DO *WE* WELCOME CHILDREN'S MATHEMATICS? WHO ARE *WE*?

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ABSTRACT

I have different approaches to this contribution. My concerns as a teacher and a teacher educator are to discuss how we manage to organise for inclusion of the variety of children's mathematics. How do we organise for the mathematics to be included into their mathematics? A message from children about what they expect mathematics to be has impact on this complexity. Their voice is a voice of the culture and affects the position of "we". What impact has the authoritarian nature of the mathematics for our discussions about diversity and inclusion?

THE "INFORMAL MATHEMATICAL KNOWLEDGE"

I begin by referring some aspects from teaching in Norwegian primary schools, and move back to around 1980. One could say that the situation was quite simple: at that time we did not have children from diverse ethnic backgrounds in the average Norwegian school. At that time children started school seven years old. It is only since 1997 that children in Norway have started school at the age of 6 years. All children were included in mainstream classes; we did to a minor degree have schools or classes for special needs. This was our reality. The challenges seemed demanding and complex: to educate *all children*, taking different background related to differences in gender, culture, class, and cognitive aspects into account.

We argued for mathematics to be taught on the bases of established knowledge; for the importance of making *it* concrete; making *it* understandable and actual; making *it* simple enough. Move slowly enough "up the stairs". The curriculum was used as point of departure when we worked to develop the best teaching methods as possible. We put the mathematics nicely into the communication. We aimed to help *them* understand the mathematics; to help them build a mathematical language. All the time, we explained that we used the children's knowledge, their experiences as the bases for our approach. I can still repeat the words we used, I still can memorise those voices. However, we realised we did not do what we claimed to do. The basis was the tradition of school mathematics. "Somebody" had decided what was important, what the children should learn. This somebody was an authoritarian somebody, represented by the textbooks (authors?), the curriculum (– makers?) or perhaps the very nature of school mathematics itself. We worked on making the mathematics concrete.

We tried to help the pupils understand; to think and express themselves in the way we expected them to. *We,* as teachers, used what *we* saw as relevant from their knowledge, to illustrate, to make it easier for them to enter our world. We did not take the knowledge of the children into account if it was broader than we needed it to be. As we were narrow-minded, we used the children's expressions *if* they helped in making links to the language we wanted them to learn. Observing our interaction with the children, we realised that our point of departure was the curriculum.

The children interacted with questions like: *Is this correct? Is this how to do? Show me once more, and then I'll remember how to do it. Am I to divide or multiply?* They visualised a conflict between our ideal thoughts and what really happened in the classrooms. We argued that children who enter school have competencies in mathematics, they have knowledge, they use that knowledge, and they communicate it. They have developed different ways of expressing themselves that function socially. The children's use of language should be characterised by the way it changes due to the contexts and due to whom they are communicating. We realised that the children show a wider range of mathematical knowledge when they argue themselves; but that they are more limited or narrow when they answer "the teachers' questions" or "the tasks of the textbooks". It became challenging to make the children's competencies actual in the school setting. It was not enough to "make them understand", it was not enough to show that the knowledge was actual. How could we inspire the processes of children's own argumentations; their mathematising; their investigative activities? At that item I worked with Stieg Mellin-Olsen (1987) who took part in the discussions, and the actuality of his theory on rationale for learning became obvious.

The contradictions mentioned above generated a project. The aim of the study was to get insight into children's ability in symbolisation. It focused on getting to know the children's mathematical reasoning, their developing of and use of mathematical language. The focus of the project was on the school starters. "The formal language of mathematics" was not introduced. The children did not even write numbers as digits in the first school term. They elaborated, investigated, and developed signs and drawings as written language. They explained their reasoning, listened to one another in a more interested way than we had experienced from first graders before. Lots of them moved between low and high numbers in a competent way. The problem of differentiation was easier to cope with than we were used to. Some children worked on numbers below 5 and others worked on higher numbers and even experimented with numbers above 1000. This work showed evidence of diversity, concerning the children's reasoning and argumentation, their way of representing, and the contexts they (we) made relevant for mathematising. The teacher's voice was important; to stimulate, actualise, and develop the classroom discourse. We found it of great importance that the teachers were concerned about learning to communicate *on the children's terms* - to learn about their way of reasoning and of expressing themselves. We found the mathematical interests of the adults to be important.

The insight developed through this study showed how the children's use of language could be characterised as flexible, investigative, argumentative, actual and descriptive. The diversity became evident.

When reflecting on this now, 15 years later, one methodological tool becomes important: The formal school-mathematics that usually is part of the curriculum was not introduced. The mathematics that was defined by the curriculum was, of course, reflected in the work – but more important, the work implied a wider range of mathematics - and other ways of symbolising. *Excluding the formal mathematical language became a tool to get in touch with the diversity of children's knowledge. In the study this was seen as a tool for releasing the children's use of mathematical tools. It was a tool for learning about the mathematics of the children, to get in contact with and learn about the diversity.*

Work related to this study became basis for Teacher Education in the Nordic Countries. The documentation of children's use of knowledge and their linguistic and communicative abilities motivates teachers and teacher students to investigate, make use of and stimulate children's mathematical competencies. To an increasing extent it serves as an aim for teachers to actualise the formal mathematics as ways of reasoning, ways of expressing – in context of the diversity of children's mathematics (one way among other ways). (Johnsen Høines, 1998). When we started focussing on these aspects, we were met by ignorance and arrogance. Children have mathematical knowledge without being formally taught? Which mathematics can they do? What do you mean by mathematics when you claim this? We had to present examples of children's mathematics and their language. The responses often sounded like: "Oh yes… but this in not *real* mathematics…." (How did we dare to *touch the mathematics*!)

