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Tensions in teachers' attempts to apply inclusive mathematics education for students with diverse learning needs

Maria Vasilopoulou and Chrissavgi Triantafillou

National and Kapodistrian University of Athens, Athens, Greece;

vasilopouloumath@gmail.com

This study explores tensions secondary mathematics teachers' experience as they simultaneously try to create inclusive mathematics settings for students with diverse learning needs (i.e., students who are struggling and those who are competent in mathematics.) Our data comes from five group discussions with eight in-service mathematics teachers. We view tensions from an activity theory perspective. The findings indicate that participants' tensions are related to the selection of proper tools (tasks, prompts), personal rules (teachers' perceptions and attitudes), and communal rules imposed by the Greek educational system.

Keywords: Inclusive mathematics education, teachers' tensions, students' diverse learning needs.

Introduction

Many research findings indicate that inclusion policies have been taking members of educational communities out of their comfort zones and become the source of several uncertainties, challenges, and tensions (e.g., Tan & Thorius, 2019). Some reasons for teachers' challenges while attempting to foster an inclusive education for students with diverse learning needs are found within systemic constraints posed by the traditional, Western-style approach to education which expects teachers to bring groups of students to one-size-fits-all outcomes (Askew, 2015). Other factors include personal constraints, such as teachers' narrow definitions of mathematical activity (e.g., realize mathematics as a collection of procedures) and students' differing levels of mathematical ability (e.g., high achievers and low achievers) (Louie, 2017). Researchers have also identified conflicts in teachers' attempts to balance their ethical commitments to inclusion (teachers' social orientation) with the development of mathematical learning opportunities for all students (teachers' mathematical orientation) (Büscher & Prediger, 2022). Researchers view orientations as general beliefs and attitudes that implicitly or explicitly guide teachers' perceptions and actions. In our study, we view inclusive mathematics education as a practice in which every pupil in the mathematics classroom is welcome regardless of their knowledge, skills, and background (Scherer et al., 2022). Inclusive mathematics education includes human resources (teachers, students) and systemic resources.

Our study explores secondary mathematics teachers' practices while trying to value and support the diverse learning needs of all students. Specifically, we focus on students who are struggling with mathematics and those who are competent in it. The aim of the study is to identify the tensions teachers are facing in the above practices and our data comes from group discussions with eight in-service, secondary-level mathematics teachers in Greece. We view tensions from an activity theory perspective as the historically accumulating structural conflicts within components of an activity system. In Greece, as in many other countries, educational

policy is shifting towards adopting inclusive teaching practices. Meanwhile, cultures of exclusion (Louie, 2017) still dominate the Greek educational system (Tsakiridou & Polyzopoulou, 2014). Exploring Greek mathematics teachers' challenges while trying to enact inclusive mathematics teaching for students with diverse learning needs will enrich our understanding and add to this field of research. Our research question is: What type of tensions do teachers encounter when they attempt to promote inclusive mathematics education for students with diverse learning needs?

Theoretical framework

Tensions from an activity theory perspective

Activity theory investigates human activity as a system that is object-oriented, collective, and culturally mediated (Engeström, 1998, p. 79). Engeström's view of an activity system is represented by a triangle identifying links between mediational means (tools), the subjects, the object of the activity and communal elements of the subjects' activity. The communal elements are the community (people and groups whose knowledge, interests, and goals shape the activity), the division of labour or how the work of the activity is divided among the community members and the rules (norms, customs, and agreements that people adhere to while engaging in this activity). The outcome is the consequences that the subject faces because of their actions driven by the object and hinder the subject's participation in future similar activities. Figure 1 shows Engeström's (1998) model of teachers' activity we adopted to analyse teachers' tensions.

