Keywords: algorithmic thinking, assessment tool development, higher education

Abstract:

This dissertation focuses on developing a test to assess the algorithmic thinking skills of first-year students in an English-language BSc program, analysing its effectiveness, and designing and evaluating a related development course. The study is particularly relevant as some students entering the English-language BSc Programming program at the Faculty of Informatics, Eötvös Loránd University, demonstrate lower levels of algorithmic thinking than required for successful academic performance. Implementing a diagnostic assessment tool and targeted intervention strategies can help bridge the initial knowledge gap among students, enhancing their chances of academic success.

The dissertation first reviews key terminologies related to developments in information and communication technologies (ICT) and examines the evolution and theoretical framework of algorithmic thinking. It introduces a *comprehensive model of algorithmic thinking*, serving as the theoretical foundation for empirical research. Additionally, the study presents preliminary investigations into young students' (grades 1–4) use of digital tools and the algorithmic thinking skills of students in grades 5–6, with findings that influenced the test design.

The initial version of the algorithmic thinking test was piloted alongside a self-report questionnaire measuring potential background variables (e.g., prior knowledge, language proficiency). Based on the pilot results, the test was refined and revised. To further support students' skill development, a problem-solving and algorithmic thinking course was also developed.

The study was conducted over three semesters, involving 137 BSc students. The reliability of the algorithmic thinking test improved compared to the pilot study results; however, the discrimination index of certain items suggested that some tasks were less effective in distinguishing between different skill levels. As expected, the most challenging tasks required students to develop their own algorithms, demonstrating a high level of cognitive demand. The analysis of students' programming course results and first-semester academic performance suggests that the remedial course contributes to student progress.

Finally, the research examines the impact of the COVID-19 period and presents the improved online version of the test, along with its potential adaptation for other student groups.