However, something has happened. When communicating with students, teachers, parents or "the average person" today, telling that children develop mathematical competencies outside school and before they start school; most people understand what it is about. They want some stories, and bring new stories. Do we see some movements concerning the attitude to mathematics in the society? How far we have moved?

If (or when) we are to teach pupils formal algorithms today, it is quite often organised in an investigative atmosphere. The pupils develop their own methods individually and by cooperating. They investigate the quality of their different methods. *To make the formal method to be investigated in the same way, and used accordingly can be seen as an aim.*

However, the processes moving between the informal and formal algorithms often seem to be difficult. The formal algorithms are not easily seen as one method among others. Should they?

DIFFERENT LANGUAGES STRUCTURE THE CONTENT DIFFERENTLY.

When discussing the different algorithms I remember saying: *There are different ways to express the same content*. At a distance I remember the voice of the child that I see supports another approach: *It is the same but it is not the same!* Different texts imply different content. They order the content differently. The content becomes different (Bakhtin, 1998; Johnsen Høines, 2002).

I see a comment from the Conference on Environment in Johannesburg 2002 addressing aspects related to this when it is said that one needs to acknowledge and support the language of indigenous people. The point was being made that their knowledge about the environment is important for the work on protecting the environment. It was argued that knowledge is implied within the language. Through language people structure their observations; they make their categories and their hypotheses. To protect languages is about protecting knowledge. It is important to the people that own the languages, and it is also important to the world (and the scientific field).

This can be seen in the context of the children's language: Their knowledge is implied in their language. This supports an approach to empower the children's mathematical language. It is important to them and it is important to us. It also tells us that the formal mathematical language is characterised by certain ways of ordering. The content is implied in the language. This is supported by the child's voice: *It is the same, but it is not the same!*

THE FORMAL MATHEMATICS – AN AUTHORITARIAN FIELD

When the authorised or formal mathematical language is positioned in this area it is not positioned as equal to the others (even if we try to introduce it that way). The formal mathematics is not easily seen as one alternative amongst others. Mathematical texts are authoritarian texts. We cannot deal with them "the way we want". Mathematics in school has an authoritarian tradition. The tradition is not easily changed, and is implied in the texts. (Text here refers to a text theoretical approach related to Bakhtin and Lotman. However I do not pretend to elaborate this perspective here). I describe the texts as authoritarian in the sense that a kind of loyalty and obedience is expected. The continuation of the text is expected to be in the line of how it is (Wertsch, 1991, p.78). This is embedded in the genre itself. It is underlined by the voices connected to it. These voices are the traces of the tradition. We can hear the "teacher's voice" making "explanations", talking about how to do it. We can identify parents' voices or voices from politicians. Those voices are implied in the text. The following section confirms that children interpret such voices.

CHILDREN HAVE EXPECTATIONS. THEY KNOW WHAT MATHEMATICS SHOULD BE.

Trude Fosse taught first grade pupils. She organised for situations where the children worked in investigative and interactive ways. The teacher and the pupils enjoyed themselves. Fosse saw lots of qualitative mathematical learning. However, the pupils commented: *This is fun, but when are we going to do mathematics?*

In her masters study Fosse (2004) questions: "*Do children have expectations about what school mathematics is to be without having been thought? If so, what do they expect mathematics to be?*" She videotaped children who had not yet started school when they "play school". Through the play they showed how they organise the classroom, how they take different roles as teacher and pupils, how they communicated and what kind of activity they focused on.

The videotape shows learning sessions dominated by correct and wrong answers, by focusing on paper and pencil, by pupils working individually, by focusing on discipline, on certain ways things have to be done and on the teacher as an authoritarian teacher, a teacher that decides which answers that *are* correct. When they played a learning session in Norwegian, the climate, the attitude and the activities showed to be different. They were supportive, polite and working friendly together. This masters study underlines the authoritarian nature of mathematics in school – it tells about what mathematics was expected to be by those children as part of the society. It tells that the teachers are not free to position the mathematics – the mathematics is positioned - even by the children.

COMMENTS

A focus on including children's mathematics into the mathematical classroom discourse is seen as a perspective on *inclusion and diversity*. This focus also implies a focus on how children have the possibilities of including formal mathematics as part of their mathematics. The authoritarian nature of mathematics affects the complexity in this field. It does not seem trivial to touch *the mathematics*. This invites questions like: Is it about avoiding mathematics as authoritarian texts or is it about what it does imply to educate people to touch, handle, and struggle with and investigate authoritarian texts?

This for me is one of the fundamental questions that underpin the theme of this panel.

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