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Chapter 11

The Missing Piece:

The Transfer and Applicability of Mathematics Pathways

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Abstract

The lack of predictable transfer policies between institutions and the inconsistent applicability of mathematics credits across departments and programs of study are significant barriers to student persistence and completion. While many states have policies designed to facilitate student transfer, they are not always used, not uniformly applied, and often prove to be ineffective in helping students advance to degree completion. Moreover, state policies typically focus more on the issue of student movement between institutions and programs of study in terms of the *transferability* of courses from one institution to another rather than the *applicability* of credits to a student's chosen program of study—even though both transfer and applicability are equally important.

Unlike the more widely understood idea of transfer and articulation, in which institutions are the unit of measure and medium for change, transfer and applicability is a student-centered approach of ensuring that mathematics pathways are properly aligned with academic and career interests. The purpose of this chapter is to examine how one emerging policy issue in the mathematics pathways movement—the transfer and applicability of mathematics credits—has the potential to positively impact student success and social mobility. This chapter discusses past approaches, current barriers, and emerging strategies related to the transfer of mathematics pathway courses and the applicability of mathematics credits to ensure that a student is provided the opportunity to take the right mathematics at the right time, from admission to completion.

Introduction

According to a Community College Research Center (CCRC) report from 2015, even though 80 percent of community college students intend to transfer to a baccalaureate institution, only 25 percent of those students make the transition to a four-year institution within five years, and only 17 percent earn a bachelor's degree within six years of transferring (Jenkins & Fink, 2015). A more recent study from CCRC and the Aspen Institute noted that of the 720,000 degree-seeking students who enrolled in a two-year institution in Fall 2007, only 14 percent transferred to a four-year institution and graduated by Spring 2015 (Wyner, Deane, Jenkins, & Fink, 2016). The outcomes are even more troubling for students of color. A 2016 report from Education Northwest found that over 80 percent of Black and Latino community college students intended to transfer, but only 20 percent did so within six years of enrollment and less than 10 percent ever completed a bachelor's degree (Hodara, Martinez-Wenzel, Stevens, & Mazzeo, 2016). Stated simply, current approaches to student transfer and persistence do not serve students well and these same students are paying the price in more ways than one.

The misalignment of requirements between the two-year and four-year sectors, and the inconsistent applicability of credits upon transfer is an often overlooked issue regarding successful student transfer. This misalignment and unpredictability lead to either the loss or the unnecessary accumulation of credits when courses taken at the two-year level do not apply to a student's chosen field of study at the four-year level. In fact, it is the applicability of credits (i.e., the acceptance of credits, particularly mathematics credits, to a student's chosen program of study) earned at the two-year level that pose one of the greatest challenges to successful vertical student transfer (two-year to four-year) and bachelor's degree completion.

Implementing multiple mathematics pathways that include quantitative reasoning, statistics, and calculus that are more closely aligned with student interests and goals is an increasingly important strategy in addressing student persistence and completion. As explained in a 2016 "Call to Action" from the Charles A. Dana Center, "Traditional entry-level college mathematics fail to serve students well because they are structured as disconnected courses whose content is misaligned to students' career and life needs" (Getz & Ortiz, 2016, p.1). Mathematics pathways need to support student academic and career goals, and address the alignment of mathematics requirements between the two- and four-year postsecondary sectors.

Education stakeholders need to ask and answer two fundamental questions as they look to implement, scale, and align multiple mathematics pathways with student interests and specific programs of study: (1) Are community college students taking the right math at the right time—that is, are they taking courses and sequences that will apply to and be accepted by their chosen field of study and future career interests? (2) Is mathematics a barrier to student transfer to a four-year institution and completion of a baccalaureate degree?

Stated simply, transfer and applicability refers to the way course credits move from a sending institution and apply to degree requirements at a receiving institution. In the context of the Dana Center Mathematics Pathways (DCMP), applicability denotes a *student-centered* process to ensure that academic pathways (such as mathematics) are properly aligned with students' academic and career interests and that credits consistently apply to their chosen programs of study. Whereas past policy approaches have primarily stressed the *transferability* of credits between institutions, the emerging issue—

and one that needs greater attention from policymakers and other key education leaders and stakeholders—concerns the *applicability* of mathematics credits between departments and programs of study. This chapter will argue the case for moving beyond the common understanding and approach of transfer and articulation—which centers primarily on agreements between institutions or systems—and make transfer applicability—which centers primarily on student needs and goals—a priority.

