

Assessment as a Tool in the Professional Identity Development of Novice Mathematics Teachers

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This paper focuses on how novice primary school mathematics teachers use assessments as a tool in professional identity development. Using assessment primer as a tool in professional identity development, rather than as a tool in planning and performing teaching, has been explored in a case study of novice primary school mathematics teachers. The respondents equate students' results in assessments with understanding and learning. They use the assessments primer as confirmation in their identity development as mathematics teachers and not as material for planning lessons. In this paper, confirmation through assessment is illustrated by the case of Helena, one of the respondents in the study.

Introduction

The empirical material and the results presented in this paper are from a study investigating novice primary school mathematics teachers' professional identity development as seen from the perspective of the teachers themselves. In the study confirmation has turned out to be a one of several elements in this professional identity development. This confirmation is expressed in many ways, one of which, *confirmation through assessment*, will be the focus of this paper. The novice teachers' need of confirmation results in them using the students' mathematical achievement assessment primer as an instrument in developing their professional identity as mathematics teachers rather than as a teaching instrument.

First in this paper, the study, its theoretical framework and its setting regarding assessment will be presented. After that, professional identity development as a mathematics teacher through confirmation by assessment will be illustrated using the case of Helena, one of the novice teachers in the study. The paper ends with a final discussion.

Theoretical framework

There are many studies regarding novice mathematics teachers and how they teach, or more often how they do not teach as intended, based on their teacher

training. For example, several of the studies that Cooney (2001), Phillip (2007) and Sowder (2007) refer to in their research reviews show that teacher education has little effect on teacher students, and that what students learn in teacher education tends to transform when they start working as novice teachers. These studies often provide an external perspective where the researcher observes and evaluates novice teachers teaching. Based on these results, the perspective of the novice teachers themselves became important in the present study when trying to understand the process of becoming and being a primary school mathematics teacher.

According to Gee (2000-2001), identity is to be recognised (by oneself or others) as a *kind of person* in a given context, which would imply that professional identity as a teacher of mathematics is being recognised recognised (by oneself or others) as a teacher of mathematics in a given context. As such identity has both individual and social elements. Similar Morgan (2010) writes that establishing a (positive) professional identity as mathematics teacher involves positioning oneself “within discourses of education in general and mathematics teaching in particular (p.109)” in ways that allows to be seen by others and oneself as a (good) teacher of mathematics.

In the study, two theoretical perspectives, communities of practice (Wenger 1998) and patterns of participation (Skott 2010, Skott, Moeskær Larsen & Østergaard, 2011), are coordinated in a conceptual framework (Figure 1) aiming to capture both the individual and the social part of identity development (Palmer 2010), involved in the over described recognition as a *kind of person*.

Skott (2010) describes patterns of participation as the pre-reified processes of teachers’ participation in social practices, some of them orientated towards the teaching and learning of mathematics. The patterns of participation of interest in this study are the respondent’s patterns of participation regarding mathematics teaching and the sense of being and developing as a teacher.

According to Wenger (1998), a community of practice is a set of relationships, an activity system regarding mutual engagement, joint enterprise and shared repertoire. In this study, communities of practice are interpreted as several individuals’ overlapping patterns of participation which give the origin of such mutual engagement, joint enterprise and a shared repertoire. Individuals’ patterns of participation in social practices give rise to these and, at the same time, are the results of them. As such, communities of practice are simultaneously both the result of and the source of patterns of participation, and vice versa.

The individual’s patterns of participation become the unit of analysis (the social in the individual¹) when the individual is in the foreground. When, instead,

¹By the *social in the individual* it is meant that the main focus is on the individual, while emphasizing that the individual can never be understood if separated from his/her social practices.

the collective is placed in the foreground, communities of practice become the unit of analysis (the individual in the social²). According to Wenger (1998), identity development is an individual's learning trajectory through different communities of practice. That learning trajectory can be interpreted as changes in the individual's patterns of participation. By freezing the process and objectifying the patterns of participation in communities of practice, you can talk about professional identity. By doing freezings like this and comparing these objectifications several times over a period of time, you can talk about professional identity development. However, the identity and identity development are not objects within the individual; they are objectifications of an ongoing process. This paper will however not focus on identity development and the conceptual framework as a whole. Instead the individuals' patterns of participation regarding assessment in mathematics will be in the foreground.

