

Diversity of assessment discourses in Swedish and Norwegian early mathematics education

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Abstract: In many countries, including those in the Nordic region, there has been a growing trend towards measuring students' knowledge and understanding, a trend that is evident even in early education. This article presents a discourse analysis of mathematics assessment materials intended for six-year-olds in two neighbouring countries, Sweden and Norway. Thus, the article presents an example of early assessment in two neighboring countries with similar culture and education system. The aim is to investigate the similarities and differences between the various meanings ascribed to their assessment materials, and to discuss how these assessment materials may both influence and be influenced by early mathematics education in these two countries. The results show a diversity of discourses – both between and within the assessment materials – indicating different views on students' learning of mathematics, on when to assess, on what knowledge to assess, and on how and why to assess. Thus, even though Sweden and Norway have similar cultures and education systems, there is no consensus when it comes to when, what and how to assess the mathematical knowledge of six-year-olds.

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Introduction

The assessment and comparison of students' knowledge have become common practices internationally, even when it comes to the education of young students (International Association for the Evaluation of Educational Achievement, 2019; Organisation for Economic Co-operation and Development [OECD], 2019). A possible reason for this is that international studies show a connection between young students' mathematical knowledge and their later academic achievements (Aubrey et al., 2006; Aunio & Niemivirta, 2010; Duncan et al., 2007; Sterner et al., 2019). Meanwhile, other studies show that early focus on students' individual shortcomings may affect their self-image negatively, which in turn can impede learning (Reay & Wiliam, 1999; Rätty et al., 2004).

In this article, national assessment materials from Sweden and Norway – countries with similar cultures and education systems – serve as the starting point. According to Lundahl (2017) the content of assessment material indicates the central content that teachers need to teach, and thus influences teaching form and content (Burkhardt & Schoenfeld, 2018; Volante, 2004; Wrigley, 2010). In Sweden and Norway, school is compulsory from age 6 to 16, and equal opportunity and inclusive schooling are important values (Klette, 2018). Within the context of the Nordic classroom, students are encouraged to be heard and to formulate arguments, and both Sweden and Norway aspire to differentiated and individualised teaching methods (Klette, 2018). In Sweden, compulsory schooling starts with preschool class, which is a school form in its own right (National Agency for Education, 2018): there, creative work and play are central, and the aim is to facilitate the transition between preschool and primary school (Ackesjö & Persson, 2019). In Norway, the so-called *six-year reform* (seksårsreformen) was implemented in 1997, which increased compulsory school from nine to ten years with students starting school at the age of six (Ministry of Church Affairs Education and Research, 1996). Since the reform, debate has been ongoing about the theoretical approaches used to conceptualise the teaching of six-year-olds (Ertesvåg & Ridar, 2018; Johansson, 2010). One of the key issues in that debate is the connection and cooperation between kindergarten and

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compulsory school (Ministry of Education and Research, 2008). A similar reform is planned for Sweden, which will also increase the number of years of schooling from nine to ten (Ministry of Education and Research, 2020).

Currently, a culture of assessment is apparent in both Sweden and Norway, each having material to assess the mathematical knowledge of six-year-olds (National Agency for Education, 2019; Norwegian Directorate for Education and Training, 2017). The expressed purpose of these assessments is similar in both countries, to offer equal and inclusive schooling for all students (Klette, 2018). Thus, one could expect that these neighbouring countries, with their similar cultures and education systems, would view the context of assessment of six-year-olds similarly; however, their approach to assessment differs. While the Swedish assessment material consists of four activities designed to be done orally in groups, the Norwegian assessment material consists of text-based tasks that students complete individually in writing within a set time.

This article presents an example of early assessment in Sweden and Norway – countries with similar cultures and education systems – its aim being to investigate the similarities and differences between the various meanings ascribed to their assessment materials, and to discuss the possible impact of these on early mathematics education. This study addresses the following question:

- What meanings relating to mathematics education can be ascribed to the assessment materials of Sweden and Norway?

Literature Review

According to Björklund Boistrup (2017), the system of schooling through assessment takes on a role as gatekeeper, where students are selected based on their strengths, which contradicts what official documents state should be the case. In this context, Björklund Boistrup (2017) uses the word assessment in a broad sense that includes both feedback in classroom interactions and feedback communicated by way of testing. At the same time as assessments in mathematics can have an impact on students' academic achievement, Volante (2004) emphasises how assessment design can also influence teaching content. There is a risk that the expectations of politicians, school staff, administrators and the general public can affect how teachers prepare their students for tests (Volante, 2004). Teaching with excessive focus on items similar to test items is called *teaching to the test* (Volante, 2004). According to Burkhardt and Schoenfeld (2018), "teachers *will* teach to the test", and they connect this with "What You Test Is What You Get", which according to them was summed up in research long ago (p. 577).

