Mathematics Teaching-Research Journal On-Line

A peer-reviewed scholarly journal
Editors: Anne Rothstein (Lehman College)
Bronislaw Czarnocha (Hostos Community College)
Vrunda Prabhu (Bronx Community College)
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Reflections of a Teacher Educator.

Harrie Broekman,
Freudenthal Institute for Math and Science Education, University of Utrecht, The Netherlands.

If we expect a lot of effect of teachers researching their own practice, we as teacher trainers have not only 'to teach as we preach', but also 'research our own practice'.

Shortly after writing about my reading of an interesting article and writing about it [1] for some colleagues, I realised that as a participant in a project for Teacher Researchers[2], I had to look more carefully at my own teaching. Not only *what I'm doing in reality*, but also the *main ideas behind my activities* had to be 'researched', or at least *reflected on in a critical way*.
The following is part of the ongoing reflection about "what tasks to use in my teacher training courses, why to use them and how to use them".

The main background ideas for selection of and work on tasks in teacher education.

[1] See appendix
[2] A EU sponsored project 'Professional Development of Teacher Researchers, called the Krygowska project.

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1. Mathematics is a human activity; a lot of doing and reflecting on the doing as well on the background of this doing. The strategy '*think, share and compare*' supports this.
2. In Realistic Mathematics Education both the horizontal mathematisation (real contexts used[3]) as well as vertical mathematisation (processing within the mathematical system[4]) are important.
3. Teachers' stories are an important tool for building a strong fundament for making teachers' tacit (hidden and not conscious) knowledge explicit.
4. Reflection – private, but also with the support of others – is useful and maybe even necessary for learning.
5. Implicitly is the importance of a questioning style, about which Vrunda Prabhu[5] wrote: "The questioning style also has the hope that the enquiring attitude m the regular classroom discourse become a part of students way of learning and creating their own mathematics"
6. As a mathematics teacher educator it is my task to investigate the most effective methods of improving learning in my pre-service and in-service courses.
7. As a trainer/educator of teacher educators it is also my task to investigate teaching and learning processes in general; the selection of classroom tasks included.

[3] Transforming a problem field into a mathematical problem
[4] Going 'deeper' in the mathematical structures etc
[5] Vrunda Prabhu, Independence of learning, MTRJ Online. V2;N1.

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An example used as a starter to 'open the minds of participating pre-service and in-service teachers for aspects of teaching, worthwhile to write about'.

A short article, written by a teacher, was given to a group of in-service teachers to comment, and – more specific - to 'look for' the aspects of her experience the teacher wrote about in this article and what aspects she didn't mention. I expected a lively discussion about what is interesting to write about and what is interesting to read about, and that happened and made us all become aware of our privileged focus points.

I named the activity: "learning from a human activity described in a teachers' story".

The teachers' story

A primary teacher – Lonneke Boels – described in a Dutch teachers' magazine how she added to the textbook (paragraph about tables and graphs) the question: "bring to the class newspapers, journals, telephone books, bus- and train time schedules, or other sources with tables and graphs in them. The children had to select from their materials at least one graph, one table and one

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diagram, and glue that on a A4 page. Next they had to circle one point in each figure and write down what the meaning was of that specific point in the given context."

The results were shared, compared. The teacher describes in the article what she observed as learning outcomes for the children and – according to her reflection, important for her own learning – what she didn't expect, what surprised here and what she intended to do as a result of that.

[Lonneke didn't mention that she was working in a classroom culture that is supportive, conversational and respectful; a community where ideas are valued (regardless of their mathematical validity), where there is trust (no ridiculisation) and where risk-taking is rewarded.]

Two illustrations of some important aspects of mathematics education.

Horizontal and vertical mathematising illustrated by two short stories.

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Story A. My daughter had to go to the railway station every working day of the week. She had the possibility to travel with bus 3 or bus 4, for both directions. Since she is not a routine person she wanted to have different routes on each day. Is that possible?

After a group of teachers worked on this many of them came with the (correct) answer NO.

The next question I gave them was: can you show this with some kind of a visualisation? And next: can you prove it?

These next questions were given because I wanted to involve the teachers in a discussion about 'modes of communication' and about the triple ' being sure', 'being able to convince a friend', and ' being able to convince a math teacher ' (proof?) The given ' realistic situation' was used to provoke different solutions. This time I did not expect a discussion about that aspect.

I was surprised by the results, both by the creative solutions as well as by the inability of some participants to visualise or explain their thoughts.

This made us – the participants agree with my decision to use a second, more inner-mathematical context, for further exploration.

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Story B. Each participant of my in-service group is asked to choose 5 lattice points on a 'square-dotted' paper with a coordinate system on it, and to find the midpoints of the connecting lines between each pair of dots. After my question if anybody found a midpoint without whole coordinates the answer was YES.

