

LEARNING MATHEMATICS WITH A DIGITAL TEXTBOOK AND ITS INTEGRATED DIGITAL TOOLS: THE KOMNETMATH PROJECT

Maxim Brnic, Gilbert Greefrath

University of Münster, Germany; m.brnic@uni-muenster.de

Although research on the use of (printed) mathematics textbooks and digital tools exists, there is still a high need for research on digital mathematics textbooks with integrated digital tools that are used by teachers and students in mathematics lessons. Since 2019, the project KomNetMath researches the impact of a regularly used digital mathematics textbook at German secondary schools. The actual use, the impact on students' beliefs towards the use of digital mathematics textbooks as well as the influence on mathematical competencies are of special interest.

Keywords: digital mathematics textbook, digital tools, use of digital textbooks

THEORETICAL BACKGROUND

Mathematics textbooks play an important role for didactic aspects of teaching organisation (Rezat 2010). In recent years, the number of studies dealing with digital textbooks has increased (e.g. Pohl & Schacht 2017, Froitzheim et al. 2016). Pohl and Schacht (2017) analysed the structural characteristics and elements of digital mathematics textbooks and the structural elements which students use. First results show that a digital textbook differs from a traditional (printed) textbook in respect of its dynamic structural elements. These dynamic structural elements characterize the potential and the technical possibilities of digital mathematics textbooks that a traditional textbook cannot provide. For the impact on the students and teacher's use of the digital textbook and on the students' learning process, in consequence of the expansion capabilities of digital mathematics textbooks with integrated digital tools, there is still a lack of research. In addition to that, the influence on students' beliefs towards the use of digital mathematics textbooks is a research gap. The digital mathematics textbook used in the project KomNetMath is also characterized by dynamic elements due to its integrated digital tools. For example, this digital mathematics textbook contains GeoGebra applets, drag and drop tasks and direct feedback functions.

The textbook is regarded as an artefact in the classroom that is an important resource for teachers as well as learners. It is employed as an instrument for different activities such as preparing lessons or learning from the textbook (Rezat 2010). Thereby a textbook can influence teaching directly or indirectly (Matić & Gracin 2016). "Whenever a textbook is explicitly or implicitly used in the classroom one can think about it as an influential factor" (Johansson 2006, p. 9). Most studies on the use of mathematics textbooks differ in terms of the teachers' use (e.g. Johansson 2006) and the students' use (e.g. Rezat 2009), whereby research results mainly refer to traditional textbooks. Studies on the utilization of a regularly used digital textbook can be found in other disciplines. Froitzheim et al. (2016) examined the use and acceptance of a digital computer science textbook. Teachers reported a frequent explicit and implicit use of the digital textbook. It was used as workbook in the classroom (direct use) and in lesson planning (indirect use). Furthermore, the study revealed a high student acceptance of the digital textbook.

In the project KomNetMath we survey what the digital mathematics textbook is used for in the classroom and assess to what extent the beliefs towards the use of the digital mathematics textbook change when using a digital mathematics textbook over an extended time period.

RESEARCH QUESTIONS

If teachers and students use a digital mathematics textbook with digital tools in the classroom over a longer period of time, the following research questions emerge 1) How do teachers and students use the digital mathematics textbook in teaching and learning? 2) How do the students' beliefs towards the use of the digital mathematics textbook change when using one?

METHOD AND OUTLOOK

From the beginning of the project in February 2019 onwards, 16 mathematics courses use a digital mathematics textbook instead of a traditional one in the classroom. One goal is to track the actual use of the digital textbook in class. For this purpose, teachers fill out lesson reports for each lesson. The teachers note down on a timeline at what part of the specific lesson the digital textbook is used. In this way, the extent of digital textbook's use can be specified. Furthermore, the teachers record what the digital textbook is used for in the classroom, whereby they have to make a distinction between explicit and implicit use. An implicit use would be the case if teachers use the textbook for lesson planning. If teachers or students use the digital textbook as a workbook directly in class, it would be an explicit use. They also have to write down the main tabs of the digital textbook that have been applied as well as the class arrangements and organisational forms of each lesson. The beliefs towards the use of the digital mathematics textbook will be measured in a pre- and posttest design. Students will get an identical questionnaire at the beginning (pretest) as well as at the end of the study (posttest). The test comprises items about students' attitude, scepticism, curiosity and acceptance towards the used digital textbook. The pilot study in 2019 includes testing the teacher lesson reports and the belief test in a first pass, thereby collecting quantitative data. In the main study, students and teachers will use the digital textbook for one school year in 2019 and 2020. When students and teachers regularly use a digital textbook, the question arises if there is an impact on the development of mathematical competencies. Another (upcoming) goal of the project KomNetMath is to compare the use of a digital and traditional textbook in relation to the progress of mathematical competencies.

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