Burkhardt and Schoenfeld (2018) discuss the question of how to create a "test worth teaching to". According to them, this is a question of combining so-called "short tasks" and "performance tasks" in a well-balanced way. While "short tasks" are described as "focused on one fragment of mathematics that takes only a minute or two", "performance tasks" are described as "non-routine tasks involving substantial chains of reasoning" (p. 577). Burkhardt and Schoenfeld (2018) also highlight the importance of including tasks that have multiple solution paths to support classroom practices that engage students in mathematical problem-solving activities. Palm et al. (2011) argue that it is much easier for teachers to assess students' calculation skills than it is to assess students' problem-solving skills. They compared what mathematical reasoning is required to solve test tasks in different types of tests, national tests and teacher-made tests. In their study, only a small proportion of the tasks in the teacher-made tests required students to use mathematical reasoning. According to Burkhardt and Schoenfeld (2018), the doing and using of mathematics is not about a checklist of fragments to be mastered; rather, it "involves an integrated use of knowledge and practices" (p. 577). To provide opportunities for mathematical thinking, students need to be exposed to multiple approaches (Burkhardt & Schoenfeld, 2018).

According to Nortvedt and Buchholtz (2018), the debate on how to design an assessment is about not only "what we assess, but also how we assess and what conclusions we can draw from our assessments" (p. 556). Related to this, Newton (2007) emphasises the importance of clarity in relation to what conclusions we can draw by thinking and talking about "assessment purpose". Illustrating a wide

range of uses, Newton (2007) points out the importance of not locating multiple discrete purposes within a small number of misleading categories. When an assessment has multiple purposes, the result may be that these conflict with each other. According to Newton, it is therefore important to define the primary purpose or an explicit prioritisation of purposes so as to avoid this.

Nortvedt and Buchholtz (2018) argue that one sole summative assessment cannot fully reflect students' level of learning or development of mathematical thinking (Nortvedt & Buchholtz, 2018). A better test result does not necessarily mean that students have learnt more. According to Volante (2004), if teachers focus their teaching on the content to be tested, the opposite may be the case. Leder and Forgasz (2018) contend that all assessment should consider different and multiple sources of individual student performance, including classroom-based performance, in order to contribute to fair assessment. They emphasise that the use of multiple tests with different types of tasks and formats might be more equitable.

Early Assessment

A common argument for the assessment of young students' knowledge is the connection between their mathematical knowledge at a young age and their future academic performance in both mathematics and other subjects (Aubrey et al., 2006; Aunio & Niemivirta, 2010; Duncan et al., 2007; Sterner et al., 2019). According to Aunio and Niemivirta (2010), students' acquisition of counting and relational skills before compulsory schooling is an important indicator of their basic arithmetic and overall mathematical performance in their first year of school. Their knowledge of early numeracy when they begin school is a greater indicator of future school achievement than such factors as gender, age and parental education (Aunio & Niemivirta, 2010). Students who have early mathematical knowledge when they begin school benefit from this in their initial school years. Such students are at an advantage, since numerical attainment with practical problem-solving as an element increases in importance by school year (Aubrey et al., 2006). According to Duncan et al. (2007), students' early mathematical skills are a stronger predictor of later reading ability than early reading is of later mathematical achievement. However, they point out that this says nothing about what type of curriculum – “play-based” or “drill-and-practice” – best promotes these skills (Duncan et al., 2007).

An international study of the relationship between academic elements in the early school years and students' later academic achievement shows that all students benefit from exposure to advanced mathematics in their early school years. However, students often encounter content they already master and do not benefit from basic content coverage (Claessens et al., 2014). Sterner et al. (2019) and Vennberg and Norqvist (2018) conducted studies in the Swedish preschool class to investigate the effect of early focus on numbers and collective reasoning about representations. One study shows positive effects on students' number sense, an effect sustained even nine months later in Grade 1 (Sterner et al., 2019). The other study shows that the same intervention can improve long-term mathematical performance and prevent at-risk students from performing poorly in mathematics (Vennberg & Norqvist, 2018). Similar to this study, Vidmar et al. (2017) have compared early mathematics assessments in two different countries. However, the comparison was not between different assessments, but the aim was to examine the same assessment in two European countries and to analyse how well this assessment is able to predict later academic achievement. Together, the studies above indicate that early efforts to promote students' mathematical skills benefit continued learning in both mathematics and other subjects.

While there are arguments for early intervention in mathematics, challenges associated with the early assessment of students' knowledge exist. International studies show that focus on their individual shortcomings can affect students' self-image negatively as they may begin to regard difficulties with assessments as a personal trait (Reay & Wiliam, 1999; Rätty et al., 2004). In the long term, focus on students' individual shortcomings can hamper their learning as they may experience the difficulties as constant (Reay & Wiliam, 1999; Rätty et al., 2004). Furthermore, international research shows that students are vulnerable to the context of the survey and the social framework of assessment situations (Zohar & Gershikov, 2008). If assessment is conducted in a group, the grouping may affect the extent to which

students dare to express their own knowledge (Zohar & Gershikov, 2008). Together, the studies above describe issues with early assessment of students' knowledge.