So, the next question that came up (asked by a participant) was: is it possible to find 5 points in such a way that all of the midpoints have whole coordinates?

And the whole group started to *think, share, compare* ***and reflect on the process.***

What didn't happen was the spontaneous emerging of the question that could have made the work on these two problems into a real "mathematics learning by horizontal and vertical mathematising". This question seemed to be in the Zone of Proximal Development of the participants. So, they needed a teacher/coach to ask some question to help them to 'learn'.

The best question I could think of was: 'What is similar in the problems A and B?'

A bit later in the conversation I also was the person who asked the question 'What presentation can you use to show that?'

Reflection on the work.

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Afterwards I realised that we missed in the conversation attention for the question: 'how can we help our students to start asking these kind of questions themselves and become independent of a teacher?' Next sessions with this group we have to find a moment to reflect on this question.

For me the most important part of the experience with these tasks (story 1 and 2) and the work on it was the reflection of one of the participants.
"At the beginning I didn't understand why you asked the second question, the one about 'presentation'. But then I listened to the reactions of my colleagues and thought that is a bit crazy that all of us tried to use 'language' (words) to 'show' the similarity in the problems A and B. Only when you pushed us to think deeper about the second question we started to look for other 'modes' of communication. Maybe that is the reason we don't stress enough the 'visual' ways of describing in our own classrooms. We don't use them easily ourselves"

These different modes of communication are – for sure – much more salient in contemporary society (Kress&Jewitt[6], 2003, p.1) and are for that reason stressed in the PISA tests as can be seen in the main processes (8 in 2000, or 7 in 2003), called *representation* (number 6) and *mathematical communication* (number 3).

[6] Kress, G. and Jewitt, C. , 2003, Íntroduction', in: Kress, G. and Jewitt, C. (eds) *Multimodial literacy,* New York, NY, Peter Lang, pp.1-18.

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My personal learning.

As a result of the described experience - and some other experiences - I'm much more focused at finding and using opportunities /tasks that can act as a challenge for participants in mathematics teaching courses. Challenges to work on, to reflect on their own work in mathematics, but also to reflect on the work of their students and to investigate their own role in the (mathematics) learning of their students.

Appendix.

Harrie Broekman, Freudenthal Institute for Math and Science Education, Utrecht University, was reading for you:

Ana Maria Lo Cicero, Yolanda De La Cruz, Karen C. Fuson.

Teaching and Learning Creatively: Using Children's Narratives.

Teaching Children Mathematics, May 1999, pp.544-547.

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Children's Math Worlds project seeks to integrate student's social, emotional and cultural experiences into classroom mathematics.

"We build on the individual experiences, interests, and practical mathematics knowledge that diverse children bring to our classrooms."

There needs to be a balance between *building on children's knowledge* and *teaching within the zone of proximal development* (also called the 'learning zone').

The project uses a Vygotskian model for unfolding, formulating, and solving mathematics problems from children's experience. This model describes one way in which teachers build on children's prior knowledge about various situations to facilitate student's construction of understandings of formal mathematical concepts, symbolism, and problems. The unfolding multiple narratives of different children's experiences provide a framework that is co-constructed by the teacher and children and within which teachers relate new mathematical ideas to children'' lives. The ZPD -–learning zone – is what children can accomplish with assistance. The teacher leads the children from a starting point to more advanced mathematical knowledge. This knowledge includes being better at listening, explaining and helping one another understand;

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learning more advanced, efficient and accurate solution methods; and learning mathematical symbolism, language, and new ideas.

- Getting started: eliciting and using children's stories.
- Understanding, listening and describing.
- Putting a story in mathematical terms.
- Problem solving, reflecting and explaining.
- The co-constructing process. The classroom conversation is co-constructed by all those involved. The active participants in a conversation each direct the conversation in certain ways. Each contribution stimulates thinking. Throughout the conversation, personal meanings are continually being constructed and reconstructed in ways that are influenced by the classroom process.

Conclusion

Listening to children, putting their stories in a mathematical context, using children's labeled mathematics drawings and number drawings, and eliciting explanations from children about how they solved problems are powerful approaches. But these approaches need constant leadership by

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the teacher so that children can progress in their knowledge of mathematical methods, vocabulary, and understanding.

In Utrecht we say that the teacher is needed to foster and coach the *horizontal mathematising* as well as the *vertical mathematising.* In classroom settings *interaction* plays an important role.

Part of the teachers' role is: giving students opportunities to share their ideas, opinions, and questions (creating a classroom environment in which mathematical thinking is encouraged and valued) The selection of tasks or learning situations/contexts as well as the teachers' own questions are an important ingredient in this teachers' role.