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Discourses on mathematics education in the context of early assessment

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Abstract: This paper is about the meanings Swedish preschool class teachers ascribe to early mathematics education when talking about assessment. The assessment material is new national, mandatory assessment material for six-year-old students. Based on a discourse analysis of four focus groups, five discourses were construed: preschool class mathematics is unique; the role of preschool class mathematics is changing; to assess is to categorize; assessment contributes to equity; and individualization implies grouping by level. The results illustrate how teachers hope that the status of and equity in preschool class mathematics education will increase by means of the assessment. However, the teachers' talk about categorizing and grouping students may have implications for equity.

Keywords: early assessment, mathematics education, focus groups, discourse analysis

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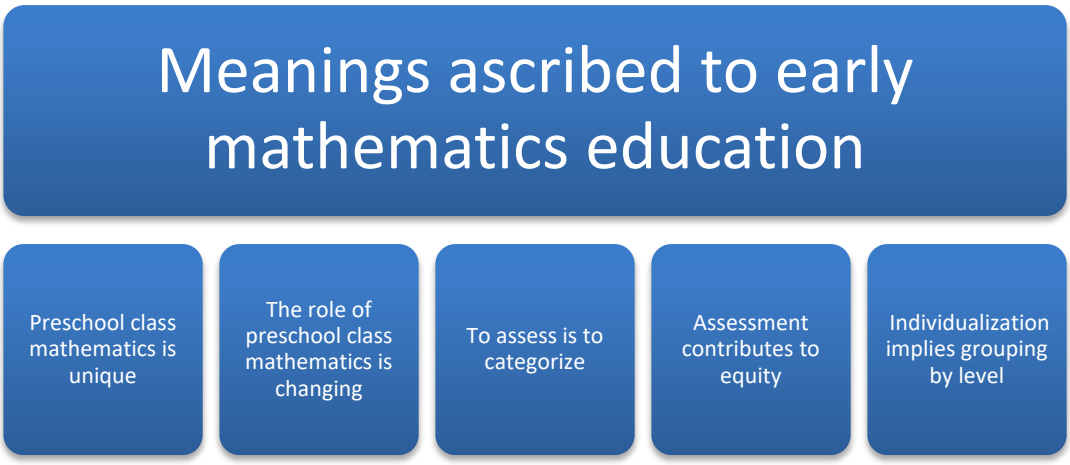

1 Introduction

This paper is about the meanings Swedish preschool class teachers ascribe to early mathematics education when talking about assessment. When conducting assessments, there are differences in, for example, who conducts the assessment, where the assessment is conducted, how the students' results are scored and interpreted, and what happens after the assessment (Black & Wiliam, 2004). The assessment material considered here was implemented in 2019 to assess mathematics at the start of compulsory school (National Agency for Education, 2019). Before this implementation, there were no similar materials for this age group. The studied situation of assessing six-year-old students was thus new for preschool class teachers. The assessment takes place at the beginning of the school year and consists of four mathematical activities to be conducted orally by the teacher with a small group of students. In the teacher's guide, the assessment material is said to have three purposes, namely, to identify: 'students who show an indication of not meeting the knowledge requirements'; 'students in need of extra support'; and 'students in need of extra challenges' (National Agency for Education, 2019, p. 3). Previous research shows that the diversity of these three stated purposes might make it unclear how assessment results are to be used, since different purposes may end up conflicting with one another (Walla, 2022). Besides identifying three groups of students, the assessment is intended to provide 'support for teachers in the continued teaching' (National Agency for Education, 2019, p. 3). Since the assessment material became mandatory, teachers working with these classes have started to focus more on assessment (Ackesjö, 2021). Based on this, the research question of this discourse study is: What meanings do Swedish preschool class teachers ascribe to early mathematics education when talking about assessment? Addressing this question is of significance as, in line with discourse analysis, these meanings may influence the assessment as well as the mathematics education at this level.

