do you see?

Here, the teacher first emphasizes the numerators as a response to the student answering ten. When this does not help the teacher asks the student to count fingers so that the correct and wanted response 'five' will be said. The large amount of 'simplification', 'closed progress details', 'notice' and redirecting actions is characteristic for Linda's practice as the teacher gives clear and direct feedbacks of both incorrect (redirecting actions), correct (notice) approaches and when the student fails to progress (simplification and closed progress details).

The dominating amount of ‘closed progress details’ combined with a large amount of ‘notice’ is characteristic for Anne’s practice as the teacher controls the process by dividing up tasks and pointing out what is important. Also, the students are quite frequently asked to explain how or what (enlighten detail).

By looking at some specific types of student comments more information is available. In Anne’s practice there are very few incorrect answers from students (7 %), which might be explained with the large amount of closed progress details that reduces complexity. In Linda’s practice the amount of incorrect student responses are larger (23%) and these are mainly followed up by redirecting actions. This indicates that the Linda is not interested in the reasons or thinking behind incorrect answers, but instead tries to change the students approach to something more productive. It might also mean that Linda opens more up for student suggestions than Anne does. Looking at student explanations changes this picture slightly. There are a larger amount of student explanations in Anne’s practice (15% of the student comments) than in Linda’s practice (9%). Also, these are more often followed up by focusing actions (mainly notice) by Anne than by Linda.

CONCLUSION

The ‘Redirecting, progressing and focusing actions’ framework adds to concepts that can describe and characterize comments and practices in detail. This article has illustrated how these concepts can be used to characterize practices and understand differences based on a simple counting of the different types of comments. Further details are accessible by inspecting how teachers respond to different types of student comments. This is just briefly exemplified for two rather intuitive types of student comments, incorrect answers and explanations. It is also possible to inspect qualitative differences within each category, for example how teachers ask students to enlighten details, how teachers use closed progress details in different ways, or even how different kinds of student explanations are followed up by the teachers. One might also be able to find patterns of comments frequently used by teachers, for example when repeated use of redirecting actions has no effect on the progress towards a solution this might lead to the use of simplification.

The example from the practices of Linda and Anne illustrates how concepts from the ‘Redirecting, progressing and focusing’ framework can be used to characterize and interpret teachers’ communication in practice. For example, a practice dominated by the use of closed progress details is a practice where the teacher takes control of the process by doing all the important strategic choices and leaving the calculation to the students. This reduces the complexity and probably also has an effect on what opportunities the students are given to learn mathematics. Another practice might be dominated by teacher comments that request the students to enlighten details. This means that the reasons, thinking and arguments behind answers are being made explicit regularly, which according to Franke et al. (2007) is one of the most powerful pedagogical moves a teacher can make. In this way, concepts from the ‘Redirecting, progressing and focusing’ framework can be used to study qualities in these practices.

But there is one main limitation to the approach in this article as only the amount of each category is studied and not how different types of teacher comments work together in sequences. To progress it is important to study how different types of teacher actions, such as for example closed progress details and enlighten details, can interact productively in a mathematics discourse in the classroom.

The power of research frameworks lies in the concepts created. Further research is needed to find out the explanatory power of the concepts developed in the 'Redirecting, progressing and focusing' framework when describing, interpreting or characterizing entire practices or shorter discussions in mathematics classrooms.

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