Diversity in an inclusive mathematics classroom: A student perspective

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This paper reports on a study exploring inclusion in mathematics education from a student perspective. The theoretical and analytical approach in the study is discourse analysis. The results presented in this paper are based on 8 interviews with students from lower secondary school and 4 observations of mathematics lessons. The teachers describe the students as students in special needs in mathematics (SEM). The results show that, from a student perspective, the teaching and learning of mathematics in an inclusive classroom is complex and diverse. At the same time, as these students are similar in that they are SEM-students, they are different when it comes to how they themselves want to be included in the mathematics. These differences regard both the organization and the content. Thus, diversity among students demands diversity in the mathematics education.

Keywords: Inclusion, diversity, equality, access to mathematics.

Introduction

A growing body of research in mathematics education is focusing on access and equity. This can be seen in some of the research books that have been published in recent years, for instance *Diversity in mathematics education: Towards inclusive practices* (Bishop, Tan & Barkatsas, 2015), *Towards equity in mathematics education* (Forgasz & Rivera, 2012), and *Mathematical literacy: Developing identities of inclusion* (Solomon, 2009). In addition to this, at school-level, the issue of the need to meet every student's needs in the mathematics classroom according to the preconditions and needs of each and every one has been recognized (Roos, 2015). This task, to be able to meet all students' needs and create opportunities to learn, is not at all an easy task. Some teachers even say that it is impossible to meet every student's needs in an inclusive classroom because of the diversity. On the other hand, one could look upon teaching diversity as Frederickson and Cline (2009) do, claiming that teaching is interesting because of the diversity among students, but it is only possible because of the similarities among students. This implies that even if there is diversity among students in our mathematics classroom the teaching does not have to be different for each and every student, but by being aware of the diversity as a teacher you can develop a sensitivity towards equality in the teaching. In that sense, you put the students' needs at the forefront in the explanations and tasks given.

In mathematics education one of the motivations to strive for inclusion and access to mathematics for all is that it is a human right to know mathematics to achieve participation in society (D'Ambrosio, 2010). Most often inclusion is discussed and researched from this ideological perspective even though it is often used as a method in schools. Hence, there is a need for studies investigating inclusion in practice, which this research aims at. This leads to the research questions of this paper, which are: how do students experience an inclusive mathematics classroom and when do they express having optimal opportunities to learn mathematics?

Diversity and Inclusion

What does diversity and inclusion in mathematics mean? It seems that when scholars talk about diversity in mathematics, they almost always speak of inclusion in the same breath (e.g., Bishop, Tan & Barkatsas, 2015), indicating the two notions are closely related. When investigating further, inclusion, if used as a tool in classrooms, can be seen as a way of meeting diversity, supporting all learners within a local community (Booth, Nes and Strømstad, 2004). Diversity on the other hand is not often defined, but used together with gender and culture (e.g., Forgasz & Rivera, 2012). It is also used together with specific subject area in mathematics and students' performances within this area (e.g., Hopkins & de Villiers, 2015); hence diversity is here connected to some kind of ability in mathematics. Accordingly, diversity can be connected to different things. In this paper diversity is connected to inclusion on the level of optimising students' performance in mathematics.

An inclusive classroom is in this paper defined as a classroom that is not grouped by ability but instead as a classroom in which students struggling with mathematics as well as students in need of more challenges in mathematics are taught working with similar tasks and the same mathematical content. Hence, diversity from an ability perspective is prioritized. This puts demands on the teacher, being aware of the diversity (Solomon, 2009), to have equitable instructional quality. This quality can be seen in the teachers' mathematical knowledge and their preparation for the teaching of mathematics as well as their beliefs about and skills in teaching diverse students (Allexsaht-Snider & Hart, 2001). So, in having equitable instructional quality, students' opportunities to learn mathematics might increase. But according to Rousseau and Powell (2005), there are factors that can work as barriers for increased opportunities to learn mathematics: large class sizes, high-stake-standardized tests, absenteeism and mobility of students and a lack of a high-quality curriculum. All these issues arise from a teaching or organisational perspective. Hence, it becomes important to also listen to the students' voices, enabling teachers to understand processes of exclusion and inclusion in the mathematics classroom like Solomon (2009) highlights.

