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# Exploring the patterns of participation framework for studying multilingual mathematics teachers' identities

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*Selecting a theoretical framework to study mathematics teachers' professional identity when focusing on multilingualism is an open question. This paper explores the affordances of the Patterns of Participation framework for studying the professional identities of multilingual mathematics teachers. A case of a multilingual teacher working in multilingual mathematics classrooms in Sweden was used as an example, with data sources comprising one informal interview and one classroom observation focusing on the communication of mathematical concepts. The framework highlighted that when the teacher participates in a multilingual mathematics classroom, she may draw from the Swedish reform, her previous experiences from the classroom and her colleagues' approach, all in relation to the learning and communication of mathematics concepts.*

*Keywords: Mathematics teacher, professional identity, multilingualism, patterns of participation.*

## Introduction

Mathematics education research at an international level has shown that teachers' linguistic backgrounds and their views on language and mathematics learning are critical in their becoming and being mathematics teachers in multilingual classrooms (Yeh, 2017). Multilingual teachers' identity is a common interest in research on language education, while research that intersects multilingualism and teacher's identity is scarce in mathematics education. In particular, Darragh (2016) has noted that studies focusing on social identities, such as language diversity or immigration, refer only to students' identities.

Research on identity takes multiple theoretical approaches (Darragh, 2016). However, this plethora of theoretical approaches has yet to be used to study particular issues of multilingualism concerning identity. Theoretical approaches used in mathematics education for tapping into issues of identity and multilingualism follow a post-structuralist perspective (e.g. Delacour, 2020). While the post-structuralist perspective usually aims to challenge societal discourses related to multilingualism, no framework that unfolds societal aspects and personal experiences that shape multilingual teachers' identities from their perspective has been tested.

To develop an understanding of the contextual and personal aspects that may play a role in being a multilingual mathematics teacher in the multilingual classroom, a framework that focuses on developing an understanding of such aspects is needed. Patterns of Participation (PoP) is such a framework. Therefore, it may be suitable for this purpose, as it views the individual in a classroom interaction as the unit of analysis, including the question of which practices (past or present) and figured worlds are of importance (Skott, 2018). Such a framework may also allow a new understanding of teachers' actions in multilingual mathematics classrooms. So far, the framework has been used to study teachers at the beginning of their careers right after graduation (Skott, 2019). While PoP focuses on teachers going through a big transition at the beginning of their careers, there

is no such emphasis on transitions later. Particularly for multilingual teachers, a significant change may include being educated or having working experience in another country. Moreover, PoP has not been used in cases where the emphasis is given not only to teachers' relation with the subject of mathematics but also to other professional aspects, such as being a multilingual teacher.

This paper aims to illustrate the affordances of the PoP framework when studying the professional identity of multilingual mathematics teachers, in terms of examining whether and how language is relevant to teachers' professional identity. The present analysis will not provide results on teachers' identities but will explore the potential of the framework offered to study teachers' professional identity when multilingualism is in focus. Thus, the question is posed: What are the affordances of the PoP framework for studying multilingual teachers' professional identities, when examining teachers' talks and interactions with students, in which language matters are brought up as a topic?

## **Multilingual teachers in the Swedish educational context**

### **Multilingualism in the Swedish context**

Multilingualism in this paper follows a sociolinguistic perspective (Valdés-Fallis, 1978) and is understood as individuals' participation in different linguistic communities. In the Swedish context, multilingual teachers are understood as those who can participate in linguistic communities that may include languages other than Swedish. Teachers' linguistic repertoire may be related to their immigration background. Multilingual teachers are a part of the Swedish educational system. Since around 2014, many refugees with university diplomas from their home countries have arrived in Sweden (Bunar, 2017). Moreover, many multilingual students needing language support have created an extensive need to integrate multilingual teachers into Swedish schools (Bunar, 2017).

### **Previous research**

Few studies in the Swedish context focus on the issue of identity and language diversity, either through the integration process of newly arrived teachers in Swedish education (Ennerberg & Economou, 2020) or in everyday preschool life (Delacour, 2020).