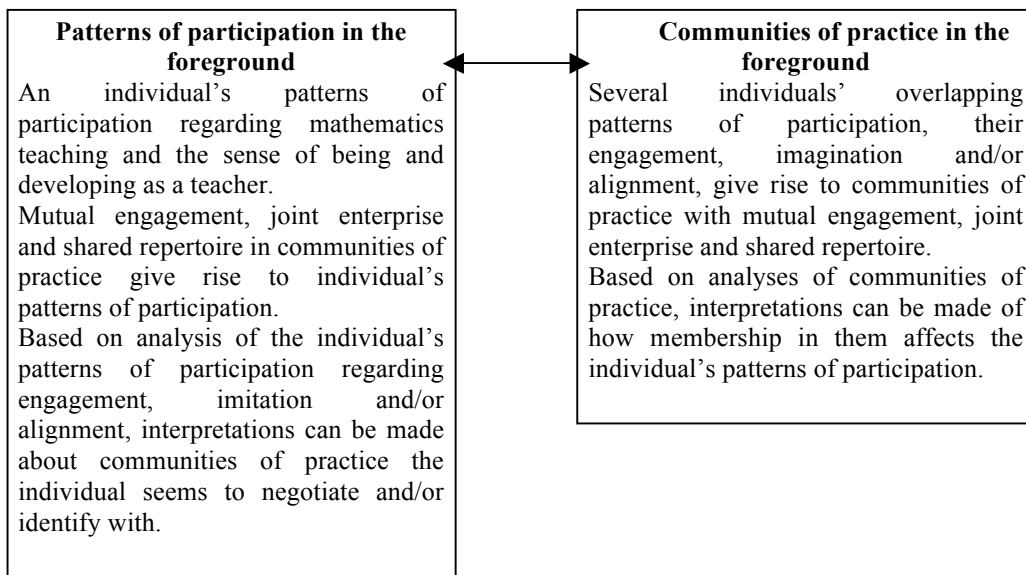


Figure 1: The relationship between patterns of participation and communities of practice.

The study

The present study is a case study where seven primary school mathematics teachers have been followed from their graduation and two years forward. The novice teachers in the study were chosen because they wrote their final teacher education Bachelor theses on mathematics education.

An ethnographic approach has been used when discovering the recognitions of others and selves as *kinds of persons* and trying to sustain the perspective of

² By the *individual in the social* it is meant that the main focus is on the social, while emphasizing that the social can never be understood if separated from its individual actors.

the participants. Ethnography is a way of looking at, listening to and thinking about social phenomena where the main interest is to understand the meaning activities have for individuals and how individuals understand themselves and others (Arvatson & Ehn 2009; Aspers 2007; Hammersley & Atkinson 2007). According to Aspers (2007), gaining such an understanding requires interaction. Interaction is not enough in itself but is a condition which implies that the researcher participates with, observes and interviews respondents in the field of study. Similarly, Charmaz (2006) emphasises the importance of researchers producing rich data that goes beneath the surface to reveal the respondents' views, feelings, intentions and actions.

The empirical material in the study has been collected through observations, interviews and self-recordings made by the respondents. These varying empirical materials have different characteristics but are treated as, named by Aspers (2007), complete-empiricism, implying all the material constitutes a whole that the analysis is based on in order to shed light on the professional identity development of the novice mathematics teachers. Neither in interviews nor in observations questions were asked about the respondents' use of assessment. When doing their self-recordings the respondents knew the purpose of my study based on interviews and observations but they were told to record whatever and whenever they wanted and that it was up to them to decide what was important for me to know about starting to work as primary teacher.

Analysis is not a separate part of ethnography; it starts in the pilot study and continues through the fieldwork and the writing process (Hammersley & Atkinson, 2007). The results presented in this paper have been developed gradually based on interplay between fieldwork and analysis of observations, interviews and self-recordings. The interviews and self-recordings have been transcribed and, together with the field notes, coded using methods inspired by grounded theory (Charmaz 2006). The coding was done gradually; building categories based on the question "what is happening here?". Confirmation is an example of one such category within which *confirmation through assessment* as presented here is a subset.

Assessment in mathematics

This paper is not about assessment per se but about novice teachers' patterns of participation regarding assessment in mathematics, about the meaning assessment has for them. In this section however, a brief illustration of research regarding teacher's use of assessment will be presented. Also a brief illustration of what is written about assessment in various steering documents which novice teachers in the present study refer to when performing and talking about assessment will be presented.

According to Lyon (2011) research on assessment at the classroom level usually takes an assessment-centered, teacher-centered, or student-centered approach. The most researched of these is the assessment-centered approach (William, 2007; Lyon, 2011). In this paper the teacher-centered approach is the one focused which according to Lyon (2011) and Shavelson et.al (2008) primarily is concerned with how teaching and students learning can be improved by the use of formative assessment. Another direction in the teacher-centered research is teachers' beliefs about assessment. There are also studies regarding teachers' use of self-assessment or self-reflection as a technique for self-improvement (Elbaz, 1988 & 1991; Ross & Bruce, 2007). In those studies self-assessment or self-reflections are used to change teacher practice. By the use of the search words teacher, assessment, identity, development and evaluation, in different combinations, I however have not been able to find any studies regarding relations between teachers' use of assessment in everyday teaching and their professional identity development.