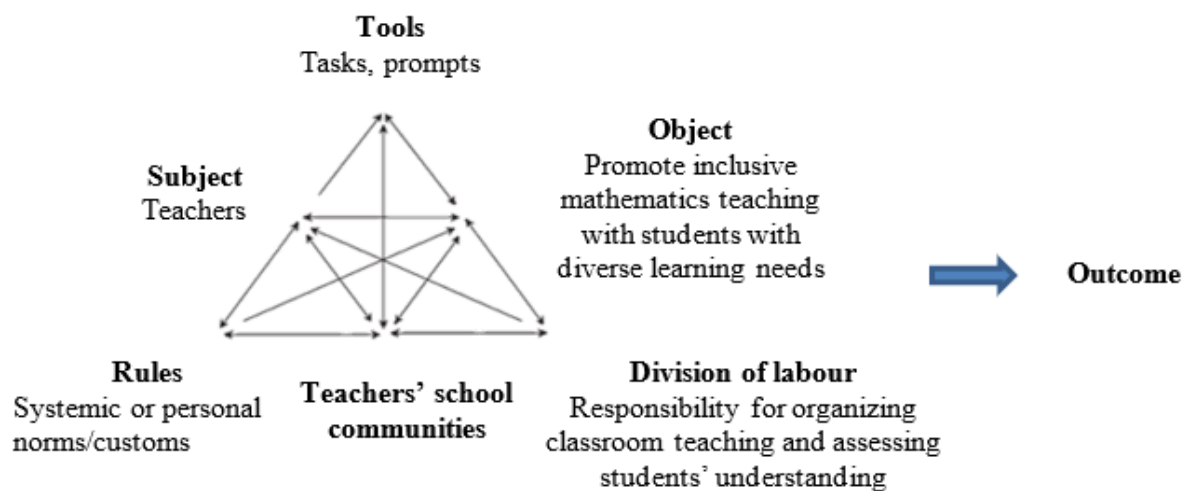


Figure 1: Model of the Activity System in this study (adapted from Engeström, 1998)

The activity represents teachers' (subjects) attempts to promote inclusive mathematics teaching for students with diverse learning needs (object). Tools are tasks and prompts that mediate teachers' actions. We see rules as systemic (e.g., curriculum resources) or personal (e.g., conceptualising students' ability) norms and customs. We consider the school as the community, and the division of labour as teachers' responsibility for organising classroom teaching and assessing students' understanding. In this activity system, tensions (indicated by the symbol \leftrightarrow) are viewed as manifestations of struggles between participants' attempts to maintain their intended objectives and their efforts to adapt to the sociocultural complexity of the classroom (Jaworski & Potari, 2009).

Teachers' challenges and tensions while enacting inclusive practices

Many studies on mathematics teachers' attempts to implement inclusive practices in their classrooms have uncovered significant challenges, even for teachers who strongly commit to equity (Louie, 2016). In their attempts to integrate the demands of inclusive education, teachers have developed specific practices. Examples are explicating conflicts between these demands, reducing task complexity, or the flexible use of visual models (Büscher & Prediger, 2022). Nevertheless, teachers struggle to step outside of dominant frames of exclusion and see alternatives, such as open, wide-ranging discussions about what constitutes students' mathematical ability (Louie, 2017). At the same time, positioning students as low achievers drives the unintentional exclusion of these students from learning opportunities. Researchers pointed out several kinds of tensions teachers experience while trying to maintain inclusive practices for all students. Louie (2016) focused on teachers' collaborative conversations about their students' abilities, revealing teachers' tensions as they tried to balance restrictive and expansive ways of inclusion. For example, teachers position some students as helpers and others as needing help. Tan and Thorius (2019) explored elementary teachers' views on equity for students with learning disabilities in mathematics during their participation in professional development activities. The researchers used an activity theory perspective to determine identity and power tensions that worked against participants' efforts for equitable practices. The identity tensions referred to challenges teachers faced either while comparing their early experiences with mathematics as students and now as mathematics teachers, or when they had to overcome their perception of some students' mathematical abilities as "deficit laden". Power tensions refer to relations between general and special educators, differences in educators' access to time and critical resources, and educators' input in planning and modifying curriculum. The researchers categorised these tensions in the "rules" component of the participants' activity system.

In our study, we explore the tensions teachers' feel when reflecting on their classroom actions to promote inclusive mathematics education for students with diverse learning needs. Most studies in this field have primarily focused on teachers' actions for students who are struggling in mathematics (e.g., Foote & Lambert, 2011), while only a limited number of studies put focus on high *and* low achieving students (e.g., Roos, 2019). The importance of nurturing everyone, including gifted and mathematically promising students, is highlighted in the literature (e.g., Leikin, 2010).

Methods

This study is part of a PhD research project exploring secondary mathematics teachers' attempts to transform their teaching from an exclusionary to an inclusionary form of instruction with students who are competent *and* those who struggle in mathematics. In this paper, students with diverse learning needs are mainly in those two categories. In the first phase of our study, we conducted online interviews with five students who felt competent in mathematics and four who were struggling with it. Students participated voluntarily in the interviews about inclusive issues in peer-collaboration discussions (Vasilopoulou & Triantafillou, 2022). In the second phase, we held five meetings with eight in-service mathematics teachers as described in detail below.

