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Using Narratives as Innovative Tools in Mathematics Education Course in Finnish Teacher Education

Abstract: *In Finland the goal of elementary teacher program is to produce innovative, reflective and collaborative-oriented teachers who can combine knowledge of educational science with knowledge of subject pedagogy, e.g. mathematical pedagogy. In this paper we are presenting the use of narratives as tools in mathematics education course as one of the innovations in Finnish teacher education. Narratives are increasingly used as a methodological approach in research of educational experience, but also as pedagogical tools for facilitating students' views. Yet, in Slovenia, use of narratives has been neglected. Here we will describe two ways to reduce negative emotions towards mathematics by handling elementary pre-service teachers' memories from their years at school. The ways are 1) autobiographical, narrative interview and 2) 'narrative rehabilitation'. Through Ulla's mathematical biography we present how she handles her school time experiences and emotions and how the use of narrative rehabilitation during the mathematics education course influenced her views of mathematics. We conclude that emphasis in mathematics courses should not only be on future teachers' professional knowledge, but also on their personal beliefs and experiences. Therefore, narratives are one possible tool to reach this objective.*

Keywords: Elementary teacher education - Finland, mathematics education course, narratives, narrative interview, mathematical (auto)biography, mathematical identity, emotions

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1 INTRODUCTION

Finnish pupils had a great success in the PISA evaluations (2003, 2006), which raised interest in many countries as well as in Slovenia. In Slovenia, Finland is usually presented as a country with good educational system and good learning results of pupils. Because teachers often contribute to pupils' success, questions are raised, how teacher education programs are conducted, especially the elementary teacher program. In the following section we point out some main differences in Finnish teacher education in comparison to Slovenia.

From the 1990's, the objective of Finnish elementary teacher education program has been to produce innovative, reflective and collaborative-oriented teachers who can combine knowledge of educational science with knowledge of subject pedagogy, e.g. mathematical pedagogy. That is why Finnish teacher education is research-based (see, e.g., Lavonen, Krzywacki-Vainio, Aksela, Krokfors, Oikkonen, & Saarikko, 2007). What may be seen as the significant difference between Finland and Slovenia is the high societal status of Finnish teachers. Elementary teacher education program is also one of the most popular university level programs among Finnish upper secondary school students. Only 10-15 % of applicants have an opportunity to begin their studies in elementary teacher education program. Therefore, Finnish program enrolls highly motivated and talented students. According to the culture of trust, in Finnish education system there are no school inspectors, no approval procedure for learning materials or national assessment system and, so teachers are really responsible for pupils' learning outcome. For that reason, the importance of research based teacher education stands out even more.

Also the contents of mathematics (education) courses in elementary teacher program in Finland and in Slovenia differ from each other. In Finland the contents of the courses seem to be closer to future teachers' needs because their main aim is to improve students' pedagogical subject knowledge. In Finland, the strong emphasis in math education of future elementary school teachers is not only on their professional knowledge, but also on their personal beliefs and experiences, which together construct "teacher knowledge" (cf. Connelly and Clandinin, 2000).

The aim of our article is to present narratives as tools in mathematics education course as one of the innovations used in Finnish teacher education. We will describe through Ulla's case an example of the use of narrative approach. Especially we will focus on how her identity work started during mathematics education course and how this influenced on her view of mathematics.

2 NARRATIVES IN TEACHING, LERNING AND RESEARCH

Even though the narrative inquiry is more and more used for educational research purposes abroad, in Slovenia so far, there has been no much interest in using narratives.

According to Bruner (1986), people organize and manage their knowledge of the world in two broad ways: paradigmatic and narrative modes of thought. The power of paradigmatic thought is to bring order to experience by seeing individual things as belonging to the category, while narrative cognitions is directed to understanding of human action and therefore focuses on the particular and special characteristics of each action. Connelly and Clandinin (1990) were the first

who used the term narrative inquiry in educational research. Their starting point was what follows: "*Humans are storytelling organisms who, individually and socially, lead storied lives*" (Connelly & Clandinin 1990, p. 2). Therefore, the study of narrative is the study of the ways humans experience the world. Narratives are variously described as a method, as the result of a method, as a way of making sense of life, as a phenomenon (e.g. Connelly and Clandinin, 1990; Gudmundsdottir, 1995).