2 Literature review

According to Wiliam (2007), there are two types of assessments, classroom assessment and external assessment, with the assessment material considered here being an example of external assessment. Furthermore, Wiliam (2007) distinguishes three different purposes of assessment: 'supporting learning (formative), certifying the achievements of individuals (summative), and evaluating the quality of educational institutions (evaluative)' (p. 1056). However, according to Tolgfors and Öhman (2016), these purposes often exist in parallel rather than being part of a dualistic system. Such parallelism may cause tensions in the classrooms when purposes differ fundamentally (Torrance, 1993).

At the same time as the assessment and comparison of young students' knowledge have become common practices internationally (OECD, 2019), research is ambivalent about their effects. One argument for early assessment refers to the connection between mathematical knowledge at a young age and future academic performance (Duncan et al., 2007). On the other hand, some studies show that a focus on students' individual

shortcomings can negatively affect their self-image as, in connection with assessments, they may begin to regard difficulties as a personal trait (Reay & Wiliam, 1999; Räty et.al., 2004). Furthermore, there is the risk that teachers may be affected by the expectations of, for example, politicians and school staff, and therefore start to teach students items like the test items – that is, teaching to the test (Volante, 2004).

According to Wiliam (2007), assessments can influence teachers' considerations on teaching and learning, with the risk of a shift from making the important assessable to making the assessable important. Hence, teachers views of assessment may affect not only how they assess their students, but also their teaching after the assessment (Black & Wiliam, 2004).

3 Method

The empirical material in this study is from focus groups with 12 preschool class teachers from eight schools in three municipalities. Altogether, four focus groups of three teachers each were conducted, led by one of the authors. Teachers of Swedish preschool class are educated as either preschool teachers or primary school teachers. In this study, ten of the teachers were educated as preschool teachers and two as primary school teachers. The focus groups were intended to investigate the teachers' experiences of conducting the assessment after having done so for the first time. To enable the teachers to express themselves in their own words, an interview guide promoting discussions were developed (Hennink, 2014). The questions addressed assessment in general and the mandatory assessment material specifically. The focus groups were held at the school of one of the teachers in each group, lasted approximately one hour, and were audio recorded and then transcribed. Before the focus groups, all teachers were informed in detail both in writing and orally about the study and agreed to participate by providing their written consent.

4 Discourse analysis

Discourse analysis can be used as a theory, an analytical tool, or, as in this study, both (Winther Jørgensen & Phillips, 2000). In this study, discourse analysis was applied in line with Gee (2014a; 2014b), who 'uses the word "language" to refer to both the structure of language and functional aspects of language use' (Ryve, 2011, p. 171). According to Gee (2014b), language both reflects and creates existing reality, with discourses being part of the ongoing processes that continually create and reshape the meaning in and of social practices. In this study, discourses are seen as part of the social practices that create and reshape the meanings of assessment in early mathematics education.

Gee (2014a; 2014b) distinguishes between small 'd' discourses and big 'D' Discourses. In <u>d</u>iscourses, so-called stretches of language, the relationship between words and sentences is described, while <u>D</u>iscourses provide a larger context of an analysis. The present analysis focuses on a 'big-picture' view of the teachers' communication – i.e., <u>D</u>iscourses. The meanings of the language used in these <u>D</u>iscourses are understood in

relation to the interaction with the immediate surroundings (Gee, 2014b). Gee offers 28 tools for discourse analysis; the transcribed focused groups were analysed using nine of these tools:

- The Deixis Tool (#1): What is talked about as given, based on the context?
- The Fill-In Tool (#2): What is not said? What knowledge and what assumptions are required for communication to be clear?
- The Doing and Not Just Saying Tool (#7): What is the teacher trying to do (keeping in mind that he or she may be trying to do more than one thing)?
- The Why This Way and Not That Way Tool (#9): Whose voice is heard? What are the teachers' intentions when they talk the way they do?
- The Context is Reflexive Tool (#13): Is what the teachers are saying and how they are saying it simply replicating (repeating) contexts like this one or, in any respect, transforming or changing them?
- The Significance Building Tool (#14): What words are used to build or lessen the significance of some things and not others in the teachers' communication?
- The Relationship Building Tool (#17): How are words being used to build and sustain or change relationships of various sorts among the teachers, other people, and/or institutions?
- The Situated Meaning Tool (#23): What situated meanings, related to the context, do words and phrases in the teachers' communication have?
- Figured World Tool (#26): What typical stories or figured worlds are assumed in the teachers' communication?

