

Online-Scaffolding-Learning Tools to Improve First-Year Undergraduate Engineering Students' Self-Regulated Learning Abilities

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Abstract : The number of undergraduate engineering students enrolled in university has been increasing rapidly recently, leading to challenges associated with increased student-instructor ratios and increased diversity in academic preparedness of the entrants. An increased student-instructor ratio makes the interaction between teachers and students more difficult, with the resulting student 'anonymity' known to be a risk to academic success. With increasing student numbers, there is also an increasing diversity in the academic preparedness of the students at entry to university. Conceptual understanding of the entrants has been quantified via diagnostic testing, with the results for the first-year course in electrical engineering showing significant conceptual misunderstandings amongst the entry cohort. The solution is clearly multi-faceted, but part of the solution likely involves greater demands being placed on students to be masters of their own learning. In consequence, it is highly desirable that instructors help students to develop better self-regulated learning skills. A self-regulated learner is one who is capable of setting up their own learning goals, monitoring their study processes, adopting and adjusting learning strategies, and reflecting on their own study achievements. The methods by which instructors might cultivate students' self-regulated learning abilities is receiving increasing attention from instructors and researchers. The aim of this study was to help students understand fully their self-regulated learning skill levels and provide targeted instructions to help them improve particular learning abilities in order to meet the curriculum requirements. As a survey tool, this research applied the questionnaire 'Motivated Strategies for Learning Questionnaire' (MSLQ) to collect first year engineering student's self-reported data of their cognitive abilities, motivational orientations and learning strategies. MSLQ is a widely-used questionnaire for assessment of university student's self-regulated learning skills. The questionnaire was offered online as a part of the online-scaffolding-learning tools to develop student understanding of self-regulated learning theories and learning strategies. The online tools, which have been under development since 2015, are designed to help first-year students understand their self-regulated learning skill levels by providing prompt feedback after they complete the questionnaire. In addition, the online tool also supplies corresponding learning strategies to students if they want to improve specific learning skills. A total of 866 first year engineering students who enrolled in the first-year electrical engineering course were invited to participate in this research project. By the end of the course 857 students responded and 738 of their questionnaires were considered as valid questionnaires. Analysis of these surveys showed that 66% of the students thought the online-scaffolding-learning tools helped significantly to improve their self-regulated learning abilities. It was particularly pleasing that 16.4% of the respondents thought the online-scaffolding-learning tools were extremely effective. A current thrust of our research is to investigate the relationships between students' self-regulated learning abilities and their academic performance. Our results are being used by the course instructors as they revise the curriculum and pedagogy for this fundamental first-year engineering course, but the general principles we have identified are applicable to most first-year STEM courses.

Keywords : academic preparedness, online-scaffolding-learning tool, self-regulated learning, STEM education

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