Method

In this section, the context of the two assessment materials, theoretical and methodological framing, and ethics are described.

The Context of the Two Assessment Materials

The Swedish assessment material was implemented in 2019 to assess the “mathematical thinking” (p. 1) of six-year-olds (National Agency for Education, 2019). The title of the Swedish assessment material is “Find the Mathematics” (Hitta matematiken), and its purpose is to identify “students who show an indication of not meeting the knowledge requirements”, “students in need of extra adaptations” and “students in need of extra challenges” (p. 3). Use of the Swedish assessment material is mandatory, and assessment takes place in the autumn term – that is to say, at the start of the first year of school (National Agency for Education, 2019). The Swedish assessment material comprises four activities, Pattern, Dice Games, Sand and Rice, and Playground (p. 4), which are carried out orally in small groups of students with a teacher.

The Norwegian assessment material was implemented in 2011 to assess the arithmetic skills of six-year-olds (Norwegian Directorate for Education and Training, 2017). The title of the Norwegian assessment material is “Mapping Test in Arithmetic” (Kartleggingsprøve i regning) (p. 1), and its purpose “is to find students who need extra follow-up when it comes to developing basic skills in arithmetic” (p. 4). Although use of the Norwegian assessment material is voluntary at a national level, most schools do make use of it (Nortvedt, 2018). Assessment takes place in the spring term – that is to say, at the end of the first year of school. The Norwegian assessment material consists of text-based tasks that students complete individually in writing within a set time.

This study focuses on the national assessment materials implemented by the National Agency for Education (2019) and the Norwegian Directorate for Education and Training (2017). A systematic review of similar analysis comparing assessment materials from different countries was conducted, but no similar studies were found. Other assessment materials are used with six-year-olds in Sweden and Norway, but these are not focused on in this study as these are not national assessments. For this study, an analysis was conducted of the teacher information from the Swedish assessment material and the first chapter in the teachers' guide for use with the Norwegian assessment material. These were chosen as they are equal in the sense that they describe *why*, *how* and *when* assessments are to be conducted. Thus, the discourse analysis was of written material. The assessment tasks were not analysed.

Theoretical Framing – Discourse Analysis

Through the use of discourse analysis, this study focuses on how the structure of language can have an impact on early mathematics education by both reflecting and creating the existing reality (Winther Jørgensen & Phillips, 2000). Discourse analysis is what we all do more or less unconsciously when we notice “patterns of language in use and the circumstances with which these are typically associated” (Trappes-Lomax, 2004, p. 133), and discourse analysis can be used as either a theory, an analytical tool, or both (Trappes-Lomax, 2004; Winther Jørgensen & Phillips, 2000).

A critical evaluation of discourse research in mathematics education show many different traditions of using discourse analysis (Ryve, 2011). Discourse analysis in line with Gee (2014a, 2014b) was chosen for this study as it offers both a theoretical view on and analytical tools for construing discourses. Gee (2014a, 2014b) focuses on situational and cultural differences, and provides an explanatory view on discourses. Based on Gee (2014b), a study of written language and its use makes it possible to say something about the specific contexts in which opinions and views emerge (Gee, 2014b). Gee (2014b) distinguishes between two theoretical notions, big and small discourses: this study includes small discourses only as the focus is on language-in-use (Gee, 2015, p. 1). “When we study language-in-use, we study language not just as an

abstract system (“grammar”), but in terms of actual utterances or sentences in speech or writing in specific contexts of speaking and hearing or writing and reading” (Gee, 2014b, p. 19). In this study, discourses are seen as part of a dialogical process that constantly creates and reshapes the meaning of early mathematics and early assessment in mathematics.

Discourse Analysis as an Analytical Tool

As presented above, the discourse analysis focused on what Gee (2014a) calls “small discourses”. Small “d” discourse analyses focus on patterns and connections in *stretches of language* and how these can lead to interpretations and meaning (Gee, 2015, p. 2). Gee (2014a) offers 28 methodological tools by which to study such patterns and connections. Each tool consists of questions intended for text or other forms of communication. Gee points out that researchers must choose and adapt the tools to fit the selected data. In this study, nine of Gee’s tools were chosen based on applicability to the research questions and the analysis of written material. Each of the nine selected tools has, in accordance with Gee (2014a), been reformulated based on the context of this study.

