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“In school you notice the performance gap and how different it is between the students” – Student teachers’ collective orientations about the learners’ heterogeneity in mathematics

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Collective orientations about the heterogeneity of the learners emerge on the basis of experiences that are unique to the individual, but in many ways structurally similar. Guided by the assumption that collective orientations significantly influence the practice of (student) teachers, our goal is to reconstruct (student) teachers’ ways of thinking in the context of heterogeneous learning groups in mathematics education using the documentary method. In the data of the project HeLeA¹, it became apparent that one main focus of the group discussions was the variety of student performance. The differences in the achievement of the students, especially in mathematics, seem to be a great challenge for student teachers. Furthermore, there are discontinuities between the everyday discourse of student teachers and the academic discourse on the topic of heterogeneity.

Keywords: Heterogeneity, group discussion, teacher beliefs, collective orientation, teacher education.

Introduction

Heterogeneity is a central term of current debates regarding education and school system in Germany. In the educational context, it is associated with various categories of difference such as language, culture, gender or (dis)ability, and it is perceived to express “difference as a challenge to be dealt with actively” (Sliwka, 2010, p. 213). In Germany, discussions on heterogeneity in classrooms have recently been stimulated by educational policies like the ratification of the UN Convention on the Rights of Persons with Disabilities and social and demographic changes, e.g. increased linguistic-cultural differences because of a higher number of children with an immigrant background (Decristan et al., 2017). Due to changes in the main areas of attention – which are mostly oriented towards current political and social debates – different facets of heterogeneity and difference have been at the centre of focus (for some periods) lately. The impetus for a renewed focus on heterogeneity in Germany has been provided by the results of international comparison studies – in particular PISA, 2000/2009 (Klieme et al., 2010) – which have highlighted especially the sizeable differentiation in student achievement, the alarmingly high number of very low-achieving pupils, and a close relationship between social background and academic success (Döbert et al., 2004; Trautmann & Wischer, 2011).

¹ “Heterogeneity in teacher education from the start” (Heterogenität in der Lehrerbildung von Anfang an – HeLeA) is a sub-project of “TUD-SYLBER” which is part of the “Qualitätsoffensive Lehrerbildung”, a joint initiative of the Federal Government and the Länder which aims to improve the quality of teacher training. The programme is funded by the Federal Ministry of Education and Research. The authors are responsible for the content of this publication.

The HeLeA project addresses this central debate about heterogeneity. The main assumptions of the project are that teachers' and student teachers' orientations, knowledge and attitudes play an important role in creating effective learning environments for all learners and in the development of an inclusive school that considers the learners' heterogeneity as something positive and normal (Booth, 2011; Reynolds, 2001). The quality of education depends to a high degree on the teaching staff, who play a key role in preparing their learners to take their place in society (Savolainen, 2009). Through qualitative (group discussion) and quantitative methods (questionnaire), the project aims at the reconstruction of student teachers' ways of thinking, speaking and feeling concerning the heterogeneity of learners in school, especially in mathematics. On the basis of the survey results, the project intends to design concepts for the education of student teachers in order to sensitize them to different facets of heterogeneity. The goal is to prepare them for encountering heterogeneity among their prospective pupils and to equip them with approaches for dealing with it in mathematics and also other school subjects. In this article, the focus is on the qualitative approach from HeLeA, as it provides interesting and emotional insights into the current state of teachers' opinions. Based on group discussions with high school mathematics students, the focus of this paper is on: "What collective orientations about the learners' heterogeneity in mathematics do student teachers have?"

Theoretical background

The pedagogical discourse indicates multiple unresolved problems, and there is some criticism of previous approaches dealing with heterogeneity in school, like the homogenisation of learning groups through selection and forms of external differentiation (Trautmann & Wischer, 2011). At the same time, however, there is no lack of existing ideas and concepts for improving these approaches. Didactic-methodological concepts for internal differentiation have been discussed since the 1970s (Sliwka, 2010; Trautmann & Wischer, 2011). Strikingly, however, for most student and practising teachers the question of how to deal with heterogeneity nevertheless represents an important problem area in planning and teaching lessons. Schönknecht and de Boer (2008) point out that in describing heterogeneity, student teachers often seem influenced by polarisations and dichotomisations, as well as a limited perspective focusing on supposed "problem children". Many studies emphasise the individual and personal views of teachers and student teachers about heterogeneity (cf. Bitterlich & Jung, 2019). Most of these studies focus on teachers' beliefs and stereotypes² (Winheller, Müller, Hüpping, Rendtorff & Büker, 2012; Zobrist 2012). We focus on student teachers' collectively shared orientations concerning the learners' heterogeneity. In contrast to studies about teachers' and student teachers' beliefs and stereotype-threat, studies about collective orientations reconstruct those experiences and types of knowledge that can be considered as shared within the group of teachers. In this regard, collective orientations could be seen as

