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► To cite this version:

Christina Bierbrauer. Students with special needs solve word problems in their mother tongue with an app. Twelfth Congress of the European Society for Research in Mathematics Education (CERME12), Feb 2022, Bozen-Bolzano, Italy. hal-03749042

HAL Id: hal-03749042

<https://hal.science/hal-03749042>

Submitted on 10 Aug 2022

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Students with special needs solve word problems in their mother tongue with an app

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Keywords: Special needs learning, word problem, mother tongue, digital media.

Description of the research topic

How can digital media support students with special needs by understanding word problems? One focus of the project presented here are word problems which are presented to students with a non-German mother tongue in their mother tongue. First, a tablet app was designed. Second, the app was tested in interviews with pupils with special needs learning.

Theoretical framework

Solving word problems is a complex process that is especially challenging for students with special needs learning (Häsel-Weide, 2016; Scherer & Moser Opitz, 2010; Verschaffel et al., 2000). Understanding the word problem is often a hurdle which affects subsequent processes of the process of modeling. The wording of a word problem is important, especially for non-native speaking students. Digital media can support mathematical teaching and learning processes (e.g. Krauthausen, 2012; Ladel, 2009; Walter, 2018). There are different possibilities to simplify the understanding of a word problem with digital media (Bierbrauer, 2021), e.g. the problem can be presented simply in different mother tongues. Based on the cognitive load theory, digital media offer possibilities to reduce cognitive loads when working on word problems (Paas & Sweller, 2014).

App Design

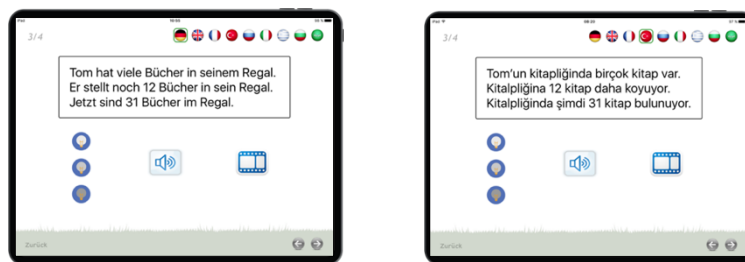


Figure 1: App “Understanding Word Problems”

Within the course of this research project, a tablet app was designed which is intended to facilitate the understanding of word problems. The design of the app is based on a theoretical background of mathematics, special education and multimedia learning. The app offers tools which reduce the cognitive load when trying to understand the problem, so that students can focus on dealing with the mathematical model. One feature is that students with a non-German mother tongue can choose simply

their mother tongue. The word problem and other informations are then presented in this language. In Figure 1, the screen of the app is presented. The same problem is presented in German and in Turkish. The app offers further tools: hints for text interpretation, a speech recording and a video.

Testing the app by students

The app was tested in guided individual interviews with pupils with special needs learning who are taught in German schools and who are 9 to 12 years. Altogether 76 word problems are solved with the app, 28 word problems are solved by students with a non-German mother tongue. The collected data was evaluated using qualitative content analysis (Mayring, 2015) with the software MAXQDA.

Results and implications

The poster presents selected results of the project. No student whose mother tongue was not German selected the whole time their mother tongue during solving a word problem. The problems were mostly solved in German even if the knowledge of languages of the mother tongue was better. This result could be due to different reasons, e.g. German is the language of teaching. When the text was presented in a non-German mother tongue the word problem was not solved better. The students reported that a text in their mother tongue does not support them in solving the problem because they cannot read and write the language. Two design principles for the conception and evaluation of digital applications which intend to facilitate the understanding of word problems could be formulated by the findings: Information that is presented in the mother tongue is always accessible in the language of teaching. Text that is presented in a non-German mother tongue is always accessible audibly.

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