And what exactly is narrative? Here narrative means a story that has characters; a beginning, middle and an end; and is held together by a series of organized events, called plots (see, e.g. Gudmundsdottir, 1995, Kaasila 2007). Analogously, Polkinghorne (1995) with narrative refers to a specific kind of prose text - the story and to particular kind of configuration that generates a story, called emplotment. In other words, emplotment is producing a meaning to the story.

Narratives have found their practical application in two areas in the field of education (Gudmundsdottir, 1995)**:** The first is the teaching content and the second one educational research. Narrative inquiry has begun to be used as tool for teacher development in teacher education programs (see, e.g. Conle, 2000, Kaasila 2007). Thus in research as well as in professional development, two aspects of narrative inquiry had become intertwined: the method itself is useful and the resulting narrative accounts are useful. So narrative has important meaning as process and as product (Connelly & Clandinin, 1990).

Telling stories involves reflection on, selection of, and arrangement of events in an artful manner, which contains meaning for the teller and seeks to persuade the listener of their significance (Watson, 2006). We agree Sfard and Prusak (2005, 16, 21) when they define identities as "collections of stories about persons" and through narrative perspective stories are seen as "words that are taken seriously and that shape one's actions".

For teachers, issues of professional knowledge and practice are deeply entwined with each individual teacher's past experiences and future goals and with their identities (Connelly and Clandinin, 2000). The importance of the concept of professional identity lies in the assumption that who we think we are influences what we do (Watson, 2006).

3 NARRATIVES AS INNOVATIVE TOOLS IN MATHEMATICS EDUCATION COURSE

3.1 Mathematical (auto)biography and mathematical identity

In our study, we will use the following central concepts: mathematical autobiography, mathematical biography and mathematical identity. We see that in mathematical autobiographies pre-service teachers tell or write about past and present experiences they will see as meaningful for their development as future mathematics teachers. Mathematical autobiographies often involve personally meaningful episodes, important persons (role models), explanations, and especially the process how protagonists' beliefs of learning and teaching mathematics have developed. A pre-service teacher's mathematical biography is a life story, whose a researcher constructs together with that student. (see also Kaasila, 2007) The researcher's main task is to

construct a retrospective explanation how the pre-service teacher's earlier experiences have influenced his or her past and present mathematical identity (cf. Polkinghorne, 1995, Kaasila 2007).

Narratives have an important role when pre-service teachers develop their sense of identity, because they see themselves as protagonists in different stories. According to Kaasila (2007), a person's mathematical identity is a part of his or her narrative identity. One's mathematical identity is manifested when telling stories about one's relationship to mathematics, its learning and teaching. What creates the identity of the character is the identity of the story and not the other way around. (Ricoeur, 1992) We want to emphasize that pre-service teachers – like all people - adapt their narration to their audiences and to the social conventions of how language is used. Mathematical identity is a context-bound concept: we can have many narrative identities, each of which is connected to different contexts or social relationships. (see also Kaasila, 2007)

3.2 Narrative rehabilitation

In this article we will describe two ways to deal with negative experiences and emotions by handling elementary pre-service teachers memories from their years at school. The ways are 1) 'narrative rehabilitation', 2) autobiographical interviews. We see that these ways complete each other.

By applying the thoughts of Valkonen (1997) we see that pre-service teachers, like all human beings, interpret their lives as a narrative. In forming their mathematical autobiography pre-service teachers will often use cultural story models. Narrative rehabilitation can support pre-service teachers in regaining authorship in their mathematical autobiography.

At the beginning of the mathematics education course (September 2008) the second author of this article presented excerpts (stories) from six pre-service teachers' mathematical biographies taken from his dissertation (Kaasila, 2000). Then he applied narrative rehabilitation (cf. Valkonen, 1997) in the following way: pre-service teachers were offered opportunities to tell stories about their school time memories and share their experiences with other in smaller groups. If students remember from their past mainly failure, and if they see only menace in their mathematical future, they unconsciously interpret their mathematical autobiography from a viewpoint of a tragic story. When students reflect occasions and have an insight that the interpretation can be changed, it can free them to search new aspects into their mathematical past and future, and their self-confidence as mathematics learner and teacher might improve. (Kaasila 2000, cf. Valkonen 1997)

3.3 Autobiographical interviews

In this study, the first author of this presentation collected in spring 2009 qualitative data for her dissertation from Faculty of Education at University of Lapland in Finland. Her data consist of six second year pre-service teachers' narrative interviews. They had negative experiences about learning mathematics during their own school time. The interviews were made after mathematics education course and teaching practice. The aim of the narrative interviews was to get these students to tell stories about experiences and persons that are important to them. She used open

questions that usually elicit narratives: the open-ended prompt "tell me …" makes it possible for interviewees to tell about things and events which are meaningful to them and often also to produce detailed narratives. In this article we will through Ulla's case describe how the use of narrative rehabilitation and autobiographical interviews did improve her identity work. The other participants of our study had same kind of experiences as Ulla had.