² Following Allport (1954), stereotypes – "the pictures in our head" – simplify our thinking and produce expectations about what other people are like and how they are likely to behave. In this sense, based on prior information (e.g. a student's test scores, social class, gender, ethnicity, race) a teacher develops expectations about the ability of the learner. Similar to this, beliefs are representative bits of information that a person has about an object, person or group of individuals based on certain facts or personal opinions (Ajzen & Fishbein, 1980).

“socially-agreed-upon knowledge base [...]. The key assumption behind them is that the members of the respective groups share a more or less common experience of enculturation into these groups” (Gellert, 2008).

Following Mannheim (1982), teachers tend to have the same or similar experiences and opinions because they belong to a ‘conjunctive space of experience’ (*konjunktiver Erfahrungsraum*).

Those who have biographic experience in common, have commonalities in their history of socialization and, thus, have a common or conjunctive experiential space, understand each other immediately insofar as these biographical commonalities become relevant in interaction and discourse. (Bohnsack, 2010, p. 105)

Teachers as well as student teachers represent a professional group whose conjunctive experiences materialise, on the one hand, via practical experience and, on the other hand, via conceptual-theoretical involvement with teaching and the didactic handling of heterogeneity (Sturm, 2012). The interweaving, or double structure, of their conceptual-theoretical conjunctive space of experience based on their own practical experiences, allows their participation in the social practice of teaching, and indeed creates it (Bohnsack, 2017).

In this context, Gellert (2008) emphasises that teaching should be perceived as a cultural practice that takes place in communities rather than an individual and independent practice that takes place in isolation behind closed classroom doors. In his findings, he emphasizes that the mathematics primary school teachers’ collective orientations about their own professional development sometimes work as obstacles against development. “Mutual validation can turn experience into law. [...] Collective teaching experience can be blind to alternative conceptions of teaching” (Gellert, 2008). Schieferdecker (2016) carried out group discussions with several groups of teachers about heterogeneity in society. The focus of his research is on the reconstruction of collective orientation patterns of teachers that can contribute to a broader understanding of the perception and management of heterogeneity in the educational practice of teachers. In this regard, the aim is to identify structures (which he assumes to be collectively shared) that teachers use in order to cope with the notions of social heterogeneity and heterogeneity in pedagogical practice. He reconstructs a tension between the conception of feasibility and the experience of powerlessness. On the one hand, teachers see themselves as solely responsible for the learning success of their students. On the other hand, they fail to ‘pick up every student where he or she stands’. But the reasons for their failure are suspected outside school (e.g. with parents). Even experienced teachers tend to see learners’ heterogeneity as a problem of increasing complexity which complicates successful teaching processes. To handle learners’ heterogeneity, teachers – and this is something that is collectively shared – homogenise them and create polarisations (e.g. high- and low-achieving learners) (Schieferdecker, 2016).

The aim of this paper is to reconstruct the collective orientations of student teachers in relation to mathematics. The performance heterogeneity³ of the students is of great importance in Germany, as

³ Helmke and Weinert (1997) point out, that in addition to subject-related and teaching aspects, the individual characteristics of the pupils, e.g. language, intelligence and learning strategies are of great relevance to the students’ performance (Helmke & Weinert, 1997).

the school system aims for homogenisation (Trautmann & Wischer, 2011). We therefore believe that the factor of performance differences in mathematics is particularly important to student teachers when talking about their experience in teaching math and when reflecting their own teacher education. We suspect that in a subject such as mathematics, the differences in performance become particularly clear. In this context, Thompson (1992) describes that American teachers consider mathematics as something static that contains a set of rules and procedures. To teach mathematics and to get a correct result, these have to be used, no matter if they have been understood. Since mathematics is often considered as a subject with 'clear answers', formal procedures and easily comparable results, student teachers might hold the (collective) orientation that especially in mathematics differences in achievement are more noticeable and with a higher weight than, e.g., in language-based subjects where different opportunities exist to express something or to write an essay.

