Inclusive Education and the Development of the Self-Concept concerning Mathematical Competences

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Abstract

The encouragement of the development of a realistic self-concept of the children in their classes is an important challenge for school teachers worldwide. Children who know about their strengths and weaknesses can work on the competences, which need to be improved, more effectively (Irmler, 2015; Kammermeyer & Martschinke, 2003).[1]

As Germany signed the UN Convention on the Rights of Persons with Disabilities (Beauftragter der Bundesregierung für die Belange von Menschen mit Behinderungen, 2018; Vereinte Nationen, 2006) the school system which is characterized by external streaming has to change in order to make inclusive settings of learning possible and create an environment in which heterogeneity is seen as a chance rather than as a problem for learning and teaching (Klemm, 2015; Aichele, 2008).

The development of mathematical competences can be seen as one part of the basic skills that should be acquired in primary school (Ministerium für Schule und Weiterbildung des Landes Nordrhein-Westfalen, 2008). To gain an understanding of quantities is important in this context and may be a challenge for students – especially for children with visual impairment (Walthes & Degenhardt, 2016; Csocsán, 2003).

This contribution presents a study which focuses on the special time of first-grade when primary school students get to know their new learning environment. In that context a survey takes place in the German county of North-Rhine Westphalia and accompanies children with and without special needs in the field of vision which learn together in inclusive classroom environments. At three times during the school year the students become interviewed about their self-concept concerning mathematical competences as well as are participating in learning assessments in

[1] Michael Pfeifer supported the author in the final language proofreading of the final version of the paper.

this subject. Furthermore interviews with the math teachers of the students take place in order to get an insight into the way they design math lessons in an inclusive classroom setting. Classroom observations of math lessons complete the triangulative research design in which different groups of people are part of the sample and different research methods are being used (Wieckert, 2013)[2].
In this means the study depicts a variety of central topics concerning educational research which implies an interdisciplinary approach to school life and therefore addresses different disciplines which are connected with education (e.g. Mathematics, Pedagogy, Psychology, Rehabilitation Sciences).

Keywords: *First-grade Students and Teachers, Inclusive Education, Mathematical Competences, Self-Concept, Triangulation, Visual Impairment*

1. Introduction

The study which is portrayed in this paper accompanies first-grade students and their teachers focusing at the development of the children's self-concepts concerning their mathematical competences. Looking at inclusive classes with children who have visual impairments, the aim is to find out whether there are differences in the self-concept development of the children with and without visual impairment and how teachers cope with the special needs of their students (Wieckert, 2013).

The demand for inclusive classroom settings increases in Germany (Beutel & Hinz, 2008; Schnell & Sander, 2004). As the German school system is characterized by external streaming the process of creating more inclusive classroom settings is an aim which affects the whole system. Together with many other countries Germany signed the UN Convention on the Rights of Persons with Disabilities (Beauftragter der Bundesregierung für die Belange von Menschen mit Behinderungen, 2018; Vereinte Nationen, 2006) and therefore needs to find ways of establishing effective school environments which see heterogeneity as a chance rather than as a difficulty (Aichele, 2008). At the moment two systems exist parallel – a quite huge system of special schools divided into different special needs (e.g. Hearing, Learning, Vision) on the one hand and on the other hand classes in regular schools in which children with and without special needs are being taught together in one class (Klemm, 2015). It is a challenge for the teachers to cope with this situation getting into contact with inclusive education. Cooperation between regular school teachers and special school teachers is required in order to plan and conduct lessons in which every student can enhance her respectively his competences as much as possible (Fischer, Preiß, &

[2] This already peer-reviewed paper is rewritten in the present article in order to make it accessible to scholars from other disciplines.

Quandt, 2017; Lersch, 2009). As the teachers who already work in schools for many years did not have such topics discussed during their education at university and school that much there is need of further education now. Momentarily the education is going through reforms so that hopefully new teachers are going to be better prepared to work in inclusive settings (Ulrich & Gröschner, 2020; Golena, 2007).

2. Objectives

This contribution presents the research design development as well as exemplary results of the study in order to give a first insight into the research findings.