The integration of teachers in the Swedish educational context has been accomplished by educational initiatives (Bunar, 2017). Ennerberg and Economou (2020), who studied newly arrived teachers' identity negotiation when participating in such an educational integration program, found three different ways these teachers negotiated their new professional identity. Some teachers added to their teaching identity according to the new idea of what being a good teacher meant in Sweden. However, others sustained their previous teaching identity while becoming critical about what was needed to be a teacher in Sweden. Finally, there were those whose personal aspects, such as their immigration status and lack of language proficiency, became embedded in their professional identity, leading to the fear of being unable to become qualified teachers in Sweden (Ennerberg & Economou, 2020).

Delacour (2020) used a case study to investigate the identity formation of a multilingual preschool teacher in preschool mathematics while navigating the multiple expectations and social discourses that may play a role in this. The teacher drew from the discourse of mathematics as an essential subject; she was interested in and good at mathematics, and her colleagues valued her for that. She also drew from the discourse that points out the role of play in Swedish preschool mathematics and

the different kinds of expression for students' learning. She achieved this via her view of language, which was seen as necessary because different kinds of expression are needed to learn mathematics. The teacher opposed the discourse that views multilingual students as performing poorly in mathematics by drawing on the discourse that points out that students need to use all their languages to understand mathematics. She used her experiences as an immigrant to influence students to develop both their Swedish and their mother tongue.

## **Theoretical background**

The PoP framework focuses on teachers' professional identities and, according to Skott (2018), was designed to understand teachers' development in everyday school practice. Through PoP, one can recentre the individual while retaining a participatory approach (Skott, 2018). In this study and according to the framework, identity is seen as the multilingual mathematics teacher's experiences during interactions with students in the mathematics classroom and with others in the school context. PoP allows an understanding of a multilingual teacher's identity starting from the present teaching context and the interactions that the teacher is a part of without neglecting the influence of several social aspects existing in those interactions. Moreover, it allows the teacher's interpretations of the situations and their experiences from other contexts to be considered.

Four concepts are presented in the framework: *interaction*, *practice*, *figured worlds*, and *participation*. The notion of *interaction* originates in symbolic interactionism (Blumer, 1969), and it is connected with the process of interpreting teaching as a teacher positioning themselves towards individuals as well as towards generalised others. *Interaction* is associated with two processes in which the teacher engages; the first is acting, which can indicate what others need to do, and the second is interpreting others' actions or reactions to specific behaviours (Skott, 2019). In every interaction, the notion of self (Mead, 1934) is involved, which is relevant to identity. The self involves the process of the person acting, but at the same time, adjusting the action accordingly by taking individuals' views or generalised others about them (Skott, 2018). A premise of PoP is that in the case of teacher *interaction* with students, different *figured worlds* and *practices* play the role of the generalised others that contribute to the *interaction* (Skott, 2019).

According to Skott (2018), *practices* and *figured worlds* may significantly orient contextually dependent identities as they evolve in classrooms and schools. The concept of *practice* is understood as a social phenomenon that does not belong to any individual and is not predetermined by anyone; instead, it is created as the individual participates in an endeavour while interpreting the situation in different ways (Skott, 2018). It may be discursive or not, as it may be related to other communities (Wenger, 1998) that are not physically present while the classroom practice unfolds. An example may be teachers' intention to develop close relationships with students (Skott, 2017).

*Figured worlds* may play a significant role for teachers while *interactions* unfold (Skott, 2017). According to Holland et al. (1998), *figured worlds* are "socially and culturally constructed realms of interpretation in which specific actors and characters are recognised, and certain acts and particular outcomes are seen as more valuable than others" (p. 52). An example of the notion may be the current reform recommendations for mathematics education ('the reform') that a teacher may or may not wish to follow (Skott, 2017).

Participation is the process of negotiating the meaning of different practices and figured worlds (Skott, 2013). Specifically, in any classroom interaction, there are different patterns of practices and figured worlds that may be significant according to the meaning the interaction has for the teacher (Skott, 2013). The framework aims to disentangle and interpret the patterns of teachers' participation in other practices and figured worlds that simultaneously influence teachers' participation in classroom practice (Skott et al., 2011).