The context

The second phase of the study focused on eight in-service mathematics teachers (5 female, 3 male) who were working at six different public secondary schools in Greece. All these teachers had more than five years of teaching experience. Participants' names (pseudonyms), schools, and grades taught are as follows: Alan (school A), Malena (school C), and Elena (school B) all taught in grades 10-12. Nathan and Victor (school E), Alexia and Poppy (school D), and Michaela (school F) taught in grades 7-9. The teachers took part voluntarily in this study because they were interested in identifying ways to encourage students with diverse learning needs to participate in their lessons. We held five online meetings with the participants: one every 2-4 months during the 2021-2022 school year. The researchers led the discussion in each meeting. Participants had the chance to ask their colleagues for clarification, provide new ideas based on their own experiences, or share their concerns and challenges. Meeting 1 aimed to engage participants in sharing their teaching experiences, efforts, and challenges, including the challenge of teaching classes of students with diverse learning needs. Meeting 2 focused on the role of tasks. Researchers presented a) excerpts of student interviews (study phase one) on the tasks they preferred working on in class and b) examples of tiered tasks, i.e., tasks that are developed to approach similar mathematical content but require various levels of accomplishment (Rubenstein et al., 2015). Questions we asked the participating teachers included: "How do you reflect on students' ideas?" or "Have you ever tried tiered activities in your class?" In meeting 3, two participants (Alan and Nathan) shared examples of their self-designed tiered tasks. Then we discussed with participants the questions: "How could these tasks promote inclusive practices?" and "Did you notice any changes in students' participation while enacting these tasks?" After the third meeting, the first author started performing pilot observations in participants' classrooms. In meetings 4 and 5, the participants presented the selected mathematical tasks, their challenges, and the positive results of the student's participation. One characteristic question was: "Did you notice something that is important to share with your colleagues?"

Research data and data analysis

Our research data comes from audio recordings of the five online group discussions. We analysed the data in five steps. In the first step, we transcribed all five discussions. Second, we distinguished extracts of teachers' discussions that could be characterised as tensions. We identified tensions when participants presented their struggles to maintain the object of their activity while taking into consideration aspects of the sociocultural complexity of the classroom. An example was when participants referred to their efforts while trying to select proper tasks that offer equal learning opportunities to students with diverse learning needs. In accordance with our theoretical framework, we analysed in our third step the components of the activity system (tools, rules, community, or division of labour) that a tension referred to. Here, we took into consideration the literature that used the same theoretical perspective we had chosen (Jaworski & Potari, 2009; Tan & Thorious, 2019). In the fourth step, we distinguished the most common types of tensions, i.e., those tensions that two or more participants referred to. We consider these types of tensions as the most dominant ones. Finally in our last step, we coded each type of tension according to its main theme.

Results

We identified two dominant types of tensions. The first was the tools→←object tension, i.e., the tension teachers experienced when selecting the proper mediating tools (tasks or prompts) so as to engage all students (especially those who are struggling *and* those who are competent in mathematics) in classroom activities. The second tension was the rules→←object tension. This tension had either a systemic or a personal character. We present specific categories of both tensions and characteristic participants' responses below.

Tools→←object tension

Selecting the proper prompts in whole classroom discussions. Some participants mentioned challenges they faced when they tried to engage students with diverse learning needs in their classroom practices and to offer equal learning opportunities. In different meetings, Malena argued: "During whole classroom discussions we try to include questions that everyone can answer and none of the students monopolise the discussion" (Malena, first meeting). "We try to make sure that everyone understands the basics, so sometimes good students lose interest and find the lesson tedious" (Malena, second meeting).

Selecting tasks that are inclusive and challenging. All participant teachers pointed out that there is an issue in the coupling of inclusion and challenge. For example, the same task can be difficult for some students and too easy for others. Alan stated in two meetings: "Everyone needs to feel challenged. It's hard though. You often need to sacrifice the mathematical challenge to ensure student participation. You can't have both" (Alan, first meeting). "The mathematical quality of the class was high in terms of what was discussed and the problems that were solved. However, inclusivity was low" (Alan, fourth meeting). Victor and Nathan also mentioned: "If you plan it for two hours, you say you will help the weak to get more time, but the good ones will finish within the first hour. What will they do after that?" (Victor, fifth meeting). "Today I asked them to add and subtract simple algebraic expressions, we devoted 15 to 20 minutes to it, but the weak students did not know how to respond while the others lost interest" (Nathan, fifth meeting). At the end of the second meeting, Poppy had an idea for handling similar tensions: "We could perhaps guide weak students and help them find and understand their mistakes, while the rest can move on to a more challenging task" (Poppy, second meeting).

Selecting group-worthy tasks. Alan, the only participant who uses group-work in his daily teaching, highlighted teachers' responsibility on selecting a group-worthy task:

Even though cooperation has been nurtured in class, students might not work well in a team. That's due to the task rather than the teamwork itself. If the student is capable of solving the problem on their own, they have no need to discuss anything with their peers.
(Alan, fourth meeting)

Rules→←object tension

This tension was recognised either in the form of *personal rules* that the participants had developed over the years about the abilities and preferences of students when involved in a mathematical activity, or in the form of *communal rules* imposed by the educational system.