In various steering documents in Sweden formative assessment are in the foreground. According to the primary school curriculum (Skolverket, 2011), teaching shall take its starting point in students' prior experience and pre-knowledge. Teaching is to be constantly examined and evaluated. Also, teachers shall evaluate and inform students, parents and principals about the knowledge development of the individual students .

The Swedish National Agency for Education provides both obligatory and optional tests. The purpose of these is, according to the Swedish National Agency for Education, to provide an equal judgement of students and to increase target achievement. The results of the tests can also be used by the teachers when planning lessons (www.skolverket.se³).

Diamond is one example of an optional test offered by the Swedish National Agency for Education. Diamond consists of 55 diagnoses intended for use in primary schools. Diamond's aim is to map the students' knowledge development and to provide material for the planning of teaching with good "supposition of students reaching arrayed knowledge goals (Löwing & Fredriksson, 2009 s.4)."

Finally, goals in the educational plan⁴ of the teacher education that the novice teachers in the study had just completed included demonstrating the ability to plan, carry out, evaluate and develop teaching, and demonstrating the ability to analyse, evaluate, record and assess students' learning in relation to goals.

In the different documents referred over different terms are used, for example evaluation and test, but in this paper the term assessment will be used as an umbrella term.

³ http://www.skolverket.se/prov_och_bedomning/2.1100 111017

⁴ <http://www.student.vxu.se/utbildning/pdf/200808281300330001.pdf> (111017)

The case of Helena

By analysing the empirical material provided by all seven respondents', confirmation appears to be a central part of their becoming primary school mathematics teachers. This confirmation is expressed in different ways where the confirmation through assessment presented here is one which relates to how novice teachers use assessment of students' knowledge as a tool in their own professional identity development. This use will be illustrated by the case of Helena. She was chosen for the paper since she directly after graduation⁵ got a job as primary teacher including teaching in mathematics. However, the patterns of participation regarding assessment that Helena illustrates refer to all respondents in the study.

After graduation, Helena starts working as a class teacher in an upper primary school. She teaches several subjects amongst them mathematics. She works at the same school for two years after graduation but since her first and second classes at the school are sixth grade, she changes changed students three times. Her last class is a fourth grade class. However, independently of students or grade she uses and talks about assessment in the same way throughout the two years.

Mathematics lessons in Helena's class often start with a Diamond diagnosis, the optional test offered by the Swedish National Agency for Education presented earlier. Helena put together the students' results in different tables which she often shows me.

Yesterday [...] we had a little test in mathematics. I am testing them with tests from Diamond. And we have been working with sequences of numbers and simple shapes. And that result was really good which felt very good. [...] I believe it feels quite nice. (self-recording)

When using and talking about the Diamond test, Helena does not emphasis how she is going to perform future teaching based on the results. Instead, she mentions how she feels. When performing assessments, Helena often equates the students' results with understanding, for example "most of them have understood what it is about" or "test how much of it they understand now".

Yesterday [...] we had planned to split the class in two halves during the mathematics lesson. [...] After the lesson I actually felt that most of them understood. They worked and when I looked through their papers it felt good because the most of them have understood what it is about. (self-recording)

In the quotation above, what is interesting is also what Helena does not say. She does not talk about the layout of the mathematics lesson (even though her saying

⁵ In Sweden, it is difficult to get a job as primary teacher as there are more qualified teachers than jobs. <http://www.hotellrevyn.se/files/1002021427416/varfinnsjobben2010.pdf> (111021)

that she has looked through “their papers” indicates that the students have written something connected to mathematics during the lesson) or about the mathematics content that the students had understood. What she singles out is that their understanding “felt good”.

In addition to the Diamond tests, Helena’s mathematics lessons mostly consist of an introductory explanation by Helena and then the students working in their math books. The math book is structured with tests at the beginning, during and at the end of chapters.

Today the students started by doing “test yourself”⁶ without them first having worked with multiplication by ten, hundred or thousand in the math book. We⁷ wanted to test how much of it they understand now based on our explanations. It turned out to be much harder than we had thought. [...] But it was rather interesting that so many actually hadn’t understood what we had been doing during quite a lot of lessons. (self-recording)

Again Helena equates the students’ results with understanding or, as in this case, non-understanding. In cases like this, when students are not learning, Helena often emphasises different possible reasons for that. For example one time, when three students failed a test in the math book, Helena explains that two of them have mathematics action programs and that the third was about to get one and that “he should have already had one in grade four”. In a way, such explanations absolve Helena from the responsibility for the non-understanding and non-learning and enable her to focus on the feedback from students which indicates that they are learning mathematics.