The discourse analysis initially focused on the big context (#26, #23) and after that on how the teachers used communication to build meaning in the specific contexts (#17, #14, #13). Next, the analysis considered the teachers' explicit sayings (#9, #7) and then how the language was used related to the context (#2, #1). This process should, however, be understood as iterative, i.e., moving back and forth from big to small perspectives, using all nine tools repeatedly. Through this iterative analysis, five Discourses were construed.

5 Results

In the results, Five Discourses construed based on the teachers' talk about early assessment are described, illustrated with passages quoted from the focus groups.

5.1 Preschool class mathematics is unique

The teachers talk about mathematics education in the preschool class as *unique* and *different* compared with mathematics education in primary school. In the teachers' communication, they describe mathematics education in the preschool class as students solving problems together, in contrast to students working alone with a mathematics textbook, as in primary school mathematics:

> Getting used to, at an early stage, to solving things together. Mathematics is not about working alone with a book; it looks different today. /…/ I think if you look through the activities, that says something. (Tuva)

Tuva's last sentence illustrates how the teachers recognize preschool class mathematics in the activities in the assessment material. There is the implicit view of preschool class mathematics as the preferred way to teach mathematics, and since the teachers recognize this view in the assessment material, this view is strengthened by this material. The teachers also talk about how the assessment material can help give teachers at the next school level a clearer picture of the uniqueness of preschool class mathematics:

> It's clear, and we have worked like this before. The difference is that now we get it in print. We use this to show teachers in grades one, two, and three. We are used to working like this, but now it becomes clearer what we have focused on. (Saga)

Implicit in the teachers' talk is annoyance that teachers at the elementary level do not always understand the important role and uniqueness of mathematics education in the preschool class.

5.2 The role of preschool class mathematics is changing

The teachers talk about how the preschool class previously had an unclear role in the Swedish school system, and how their work has been invisible. They talk about the National Agency of Education with great respect, as a high-status institution. Since the assessment material has been implemented by the National Agency of Education, the teachers imply that this status will be transferred to the preschool class:

> I also hope that the material contributes – coming from the National Agency for Education – has status in some way. We are obliged to use it. I think it contributes to higher status, when handing over our students. (Saga)

The teachers' communication implies that the previously unclear role of the preschool class has now become clearer due to the implemented assessment material. Furthermore, teachers working in the preschool class will now become visible:

> Well, as you say, the preschool class is still sloshing around. Maybe it will be more like we are actually doing a fundamental job in the preschool class /…/ Now, how we work will hopefully be more visible. (Ylva)

Implicit in the teachers' communication is a desire for the preschool class to be seen and treated as an important part of primary school.

5.3 To assess is to categorize

The teachers talk about how students, based on the assessment material, belong to one of two groups: 'students who need extra challenges' or 'students who need extra support'. Students who do not belong to either of these groups are not mentioned by the teachers. Furthermore, assessing students implies categorizing them based on their assessment results:

> It is these children who need to be challenged. (Anna)
>
> And these children who have difficulties too, but maybe we can talk to the special needs teacher about how [to teach them]. (Elin)
>
> Yes, and we have so much experience there too, I think. We have known these children for many, many years. So those who need extra support, I don't think it's that difficult to offer extra support. But then these are the other ones – what are we actually going to give them? /…/ What do you give a student who understands patterns really well? Should you continue, or what should you do? (Saga)

The teachers describe being less used to identifying students in need of extra challenges and to adapt their teaching to these students. The teachers talk warmly about the fact that students in need of extra challenges are now being identified, so that they can receive more attention. The teachers describe how students in need of extra challenges previously had to manage by themselves, because students in need of extra support needed a lot of attention. The teachers' talk about identifying different groups of students implies categorizing students based on their assessment results. When talking about adapting teaching to students in need of extra support, the teachers describe themselves as experienced and as supported by special needs teachers. In contrast, when talking about adapting teaching to students in need of extra challenges, the teachers imply that this is a new responsibility for them.