The Process of Analyzing the Assessment Material

Initially, two tools were used to discern between significant content of the assessment materials of both countries. *The Significance Building Tool (#14)*: What is identified as being significant in the assessment materials of both countries? What is the importance of what is written? *The Fill-In Tool (#2)*: What knowledge, assumptions and conclusions must be filled in by a reader for the text to be clear? Three tools were then used to show how shorter sections of text relate to the whole context of the two texts. *The Diexis Tool (#1)*: What is taken for granted, based on the context? *The Connections Building Tool (#19)*: How are choices and omissions justified in the assessment materials? *The Situated Meaning Tool (#23)*: What specific meaning do words and concepts have, based on the context? In the next step, two tools were used to discern between intentions and between relationships in the assessment materials. *The Why This Way and Not That Way Tool (#9)*: What intentions are identified in the assessment materials? *The Relationships Building Tool (#17)*: How is the language used to build and maintain relationships between students, teachers and head teachers? After this, one tool was used to show the purposes of the assessment materials: *The Doing and Not Just Saying Tool (#7)*: What purposes are stated in the assessment materials? Finally, one tool was used to show which view of mathematics appears in the assessment materials: *The Systems and Knowledge Building Tool (#21)*: How is the language used to describe mathematics in the assessment materials?

Table 1 illustrates an example of the gradual shift in focus of the discourse analysis, from significant words to a bigger picture. However, the table should be understood as circular, not linear. The questions from Gee were used more iteratively in the discourse analysis than can be illustrated in a table.

Table 1. An illustration of the process of analysing the assessment materials. Text and quotations in the table should be understood to be part of the iterative process and not the complete analysis that supports the construction of a discourse.

Tools: #14, #2	Tools: #1, #19, #23	Tools: #9, #17	Tool: #7	Tool: #21
The concepts of <i>activity</i> and <i>activities</i> are mentioned about 60 times in the Swedish assessment material.	Activities should arouse <i>curiosity</i> and <i>interest</i> in mathematical content.	The intention with activities is to arouse <i>interest</i> .	Purpose, to show knowledge.	The activities are not named based on the mathematical content to be assessed.
<i>Activity</i> is not defined. It is implied what activity is.	Assess how the student: <i>shows curiosity and interest in the mathematical content of the activity</i> (p. 4-5).	<i>Students at this age are more dependent on the teacher arousing interest in the activity or that the activity itself is interesting</i> (p. 4).	<i>The activities are designed so that each student, in a playful way, will have the opportunity to show knowledge that is important for the development of mathematical thinking</i> (p. 4).	<i>Patterns, Dice Games, Sand/Rice, and Playground</i> (p. 4).

An important aspect of discourse analysis as applied in this study is that it is not about evaluating – but rather about studying the written language. I, the researcher, am familiar with both the Swedish and Norwegian school systems. Fluent in Swedish and Norwegian, I was born and raised in Sweden, and lived 12 years in Norway, where I qualified as a primary school teacher. Furthermore, I have taught mathematics

in both countries. In Norway, I was a Grade 1 teacher and therefore used the Norwegian assessment material with six-year-old students. I have not taught in preschool class in Sweden.

Results

In the results, the discourses that were construed based on the nine tools above are presented.

Discourses in the Swedish Assessment Material

The following discourses are construed and described based on the Swedish assessment material (Figure 1): curriculum discourse, competence discourse, equity discourse, activity discourse and support discourse. In the Swedish assessment material, reference to the *Curriculum for the Compulsory School, Preschool Class and the Recreation Centre* (National Agency for Education, 2018) is frequent. Below, this will be termed “the Curriculum”.

Curriculum Discourse

This discourse is construed based on the significance of the Curriculum, a frequently recurring voice. Both the design and the content of the assessment material are motivated with reference to the Curriculum. For example: “The assessment is based on the Curriculum for the preschool class and the abilities that the teaching should give students the opportunity to develop” (p. 3). The Curriculum is mentioned several times, both implicitly and explicitly. However, only certain parts of the Curriculum are apparent and the focus is on the “observation points” (p. 5) to be assessed. Also, the expression “mathematical thinking” (p. 3) is often mentioned. This expression is used in the general section of the Curriculum (section 2.2), and not in the section specific to the preschool class.

Competence Discourse

This discourse is construed based on the significance of competencies as three “observation points” (p. 5) in relation to the purpose of the Swedish assessment material: “how the student shows curiosity and interest in the mathematical content of the activity”, “the ability to try and use different ideas” and “the ability to communicate and reason about mathematical concepts” (p. 4-5). These three observation points are in line with two of three competencies emphasised in the preschool class curriculum: “try to develop ideas and convert the ideas into action” and “use mathematical concepts and reasoning to communicate” (p. 19-20). In the Swedish assessment material, the assessment of these is described as significant since they are considered important competencies for children to develop. At the same time, the assessment material describes how using it may also make other knowledge visible.