## **Methods**

The study was conducted at a middle-sized school with multilingual teachers and students in a small town in Sweden. The case of a multilingual mathematics teacher, pseudonymised here as Aza, in this paper, is used as an example when studying the affordances of the PoP framework. This selection was because the teacher had multiple experiences learning and teaching in different languages and educational systems and was reflective and conscious about multilingualism and language in mathematics classrooms. Aza was a mathematics teacher in lower secondary education. She had studied mathematics in her home country, and during the year before the study, she had completed further education for foreign teachers to become a qualified teacher in Sweden. She spoke Kurdish, Arabic, and Swedish and could understand English in everyday school contexts. She used Arabic and Swedish in the school context. She only used Swedish in her teaching, as most students had a mother tongue other than her own or preferred to communicate in Swedish. She had 15 years of working experience as a mathematics teacher. For the first eight years of her career, she was a mathematics teacher in her home country, and for the past seven years, she has continued her career in Sweden. During her first five years working in Sweden, she was a mathematics teacher in introductory classes only. She had also worked in regular mathematics classes (grades 7 and 8) for the past two years.

According to PoP, multiple data sources may provide access to different practices and figured worlds (Skott, 2018). Thus, the data to be used in this paper are participatory observations of lessons and informal discussions with the teacher about the lessons after the lessons have finished. In this paper, the data examples presented come from one informal interview and one lesson observation. The data was selected because their content was related to language matters. Language matters are understood as the teacher's explicit reference to the language of mathematics, mathematical concepts or mathematical communication. Specifically, the teacher referred to the importance of the definition and verbal or written communication of mathematical concepts and their use in the written communication of mathematical solutions. The reason for such a selection was to test how the PoP framework works in cases of language matters being central and on different kinds of data, such as observations and interviews.

The video and audio-recorded data were transcribed into Swedish and translated into English. An additional auditor reviewed the translations to ensure the meanings remained the same during this process. The analysis of the examples presented follows an inductive analysis approach with no predefined codes (Skott, 2018). The basic concepts of the PoP framework were recognised by finding the different topics according to what the teacher does and the different actors. The project was ethically reviewed by the Swedish Ethical Review Authority (ref: 022-02754-01).

## Examples

### Excerpt 1

The following excerpt comes from an informal interview with the teacher after a lesson in grade 8. In several lessons, it had been noted that she repeatedly emphasised the same mathematical concepts, what they meant, and how they were used in the mathematics tasks in the textbook chapter. Therefore, a discussion was initiated about why she heavily emphasised mathematical concepts. Aza explained her planning of lessons and her reasons for focusing on mathematical concepts.

Researcher: That's why you start with concepts and get to work with them. This means this, that means that. And you repeat the concepts often.

Aza: Oh, sure. Lots of them have difficulty with concepts. They think mathematics is just calculating numbers. So I believe that it's important for them to practice concepts as well, and to be able to describe them. What is a proportion? Yes, they understand. But find the words, use mathematical language. You must be able to use your language in order to... Then we've done that. (...) For example, what is a power. So one student wrote that a power refers to "raised to", another one wrote (...), and then I demonstrated on the board. Which is best?

This particular excerpt contains a recall of a repeated *interaction* of the teacher with the students in the classroom. The *interaction* involved Aza asking students to explain and define the basic mathematical concepts of the chapter at the beginning of each lesson.

Aza's explanation of this particular interaction indicates that she may draw from her participation in other previous *classroom practices* where communication of mathematical concepts was in focus. Her reference to students' difficulty with mathematical concepts ("*Lots of them have difficulty with concepts*"), and their views of mathematics as just calculation may be understood as something that she has noticed.

Moreover, she may also draw from the *figured world* of Swedish educational reform. According to her, she participates in the current classroom practice focusing on issues of concepts ("*it's important for them...to be able to describe [concepts]*") and students' communication of the concepts ("*But find the words, use mathematical language. You must be able to use your language in order to...*"). These are indicators that she may draw from the students' conceptual competency, one of the five mathematical competencies that students need to develop according to the Swedish curriculum. This ability includes "*describing concepts*" based on their definitions and characteristics (Swedish National Agency for Education, 2017, my translation). Assessment can be viewed as another *figured world* that she may draw from, as she refers to how students define mathematical concepts on a test on concepts.

When she refers to the concept of proportion, she re-engages in the current classroom practice, particularly the lessons she currently has in grade 8, as it is the main concept being discussed in the lessons. She re-engages in the classroom practice by drawing on the figured world of the Swedish educational reform as she brings again the issue of language ("*Yes, they understand. But find the words, use mathematical language*").

## Excerpt 2

The following example comes from a discussion that Aza conducted with her grade 8 students about a forthcoming exam. Aza was planning a test on concepts and a final exam for the semester. She was the only mathematics teacher at her school who intended to set an examination on mathematics concepts for her regular classes.

