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Mathematical tasks, study approaches, and course grades in undergraduate mathematics: a year-by-year analysis.

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Summary: Students approach learning in different ways, depending on the experienced learning situation. A deep approach is geared toward long-term retention and conceptual change while a surface approach focuses on quickly acquiring knowledge for immediate use. These approaches ultimately affect the students' academic outcomes. This study takes a cross-sectional look at the approaches to learning used by students from courses across all four years of undergraduate mathematics and analyses how these relate to the students' grades. We find that deep learning correlates with grade in the first year and not in the upper years. Surficial learning has no correlation with grades in the first year and a strong negative correlation with grades in the upper years. Using Bloom's taxonomy, we argue that the nature of the tasks given to students is fundamentally different in lower and upper year courses. We find that first-year courses emphasize tasks that require only low-level cognitive processes. Upper year courses require higher level processes but, surprisingly, have a simultaneous greater emphasis on recall and understanding. These observations explain the differences in correlations between approaches to learning and course grades. We conclude with some concerns about the disconnect between first year and upper year mathematics courses and the effect this may have on students.

Classification: C35 D55

Keywords: undergraduate mathematics education; student approaches to learning theory; study process questionnaire; conceptions of mathematics questionnaire

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