Of course, the activity can provide additional information about the students’ mathematical knowledge than what is described with regards to the observation points (p. 5).

There is no mention of mathematical problem-solving as an observation point, despite its mention in the Curriculum. Nor is there an explanation as to why this competence is not to be assessed despite problem-solving being highlighted as a competence that students can develop through the assessment.

By giving students the opportunity to encounter activities of a different kind, they can develop confidence in their ability to solve problems in different situations and contexts (p. 4).

Equity Discourse

This discourse is construed based on the significance of equity and the adaptations to be made for students who may not achieve the learning goals. In the teacher information, equity is explicitly referred to on several occasions. The first sentence in the Swedish assessment material states that assessment needs to be conducted in the autumn term so that “the teacher can identify students at an early stage who risk not reaching the knowledge requirements to be achieved in year 3...” (p. 3). This appears several times and is always first mentioned in the descriptions of the purpose of the Swedish assessment material. The assessment material also states that it should “support the teacher in identifying the students in need of extra adaptations” (p. 3). Since students who risk not achieving the goals may need extra adaptations, these two aims may relate to the same students. The expressions *students in need of extra adaptations* and *students*

in need of extra challenges often appear together, which makes it seem that they are distinct groups. Also, the purpose of identifying “students who show an indication of not meeting the knowledge requirements” always comes first, followed by “students in need of extra adaptations” and finally “students in need of extra challenges” (p. 3). The intention with the identification of these three student groups in the Swedish assessment material is to contribute to equity, as those who risk not attaining the necessary knowledge can receive special support and extra adaptations (p. 7-8). The Swedish assessment material does not define which students are included in *students in need of extra adaptations* and *students in need of extra challenges*.

Activity Discourse

This discourse is construed based on the significance of *activity* and *activities* in relation to the intention to arouse interest. In the teacher information alone, these two words appear about 60 times, but they are not defined. On several occasions, the word activity is associated with playfulness.

The activities are designed so that each student, in a playful way, will have the opportunity to show knowledge that is important for the development of mathematical thinking (p. 4).

Furthermore, activities are linked to the observation point “how the student shows curiosity and interest in the mathematical content of the activity” (p. 4-5). The importance of curiosity and interest is motivated by references to the Curriculum: “Teaching should take advantage of students’ curiosity and give them the opportunity to develop their interest in mathematics...” (p. 18). The implication is that the activities in which students encounter mathematics should be designed in a way that makes them interesting. Teachers are described as being responsible for adapting and replacing activities so that students find them interesting.

Students at this age are more dependent on the teacher arousing interest in the activity or that the activity itself is interesting (p. 4).

The four activities “Pattern, Dice Game, Sand/Rice and Playground” (p. 4) have names that say more about the game than the mathematical content to be assessed. Thus, mathematics itself does not seem to be what arouses students’ interest but rather it is the doing of the activities that is interesting. Through the activities, students’ interest should be both aroused and assessed. As the quotation above illustrates, students may also need help from teachers to arouse their interest.

Support Discourse

This discourse is construed based on the significance of mandatory support in the assessment material. The mandatory support relates explicitly to teachers receiving assessment support to teach students mathematics, and also to teachers receiving support to identify students in need of extra support. For example: “The assessment is a support for the teacher’s continued teaching” (p. 3) and “The purpose is to support the teacher in identifying the students who...” (p. 3). The fact that assessment is conducted early in the autumn term demonstrates how teachers should receive such support at an early stage.

The teacher can also, with the support of the assessment, discover areas that further teaching needs to focus on. Also, the material provides support in identifying the students who need extra adaptations, special support, or extra challenges (p. 3).

Because the assessment material is compulsory, all teachers must receive this support.

Discourses in the Norwegian Assessment Material

The following discourses are construed and described based on the Norwegian assessment material (Figure 1): framework discourse, arithmetic discourse, solicitude discourse, formative assessment discourse and management discourse. In the Norwegian assessment material, frequent references are made to the Framework for Basic Skills, and the National Curriculum for Knowledge Promotion in Primary and Secondary Education and Training (Norwegian Directorate for Education and Training, 2013, 2017). In the text below, these are referred to as the Framework and the Curriculum respectively.

Framework Discourse

This discourse is construed based on the significance of the Framework and the Curriculum in relation to the intention of the assessment material.

The test is anchored in the definition and progression description for counting in the Framework for Basic Skills and competence goals in the curriculum (p. 5).

How the competence goals mentioned in the quotation above are anchored in the Norwegian assessment material is not clear. On the other hand, the Curriculum is implicitly apparent, as *Basic Skills* are integrated into *the competence goals*. The design and content of the Norwegian assessment material are justified based on how arithmetic is described in the Framework. Four areas of skills from the Framework are described as starting points for the form and content: "Recognise and Describe, Use and Process, Reflect and Evaluate, and Communication" (p. 5). The Norwegian assessment material measures and is based on competence at the lowest level in two of the four skill areas: *Recognise and Describe*, and *Use and Process*.