Methodology and procedures

One way to access collective and action-leading orientations of prospective teachers is through group discussions (e.g. Przyborski & Wohlrab-Sahr, 2014). Group discussions can help to identify and analyse the implicit or tacit knowledge of the participants while they talk about a specific topic (e.g. heterogeneity). The self-dynamic of the discussion process, without any interruptions by the researcher, is important to discover conjunctive spaces of experience, which become visible through 'focusing metaphors' in which the group adjusts itself to those specific topics that are most relevant in its members' common experience (Bohnsack, 2010).

Concerning group discussions, the immanent meaning comprises that stock of knowledge which is made explicit by the participants themselves. This has to be distinguished from knowledge of experience, which is so much taken for granted by the participants that it must not and often cannot be made explicit by themselves. The participants understand each other because they hold common knowledge without any need to explicate it for each other. (Bohnsack, 2010, p.103)

The documentary method is a suitable method to analyse data from group discussions to identify and reconstruct collective experiences and common (used) ways of acting (Weller & Malheiros da Silva, 2011). In the identification, description and reconstruction of the (future) teachers' collective perceptions, we see one possible way to gain an impression of the current perspectives of teachers and student teachers on dealing with the learners' heterogeneity, especially in mathematics.

The documentary method offers [...] an access to the pre-reflexive or tacit knowledge, which is implied in the practice of action. Asking for the documentary meaning can [...] be understood as asking for *how*: how is practice produced or accomplished. (Bohnsack, 2010, p. 103)

So far, six group discussions have been held during which teacher students spoke about the general question: What kind of experiences have you made concerning the difference of learners in school and in class? The groups were homogeneous in terms of the participants' school type. In each discussion, between four and seven student teachers spoke together for around one hour about their experiences in dealing with heterogeneity in the school context. Each discussion was video recorded and transcribed. This paper focusses on statements on the performance heterogeneity of students in relation to mathematics. We compare transcript scenes from two different group discussions

(number two and four), because there the student teachers are from the same school type (high school) and all are teaching mathematics. As we described above, the teachers, in our case mathematic high school teachers, tend to have the same or similar experiences and opinions. Because of their academic background they belong to a 'conjunctive space of experience'. To answer the research question "What collective orientations about the learners' heterogeneity in mathematics do student teachers have?" the scenes are analysed with a reflective interpretation. Within the framework of the documentary method, the stage of reflective interpretation is particularly promising for the identification and reconstruction of the 'conjunctive space of experience' (Mannheim, 1982).

Results

From the very beginning of both group discussions, the focus was less on education in general than on mathematics, as the student teachers seem to have a 'conjunctive space of experience' concerning this topic. Differences in the learners' achievement was a meaningful aspect of the discussion. Following the research question, we could identify the collective orientation that, especially in mathematics, performance differences are visible and challenging. We will illustrate this by showing short transcript extracts of group discussion number two and four, each followed by a brief analysis of the scene.

Group number two

- Wiebke: I think in school you notice the performance gap and how different it is between the students. I think, especially in the subject math you always have these, [laughs] that are bomb in math and those, who do not understand it at all. To arrange the lessons in a way that all can somehow follow or are not under-challenged is quite difficult.
- Natalie: Yes. What is also always a topic are differentiated tasks, in a way, that either the tasks get more difficult in the end or the top-performing pupils get more tasks. And at the beginning the easier tasks. That is also addressed in teacher education. And also, that you should have extra tasks for those who are faster so they still have something to do or talk about. That happens all the time.
- Wiebke: But I think it is only about these differentiated tasks and for the faster pupil new tasks. I had a seminar, not in math but in English, where another heterogeneity, like language differences, was mentioned. And this could be transferred to math. Maybe a child is super good at math but just does not understand what's in the task. I think, you don't learn anything about this at university.