4 ULLA'S CASE: How did Ulla's identity work begin?

Ulla: Needed encouragement, resigned

Motto: ***" I was really happy that first we...were discussing about our experiences in math..."***

Ulla's experiences with mathematics during her school years: Ulla's negative experiences started in fifth grade. Math somehow became more difficult for her, mostly because of the content and the teacher. Ulla developed negative attitudes towards math: » *So then, I started to think like really negative about it, like this patience...I didn't really have towards math, I just gave up...I don't get this and the teacher doesn't teach me, so I don't care.* ***[...]*** *Of course if you have some difficulties it gets more challenging and then it's easier to give up [...].*

In secondary school, Ulla's negative experiences continued. Again, the teacher was main character of her memories that time, mostly because he favored pupils who were good in math: *"Like I just remember that she was helping those very much and talking to them and giving them more challenging tasks.... she didn't have the patience to teach those who are not good…she didn't encourage weaker pupils.«* Her grades were lower at that time what also affected her attitude and emotions towards math. The second cause for her negative emotions was her teacher: "*...I think the teacher in secondary school it was a final drop. Like in a way that I'm just...I'm not going to succeed in math ever«*. Ulla also blamed herself for contributing to her negative experiences by giving up on math: *» I think kind of...that I have already gave up on math. And then I didn´t get this encouragement from the teacher, like…i just gave up on learning...on trying to learn math«*.

In upper secondary school, Ulla experienced some positive changes mostly because of the teacher: »*And she was really like encouraging and when I asked for help, she explained. She helped people who needed help, and she was really excited about math herself […] she was not just assuming that everybody knows that.«* Ulla compared her teacher in upper secondary school with teachers that taught her before: *»I think she was a first teacher for a long time that actually believed in me and she actually said...you can, you can do this [...] and she did not make me feel stupid«*. Yet at the end of upper secondary school, Ulla's negative attitudes towards math returned due to the new math teacher.

Ulla's experiences with mathematics at university: Ulla is in second year of her studies to become an elementary teacher. Ulla said, she liked mathematics education course and the lecturer of it: »*I liked his methods very much, but I was really happy that first we...we started that we were discussing about our experiences in math...and that was really like...for me it was really important and I didn't expect that we would do that kind of things*«. It was very relieving for her to see that she is not the only one with negative experiences and feelings. Ulla told that

due to this course, her experiences with mathematics at university changed towards positive. The main reason for change was the teacher of the course: *» [...] even though he is very good in math himself, he's not looking at you that you can't do it...he's encouraging«.*

After the mathematics education course Ulla taught mathematics during the second year teaching practice. Before the teaching experience in grade 1, she was afraid and worried, but at the same time excited to teach math. About her teaching experience, she said: "*I liked it and It was also surprising for me that it was actually...it was one of the most interesting subjects to teach, even though it was the first grade and the math is so simple there, but in a way how many different things you can do when you are teaching math to children«.*

For future teaching, Ulla is *»a bit scared«*. She is confident about teaching lower grades, but she feels *"challenged"* to teach math to fifth or sixth graders. She sees some benefits from her negative experiences and emotions: *»At least that I can understand students that have difficulties in math and that I know myself how to deal with those students, how to teach them. I would like to encourage them...all of them«.* As a future teacher, she wants for her pupils to have positive experiences with math, but she knows that she herself still has some negative attitudes towards math. Because of the pupils, she would like to change her attitude**.**

Summary of Ulla's case: Ulla had many negative experiences and emotions during her schooling. It seems that teachers are the main characters in her negative experiences with mathematics. Due to difficulties with the content and teachers' lack of encouragement, she developed negative attitudes towards math and completely gave up on it. During Ulla's school years, she met with failure, she experienced math test anxiety and she was disappointed of herself. Belief of "not being able to succeed in math ever" was strongly present in her identity talk. In upper secondary school, she experienced first positive change due to the teacher. Ulla felt encouraged and believed in. At the end of upper secondary school, Ulla's negative attitudes towards math returned due to the new math teacher.