Transfer Policy and Practice

Policymakers at the state and system levels have developed a variety of common policy solutions to ensure smooth and efficient transfer, and include (Education Commission of the States, 2016):

- **Common course numbering:** Sixteen states use common course numbering systems with the same course titles, descriptions, and identification numbers for comparable courses at all public institutions within a state, thereby helping to eliminate any confusion about the transferability of students' lower-division coursework.
- **Transferable lower-division core:** States, systems, or institutions can determine what constitutes a common general education core of classes in order to help two-year students automatically transfer their lower-division credits to a four-year institution. Thirty-six states allow for a transferable lower-division core of general education courses.
- **Guaranteed transfer of an associate's degree:** Thirty-two states guarantee junior standing at a four-year school to a student who earns an A.A. or an A.S. degree at a community college.
- **Course equivalency guides and transfer websites:** Twenty-four states have created online resources to help students understand how credits completed at their community college will align and apply to their major at the four-year institution.
- **Declaring a major before transferring:** One predictor of possible student success post-transfer is the declaration of a major before making the move from a sending to a receiving institution. Declaring a major while still enrolled at the two-year level allows a student to take the appropriate courses before transferring to a four-year college or university.
- **Ensuring advisors are adequately trained:** In order to properly communicate information about mathematics pathways to prospective transfer students, advisors need to understand the possible pathways to choose from, how they align with student goals, and how to navigate students through the successful completion of a bachelor's degree.
- **Making transfer part of the institutional mission:** Dedicating resources and staff to deal directly with transfer students and making them a priority can create efficient and predictable pathways.

Additionally, recent studies have shown that other factors can positively impact student transfer (Bailey, Jenkins, Fink, Cullinane, & Schudde, 2017; Wyner et al., 2016):

While policymakers at the state and system levels have developed approaches to ease the transfer of general education courses, the approaches have been less successful in addressing completion of specific degree requirements and the consistent applicability of credits to specific programs of study. In other words, applicability remains the missing piece.

When considering the common policy solutions related to student transfer listed above, the barrier of applicability becomes more apparent. Comparing policy to practice in each of those areas reveals ongoing challenges:

- A 2017 study about community college transfer in Texas argued that “[w]hile common course numbering might reduce confusion and the information burden for students and registrars, it still [does] not address the problem of the applicability of courses to a student’s major or program of study” (Bailey et al., 2017, p. 7). The same study further pointed out that “even community college students who complete Texas’s 42-credit general education core may find that these courses may not meet general education requirements for particular majors at a four-year college. As a result of this misalignment, students must in effect retake lower-division general education courses to satisfy bachelor’s degree requirements” (p. 5).
- A 2016 study about tracking transfer outcomes in states concluded that the “connection between earning a community college credential before transferring and the probability of earning a bachelor’s degree is not clear in most states,” including Kansas, Maryland, Tennessee, and Texas (Jenkins & Fink, 2016, p. 6).
- A 2012 College Board report asserted that statewide articulation agreements have shown no impact on transfer rates at all (Handell & Williams, 2012).
- In the case of course equivalency guides or transfer websites, the burden for navigating the complex maze of requirements is often placed solely on students, many of whom are ill-equipped to understand exactly how their courses align with their intended fields of study.

Applicability: The Missing Piece

According to recent research, the largest barrier to completion of a bachelor’s degree for community college students was the loss of credits upon transfer. For example, a 2014 study found that less than 60 percent of transfer students were unable to transfer a majority of their credits and that 15 percent were unable to transfer *any* of their credits at the community college. Essentially, one in seven students started the bachelor’s degree as a freshman upon entrance to the receiving institution (Monaghan & Attewell, 2014).

The accumulation of excess credits can have the same negative effect on student persistence and completion. According to a 2011 study conducted by Complete College America, students who graduated from public four-year institutions in the U.S. earn an average of 14 percent more credits than are required to graduate and some earn up to 50 percent more credits than are needed (Complete College America, 2011). A 2013 study from the Edunomics Lab at Georgetown University stated, “These excess credits drive up cost per degree, when they are subsidized by public funds; leave fewer spots available for other students; and can slow or inhibit degree completion, given the fact that more credits equals more time and tuition for students” (Kinne, Blume, & Roza, 2013, p. 1).

As CCRC and the Aspen Institute made clear, “statewide general education agreements generally do not specify which courses can satisfy requirements for specific majors. This is particularly problematic for students seeking to enter majors in fields that have specific lower-division mathematics and science requirements, like business, nursing, and STEM” (Wyner et al., 2016, p. 50).

One example of the applicability problem is a student who takes a quantitative reasoning course that satisfies a mathematics requirement

at the two-year institution because it aligns with their desire to become a historian. The receiving institution may accept the credits, but the specific requirements for a degree in history at the receiving institution call for college algebra instead of quantitative reasoning or statistics. Another example is a community college student seeking to pursue a degree in psychology who is faced with multiple and conflicting requirements at the four-year level, with some institutions requiring statistics, others requiring college algebra, and others requiring no college-level math at all. This unnecessary, but all-too-common scenario demonstrates just how complex and confusing the transfer process can be for students, particularly low-income or first-generation students who might not have the resources or support to navigate the maze of requirements.