One important issue arising when talking about the ability of individuals is labelling. There are many teachers that claim that in order to be able to meet the diversity of students they have to "label" them in some way. Though, Askew (2015) claims that meeting diversity does not imply that we have to label the students, because labelling might perpetuate exclusion instead of promoting inclusion. One way to meet diversity and create an inclusive classroom is to support cooperative learning (Askew, 2015) by building a sense of belonging and safety where diversity is valued (Reid & Valle, 2004). This implies that the teacher and the pedagogy the teacher uses in the classroom are really important to create this learning community. Then, as Liasidou (2012) points out, pedagogy is an important dimension of inclusion. All this implies that diversity and inclusion are intertwined, and if striving for inclusion one has to respect diversity (Booth, Nes & Strømstad, 2004). Accordingly, in this study the objective is to investigate diverse students' experience of an inclusive mathematics classroom.

The current study

The focus in this research is on students in special educational needs in mathematics (SEM-students). Special educational needs are here defined as a need of another teaching then the regular mathematics teaching. This is not unproblematic, since it signals a labelling of students in the

research. To be vigilant in terms of that issue, the teachers in the study have made the selection of students. In this research, inclusion in mathematics is investigated from two different SEM-directions: students struggling with mathematics, and students in need of more challenges in mathematics. This kind of selection is information-oriented and used to "obtain information on unusual cases which can be especially problematic or especially good in a more closely defined sense" (Flyvbjerg, 2006, p. 230).

An ethnographic approach is used, meaning the researcher participates directly in the social setting collecting data without meaning being imposed on the participants (Brewer, 2004). The ethnographic approach also offers in-depth study (Hammersley & Atkinson, 2007), which can be used to follow a process in a particular case, such as to be included in mathematics teaching and learning. An ethnographic study usually investigates people's actions and accounts in an everyday context. In this study, a Swedish lower secondary school (students are 13 to 16 years old) that sets out to work inclusively is observed. That is, the school strives to have all students in the classroom, even the students assumed to be in special educational need of any kind. To be able to meet all students' needs, they strive to have at least two teachers in the classroom for each lesson. The school is an urban school with about 500 students, located in the outskirts of the city.

One grade 7 and one grade 8 class were observed. The mathematics teachers in a discussion with the researcher selected the classes and the students. Grade 7 was selected based on the criteria that working inclusively might be new for them. Grade 8 was selected since they have been working inclusively for a year. Students from grade 8 and grade 7 that struggled with mathematics as well as students that needed more challenges were chosen and interviewed several times. Ethical considerations were made both before and during the process. Both the students and their guardians gave written consent. As a researcher, I reflected on what ways I affected the students and the research. Another aspect was that the students in the classes would be able to handle a researcher in the classroom.

Methodology

The approach used in this research is Discourse Analysis (DA) and the data consists of observations from two classes.

Discourse Analysis

Discourse Analysis is chosen as approach because of the power of DA to focus on language in interaction and language above or beyond the sentences (Gee, 2014a) and its explanatory power of social contexts and meaning making. The focus of DA is on language and text, what we actually can see, hear and read. In this study, ethnography was applied together with DA in order to make students' expressions of mathematics teaching and learning visible. DA and the ethnographic approach complement each other in this research; DA provides theoretical and analytical notions, while ethnography provides a way to conduct research.

In this paper, DA is used from the perspective of Gee (2014a, 2014b), since this focus is descriptive and I intend to describe how students want to participate in an inclusive mathematics classroom to be able to have optimal opportunities to learn. From Gee's perspective, DA covers all forms of interaction, both spoken and written, and he provides a toolkit for analysing this interaction. These

tools put focus on the communication and ask questions of the text. Hence, in this research, the toolkit is used as a methodological tool.

Gee (2014a, 2014b) also provides theoretical notions, such as *big and small discourses* (henceforth referred to as Discourse with capital D and discourse with lowercase d), where Discourse is looking at a wider context, social and political. Discourses are always embedded in many various social institutions at the same time, involving various sorts of properties and objects. For example, a Discourse can be "assessment in mathematics." Discourses are always language *plus* "other stuff" (Gee, 2014a, p. 52). This other stuff compromises actions, interactions, values, beliefs, symbols, objects, tools and places. Small d discourse is focused on language in use, what *stretches of languages* we can see in the conversations or stories we investigate (Gee, 2014a). In this research, big and small discourses will be the theoretical perspective. Hence, DA is used both as a theory and a tool and provides a set of methodological and theoretical lenses.

