A Technology-Enhanced 'Assessment System for Teaching and Assessment using a Computer Algebra Kernel' (STACK)

The Best Contributions of 2022's STACK Community Meeting at the Montanuniversitaet Leoben, Austria

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Abstract—The LMS plugin System for Teaching and Assessment using a Computer algebra Kernel (STACK) allows for a wide variety of technology-enhanced teaching, learning and assessment approaches. The accelerated significance of this approach over the last couple of years has been impressively demonstrated at the Meeting of the STACK Community 2022. After two years of online meetings, we had the great pleasure to host this meeting in a hybrid setting at the Montanuniversitaet Leoben in Austria. The best contributions to the meeting have been carefully selected by an international program committee and are collected in this special issue.

Keywords—editorial, technology-enhanced learning, technology-enhanced assessment, automated assessment

1 The importance of STACK and automated assessments

"Assessment drives learning" is one of the key messages in educational science. While a variety of new teaching concepts have entered the classrooms in recent years in the wake of the advent of technology-based learning tools, only little emphasis has been laid on the redesign of student assessment performance considering the possibilities these new tools offer. In STEM courses multiple choice quizzes have some limitations with respect to reliably assessing the skills and competencies that are required from a future engineer or scientist. That is why many teachers still mostly rely on traditional paper-pencil, free-format exams that allow them to judge the student's abilities to analyze a problem, formulate the pertaining equations, solve them, and critically challenge the results. While such a classical approach gives in general an accurate impression of the individual student's performance, marking and grading the exams is time-consuming and prone to subjectivity. This is of particular significance in subjects such as Mathematics or Physics which many students must complete as part of

their study program. Until recently an automated assessment was out of the question in STEM fields as sufficiently powerful symbolic computation features were unavailable in learning management systems such as Moodle. This is where STACK, the "System for Teaching and Assessment using a Computer algebra Kernel" [1,2], based on Maxima [3] opens a whole new dimension for STEM teachers, as it enables tailoring meaningful example problems as part of a quiz embedded in Moodle thereby eliminating the deficiencies of both the classical paper-pencil exam as well as those of multiple-choice exams. At the Institute of Mechanics of the Montanuniversitaet Leoben, we started to research electronic assessments including the use of STACK well before the Covid pandemic [4,5]. However, the pandemic significantly accelerated the use—and more importantly—the acceptance of automated assessment tools so that the small community of STACK users grows and flourishes. The Montanuniversitaet had the great pleasure to host the STACK community meeting in April 2022 in Leoben, Austria. The conference was held in hybrid mode with about half of the participants attending online. The present special issue summarizes the findings of the meeting. Every contribution uniquely demonstrates the great progress in e-didactical methods that has been achieved during the pandemic years. The individual papers deal with topics ranging from the usage of STACK to aid in teaching huge classes across Africa, running online exams, and developing interactive workbooks to adding blocks to the STACK, e.g., by making use of graphics libraries to create interactive figures during an assessment.

Automated evaluation allows taking tests at a higher frequency than this would be possible in the case of classical, manual evaluation. This is especially valuable for formative assessments, which, in turn, opens the door for entirely new teaching strategies. Hence, the full potential of STACK is yet to be exploited. We are absolutely convinced that STACK will become a standard tool in STEM education in the years to come.

2 Acknowledgement

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3 References

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