The main research questions are, if there is a significant difference in the self-concept development concerning mathematical competences of the students with and without visual impairment as well as if there is a positive effect of activities in math lessons which give children a chance to think about their own strengths and weaknesses so that they can develop a realistic self-concept and improve their competences correspondingly. Therefore alongside the students' point of view the teachers' perspective is being assessed in order to find out how they plan school lessons for heterogeneous student groups (Wieckert, 2014).

3. Theoretical Framework

As mentioned above in the study the self-concept concerning mathematical competences of first-grade students is surveyed in inclusive classroom environments focusing on special needs in the field of vision alongside the teachers' main focus concerning the planning of math lessons. Hence the theoretical framework concentrates on the topics self-concept, mathematics in primary school as well as diagnostics concerning vision as requirement for inclusive education and thereby considers the relevance of teachers and their lesson design in the process of learning.

3.1. Self-Concept

The multidimensional self-concept model of Shavelson, Hubner and Stanton (1976) and its revision by Marsh (1990) are used as a basis for the classification of self-concepts. Does an individual have a high self-concept it can forward security and confidence in the own performance. In the context of a research project called KILIA the self-concept has been

identified to be particularly important for the performance development in mathematics when entering primary school (Kammermeyer & Martschinke, 2003). A lot of students get used to their new learning environment in school without difficulty and they mostly overestimate their own school relevant competences (Praetorius, Kastens, Hartig, & Lipowsky, 2016; Prücher, 2002).

According to disadvantageous or difficult learning conditions such as a visual impairment a lower self-concept could be anticipated concerning students with special needs in this field (Cloerkes, 2007).

3.2. Mathematics in Primary School

The mathe 2000-project which has started in 1987 at the University of Dortmund is still having a huge impact on the teaching methods concerning mathematics in German primary schools. The focus lies on self-active learning and productive exercises in order to give the students the possibility to get an insight into the structure of mathematics. Besides the development of a variety of learning materials for math lessons the research results are used to conceptualize further education programs for math teachers (Müller, Selter, & Wittmann, 2012; Sundermann & Selter, 2006; Wittmann, 2003). In addition in the project KIRA different learning strategies of students are documented and analysed to make teachers aware of alternative ways of thinking and using mathematics (Spiegel & Selter, 2003).

For the study it is of interest whereas teachers modify their teaching methods if there are children with visual impairment in their class and how this may affect the whole learning group as teaching methods which include different senses may be of benefit for students without visual impairment as well looking at different learner types.

3.3. Diagnostics concerning Vision as Requirement for Inclusive Education

A medical diagnosis itself does not include far-reaching information about the functional vision of a child (Walthes, 2005). As this is highly relevant for the school practice the following questions are being assessed in the survey:

1) Works or plays the child more with tactile or visual material?
2) Which distance chooses the child to the material?
3) Is the child able to identify characters?

4) Which enlargement is necessary so that the child can work efficiently?
5) How long can the child work with tactile or visual material?
6) Which conditions in the classroom must be created?
7) Are there changes in vision during time?

Thereby the aspects communication, orientation and movement, activities of everyday life as well as tasks in close range of the functional oriented classification system (Hyvärinen & Jacob, 2011) are being taken into account.

4. Sample and Methods

As – due to federalism – in Germany the educational system of each of the sixteen German counties varies one county – North-Rhine Westphalia – has been chosen to be involved in the study. In the research relevant school year five inclusive first-grade classes had students with visual impairment among them in North-Rhine Westphalia and participated in the study. In this means the survey functions as a case study and does not claim generalizability of the results.

Research has taken place at the beginning, in the middle and at the end of first-grade by interviewing all ninety-four students of those five classes in order to find out how they rate their mathematical competences and their position in class. Therefore the students have been asked for example if they can count, add and divide numbers, if they know forms – and which ones if they did – and so on. At each time of survey the questions portrayed the main focus learning contents of the math lessons as well as questions concerning the overall wellbeing in class.