One personal rule they developed is that the students who are competent in mathematics do not collaborate with their peers in group activities. Characteristic examples are Elena's and Nathan's reflections during the fifth meeting: "There were very high achieving students who pulled back. They are used to just cracking on and solving the problem on their own, so they were a bit shocked" (Elena). "They've never learned how to work as part of a team. They haven't learned how to give; they only know how to show off" (Nathan). On the other hand, there were also personal rules about students who struggle in mathematics: "In heterogeneous groups, the under achievers struggle to keep up and rarely participate in the group discussion" (Malena, fourth meeting). Another personal rule that these teachers have developed is that pupils who are struggling in mathematics are reluctant or unable to do even very simple tasks. Characteristic examples are Alexia's and Alan's reflections: "Not only do they not know, but they do not care to learn. While I gave them handouts to work on a lot of simple exercises, they didn't work at all" (Alexia, second meeting). "Even performing simple calculations, for example 3 times 4, it takes them a while to respond. I have no idea what these kids can learn and how" (Alan, third meeting). It seems that many participants have developed personal rules about students such as what students want and can do. Thus, participants created a barrier that hinders their actual goal—the inclusion of students in their classroom practices—as well as their future attempts to foster inclusive mathematics teaching as described.

As far as the communal rules, *time management* issues were central in all participants concerns: "For instance, do something new or different, split them into teams, experiment ... all that will take a long time, so eventually I won't be able to get through the syllabus" (Michaela, second meeting). "Whenever I decide to devote more time to an activity... I've then had to rush through the rest" (Malena, fourth meeting).

Another community rule is *constraints posed by the norms while teaching*, especially in upper secondary school, because of the national exams for the admission to higher education. As Nathan put it, "in high school you can't afford to start low and build up to the students' level" (Nathan, fifth meeting). In the fourth meeting, Alan highlighted how students who were attending extra tuition outside the classroom in order to pass the national university entrance exams were affecting his attempts at inclusive teaching:

As we move up through lower to upper grades, inclusivity becomes more elusive. Many high school students, in order to prepare for the national exams, thanks to intensive tutoring classes, already know all the syllabus at the beginning of the school year. Thus, the cognitive gap [between students with diverse learning needs] keeps getting bigger.
(Alan, fourth meeting)

Highlighting the absence of proper curriculum resources. When we suggested the idea of selecting tiered activities, some teachers highlighted the absence of these tasks in the curricula: "The tasks that the syllabus proposed do not always combine all these elements" (Poppy, second meeting). "It's not easy to design your own tiered activities with enablers and extenders (Victor, fifth meeting).

Conclusion

Our findings indicate areas of tension that seem to play an influential role on the participants' perspectives, actions, and goals as these teachers attempted to foster inclusive mathematics education for students with diverse learning needs. These tensions might negatively influence the outcome of this activity. The rules→←-object tensions seem to consciously (communal rules) or unconsciously (personal rules) dominate participants' activity. These tensions might be responsible for creating cultures of exclusion (Louie, 2017) in the Greek educational system (Tsakiridou & Polyzopoulou, 2014). Teachers seem helpless in the face of these tensions, as the systemic rules appear to the teachers to be inaccessible obstacles to inclusion. The role of systemic rules as constraints for developing inclusive practices is also reported by Askew (2015). Teachers' perceptions, for example that students who are struggling in mathematics can only work on simple routine tasks, seemingly block teachers' efforts to foster inclusivity. It is interesting that personal rules→←-object tensions are related to different orientations (Büscher & Prediger, 2022) that teachers follow when trying to promote inclusive practices for students. Specifically, we identify here teachers' *mathematical orientations* towards students who struggle in mathematics. An example is Alexia's comment "Not only do they not know, but they do not care to learn [mathematics]". On the other side, we identify teachers' *social orientations* while trying to establish joint learning experiences especially for students who are competent in mathematics. An example is Alan's remark "If the students are good and capable of solving the problem on their own, they have no need to discuss anything with their peers".

The tools→←-object tension was related exclusively to teachers' *mathematical orientation*. This includes such things as selecting proper prompts and mathematical tasks and engaging students with diverse learning needs in a rich activity. Furthermore, we identify within the two types of tensions presented in this study aspects of a narrow definition of mathematical activity and of the students' mathematical ability (Louie, 2016).

Finally, it seems important to further explore how teachers could be supported in overcoming their tensions. This key aspect is included in the final phase of this PhD study that is currently in progress.

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