5.4 Assessment contributes to equity

In the teachers' communication, an expectation that the assessment material will contribute to equity becomes visible. With the assessment material, there is the expectation that all six-year-old students will be assessed in the same way, which will contribute to equity:

> Yes, everyone in the whole of Sweden focuses on the same things, so it will be, somehow, it will be… (Ylva)
>
> Equity (Alva)
>
> Yes, exactly. (Ylva)
>
> /…/ it's the same thing. (Alva)

> It's this, and that's what we have, the same. Then we can always have different literature and books and textbooks. But this is the same thing. (Ylva)

The teachers describe how the assessment material will improve equity because now all preschool class students in Sweden will be assessed in the same way. Implied in the teachers' talk about equity is the view that not everything needs to be similar, as long as something – in this case, the assessment material – is similar. Even though the teachers welcome the assessment material, they still say that freedom is needed in teaching. However, implicit in the teachers' communication is the view that there has been too much freedom, which has led to major differences between preschool classes. Therefore, a national assessment material is seen as contributing to equity.

5.5 Individualization implies grouping by level

In the teachers' communication, it is visible how different students will be given different mathematical tasks based on their assessment results:

> To sum up, this will affect how we work with the whole class. That we will actually distinguish what kinds of tasks they will be assigned and what we can expect from different students. In particular, we will keep an eye on those who need extra /…/ (Nora)

Implicit in the teachers' talk is a view of mathematics teaching as occurring at different levels, since the assessed students are identified as at different levels. The way in which the teachers talk about changing their teaching after the assessment indicates that the assessment contributes new, previously unavailable information about the students. Regarding teaching students at different levels, the teachers say that it is challenging to provide all students with exciting tasks arousing their interest in mathematics for the future. The teachers' communication about teaching implies that teaching needs to change due to the mandatory assessment material. The teachers talk about moving towards a division on what tasks students are assigned and what to expect from different students. When this is described as a change, it indicates that before this assessment material was implemented, the teachers did not undertake such division of tasks or adaptation of expectations for different students.

6 Discussion

The five Discourses construed in this analysis highlight different meanings ascribed to early mathematics education in teachers' communication about assessment. In this section, these different meanings will be discussed in relation to previous research.

The meanings ascribed to assessment in early mathematics education in *preschool class mathematics is unique* and *the role of preschool class mathematics is changing*, is somewhat contrasting. The teachers talk about a desire for the preschool class to become

part of primary school, while simultaneously describing how preschool class mathematics education is unique and differs from mathematics education in primary school. With the assessment material, the teachers' view of what constitutes good early mathematics education is strengthened, since they recognize their way of teaching mathematics in the activities provided in the assessment material. The assessment material thus verifies the importance of preschool class mathematics and that mathematics education in preschool class represents the preferred way of teaching mathematics. Thus, it is not preschool class mathematics education but rather the *status* of the preschool class that is to change. Through this external assessment (Wiliam, 2007), initiated by the National Agency for Education, the teachers express a desire to be an important part of primary school. This desire for preschool class to belong to primary school, rather than to be its own form of school, is strengthened by the teachers' expressed desire to be respected for the work done in the preschool class. In the teachers' communication about the increased status of the preschool class, they relate to primary school but not to preschool. Depending on how strong this desire to belong to primary school becomes over time, the unique preschool class mathematics may be threatened by 'schoolarization' (Ackesjö & Persson, 2019).