Furthermore the children attended on matching mathematical tests in order to gain data for comparison of their actual skills with their self-concepts. The competence tests used are part of the materials which have been created in the context of the mentioned mathe 2000-project and therefore have been tested of their reliability (Wittmann & Müller, 2017).

Interviews with the teachers provided a basis for analysing the teaching methods they use and their overall strategies to meet the heterogeneity in their class. The manuals for the interviews have been developed to meet the demands of the study.

Observations of school lessons with the main focus on mathematics completed the research design.

The teacher interviews have been analysed by using the qualitative analysis of content (Mayring, 2015) working with MAXQDA. The students' data has been evaluated both qualitative and quantitative with MAXQDA as well as SPSS (Baumann, 2018). Children with and without visual impairment who started with comparable competences and self-concepts have been grouped as tandems for a direct comparison of their development. The observations' materials enhance the interpretation of the collected data outcomes.

5. Results

By using a longitudinal and triangulative research design focusing on students and teachers as well as combining quantitative and qualitative data interpretation techniques interesting results have been found concerning the development of self-concepts itself and possibilities of fostering realistic self-concepts.

5.1. Students

The data shows that there is no significant difference in the self-concept development of the tandems of students with and without visual impairment in the sample. This is an interesting finding as one could argue that as a result of labelling processes of having special needs in the field of vision children with visual impairment are likely to have a lower self-concept than their classmates (Cloerkes, 2007). As the results do not prove this assumption one explanation could be that children with visual impairment receive feedback of their environment (parents, friends etc.) quite early during their development that they need to be careful in certain situations and aware of their abilities because of their restricted vision. This may lead them to a more reflected self. Children who experience this from early childhood on may be more aware of their own strengths and weaknesses which could result in a realistic estimation of their mathematical competences. Another indication for this possible explanation is the fact that the self-concept of the children with visual impairment shows to be not over- or underestimated but realistic. Looking at the whole sample the findings indicate that most of the students overestimate their mathematical competences which corresponds with results from other studies in this field (Ehm, 2014).

Concerning the overall wellbeing in class the results state that most of the children – including the children with visual impairment – have the opinion that the learning atmosphere during math lessons is positive. Throughout the school year they became acquainted with the other children in class and first friendships emerged. For the most part the children like to go to school and are eager to get to know new learning content.

5.2. Teachers

Activities during school lessons which encourage students to rate their competences on their own can help to build a realistic self-concept as in classes in which such activities took place the children's self-concepts proved to be more realistic than the ones in the classes without this kind of practice. The teachers who included such practices in their math lessons stated that it was important to them to support the students' competence to know their skills and that they therefore emphasized it. In this context the teachers gave the students the possibility to rate their mathematical competences by themselves. Afterwards they got the chance to compare the self-assessment with the teachers' assessment in order to reflect on the different perspectives.

The teachers tried to plan math lessons with fewer focus on visual learning methods than they did in classes before. Instead they used tasks which integrated different senses into the learning process. They noticed that such a variety of methods seemed to be helpful not only for the students with visual impairment but also for many other children in the class. This indicates that the use of varied methods which do not emphasize vision in particular meets the different needs of students in heterogeneous classes (Leuders, Leuders, Prediger, & Ruwisch, 2017).

6. Conclusions

Aspects of teaching methods and the children's view on their school experiences in an inclusive environment are of interest as children with visual impairment mostly have been taught in special schools in Germany but inclusive schooling will be the choice of the future as the German government claims (Walthes, 2009). Furthermore heterogeneity is found in every school class and therefore one of the challenges for teachers is to cope with the different needs of their students in order to provide helpful teaching surroundings. The self-concept can have an impact on the development of competences (Möller & Trautwein, 2009) and is therefore a relevant aspect concerning teaching. Teachers can help students to develop a realistic self-

concept by giving them the chance to evaluate their performance and compare it with the point of view of the teachers. In this way teachers can foster students' self-reflection and create a learning environment in which communication about strengths and weaknesses is seen as important.

This work can function as a basis for further research in this field including larger samples in the research design as well as looking at other subjects and special needs in school.

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