Computer-aided assessment based on dynamic mathematics investigations

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In the poster, we will present a planned study focusing on the design of DMS tasks and elaborated feedback within a CAA system. The study will be conducted in a first year engineering mathematics course during autumn 2020.

Keywords: computer-aided assessment, feedback, engineering mathematics, dynamic mathematics software.

BACKGROUND

It is well established that the transition from secondary school mathematics to university mathematics is a major issue among mathematicians and mathematics educators. Larger student groups, and hence less teacher contact, and changes of study methods towards more independent study requires a greater responsibility among students. To tackle this issue, many educators in higher mathematics education have introduced continuing assignments to increase students' engagement (e.g. Rønning, 2017).

At Karlstad University, a developmental project to increase first year engineering students' learning in mathematics was initiated in 2015, based on experiences from research projects at upper secondary school (Fahlgren, 2015). The focus has been on the development of student activities designed for a dynamic mathematics software (DMS) environment, in this case GeoGebra. The intention behind these activities is to deepen students' understanding by providing learning environments where they can explore and communicate mathematics with peers. Course evaluations indicate that students appreciate this part of the course. For example, in the latest course evaluation when requested to answer the open question "What has been good with the computer-based activities?", 119 out of 193 students in some way expressed that it gave them increased understanding. Since the project turned out well, today these activities constitute mandatory parts of the first year engineering mathematics courses at Karlstad University. However, due to the limited time available to the course teachers, the feedback provided to students on their submitted answers has so far only been on correctness. Moreover, the feedback has often been delayed since it has been a challenge for the teacher to assess (in a short time) a large number of student responses. One way to reduce the workload of correction is to outsource it by using technology (Rønning, 2017).

COMPUTER-AIDED ASSESSMENT

The past decade has seen a rapid development of technology that facilitates assessment in mathematics, as well as in other subjects. A common name for these types of

technology is computer-aided assessment (CAA) systems. One advantage of using these types of technology is that they are time saving by providing automated correction of student responses. Furthermore, besides providing students with immediate feedback on their submitted answers, CAA can also be used to provide feedback on students' ongoing work, e.g. appropriate hints and suggestions. In addition, there are CAA systems, e.g. STACK, in which it is possible to embed dynamic interactive environments, such as GeoGebra (Sangwin, 2015). However, it is a challenge to design CAA-tasks and elaborated feedback addressing students' conceptual understanding and mathematical reasoning. One way to tackle this could be to create tasks which request students to construct 'examples' that meet certain mathematical conditions (Olsher, Yerushalmy, & Chazan, 2016).

THE PLANNED STUDY

We plan to perform a study during autumn 2020. The focus will be on the design of DMS tasks and elaborated feedback of the ambitious type outlined above within a CAA system. The purpose is to provide feedback based on students' responses. The aim of the study is to investigate students' utilization and perception of various types of elaborated feedback provided in a CAA system. The study is planned to be conducted in a first year engineering mathematics course involving approximately 200 students. To better understand students' way of using (or not using) the provided feedback, we plan to perform a survey that will be followed up by focus group interviews. The main focus will be on comparing and contrasting what impact various types of elaborated digitized feedback might have on students' learning strategies.

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