How to design educational material for inclusive classes

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Keywords: Inclusion, symbols, easy-to-read, fractions.

Inclusion is based on international legitimate developments like the Salamanca statement, which emphasizes the right of education for all (UNESCO, 1994). Furthermore, several studies showed that coeducation can have a positive effect on the development of performance of pupils with and without special educational needs (Markussen, 2004). But to include all students regardless of their physical, intellectual, social or other abilities the educational framework conditions need to be adopted at first. One important step into this direction consists in providing all pupils access to the assignments by enhancing their readability.

Theoretical background

Readability can be enhanced by linguistic simplifications like the application of the *easy-to-read guidelines* (Netzwerk Leichte Sprache, 2006). Easy-to-read language has been established to facilitate understanding in everyday life for people with disabilities. It is, for example, used for the simplification of manifestos in order to support participation in society. So far, these guidelines are not verified scientifically, but show several similarities to empirically based linguistic simplification rules, like the *Hamburger Modell* (Langer, Schulz von Thun, & Tausch, 2011). The authors state, among others, that only one statement should be made per sentence. Another possibility to facilitate the comprehension of assignments is the use of symbols. A symbol can be defined as a graphical image conveying a single idea or concept (Detheridge & Detheridge, 2002). Little empirical data about the use of symbols to foster the readability of texts exists (Jones, Long & Finley, 2007; Poncelas & Murphy, 2007). Nevertheless, a positive influence can be assumed, e.g. because of the multimedia principle (Mayer, 2009). It indicates that people learn better from words and pictures than from words alone. An explanation is given by the cognitive theory of multimedia learning (ibid.) which assumes that pictorial and verbal information are processed in two different channels in our brain. When words and pictures are presented, both channels are used and the cognitive load on the limited capacity of the working memory is reduced.

Methodology

Does the use of easy-to-read language and/or enriching text with symbols facilitate students' performance in mathematical tasks? This research question shall be answered with the following methodology. The tasks of this study deal with introducing fractions. These are taught in activity-oriented manner with hands-on material. The tasks are divided into two complexes. The first complex aims at the conduction of more basic actions like counting. Then, the pupils receive an input about fractions by watching a video. The pupils use the information of the video for more complex mathematical considerations which are necessary in the second task complex. Thus, the pupils' conceptualization of fractions is fostered, e.g. by the naming and comparison of fractions. In November and December 2016, a pre-study was conducted with 30 students in grade 5, 6 and 7. The sample consisted of pupils with learning difficulties and students without special educational needs. The students worked on the tasks individually and participated in a subsequent interview. Data was

also collected by use of eye tracking and thinking aloud. A first result of the pre-study is that the symbols are used by the students without explanation. This result can be exemplified by the following excerpt of the interview and the corresponding eye-tracking data. The different colors of the heatmap represent different durations of the fixations:
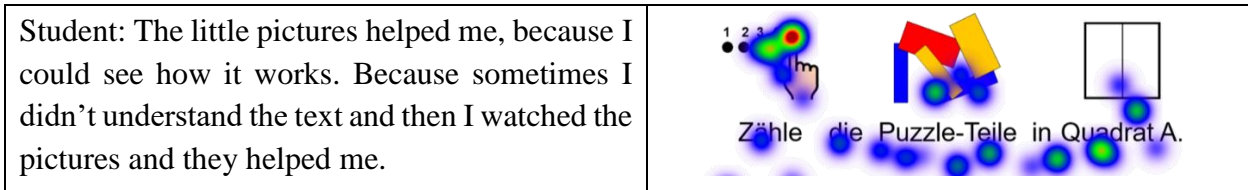
Student: The little pictures helped me, because I could see how it works. Because sometimes I didn't understand the text and then I watched the pictures and they helped me.	

Figure 1: Primary data insights

Deeper qualitative analyses, which focus on how the symbols are used by the students as well as on the linguistic comprehensibility of the tasks, will follow. For the main study a posttest-only design, which includes two experimental as well as one control group, is planned. While experimental group 1 receives a linguistically and pictorially simplified version of the tasks, experimental group 2 works with a variation which is linguistically simplified only. The control group receives a not simplified version. After working with the exercises, the students' knowledge about fractions will be measured. The participants' reading ability and their IQ will be elevated beforehand. These control variables shall help to build comparable groups.

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United Nations Educational, Scientific and Cultural Organization [UNESCO]. (1994). *The Salamanca Statement and Framework for Action on Special Needs Education.*