The meanings ascribed to assessment in early mathematics education in *assessment contributes to equity*, makes visible how the teachers expect the assessment material to contribute to equity. This is consistent with the National Agency for Education (2019), which describe the purpose of the assessment material as to contribute to the schools' compensatory mission and to improve equity. However, previous research has shown that issues related to managing assessment materials may affect the extent to which assessments contribute to equity. According to Nortvedt and Buchholtz (2018), one single assessment cannot completely capture a student's level of learning or development in mathematical thinking, which is why multiple tests incorporating varied tasks and in different formats might be more equitable (Leder & Forgasz, 2018). In addition, the context of an assessment is significant. When conducting assessments with groups of students, as in the case of the assessment material focused on in this study, the grouping may affect the extent to which students are emboldened to express their knowledge (Zohar & Gershikov, 2008). Since the assessment is conducted at the beginning of the students' first year of formal schooling, there is the risk that teachers may not have had time to get to know the students well enough to know who works well together in a group. And, considering the issues discussed above there is the risk that students' assessment results may be affected by the context of the assessment.

The meanings ascribed to assessment in early mathematics education in *to assess is to categorize* and *individualization implies grouping by level*, are closely connected. These meanings make visible how this assessment material has contributed to a changing view of students in need of extra challenges. The meaning ascribed in *to assess is to categorize* makes visible that the assessment material contributes to a view that students enter preschool class with different prerequisites for learning mathematics. The meaning ascribed in *individualization implies grouping by level* can be described as transforming the view of which students are considered in the classroom. According to previous research on beliefs, teachers' beliefs about mathematics teaching and learning seem to

affect their mathematics teaching (Ernest, 1989). Then, if assessment becomes a way to sort students into different categories (*to assess is to categorize*) and the assessment prepares teachers for teaching at different levels (*individualization implies grouping by level*), how will this affect the mathematics education in preschool class? There is the risk that the teachers will start to group their students by level based on the assessment results, meaning that some students will be placed in a group of students needing extra support while others will be placed in a group of students needing extra challenges. This may be seen as a risk, as previous research has shown that, through assessment, students may start to focus on their individual shortcomings, which can negatively affect their self-image as they may regard difficulties as a personal trait (Reay & Wiliam, 1999; Räty et al., 2004). Thus, the meaning ascribed to assessment in early mathematics education, *individualization implies grouping by level*, can be seen as a counterpoint to *assessment contributes to equity*.

7 Conclusions

This study shows that the participating teachers ascribe different meanings to early mathematics education when talking about new mandatory early assessment material. The study shows that the teachers view the assessment material with great respect, since it is initiated by the National Agency for Education (2019). To change the role of preschool class mathematics education, and to become an essential part of primary school, the teachers express a desire to gain status from the assessment material. However, the teachers do not wish to change the unique format of mathematics education in preschool class. Furthermore, the results indicate a risk that the assessment material will lead towards sorting students by level. Taken together with previous research, this stands in contrast to the teachers' desire that the assessment should contribute to equity. However, as the meanings ascribed to assessment in early mathematics education in the construed Discourses provide a big-picture view, here and now, and since this was the first time assessment material has been implemented in the Swedish preschool class, further research is needed to study whether and, if so, how mathematics education in the preschool class might change as a result of this mandatory assessment material.

Author contributions

M.W.: project administration, investigation, analysis, writing, reviewing, and editing

H.P.: analysis, writing, reviewing, and editing

All authors have read and agreed to the published version of the manuscript.

References

Ackesjö, H. (2021). Early assessments in the Swedish preschool class: Coexisting logics. *CEPRA-striben, 27*, 38–49. doi:10.17896/UCN.cepra.n27.417

Ackesjö, H., & Persson, S. (2019). The schoolarization of the preschool class: Policy discourses and educational restructuring in Sweden. *Nordic Journal of Studies in Educational Policy, 5*(2), 127–136. doi:10.1080/20020317.2019.1642082

Black, P., & Wiliam, D. (2004). Classroom assessment is not (necessarily) formative assessment (and vice-versa). *Teachers College Record, 106*(14), 183–188.

