

Challenges when implementing the Elkonin–Davydov curriculum in mathematics

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Teachers interested in developing students' possibilities to take part in joint discussions in problem-solving often have to deal with challenges regarding norms in the mathematics classrooms. Dominating classroom norms is a factor in mathematics teaching, be it of social or sociomathematical type. Here we address challenges in relation to norms experienced when attempting to create possibilities for mathematics learning starting at a general and algebraical point rather than a specific and arithmetical one. We draw on two projects that explored the Elkonin-Davydov curriculum in Swedish classrooms. The results indicate that norms, of different kinds, are impedimental in different ways, when performing a theoretical work in mathematics teaching.

Introduction

The overarching aim of this symposium is to discuss experienced challenges concerning, what Yackel and Cobb (1996) describes as social and sociomathematical norms, among Swedish teachers who have tried the Elkonin-Davydov curriculum (ED-curriculum) (Davydov, 2008).

To create opportunities for students to develop their theoretical or algebraic thinking, the ED-curriculum is developed based on the theoretical foundation of learning activity (LA) (Davydov, 2008; Kaput, 2008; Schmittau, 2004). Mastering the general / theoretical that is built into a mathematical object or concept is an important starting point for a learning activity. In order for students to engage in LA a content-rich problem situation must be provided. Such a situation should be complex enough to create some challenges for students in a way that their current knowledge is not fully sufficient. When planning a problem situation, possible learning models must also be constructed because it is with the help of the learning models that students in their inquiry work should be able to develop new knowledge. However, getting students to engage in LA is a very delicate process. The students' agency can easily be turned into something where they try to do what they think the teacher wants them to do, if so the students are no longer the active part of the problem-solving process. In part, balancing this delicate process is a matter of classroom norms, both social and sociomathematical (Yackel & Cobb, 1996).

The ED-curriculum for mathematics teaching has several similarities with inquiry mathematics teaching (e.g. Brousseau, 1997; Yackel & Cobb, 1996) which emphasizes

sociomathematical norms as argumentative and explanatory, autonomous or agentive actions collectively directed at mathematical objects rather than procedural operations. Specific to the ED-curriculum is its overall goal: the development of the youngest students' algebraic thinking (Vygotskij, 2001). With algebraic thinking, students' understanding of a mathematical object and its conceptual and theoretical structures is in focus in the curriculum, and thus in the teaching situation. To use the concepts of social norms and sociomathematical norms, both inquiry teaching and ED-curriculum in some respects relies on similar norms. Enabling the students' agency presupposes that the teacher is able to establish social classroom norms of cooperation and collective problem-solving processes. Specific to LA is that a problem situation needs to be complex and demanding enough so that the students' current knowledge is always insufficient in some respect. As a common classroom norm, therefore, students have to presume that their current knowledge is insufficient and that new knowledge needs to be developed. Another social norm is that students use the experiences of others as a resource. In relation to the ED-curriculum, examples of a sociomathematical norm that needs to be established in the classroom concerns students' engagement in the problem identification process, and that solution-proposals are to be given in an algebraic form.

A curriculum developed in one cultural setting cannot just be implemented in another cultural setting without challenging the dominating norms (Stigler & Hiebert, 2009). The research projects we have been involved in indicate challenges that must be handled if the ED-curriculum is to be implemented in Swedish schools. Therefore, the purpose of this symposium is to, on the basis of two research projects in a Swedish context, exemplify and discuss some social and sociomathematical norms we have identified. The two projects are 1) Helena Eriksson's doctoral project and 2) a research project funded by the Swedish Institute for Educational Research.

Project 1: Challenging norms in joint work on learning models

Project 1 is an ongoing research project that started in 2014 as a doctoral project (see Eriksson, 2021). In different extensions, twelve teachers, one researcher and about 150 students in preschool class–grade 5 participate. Most of the students were newly arrived in Sweden. This project aimed to explore the ED-curriculum as a tool for designing mathematics teaching in a multilingual primary school in Sweden. The data consists of about 90 research lessons and about 30 sessions when the teachers were planning the research lessons. Some results from the project are presented concerning algebraic thinking. A challenge of norms when developing a learning activity that has been identified is the joint work on learning models in the research lessons. Traditionally the students are used to following teachers' instructions about what model to use and how to solve a problem. But, in the research lessons the students were supposed to suggest, and argue about, which, why and how models should be constructed in order to discuss a specific concept aiming to solve the identified problem.

Project 2: Challenging norms in joint theoretical work

Project 2 was implemented collaboratively between teachers and researchers in four schools during the years 2017–2019. Altogether, eight teachers, eight researchers and about 310 students participated in the project. The research lessons were completed in compulsory school grades 1, 5, 7 and in upper secondary school. A total of 17 video-recorded research lessons aiming to explore how teaching, including problem situations, can be designed in order to enable students to develop a capability to reason algebraically were conducted. Principles from the ED-curriculum guided the design and analysis of the research lessons. The results are similar across the school years and points towards challenges related to norms connected to, for example, students' voluntarily showing their suggestions on the board for everyone to see, or teachers choosing to listen to, and managing, students' taking turns when elaborating on each other's suggestions rather than asking for answers (Eriksson et al., 2021; see also Eriksson et al., 2019). Both factors are pivotal for creating and maintaining the dimension of joint theoretical work signifying a learning activity when working with the general structures and relationships in mathematical objects.

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