The test is adapted to this level. The assignments thus measure competence at the lowest level in the description of progression for arithmetic in *the Framework for Basic Skills* (p. 5).

The Norwegian assessment material does not state why the two areas of *Reflect and Evaluate* and *Communication* are not assessed. However, the omission of these skills is explicitly described in the Norwegian assessment material.

Arithmetic Discourse

This discourse is construed based on the significance of arithmetic in relation to the purpose and the title of the Norwegian assessment material, "Assessment Material in Arithmetic" (Kartleggingsprøve i regning) (p. 1).

The purpose of the assessment is to find students who need extra follow-up when it comes to developing basic skills in arithmetic (p. 4).

The tasks in the Norwegian assessment material are connected to *numbers*, which is one of the four areas highlighted in the competence goals in the Curriculum. There is no reason given as to why the other three areas (*geometry*, *measurement* and *statistics*) are excluded or why the Norwegian assessment material deals with only one of four areas in the Curriculum. However, there is a detailed explanation of how the selected area of *numbers* can, in turn, be divided into four themes: "counting skills, number concepts, number series and number line, and arithmetic skills" (p. 6). There is no explicit reason given as to why these four themes should be assessed or where they derive from, as they are not used in the same way as *numbers* is in the competence goals in the Curriculum.

Solicitude Discourse

This discourse is construed based on the significance of solicitude in relation to the intention of comparing students' results with a specific *limit of concern*. The Norwegian assessment material states explicitly that it should not provide information about all students at different levels, only those "who need extra follow-up" (p. 3).

The only thing we can say about the students who accomplish a lot, or everything, on the test is that they have sufficient skills as a basis for further learning, but we know little about how much they really know (p. 3).

The purpose of the Norwegian assessment material is to "find out if there are students who have not acquired the necessary skills in initial education" (p. 3). To find the students who need extra follow-up, teachers and head teachers are encouraged to look at students' results in relation to *the limit of concern* (p. 3-4). Students with results that place them as the lowest 20 percent in the country are defined as on or below the *limit of concern*. The Norwegian assessment material states that the results of these students should be assessed together with other information about the student before a decision is made as to whether they need follow-up. This means that one fifth of all students may need some form of solicitude to be able to assimilate the continued teaching.

Formative Assessment Discourse

This discourse is construed based on the significance of formative assessment in the Norwegian

assessment material. The notion of formative assessment is used and described in terms of what teachers are expected to do before, during and after assessment. By assessing students, teachers acquire information that will benefit their future teaching.

The test results can be seen in connection with other information about the students and as part of formative assessment and adapted teaching (p. 6).

The voice that advocates formative assessment is the *Regulation to the Education Act*, §3-10, where a model for formative assessment is described (Ministry of Education and Research, 2009). In the Education Act, four principles are referred to as being particularly important in formative assessment, which is also described in the assessment as central to the work with assessment material. Three of these four principles are highlighted as important in the Norwegian assessment material.

The students' capability for learning can be strengthened if the students understand what they are supposed to learn and what is expected of them; if they receive feedback that tells them about the quality of the work or performance; and if they are involved in their own learning through assessment of their own work and development (p. 6).

Management Discourse

This discourse is construed based on the significance of management in relation to the responsibility of the head teacher to conduct the assessment. The head teacher is responsible for preparing, implementing and finishing work that relates to the Norwegian assessment material at the level of both group and individual student.

The head teacher has the overall responsibility for ensuring that all students are assessed (p. 3).

It is also the head teacher who is described as being responsible for arranging the assessment material for students who have special needs. Additionally, it is the head teacher who must be helped to identify students who need extra follow-up. This applies to both small schools with one class per age group and large schools with several parallel classes.

Conclusion and Discussion

According to Gee, the study of written language and its use makes it possible to say something about the specific context in which opinions and views arise (Gee, 2014b). Thus, in this discussion, the discourses presented in the result will be discussed in relation to their context and different views on early mathematics assessment.

This article focuses on assessment material from two neighbouring countries that have similar cultures and education systems (Klette, 2018). Although their assessment materials are for use with six-year-olds, their content and context of implementation are somewhat different. The results show five different discourses in both the Swedish and the Norwegian assessment material, with slight differences between these discourses (Figure 1).

