Prevalence of Students Changing to STEM Majors:
Implications for Mathematics Pathways

Dana Center Mathematics PATHWAYS

Overview

The implementation of mathematics pathways in institutions of higher education raises some issues about how to best provide students with equitable access to and the opportunity for success in rigorous mathematics pathways relevant to their programs of study. A critical concern is that mathematics pathways will create obstacles for students who change their majors, particularly for those students seeking to switch from non-STEM to STEM majors.

This brief summarizes institutional, state, and national studies examining the prevalence of students who changed majors from non-STEM to STEM fields. It is intended to support institutional discussions and decision making by offering evidence on the number of students who might be impacted by this issue and by providing recommendations for serving these students.

Key Findings from Institutional Studies

- Data analysis at City University of New York (CUNY) of the Fall 2011 cohort of first-time, associate degree-seeking students who declared a major from Fall 2011 to Spring 2013 revealed that less than 4% of all students changed from a non-mathematics intensive major to a mathematics intensive major (CUNY, 2017).
- University of Texas Rio Grande Valley (UT–RGV) implemented a bridge mathematics course for students who decide to switch to an algebraically-intensive major. Of 28,000 first-time in college students over three years, six students inquired about the bridge program and two enrolled in the course. According to Dr. Virgil Pierce, UT–RGV Associate Dean for Student Success in the College of Sciences and Associate Professor of Mathematics, "Truly, the changing of majors is more substantial from algebraic intensive to non-algebraic intensive—that is the bigger concern."
- An analysis of the academic movement patterns of 2,200 students at California State University, Stanislaus from 2012–2014 found that 13% of non-STEM students switched to STEM majors, whereas 17% of STEM students switched to non-STEM majors (Stanislaw, 2014).
- Of first-time, full-time freshmen entering a Midwestern research university in Fall 2000, less than 5% of students initially declared as non-STEM majors changed to STEM majors (Whalen & Shelley, 2010).

Key Findings from National and State Studies

- Of students who entered four-year Ohio public colleges in Fall 1998, most (95%) students intending to major in non-STEM fields stayed in non-STEM fields with only 5% changing to STEM majors (Bettinger, 2010).

- An analysis of first-time students enrolled in postsecondary education examined student entrance, persistence, and attainment in STEM fields from 1995 to 2001 (Chen, 2009). The study found 36% of intending STEM students changed their majors to non-STEM fields and 7% of intending non-STEM students changed their majors to STEM fields.
- Enrollment and completion data from the National Student Clearinghouse from 2004 to 2010 revealed that of the 34,616 students who graduated with a STEM degree, only 17% had originally intended to pursue a non-STEM major (Eagan, Hurtado, Figueroa, & Hughes, 2014).

Recommendations

The evidence from these studies overwhelmingly shows that the vast majority of students who start in a non-STEM field will remain in a similar field. Therefore, institutions should design normative practice of mathematics pathways to serve the needs of the greatest number of students possible and ensure that appropriate options exist for students who change to STEM majors. The Charles A. Dana Center makes the following recommendations:

- The normative practice for the student intake and enrollment process should help a student make an informed choice from a small set of meta-majors or guided pathways. The student's mathematics pathway should be based on that selection. In the case of an undecided student, the default mathematics pathway should be the one aligned to the highest enrollment programs.
- Mathematics departments should create viable, alternative options to meet the needs of the small percentage of students who will change from one mathematics pathway to another. For example, a bridge between pathways might consist of a non-course-based option paired as a pre- and/or co-requisite with a course such as Pre-Calculus to cover content gaps between courses. It is not enough for an alternative option to exist; it also needs to be accessible. Advisors and faculty across disciplines need to be aware of the option and be able to direct students to it.

References

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About the Dana Center

The Dana Center develops and scales math and science education innovations to support educators, administrators, and policy makers in creating seamless transitions throughout the K–16 system for all students, especially those who have historically been underserved. We focus in particular on strategies for improving student engagement, motivation, persistence, and achievement. The Center was founded in 1991 at The University of Texas at Austin. Our staff members have expertise in leadership, literacy, research, program evaluation, mathematics and science education, policy and systemic reform, and services to high-need populations.