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., … Brooks-Gunn, J. (2007). School readiness and later achievement. *Developmental Psychology, 43*(6), 1428–1446. doi:10.1037/0012-1649.43.6.1428

Ernest, P. (1989). The knowledge, beliefs and attitudes of the mathematics teacher: A model. *Journal of Education for Teaching, 15*(1), 13–33. doi:10.1080/0260747890150102

Gee, J. P. (2014a). *How to do discourse analysis: A toolkit*. Routledge.

Gee, J. P. (2014b). *An introduction to discourse analysis: Theory and method*. Routledge.

Hennink, M. M. (2014). *Focus group discussions*. Oxford University Press.

Leder, G. C., & Forgasz, H. J. (2018). Measuring who counts: Gender and mathematics assessment. *ZDM Mathematics Education, 50*(4), 687–697. doi:10.1007/s11858-018-0939-z

National Agency for Education. (2019). *Hitta matematiken: Nationellt kartläggningsmaterial i matematiskt tänkande i förskoleklass* [Find the mathematics: National assessment material in mathematical thinking in preschool class]. Stockholm, Sweden: National Agency for Education

Nortvedt, G. A., & Buchholtz, N. (2018). Assessment in mathematics education: Responding to issues regarding methodology, policy, and equity. *ZDM Mathematics Education, 50*(4), 555–570. doi:10.1007/s11858-018-0963-z

OECD. (2019). What is PISA? Retrieved from http://www.oecd.org/pisa/

Reay, D., & Wiliam, D. (1999). 'I'll be a nothing': Structure, agency and the construction of identity through assessment. *British Educational Research Journal, 25*(3), 343–354. doi:10.1080/0141192990250305

Ryve, A. (2011). Discourse research in mathematics education: A critical evaluation of 108 journal articles. *Journal for Research in Mathematics Education, 42*(2), 167–199. doi:10.5951/jresematheduc.42.2.0167

Räty, H., Kasanen, K., Kiiskinen, J., Nykky, M., & Atjonen, P. (2004). Childrens' notions of the malleability of their academic ability in the mother tongue and mathematics. *Scandinavian Journal of Educational Research, 48*(4), 413–426. doi:10.1080/0031383042000245807

Tolgfors, B., & Öhman, M. (2016). The implications of assessment for learning in physical education and health. *European Physical Education Review, 22*(2), 150–166. doi:10.1177/1356336x15595006

Torrance, H. (1993). Formative assessment: Some theoretical problems and empirical questions. *Cambridge Journal of Education, 23*(3), 333–343. doi:10.1080/0305764930230310

Volante, L. (2004). Teaching to the test: What every educator and policy-maker should know. *Canadian Journal of Educational Administration and Policy, 35*, 1–6. https://journalhosting.ucalgary.ca/index.php/cjeap/article/view/42715

Walla, M. (2022). Diversity of assessment discourses in Swedish and Norwegian early mathematics education. *Journal of Childhood, Education & Society, 3*(2), 98–111. doi:10.37291/2717638X.202232178

Wiliam, D. (2007). Keeping learning on track: Classroom assessment and the regulation of learning. In F. K. Lester (Ed.), *Second handbook of research on mathematics teaching and learning: A project of the National Council of Teachers of Mathematics* (pp. 1053–1098). Information Age Pub.

Winther Jørgensen, M., & Phillips, L. (2000). *Diskursanalys som teori och metod* (Discourse analysis as theory and method). Studentlitteratur.

Zohar, A., & Gershikov, A. (2008). Gender and performance in mathematical tasks: Does the context make a difference? *International Journal of Science and Mathematics Education, 6*(4), 677–693. doi:10.1007/s10763-007-9086-7