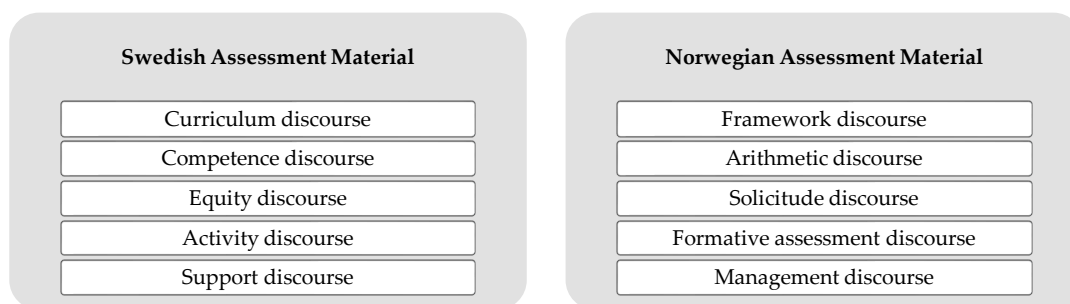


Figure 1. The five discourses in the Swedish assessment material and the five discourses in the Norwegian assessment material.

The Curriculum and the Framework are central in both countries, while there are differences in *when* the assessment is to be conducted, *what* to assess, and on *how* and *why* to assess. Implications of these differences are discussed in the next sections.

When the Assessment is to be Conducted

The Swedish assessment is to be conducted at the start of preschool class, in the autumn term. This is described in the support discourse and equity discourse. Based on when the assessment is conducted, it can be perceived that all teachers need external support before teaching. In contrast, the Norwegian assessment takes place in the spring term, which means that teachers first teach the students and then assess them to identify those in need of extra support. Based on the solicitude discourse and the time the assessment is conducted, possible problems are assigned to the students as individuals. The focus on students as individuals is strengthened by the formative assessment discourse and the management discourse.

As a result of the timing of the assessment, the risk of *teaching to the test* is greater in Norway than it is in Sweden. According to Volante (2004), preparing students for tests by focusing on items similar to test items is called *teaching to the test*. Because the assessment in Norway takes place in the spring term, teachers teach their students before conducting the test; meanwhile, assessment in Sweden takes place at the start of the autumn term, most likely before teaching begins. In Sweden, the greatest risk of teaching to the test is in preschool.

What to Assess

A curriculum/framework discourse is apparent in both the Swedish and the Norwegian assessment material. Despite the discourse analysis demonstrating that the national curriculum of each country is adhered to in the respective assessment material, it is notable that focus is only on selected parts of each one. The Swedish assessment material assesses “mathematical thinking” of six-year-olds in the four activities “Pattern, Dice Game, Sand/Rice and Playground” (p. 4). The competence discourse describes how the assessment material assesses three “observation points” (p. 5): “how the student shows curiosity and interest in the mathematical content of the activity”, “the ability to try and use different ideas” and “the ability to communicate and reason about mathematical concepts” (p. 4-5). The Norwegian assessment material assesses the arithmetic skills of six-year-olds, and the tasks are divided into four themes: “counting skills, number concepts, number series and number line, and arithmetic skills” (p. 6). The framework discourse describes how the assessment material measures competence at the lowest level in these two skill areas: *Recognise and Describe*, and *Use and Process* (p. 5).

What is assessed in the Swedish assessment material can be related to the activity discourse. Playful activities are the “good” and “true” way to assess and teach mathematics to young students. Furthermore, young students require that the teacher arouse their “interest in the activity or that the activity itself is interesting” (p. 4). Even so, it is unclear what is being assessed. According to Newton (2007), it is important to clarify “assessment purpose” and not use multiple discrete purposes within a number of different categories. Multiple purposes may result in conflicting purposes, and thus, not knowing what conclusions it is possible to draw from the assessment (Newton, 2007; Nortvedt & Buchholtz, 2018). In the Swedish assessment material, it is not clear what is being assessed – the teachers’ ability to arouse interest among students and/or the activities ability to arouse interest in the students and/or the mathematical knowledge of the students? What is unstated yet taken for granted, is that students should show interest in the activities. According to the Swedish assessment material, students who do not show an interest must be considered in the teachers’ continued planning and teaching. What the Norwegian assessment material assesses can relate to the arithmetic discourse and be justified with research on early numeracy. Aubrey et al. (2006); Aunio and Niemivirta (2010) argue that the level of students’ numeracy skills increases in importance by school year, and early numeracy has a greater impact on later school achievement than factors such as gender, age and parental education. Thus, focus on arithmetic is in line with research studies that show the importance of early mathematical skills (Aubrey et al., 2006; Aunio & Niemivirta, 2010; Duncan et al., 2007). To help address the differences in ability between children, the early identification of

students in need of extra support is essential. However, according to Duncan et al. (2007), early identification does not say anything about which curriculum type is most effective: “play-based” or “drill-and-practice-based”.