Focusing exclusively on general education agreements or a transferable core of courses fails to address the more complex issue of major requirements. Likewise, placing the burden of navigating transfer portals or course equivalency databases solely on students can lead to confusion and inappropriate course selection. Several of the “top” fields of study such as Business, Nursing, Engineering, and Education have very specific—and often very different—lower-division mathematics requirements. A “one size fits all” approach simply does not work.

The Right Math at the Right Time: Recommendations

With these challenges in mind, the time has come for stakeholders at the state and system levels to look beyond common policies in order to more fully address the applicability issue. In particular, consistent and predictable transfer and applicability of mathematics credits between institutions and programs of study are important for students in mathematics pathways.

Two- and four-year institutions and systems must work in concert with state agencies, policymakers, and other key stakeholders to turn proposed policy into effective practice. Recommendations and successful initiatives include:

- **Collecting comprehensive data** related to total student transfer by major, the most in-demand programs of study, and how mathematics requirements align and credits apply across the postsecondary sectors can help states positively impact transfer pathways for the greatest number of students in the short term and create a foundation for future efforts related to other disciplines. The Oklahoma State Board of Regents has taken the first steps towards understanding student pathways and persistence by creating a framework capable of establishing baseline data and tracking a student’s progress across the higher education pipeline to determine if they are taking math courses that appropriately correspond with their academic interests and whether those credits are being applied to their programs of study.
- **Developing major-specific program maps** between institutions that specify mathematics requirements is critical to successful transfer and persistence. Legislators in Missouri passed a “Guided Pathways to Success” pilot program in 2016 that includes degree-based transfer pathways and the utilization of meta-majors to “minimize the loss of credit due to changes by students in their degree majors” (Missouri S.B. 997, 2016, 19). The Tennessee Transfer Program is another example of this approach. According to the National Conference of State Legislatures (NCSL), the program “lists all the courses necessary to earn an associate’s degree at a community college. When a student takes those courses and transfers to a four-year college or university, the transcript will indicate that the pathway has been followed. The student then

is guaranteed that all the community college courses will count toward completion of a bachelor's degree in the designated major" (Bautsch, 2013, p. 3).

- **Developing policies that offer more than helpful guidance**, but instead require increased student supports and adequate funding, in addition to legally binding accountability measures and deadlines to complete the work will help address the issue of transfer and applicability. In Missouri, the passage of its guided pathways legislation (Missouri S.B. 997, 2016) demonstrates the first step in addressing the transfer and applicability problem in the state.
- **Understanding how state policy aligns with institutional practice** may help to identify additional disconnects and barriers that students face when trying to move between institutions. Determining if there are additional institutional requirements or examinations that lead to unnecessary loss of credits or improper placement at the receiving school can allow stakeholders at the institutional, system, and eventually state levels to address and rectify these issues. A transfer and applicability working group in the state of Washington is currently reviewing its statewide Direct Transfer Agreement degree in order to determine how the transfer math requirements specifically align with the requirements at the individual four-year institutions once students select a degree program and if the credits they took in community college apply to those degree programs.

These initial, isolated state policy efforts are a good start; however, the applicability issue remains mostly unaddressed in the vast majority of states. States involved in the Dana Center's Mathematics Pathways to Completion (n.d.) project have begun investigating and developing

strategies, including the creating data templates capable of tracking student course-taking patterns, developing student transfer maps, and establishing regional partnerships between two-year and four-year institutions. States are gaining a better understanding of how mathematics credits transfer from two- to four-year institutions in specific programs of study. States are focusing their initial efforts on activities that are targeted and realistic. Understanding the issues between specific programs and institutions, as well as within specific regions, can help policymakers and practitioners develop larger and longer term, statewide strategies and solutions.

Conclusion

The work of implementing multiple mathematics pathways in the states is just beginning. There is still much to learn as the process moves forward, but one issue is clear: Moving from an understanding of transfer and *articulation* to a fuller understanding of transfer and *applicability* allows states, systems, and institutions to focus on the student needs first and foremost.

When developing ways to address transfer issues and implement multiple mathematics pathways in the states, policymakers and education practitioners must maintain an equal focus on the transfer *and* the applicability of mathematics credits. Education stakeholders in the states who are in a position to address issues related to transfer and applicability can and should focus on expanding and improving data collection that identifies transfer gaps, establishing program maps that foster coordination and develop a common language between institutions, and creating new ways to measure student progress and success as students move from one level to the next.

Ultimately, the goal is for individual efforts at institutions or within systems to stimulate

collective action that leads to the development of eventual statewide solutions and to ensure that all mathematics pathways are aligned. The goal includes having courses and credits that are not only accepted but also applied across all institutions and disciplines. Implementing and scaling mathematics pathways that are both transferable between institutions and applicable across disciplines will enhance student persistence and boost completion rates throughout the country, improving social mobility for individual students and economic productivity for an entire state.

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