Exploring Resilience for Effective Learning in Computer Science Education

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Background and context

Many factors have been shown to be important for supporting effective learning and teaching – and thus progression and success – in formal educational contexts. While factors such as key introductory-level computer science knowledge and skills, as well as pre-university learning and qualifications, have been extensively explored, the impact of measures of positive psychology are less well understood for the discipline of computer science. This preliminary work investigates the relationships between effective learning and success, and two measures of positive psychology, Grit (Duckworth's 12-item Grit scale) [6] and the Nicolson McBride Resilience Quotient (NMRQ) [3], in success in first-year undergraduate computer science to provide insight into the factors that impact on the transition from secondary education into tertiary education.

Research methods

This quantitative study was conducted by incorporating two survey-based measures of positive psychology – on Grit and Resilience – into the teaching of a first-year core subject as part of a UK computer science degree programme in February 2019. Students were asked to complete the surveys using the University's electronic learning platform. The students were supported in the interpretation of their results and guidance was provided regarding strategies they could adopt to improve them in the context of their degree studies. The study was approved by the University's ethics board and student consent was explicitly obtained to use their data for research. Data on student performance was obtained at the end of the teaching year and consists of the results from five different subjects over both semesters of the academic year as well as attendance data over the year.

The data was analysed by a combination of correlation analysis and logistic regression. The intention of the logistic regression was to explore the potential strength of relationship rather than to develop a model for predictive purposes.

Findings

Data was captured by related to Grit (N=58) and Resilience (N=50) questionnaires and related coaching. Analyses demonstrate that Resilience is statistically significantly (1% level) linked (correlation analysis and logistical regression) to attendance and performance for individual subjects and year average marks; however, this was not the case for Grit.

Conclusion and implications

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Promoting effective learning and student success remains a challenge in computer science, with high failure rates reported in foundation areas, such as introductory programming [1, 8]. The results of this preliminary study demonstrate that the 12-item resilience scale could be a factor in promoting success, but that the same was not true for the 12-item grit scale. The results of this single-institution study lead to a number of possibilities for future work analysing the transition from secondary education to tertiary education, providing insight into learner attitudes, behaviours and dispositions, especially how this links to the teaching and assessment of key curricula concepts in computer science. For example:

i) Initiatives related to the active development of student resilience can be deployed and their effectiveness evaluated
ii) Replicating the study with larger cohorts and at other schools/colleges/universities to validate this study, increasing the sample size and strengthening the statistical basis.
iii) Using resilience in predictive models alongside other key factors in order to further augment and enhance the prediction of student success.

Alongside substantial national curriculum and qualifications reform across the four nations of the UK [2], as well as a significant socio-economic push to produce more graduates with "high-value" digital, data and cyber skills [4, 5, 7], these changes are being monitored and replicated internationally. With changes to curricula, as well as rethinking programmes, pedagogies and practice, we thus recognise similar challenges and opportunities in a number of other jurisdictions, providing a platform for replicability, portability and extension of this work.

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