Metacognitive support in digital learning environments for primary school students

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Abstract

Effective learning in digital learning environments requires a degree of proficiency in self-regulation skills that especially younger students in primary school may not yet have acquired (Devolder et al., 2012). Although this represents a challenge, digital learning environments at the same time offer numerous opportunities to promote self-regulated learning, for example by providing a student with digital metacognitive prompts and scaffolds. Expanding possibilities regarding formats, frequency, timing and adaptability of digital prompts open up new opportunities to activate and also automize metacognitive activities.

However, the potential of digital learning environments to promote self-regulated learning has so far not received sufficient attention in the primary school environment. Therefore, we developed and tested a software-based support system (i.e. *Learn2Learn-Assistant*), which, by providing metacognitive prompts, helps primary students with planning and monitoring as crucial elements of self-regulated learning.

To empirically test this newly designed *Learn2Learn-Assisstent*, we developed a digitally supported learning unit ("*Mysterious Glaciers*") and conducted field experiments in 20 primary-school classes at grades 5/6 (n=370) in a pre-post test experimental design (within class randomization). The presentation will describe and discuss the theoretical basis and practical design of the *Learn2Learn-Assistant* and the learning unit, and include first results from our analysis of student interviews exploring students' interaction with the *Learn2Learn-Assistant* and the learning benefits they experienced during the intervention.

Extended summary (600-1000 words)

Introduction

Digital learning environments (e.g. learning management systems), which are increasingly employed also with younger students and have further gained in relevance during the Corona-Pandemic, offer new opportunities for individualized learning. However, they also present new challenges: Research has shown that effective individualized approaches in digital learning environments require students to have a proficiency in self-regulation skills (e.g. setting of learning goals, planning of learning activities, monitoring and regulation of learning processes, Boekaerts & Corno, 2005). Especially younger students in primary school may not yet have the necessary skills or still lack the motivation to apply these (Devolder et al., 2012; Netcoh, 2017).

At the same time, digital learning environments also offer numerous opportunities to promote self-regulated learning, for example by providing students with digital metacognitive prompts and scaffolds (e.g. through an avatar) that can heighten their awareness and understanding of their learning processes and stimulate reflection (Carter et al., 2020; Wong et al., 2019). Expanding capabilities of digital learning environments regarding formats, frequency, timing and adaptability of such prompts open up new opportunities to activate and also automize metacognitive activities in students. Digitally presented metacognitive prompts have been found to often have positive effects not only on metacognitive and strategic learning activities, but also on academic performance (Bannert et al, 2015; Devolder et al., 2012; Zheng, 2016). However, prompts can also interrupt learning processes (Manlove, Lazonder, & de Jong, 2007), especially if they are not well designed for the specific target group (Devolder et al., 2012).

There is thus far little insight into how the potential of digital learning environments can be used for the development and application of self-regulation skills in the primary school environment, although this is precisely where the foundations for these competencies are laid. Therefore, we developed and tested a software-based support tool (i.e. *Learn2Learn-Assisstent)*, which helps primary students with planning and monitoring - as crucial elements of self-regulated learning - by providing metacognitive prompts.

Methods

In order to empirically test this newly designed *Learn2Learn-Assistant,* we developed a digitally supported learning unit in the learning management system *LearningView* (Hielscher et al., 2017) in the subjects *Media & Computer Science* and *Nature-Man-Society*. This learning unit (titled "Mysterious Glaciers") consists of 12 lessons spanning a period of 3 weeks, where students write an article for a fictitious magazine. Embedded in this learning unit, students are provided with a software-based support tool for planning and monitoring their learning activities and provided with metacognitive prompts.

We conducted field experiments in 20 primary-school classes at grades 5/6 (age 10-12, approximately 370 students) in November and December 2020. All classes are equipped with personal digital devices (tablets). The intervention has a pre-post test experimental design, where half of the students from each class were randomly assigned to the experimental group and half to the control group (within class randomization). Before, during and after the intervention, questionnaire and interview data are gathered.

Our research questions address the effectiveness of the specific digital metacognitive support in the project's intervention group. We assume that by interacting with these metacognitive prompts, students will make better use of learning opportunities in their self-guided work phases, which should then show in their learning outcomes as well as in their attitudes, knowledge and application of metacognitive activities. We will further analyze whether effects are moderated by individual preconditions (e.g. academic performance level, general learning motivation, socio-economic status).

Results

The presentation will mainly describe and discuss the theoretical development and practical design of the *Learn2Learn-Assistant* and the accompanying learning unit and the challenges of a complex research design applied in a practical school context.

We have identified specific challenges for students (e.g. planning of task, time management, monitoring of understanding) through a qualitative preliminary study in 2019, which provided critical input for the design of the *Learn2Learn-Assisstent*. Post-Intervention tests and interviews are under way and will be completed in January 2021, followed by qualitative and quantitative analysis of interview and questionnaire data. The poster will include first results from our interviews with a subsample of students (n=40) to explore the interaction with the *Learn2Learn-Assisstent* and the learning benefits students experienced during the intervention. The conclusion will focus on opportunities and challenges of designing digitally supported metacognitive prompts for a non-laboratory primary school context.

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