Procedure

During one semester (January to June 2016) I observed the two classes at the chosen lower secondary school. I was present at least one mathematics lesson each week for each class doing observations. After observations, I conducted interviews with the selected students. Since I had both ethical and organisational issues to take into consideration, the interviews were done when the students wanted to and had time, and the teachers allowed it (they did not want me to interview them when they had their ordinary lessons). The interviews took place in a room next to the classroom when the students had "class time" once a week. The interviews were based on the close in time observations; hence, they were situated and narrative. I asked questions about situations and tasks and showed photos of tasks on the blackboard. We also looked at tasks in their textbooks. The first and the last interview were based on a questionnaire about their mathematics education.

Data analysis

In this paper, eight interviews and four observations have been used in the analysis, two interviews with a student in grade 7 named Billy and two interviews each with three students in grade 8, Edward, Ronaldo and Jeff. The teachers perceive Ronaldo and Jeff as students in struggle with mathematics and Billy and Edward as students in need of more challenges in mathematics. In the interviews the students got questions about what they wanted from the teaching in mathematics, how they learned mathematics best and also got questions arising from the previous mathematics lesson, which were the four observed lessons. The observations were used as contextualisation for the interviews as well as for supporting identification of big Discourses. When analysing the data by asking questions to the text, both small and big discourses appeared. That is, while examining the text, I used Gee's toolkit by asking specific questions. Depending on the type of text, different questions were asked. For example, when using the subject tool, I asked, "What are they talking about here, and why?" When using the deictic tool, I asked, "What is pointed out in the text, and what is the listener assumed to already know?" When applying the fill-in tool, I asked, "What needs to be filled in to achieve clarity? What is not being said overtly, but is assumed to be known or inferable?" Then, stretches of language(s) appeared when finding answers to the questions, which signalled for small discourses. When adding analysis of the data from the observations, such as text on the blackboard and the actions of the teachers, big Discourses could be identified.

Result and analysis

In the analysed data, three themes, or using Gee's (2014b) terminology, three "stretches of languages" emerged. The first theme was about how students wanted to participate from an organisational perspective. The second theme was about tasks they did or did not like and the third theme was how the student wants a mathematics lesson to be like for an optimal learning opportunity.

Organisational aspects

In the interviews, stretches of languages about organisational aspects were showing. In the first interview Ronaldo says, "We are starting to *go outside [the classroom]* into small groups, like we did not do before, and it feels much better now. I am concentrating a lot better [in a small group] and like that." He also explained why it felt better to be in a small group: "It feels better actually, you get peace and quiet and then… like me… if they talk a little there [inside the classroom] I lose concentration right away and listen to what they [the other students] are saying; when it's smaller groups I am able to concentrate better and learn more." In Jeff's first interview he also highlights the possibility of being able to *go outside the classroom*: "… if it's a test or something I would rather be outside [the classroom] since I am more focused then." Edward also talks about the organisation, but within the classroom when he is discussing cooperation. "It is not very easy, since I have often come a long way, so I always explain to them, it never gets to a discussion for me… I mean, with somebody else, that we discuss and so on […]." When the researcher asks Edward if it is hard to discuss with everybody he says, "It depends on whom I am sitting next to." He also expresses that he does not *sit next to someone who can challenge* him, and says that he would like to do that more. "I think I would get more out of it."

Tasks

Other stretches of languages showed talk about tasks. Billy explicitly talks about his need of *more challenging tasks* in the classroom. "I like those [tasks] which are harder, those that challenge you." "[I would like to have] more challenges […] at the lessons." He explicitly talks about *problem solving tasks* as something challenging: "I like it when we have problem solving. You get to think for yourself and then talk to friends [about it]." Ronaldo also talks about *problem solving* but in a rather different way. "I hate problem solving tasks more than anything! I just cannot do it." He also describes why he does not like it: "It is hard with reading comprehension and like that, and to connect it with like the task and the text, it gets too much. It is often that kind of task I fail at on the tests." Jeff talks about tasks that he likes. These are tasks he knows "how to calculate and tasks that I understand." He mentions geometry tasks as tasks he likes. The type of tasks Edward likes the most is Algebra tasks. "To be able to find out all the variables, it is fun to figure out what it is." Here we can notice a difference to how Ronaldo thinks about algebra tasks when he states that he thinks that it is hard with "like all this with X and Y and everything … it is terrible."