Helena often talks, both with me and her students, about the curriculum and the importance of students reaching their goals. However, there are few signs of her using the results from the different assessments when planning and performing her mathematics teaching. Instead, the math book and the Diamond test together frame the structure of and not the design of her mathematics teaching.

The plan is for them to reach the diagnosis⁸ this week so we can get further and start with fractions before Christmas. My plan is to do another Diamond test⁹ with them this week to check them a little. (self-recording)

⁶ In the math book, every other chapter is followed by a section “test yourself”. The purpose is to see if the student has learned the content of the chapters.

⁷ ”We” is referring to Helena and a teacher of special educational needs.

⁸ In the math book, every chapter starts with an introduction to the mathematical content in that chapter. The introduction is followed by a diagnostic test of that content. Based on their result in the diagnostic test, the students then continue working at different levels of difficulty.

Final discussion

The way Helena uses and talks about assessment in mathematics can be seen as her patterns of participation regarding assessment in mathematics which I interpret as *confirmation by assessment*. As previously mentioned, identity according to Gee (2000-2001) is to be recognised as a *kind of person* in a given context, and according to Morgan (2010) to be seen by others and oneself as a teacher of mathematics, which would imply that professional identity as a teacher of mathematics is being recognised as a teacher of mathematics in a given context.

Being a teacher of mathematics means developing a sense of self [as] a teacher. Such an identity grows over time. It is built from many different experiences with teaching and learning. Further, it is reinforced by feedback from students that indicates they are learning mathematics, from colleagues who demonstrate professional respect and acceptance [...] (NCTM, 1991, p.161)

The quotation from NCTM over is not based on research but the results presented in this paper validates the part regarding development of self [as] a [mathematics] teacher being “reinforced by feedback from students that indicates they are learning mathematics”. The novice teachers in this study use *confirmation by assessment* to get this feedback. Through their use of assessment, their patterns of participation regarding assessment in mathematics, they recognise themselves as a [good] teacher of mathematics. This may also be the case for experienced teachers but that has not been a part of this present study.

Based on the different steering documents presented in this paper, assessments are intended to be used to evaluate and inform students, parents and principals about the knowledge development of the individual students, to provide an equal judgement of students, to increase target achievement, to map the knowledge development of students and to provide material when planning lessons. When talking about teaching in general, Helena sticks strictly to the curriculum but in her use of and talk about assessment, those aims are no longer the focus. She maps the students’ results but does not use them as material for planning lessons instead she sees them as confirmation that she is doing a good job as a mathematics teacher.

An individual’s pattern of participation is a merge based on different experiences in different communities of practices (Wenger, 1989). The content in steering documents frame a shared repertoire in a document-based community of practice regarding assessments. Through the use of ethnography in this study, the respondents’ patterns of participation regarding assessments have been explored as a merge of the approach in that community of practice and the need for confirmation of student learning in the respondents’ identity development as

mathematics teacher. Wiliam (2007) mentions evaluating the quality of educational programs as one purpose with assessment. In this present study the novice teachers use assessments to evaluate their own teaching. To get feedback on student learning the novice teachers have developed a pattern of participation regarding assessment in mathematics that could bring about the wanted feedback. Assessments (the tests in the math book and the Diamond diagnoses) designed for formative assessment (supporting learning) are used in a summative way (certifying the achievements or potential of individuals) as confirmation of students understanding and learning.

In one way, Helena and the other respondents are able to determine their own confirmation. They can choose when to test the students and on what. Even though there is not a straight line between teaching and learning they by their teaching and choice of tests have a big influence on their own confirmation.

In a final group interview two years after their graduation, the respondents were united in wanting to show that they know how to teach mathematics. One way for them to demonstrate that, both to themselves and others, is confirmation by assessment. In order to know that she is doing a good job Helena keeps records of the students' learning. For Helena the records of test results become records of students learning. As such the records make it possible for Helena to demonstrate that she has the qualities of a good mathematics teacher which, according to Morgan (2010), is one part of being seen by others and oneself as a teacher of mathematics. As such, confirmation by assessment is a part of these respondents becoming and being primary school mathematics teachers. However, confirmation by assessment is just a partial result in the present study and does not mould the professional mathematics teacher identity as a whole but it is part of a big puzzle.

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