The Impact of Attending Mathematics Tutoring on STEM Retention

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University students who choose STEM majors often do not complete their degrees in STEM. A 2009 study found that 55% of STEM majors leave STEM fields altogether (Chen, 2009). Many STEM majors require a sequence of mathematics courses. The PCAST 2012 report found that engineering majors who were enrolled in math courses that utilized active learning strategies were more likely to persist in engineering majors (PCAST, 2012). Students have been shown to be more actively engaged during a peer tutoring session than in lecture, as measured by the number of questions asked by the student (Graesser & Person, 1994). This study examines how attending peer tutoring for mathematics courses impacts STEM retention.

Multiple studies have found that attending peer tutoring correlates to higher grades in mathematics classes (Byerley et.al, 2018; Rickard & Mills, 2018; Xu, et al., 2001). In fact, a study of ten mathematics tutoring centers in the USA found that five centers had a statistically significant positive correlation between course grades and number of visits, three had no significant correlation, and two had a negative correlation (Byerley et al., 2022). Clearly, passing required mathematics classes is necessary for a student to persist in their major, but there may be other social benefits to attending tutoring such as students' sense of belonging and formation of a positive mathematical identity (Bjorkman, 2019).

Our research questions are: What is the relationship between math tutoring center usage and STEM persistence? What do students identify as factors contributing to their STEM retention?

For this study, we employed an explanatory sequential mixed methods design. Our first quantitative phase examined the statistical correlation between tutoring visits and STEM persistence. These results informed the second qualitative phase which consisted of interviews with seven STEM majors who attended tutoring.

We gathered quantitative data for all STEM majors every semester for a two-year period. These measures included their major at the beginning of each semester, math course grades each semester, and the number of visits to the math learning center each semester. We utilized a logistic regression model to determine the likelihood of STEM retention over the two-year period based on the students' passing rate for their math courses and average tutoring attendance per course. We found a statistically significant positive correlation between tutoring visits and persistence, and that the odds of persisting in STEM increases by 10.92% for each additional visit to the MLSC per math course.

We then recruited STEM majors who passed 4 or more math courses to participate in an interview. Seven students agreed to participate, and six of these students utilized the math learning center. We utilized the constant comparative method (Glaser & Strauss, 1967) to identify themes in the interview data. All seven said that they had mostly positive experiences in their mathematics courses. They viewed the peer tutors as helpful and several mentioned that they met up with friends at the math learning center. Several of the students discussed how the tutors helped him understand the process but didn't give away answers, which implies that they were actively engaged in the tutoring session. They also mentioned other spaces where they connected with classmates to study, both virtually and in person.

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