The first reaction on the impulse of the discussion concerned the differences in the learners' performance. Wiebke argues, that in mathematics there are 'always' pupil who are extremely high achieving, what she illustrates with the metaphor of a bomb (which is a common expression in Germany) while there is also 'always' a group of pupils who do not understand mathematics at all. Through this dichotomous distinction, she describes from personal experience that it is 'quite difficult' to arrange lessons. The metaphorical use of 'bomb' for something exploding and powerful

illustrates that such ‘bomb’ students are not necessarily considered by her as something positive. Natalie seems to understand Wiebke and argues that in university they ‘always’ heard something about how to use differentiated tasks and how to make sure they work. This could be seen as something positive. But in contrast to Natalie, Wiebke is not satisfied with this one-sided preparation with the focus on achievement and tasks. In her opinion, it is also important to ‘learn’ something about other facets of heterogeneity, like language differences, which she emphasizes with the comparison to her studies in English. She notes that it is important for students to understand the tasks in order to solve them because linguistic competences are often needed to show mathematics performance. But her claim, to learn ‘nothing’ about this in university, could also be seen as an exaggeration.

Group number four

Konrad: Especially during internships, I have seen great differences in the performance and skills. When you walk around during times of individual work, you could really see what the student is currently thinking about the task. As trainee that is usually very noticeable because you do not stand in front of the class but you help students in the back or walk around during individual work.

Niklas: Yes, I also noticed that. Either in middle school or in ‘pure’ high school classes. In one such pure high school it was such a monotony and all students were well-mannered and from suburban areas and tagged along even during the worst lessons. But even there you recognized achievement differences in mathematics like in middle school classes. Even in urban areas you have the same differences.

As in group discussion two, in discussion number four the reaction on the impulse for the discussion is about differences in achievement. Konrad's statement shows, that it seems easier to ‘see’ the learner's heterogeneity when you are not the person teaching in front of the class. Konrad seems to protect teachers as they are not able to ‘see’ differences when they have to concentrate on the lesson itself. Perhaps, he himself also made the experience of not being able to perceive so many achievement differences and to adequately respond to them when teaching himself. Niklas enlarges this topic by comparing different types of school and different environments. Either in (lower-achieving) middle school classes or in (higher-achieving) ‘pure’ high school classes, he claims that in mathematics the same differences in achievement exist. This also applies for urban and suburban areas. He points out one class of well-mannered students, which is a ‘pure’ high school class in a suburban area, which tolerates even the worst and most boring lessons.

Discussion

Especially in the group discussion with high school student teachers for mathematics, differences in achievement was a central point of the discussion. In both conversations we could reconstruct the view, that especially in mathematics differences in achievement are suspected to be ‘visible’ and that teachers have to react to them through (differentiated) tasks. This aspect could therefore be seen as the most important for student teachers when they consider the heterogeneity of their prospective class in mathematics. It is noticeable, that it is less discussed, how differentiation of the content or the social formation in the class could look like. Differences in achievement seem to be important

for the student teachers but possibly they don't know how to deal with this heterogeneity. The predication of Nathalie shows that theoretical knowledge of how to deal with heterogeneity and differentiated tasks has apparently been taught in the university. However, the two excerpts show that this knowledge cannot be applied in practice. This result also coincides with the four other group discussions of the HeLeA project. Similarly to Gellert (2008) and Schieferdecker (2016), tensions were reconstructed which have to do with the problem of making pedagogical specialist knowledge (learned in university) compatible with the practice of teaching a heterogenic learning group. In all six group discussions, it was possible to reconstruct discontinuities between the everyday discourse of student teachers and the academic discourse on the subject of heterogeneity. One result of the HeLeA project is that the theoretical knowledge seems to be incompatible with the student teachers' experiences in school practice. To ensure that future teachers are more capable to apply the theory they have learned in practice, we have to give them tools to reflect their own lessons and train their ability to interpret situations. Personal practical experiences should be constantly analyzed and reflected in professional life – one possibility for this is team teaching. The results collected so far already provide initial insights into mathematics student teachers' collective orientations and guiding ideas on heterogeneity in mathematics (c.f. Bitterlich & Jung, 2019). One limitation of the used group discussions approach is that only collectively shared orientations can be reconstructed. What remains in the individual is hidden. But if we follow the assumption that teachers can be seen as a common group with shared experiences, collective orientations could be more important in certain circumstances.

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