

Alexander Jonas Viktor Selling

Guri Nortvedt & Kirsti Klette, University of Oslo

Faculty of Educational Sciences

Doctoral Research Fellow

Mathematical Competency Goals and Activities in Nordic Mathematics Classrooms

**Abstract** (300 words)

The aim of this study is to investigate how competency-oriented activities and learning goals align during lessons in lower secondary mathematics classrooms in Finland, Norway, and Sweden. One of the end goals of mathematics education is to provide students with opportunities to develop mathematical competence, and thus, it has been adapted into many curricula, among them in the Nordic countries as overarching goals.

In a previous study, part of the LISA Nordic project, analyses from 28 lower secondary mathematics classrooms in Finland, Norway, and Sweden, indicated that explicit learning goals mostly targeted content and rarely mathematical competencies (Selling et al., in review). However, some of the tasks and activities that were observed during lessons suggested that competencies were still promoted to some extent, albeit mostly implicitly. While opportunities to develop mathematical competency may be promoted implicitly, having learning goals with a different focus might make such opportunities less visible and clear for students, while alignment between goals and activities could accentuate important ideas regarding competencies.

In the present study, a sub-sample of the video data is analyzed in-depth with a targeted framework for mathematical competency, looking specifically at learning goals uttered by the teacher, as well as competency-oriented activities and tasks. The analyses will be used to investigate how competency-oriented activities and goals align during lessons. The data is purposefully sampled to include lessons where students engage in competency-oriented activities.

Preliminary findings indicate that lessons tend to focus on procedural competency. While there are opportunities for developing other competencies in the activities, the teacher seldom seems to focus on or highlight these instances.

**References**

Selling, A. J. V., Klette, K., & Nortvedt, G. (in review). Teacher enactment of goals in Nordic mathematics classrooms.

**Extended summary****Introduction and Rationale**

Students' development of mathematical competence is often suggested as one of the overarching goals of mathematics education. This is to enable them to apply mathematics in both extra and intra-mathematical contexts, which consequently would provide them with skills necessary for everyday life, work, and participating in society (Niss, 2007). In similarity to many countries in the world, mathematical competencies are part of the national curricula in Nordic countries (Niss et al., 2016), where they for example can be found as overarching goals in mathematics.

However, while mathematical competencies are set as overarching goals, their implementation can vary from teacher to teacher. Previous research indicates that mathematical competencies are seldom discussed explicitly in classrooms, and when present, often tend to focus on the procedural skills (e.g., Boesen et al., 2014; Selling et al., in review). In a previous study from the LISA Nordic project, analyses of teachers' learning goals indicated that teachers rarely set explicit competency goals for lessons, but usually focused on content (Selling et al., in review). Observations from this study indicated that even if there were opportunities for developing a variety of competencies, during for instance activities, the learning goals seldom reflected this.

In light of this previous study, as well as other research, we aim to further investigate the alignment between competency-oriented activities and teachers-set goals in Nordic classrooms. We argue that alignment between explicit learning goals and activities that students engage with is an important element during lessons. Providing students with activities that provide opportunities to develop competencies, without stating such purposes is certainly possible (Boesen et al., 2014). However, setting learning goals focused solely on content or procedural skills, might make other competencies less clear for students. On the other hand, providing lesson goals that are aligned with activities, could help students reflect upon important mathematical ideas and their own development of mathematical competence.

**Theoretical background**

The concept of competency is widely discussed in mathematics education research, thus laying the foundation for several different frameworks and definitions (Kilpatrick, 2014; Weinert, 2001). However, competency does usually involve students engaging in different situations, utilizing mathematics, thus requiring them to possess a sufficient understanding to do so.

While many curricula aim at developing students' mathematical competency, research indicates that teaching might not have adapted the competency-related input from the curricula to a full extent. In the previous study on teachers' enactment of goals in lower secondary mathematics classrooms (Selling et al., in review), the progenitor of the present LISA Nordic study, we found that teachers tended to focus on content when setting explicit learning goals for lessons, while seldom stating competency goals. Thus, even as some activities might provide opportunities for competency-development, most lessons seemed to have a procedural focus. Similarly, Boesen et al. (2014), studied the impact of the competency goal reform in Sweden, comprising observations, interviews, and surveys, and found an overrepresentation of procedural handling competency in the classrooms. Internationally, for example Gravemeijer et al. (2016) discussed a focus on classroom practices that mostly targeted development of procedural skills for students.

It should be noted that activities and tasks that are utilized in classrooms may still promote competency-development, even if introduced implicitly (Blomhøj & Jensen, 2007; Boesen et al.,

2014). However, explicit teaching practices, among them clear goals, have been suggested as important factors in students learning processes and motivation (e.g., Alles et al., 2018; Seidel & Shavelson 2007), and could be employed by students to assess their own development of competencies (Blomhøj & Jensen, 2007).

Overall, we argue that the alignment between learning goals and activities is of importance. Being able to highlight opportunities for competency-development explicitly, may be one way of facilitating students' learning during competency-oriented activities. The study is within the QUINT ambition, specifically the LISA Nordic study, with a focus on instructional quality and observation of teaching practices.

### **Methodology**

This study uses video data from the LISA Nordic study, which uses the LISA study research design (Klette et al., 2017). Classrooms are recorded with a two-camera setup (one camera facing the teacher and the other the students), with one microphone attached to the teacher, while the other is placed centrally in the classroom. Classrooms from Finland, Norway, and Sweden will be purposefully sampled from the data set, inclusion criteria based on presence of group work activities, as such activities has been suggested to allow for students to engage with more complex mathematical ideas in tasks (see e.g., Gravemeijer et al., 2016).

The data is coded with the Mathematical Competency Research Framework (Lithner et al., 2010), targeting learning goals, from for example teacher utterances, as well as the activities and tasks that are used. The MCRF framework is divided into six competencies, with each competency being divided into three competency-related activities: "Interpret", "Do and Use", "Judge" (Lithner et al., 2010). The six competencies are adapted from previous competency frameworks, with the intention of decreasing category overlapping, comprising: Problem solving, Reasoning, Applying Procedures, Representation, Connection, Communication (Lithner et al., 2010).

### **Preliminary findings**

Data from the previous study (Selling et al., in review) indicated that explicit competency goals were seldom present in the analyzed classroom sample (28 lessons). However, observations and preliminary analyses indicate that activities provide several opportunities for students to engage with a variety of competencies, not only procedural handling. Going further, goals and activities will be analyzed in relation to each other, discussing the alignment and specificity of the learning goals.

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