A good mathematics lesson

A third stretch of language is the talk about what the students want from a mathematics lesson in order to be able to learn mathematics the best. Jeff states that what is most important for him in a mathematics lesson is "if they [the mathematics teachers] explain good … and thorough, if they write step by step." He also says if he knows what to do it "feels good, I know what to do and I get

on with it right away." Meaning, for him the *thoroughness and structure in the instructions* is important. Ronaldo likes to have a lesson when you "first work a little [by yourself] and then some 'going through'[1] and then you *work a little by yourself and then you do some group* work with those you sit with […]. It is more fun when you are in a group and cooperate." Edward on the other hand thinks that it is hard to cooperate and "extremely hard to get something from the others in the class." Instead, he like *lessons "with variation* so that you don't get tired." He also likes "a going through or something like that, gladly a game or something. You should [also] count a little by yourself I think." Billy thinks that the lessons are best "when you get to *explain to others* [students] how you have done it." He likes when "we have like problem solving." He also stresses that he wants "more challenges at the lessons."

Identified discourses and Discourse

The three themes appearing in the data – organisational aspects, tasks and a good mathematics lesson – can be interpreted as small discourses (Gee, 2014a) in the students' talk of their mathematics education. There are aspects in this talk from the different students that overlap, such as wanting to be in a small group sometimes, which both Jeff and Ronaldo stressed. Another aspect that overlaps is collaboration. Both Billy and Ronaldo highlighted collaboration, but Edward on the other hand felt that his peers did not challenge him in the discussions, but he said that he thought he would get more out of it (meaning the discussions) if he sat by a peer that had the possibility to challenge him. There are aspects that diverge, such as what type of task they want to have. Billy says he wants more problem solving and Ronaldo "hates" problem solving. Edward likes algebra tasks and Jeff likes geometry; hence there was no consensus on types of tasks or mathematical content they prefer. Another aspect that appears in the students' talk was the organisation of the lesson. To attend a structured lesson, with both explanations by the teacher and work by yourself or together with others seemed to fit them all. Jeff is more explicit about his wishes for structured lessons, indicating a need of structure to explain what to do. Even though all these small discourses contain diversities, they together indicate a big Discourse. When looking at the observation notes from the lessons you can identify support to this big Discourse, in terms of talking about tasks, organisational aspects such as "talk to your neighbour" or when the special teacher attending the classroom walks outside the classroom with some students; also, the type of task being addressed at the blackboard, and the way the teachers structure the explanations at the blackboard and the talk of what to include in an explanation. This big Discourse can be named "mathematics in school": what mathematics in school is or means for the students and what they want from the mathematics to be able to learn best.

Summary of results

The result shows both overlapping and diverging issues regarding how students experience an inclusive mathematics classroom and having optimal opportunities to learn mathematics. Regarding organisational aspects, Jeff and Ronaldo stressed the need of *being in a small group outside* the classroom from time to time even though the school promotes physical inclusion, and Billy and Edward highlighted *collaboration* in order to have opportunities to learn. Diverging aspects are type

[1] Going through is "genomgång" in Swedish, which is when the teacher is explaining something on the blackboard.

of tasks; for example, where Billy wants *challenging tasks* in the form of *problem solving*, Ronaldo hates problem solving. How the students want a mathematics lesson both diverges and overlaps: *thoroughness and structure in the instruction; work a little by yourself and then in a group; lessons with variation* and *explain to others* were expressed as good ways of learning.

Discussion

A diverse picture of how students want to participate in an inclusive mathematics classroom to be able to get optimal learning opportunities appears in this research. Although this is not unexpected, it is important to highlight this diversity and address the question of how the organisation and the education can support this diversity in order for students to be included in mathematics. This is not just only spatially included, but is also included in the teaching and learning of mathematics. The diversity of how students want to participate in the mathematics classroom that appears in this research stresses the need for diversity in mathematics education at school. One thing that is striking is that students expressed a need of being in a small group outside the classroom from time to time. The school promotes physical inclusion, and it did not seem to always benefit these students. You might say that diversity among students demands diversity in mathematics education. But, as Fredickson and Cline (2009) stress, even though students are different, teaching is only possible because students are similar in some ways. This research supports this, because even if the results showed diversity among the students (both within and between students that are perceived as students in need of more challenges in mathematics and students that are perceived as struggling students in mathematics), the results also showed similarities between the students. These similarities are something the teaching can take advantage of, in the organisation and planning of the mathematics education in order to get equitable instructional quality. However, barrier factors such as large class sizes, high-stake-standardized tests (Rousseau and Powell, 2005), etc. can be prohibitive to the work of equitable instructional quality. If the organisation is responsive to the diversity among students and is aware of barrier factors it might be dynamic and adjust accordingly to improve access to mathematics and an increased inclusion in mathematics.

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