Ulla's second change occurred after mathematics education course at university. She liked it, especially the teacher and his way of teaching. Especially she emphasized the role of narrative rehabilitation applied during the course. Being encouraged to discuss about her prior experiences and realization of not being the only one with this kind of experiences elicited more positive attitudes. After the course Ulla had her first teaching experiences in mathematics, which turned out to be positive. She still has some doubts about teaching in higher grades, mostly because of her math abilities. As a result of narrative rehabilitation she sees also benefits about her negative experiences, because she is able to take a role of a weaker pupil. She wants to offer her pupils positive experiences with math.

5 DISCUSSION

Earlier we have considered how elementary education students' views of mathematics changed during their mathematics education course in three Finnish universities. We identified the following central facilitators of change: 1) handling of one's experiences of learning and teaching mathematics, 2) exploring content with concrete materials, and 3) collaboration with a partner or working as a tutor of mathematics. (Kaasila, Hannula, Laine & Pehkonen, 2008) Here

we focused on the use of narratives as tools in mathematics education course, and we see it two folded.

Narratives in mathematics education course serve as rehabilitation of negative views that pre-service teachers carry with them from their previous school years. By giving to the students opportunity to talk about their memories, discuss them in groups and reflect them, students with negative memories, seem to experience positive change just by recognizing "they are not the only ones". When giving voice to pre-service teachers, a safe and supportive learning environment is created, and students feel that their stories matter. As we saw in Ulla's case, there were some key events and significant others, especially some teachers, that formed her negative attitude towards mathematics.

At the same time, narratives have another role. Through autobiographical interview conducted here, we can see the development of Ulla's mathematical identity. All Ulla's past experiences influenced her past and present mathematical identity. In her past mathematical identity, Ulla's view of herself as a learner shows strong "giving-up orientation" (Yrjonsuuri, 2007). Recently, when narrative rehabilitation was applied in mathematics education course, her view of mathematics changed through reflection of these experiences. It seems that narrative rehabilitation enabled her to find and reflect her negative experiences and to turn them into benefits. Ulla's past and present mathematical identity have influence on her future one, especially on her view of herself as a mathematics teacher and on her future practice. According to Watson (2006), there is a link between professional identity and professional action; therefore mathematical identities can be seen as closely connected to mathematical practice.

According to Polkinghorne (2007), in narrative studies the purpose of the validation process is to convince readers of the likelihood that the claim can serve as a basis for understanding of action in the human realm. Often it is difficult to pinpoint the factor that has been most significant in pre-service teachers' process of change. Here we have described Ulla's case in detail, so that readers have an opportunity to see how the use of narrative rehabilitation has influenced her mathematical identity. Yet, all persons reflect on their past events from the perspective of their present situation: when relating a narrative, one knows how it will end and the narration is adapted accordingly (see e.g., Schütze 1984, Kaasila 2007). Although the findings of this study are promising, we will see later how long lasting the changes are.

The use of narratives as pedagogical tool and for purposes of professional development of pre-service teachers, as seen in this paper, was also studied and used by Chapman (2008). We agree with her, that narratives provide a reflective way of knowing, which is widely accepted as a central goal in teacher education, also in Finland.

It is also possible to use bibliotherapy to handle of one's mathematics experiences. It means the use of reading to produce affective change and to promote personality development (Lenkowsky, 1987). The second author of this article has applied bibliotherapy during mathematics education course in the following way: when pre-service teachers wrote their mathematical autobiographies, they read the six mathematical biographies included in Kaasila's (2000) dissertation and selected the one that most closely resembled their own background. Pre-service teachers' identification

with another student, having a similar background, can significantly contribute to changes in their mathematical identity (Kaasila, Hannula, Laine & Pehkonen 2008).

Some of the students due to their prior experiences, have poor attitude toward mathematics and one-sided beliefs on teaching mathematics (Pietila, 2002), and on the other hand, there are also students who have experienced only success in mathematics during school years and may find it hard to understand pupils who are »weaker« in math (Kaasila, 2000). Considering also some findings that pre-service teachers can transmit e.g. their emotions (e.g. math anxiety) towards mathematics to their students (e.g. Gresham, 2007; Pietila, 2002), it is especially important to emphasizes narratives during mathematics education courses. We believe that emphasis in courses should not only be on future teachers' professional knowledge, but also on their personal beliefs and experiences. So these kinds of innovations would be very welcome also in mathematics education courses in Slovenia.

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