- Student: Then you can take away the test on concepts, so we'll be the same.  
Aza: Yes, sure, but listen, listen. Taking a test on concepts isn't a punishment.  
Students: [The students are talking. They disagree.]  
Aza: On the contrary. It's just the opposite. You learn your stuff. Ask the others if they get the concepts. They can't put things into words and describe things with concepts, but you can. But you can. You can. Do you get that?  
Student: We can include concepts in the normal tests.  
Student: [Students are uncertain] [inaudible]  
Aza: The test on concepts is only going to take around 20 minutes max. No more.

In this example, the *interaction* includes a negotiation between Aza and her students about why they need to have a test on mathematical concepts. The students complain about the test on concepts. Aza points out the advantages and minimises the possible disadvantages of the test.

While interacting with her students, Aza may draw on different *practices* she has participated in. Here, she draws on how the other mathematics teachers in the school handle the idea of mathematics concepts in the classroom, and how students view the idea of tests. This is particularly relevant in connection to her being a member of the community of the mathematics teachers in the school, as she is the only mathematics teacher who sets a test on concepts (“*Ask the others if they get the concepts*”). When Aza compares her students with other students (“*They can't put things into words and describe things with concepts, but you can*”), this indicates that she may interact and interpret the situation according to what her colleagues are not doing in their classrooms and what they think are essential skills for students in mathematics.

Finally, she may draw from the same *figured world* as before, which is the Swedish curriculum. This is manifested when she focuses on her students' ability to describe mathematical concepts (“*put things into words and describe things with concepts*”). She also draws from assessment as a way for students to build on those curriculum skills, which is indicated when she answers students' concerns about the separate test on concepts (“*isn't a punishment... It's just the opposite. You learn your stuff.*”).

Aza's participation in the current classroom practice involves her interpretation of students' reactions to a test on concepts. However, she may also draw from further practices or figured worlds. Those are her colleagues' views on the idea of mathematical concepts and the Swedish curriculum, which is implemented through assessment, as a formal way for the students to learn and develop their skills concerning mathematical concepts.

## Discussion

This paper aims to illustrate the affordances of the PoP framework when studying multilingual mathematics teachers' professional identities. The framework allows different experiences to be considered to understand teachers' identity formation and development, though the current examples do not provide explicit information about teachers' identities.

The interplay of multiple practices and figured worlds was apparent in the multilingual teacher's participation in the multilingual classroom. Especially when *interactions* with students were related to language matters and particularly aspects of supporting and assessing the knowledge and the ability to communicate mathematical concepts. Concerning the concept of practices, participation in previous classroom practices is one main practice that includes aspects such as noticing students' views about mathematics and the role of mathematical concepts. Another practice that became apparent in the interaction with the students was participating in the school's mathematics teachers' community, and how this community viewed such language matters. Concerning the concept of *figured worlds*, it seems that the teacher drew from the current Swedish curriculum. However, she gives meaning to it by focusing only on issues related to language and assessment.

Drawing on the Swedish curriculum and complementing it with ideas related to language or communication of mathematics is something that has been seen in previous case studies of multilingual teachers (e.g. Delacour, 2020). Moreover, while some teachers build their new professional identity by combining aspects of their previous career with the current context (Ennerberg & Economou, 2021), in the present case, it is not particularly obvious whether the teacher was drawing from her participation in previous practices from her home country. The present data revealed are not enough to reveal experiences from the teacher's home country, her participation in an integrative professional development program or teaching multilingual students that might be related to such interactions in the classroom. Data that include stories from those different contexts in relation to the present classroom practice may be relevant.

Overall, this case study reveals several implications for researchers when following the PoP framework. First, there is the question of how to get access to other practices and figured worlds that are related to the teacher's past teaching experience or the issue of multilingualism. The data needed for providing an idea about teachers' identities may be created, by teachers' interpretations of a particular situation after that situation has happened. However, it is not always possible to get an idea of all the practices or figured worlds that are relevant at the moment. This can be viewed as different practices and figured worlds being highlighted by the two excerpts. Thus, the connection of different methods is needed. Discussions about what it means to be a teacher in Sweden or what it means to be a multilingual teacher, along with everyday discussions with colleagues, may indicate relevant practices and figured worlds at that moment.

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