The discourse analysis indicates a difference when it comes to the kinds of tasks in the Swedish and Norwegian assessment material. The Swedish assessment material includes “performance tasks”, which can be described as “non-routine tasks involving substantial chains of reasoning” (Burkhardt & Schoenfeld, 2018, p. 577). The Norwegian assessment material includes “short tasks”, which can be described as tasks “focused on one fragment of mathematics that take only a minute or two” (p. 577). Neither of the assessments is what Burkhardt and Schoenfeld (2018) would call well-balanced – a combination of “short tasks” and “performance tasks” (p. 577).

How to Assess

The discourse analysis indicates that there are differences between the assessment materials of the two countries in terms of *how* to assess. The Swedish assessment material consists of four activities that are carried out orally in small groups of students with a teacher. The Norwegian assessment material consists of text-based tasks that students complete individually in writing within a set time.

The design of assessment material may affect teaching content. Teaching with a focus on items similar to test items is called *teaching to the test* (Volante, 2004). Assessment with “short tasks” (Burkhardt & Schoenfeld, 2018) that are to be completed within a set time (as is the case with the Norwegian assessment) may result in less teaching about complex mathematical problems with multiple solution paths. The risk of “teaching to the test” (Burkhardt & Schoenfeld, 2018; Volante, 2004) is more apparent in the Norwegian context of mathematics education for six-year-olds than it is in the Swedish context. This is because the Norwegian assessment tasks can be readily replicated for use with only minor variation. In the case of the Swedish assessment material, the risk of teaching to the test decreases since tasks are completed orally in groups. Nevertheless, one issue to be aware of in relation to the Swedish assessment material is that research shows that working in groups may affect the extent to which individual students dare to show their ability (Zohar & Gershikov, 2008). In Sweden, the greatest risk of teaching to the test is in preschool, since the Swedish assessment material is used at the start of the autumn term. Thus, the risk of teaching to the test exists in both countries, be it in different ways. At the same time, both the Swedish and the Norwegian assessment materials describe the abilities to be assessed, which may encourage teachers in both countries to focus their teaching on abilities rather than solely on specific tasks.

Why to Assess

The Norwegian assessment material has a clearly defined purpose: the identification of students in need of follow-up and extra adaptations (p. 3). Also, it specifies both what the results can be and what they should not be used for. The formative assessment discourse and the management discourse in the Norwegian assessment material stipulate that the head teachers are responsible for ensuring that students at or below *the limit of concern* receive follow-up. In the Swedish assessment material, several aims are stated: the purpose of identifying “students who show an indication of not meeting the knowledge requirements”, “students in need of extra adaptations” and “students in need of extra challenges” (p. 3). These different aims may make it unclear how assessment results are to be used. Also, the discourse analysis indicates that the Swedish assessment material is useful for the purposes of both assessment and learning. However, it is not clear whether the teachers should assess students’ mathematical knowledge from previous years and/or whether they should assess what the students learn during the assessment. According to Newton (2007), several goals without a clear ranking can end up conflicting with each other.

According to Palm et al. (2011), it is much easier for teachers to assess students’ calculation skills than it is to assess students’ problem-solving skills. Perhaps this is why the Norwegian assessment material, which consists of “short tasks”, may be easier for the teacher to use than the Swedish assessment material, which consists of “performance tasks” (Burkhardt & Schoenfeld, 2018). According to Nortvedt and Buchholtz (2018), however, one sole summative assessment cannot display learning or development of

mathematical thinking. In order to contribute to fair assessment, all assessment should consider different and multiple sources of individual students' performance (Leder & Forgasz, 2018).

Implications

The results of this study provide a big-picture view, here and now, with awareness of the fact that the context of the assessment materials of both countries is constantly changing. For example, from 2022, the Norwegian assessment material will be conducted digitally. Furthermore, in 2020, a new Norwegian curriculum was introduced (Norwegian Directorate for Education and Training, 2020): in it, play was given a more prominent role than in the curriculum referred to in the Norwegian assessment material. A greater focus on play may be seen as a reaction to the theorising of the schooling of six-year-olds (Ertesvåg & Ridar, 2018; Johansson, 2010). In Sweden, an opposite development can be seen with the implementation of a 10-year primary school education where preschool class will become Grade 1 (Ministry of Education and Research, 2020).

In this study, similarities and differences between the various meanings ascribed to the assessment materials of Sweden and Norway are investigated and discussed. Thus, the article describes an example of early assessment in two neighbouring countries that have similar cultures and education systems. The results show a diversity of discourses, which indicates different views on young students' learning of mathematics in terms of when to assess, what knowledge to assess, and on how and why to assess. Thus, insights from this comparative analysis can contribute to a more nuanced picture of early mathematics assessment. This article invites educators and policymakers to reflect on their assessment practices in mathematics classrooms with young children. Even though Sweden and Norway have similar cultures and education systems, there is no consensus as to when, what, how and why to assess the mathematical knowledge of six-year-olds.

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