Improving Postsecondary Transfer and Mathematics Course Applicability in Minnesota State

Executive Summary

This report focuses on existing challenges and recommendations for improving student transfer in Minnesota State. It is important to note that the transfer barriers highlighted here are neither unique nor uncommon in other states. Using Minnesota State as a case study, the purpose of this report is to provide other states and regions with a specific example that can be used to both help them identify how their own systems may perpetuate similar barriers and to propose strategies to help them resolve those challenges.

In 2019, the Minnesota State system office set an ambitious strategic goal to eliminate inequities in access and outcomes for racially minoritized students in the state by 2030.[1] While significant progress has been made, Minnesota State needs to consider both process and structural changes to its transfer policy in order to fully realize the Equity 2030 plan.

On average, about 80% of Minnesota State community college students identified transferring to a four-year bachelor's program as their postsecondary goal; yet, only 12% of student cohorts evaluated in Minnesota achieved this goal. Although Minnesota State has been working diligently to respond to legislative mandates to increase student degree completion by reforming the developmental education and transfer policies and practices, much work remains to be done.[2] **Simply put, the system will not achieve the Equity 2030 goals without bold action to support its transfer students.**

Three specific transfer barriers inhibit progress as institutions in Minnesota begin designing and scaling corequisite mathematics courses:

1. Misalignment of default math courses for programs.
2. Lack of common course numbering and transparent degree applicability information.
3. Limited mechanisms for confirming course equivalency or updating transfer guides.

The following recommendations would significantly increase the likelihood of achieving the goals of Equity 2030:

1. Scale and systematize the meta-majors framework.
2. Utilize and expand existing regional partnerships and infrastructure to construct local transfer solutions.
3. Strengthen policies that ensure course transfer based on student learning outcomes, including common course numbering.
4. Build on the Transfer Pathways initiative.
5. Scale equity-based policies and practices based on recommendations of mathematics faculty leaders.
6. Improve data access, including key performance indicators for transfer students.

[1] https://www.minnstate.edu/Equity2030/index.html

[2] Minnesota State, 2018a.

Background

Minnesota State is the third largest postsecondary system in the United States and plays a crucial role in delivering educational opportunities to the state's diverse student population. Each year, more than 340,000 students enroll in Minnesota State's 30 community and technical colleges and 7 universities, with hopes of completing a credential or degree to improve their economic mobility and provide opportunities for their families and communities.[3]

The system office at Minnesota State set an ambitious strategic goal in 2019, known as Equity 2030, to eliminate inequities in access and outcomes for racially minoritized students in the state.[4] While there has been significant progress towards achieving the strategic vision, Minnesota State needs to consider both process and structural changes to transfer policy to achieve Equity 2030.

Improving the efficiency of student transfer and applicability of course credit between two-year colleges and four-year universities are among the most critical actions that the Minnesota State system can pursue in working towards the Equity 2030 goal. Indeed, the very creation of the Minnesota State system in 1994 occurred by legislative mandate in an effort to improve the transfer student outcomes.[5] The equity imperative is in part driven by the fact that the two-year college sector serves a disproportionate number of students experiencing poverty and those from racially minoritized backgrounds, and also because a significant portion of all students in the state will be transfer students. According to the most recently available legislative report on student transfer, there were 33,254 transfer students in the Minnesota State system in 2013 with at least 60% of those students transferring between Minnesota State institutions.[6] Data from the National Student Clearinghouse show that between 2008 and 2014, 63% of all students at public institutions of higher education in Minnesota transferred at least once.[7] In AY2015–2016, 45% of all bachelor's degree completers in the state carried two-year college credit on their transcripts.[8]

Despite these impressive statistics, Minnesota's overall transfer outcomes fall below the national average on a number of key indicators. Based on a comparative 50-state study of transfer student outcomes from the Community College Research Center at Columbia University, students in Minnesota experienced outcomes below the national average for transferring out of a two-year college (31%), transferring with an award (24%), and completing a bachelor's degree after transferring (38%).[9] These figures, however, only captured the number of students who succeeded in transferring.

Although about 80% of community college students identified transferring to a four-year bachelor's program as their postsecondary goal, Jenkins and Fink (2016) found that only 12% of students in the 2007 Minnesota cohort (degree-seeking students entering higher education at a community college in the fall of 2007) achieved this goal. The same study found equity gaps in each of these metrics for Minnesota, with students experiencing poverty having less success than their higher income peers.

The traditional gatekeeping role of mathematics in higher education partially explains the low overall rates of community college students transferring and completing a bachelor's degree.[10]

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[3] https://www.minnstate.edu/system/index.html

[4] https://www.minnstate.edu/Equity2030/index.html

[5] Nobles, 2010.

[6] Minnesota State Colleges and Universities, 2014.

[7] National Student Clearinghouse, 2015.

[8] National Student Clearinghouse, 2017.

[9] Jenkins & Fink, 2016.

[10] Burdman, 2018.

Historically, students entering postsecondary institutions who are deemed underprepared for college-level, algebraically intensive mathematics are assigned to multiple semesters of non-credit-bearing prerequisite coursework that costs time and money. This path does not propel students forward with the credit accumulation needed to transfer and complete a degree.[11] The traditional placement process and developmental mathematics structures are built on curricular assumptions from the 1960s that prioritized a pathway to calculus.[12] However, a convergence of factors have shifted the curricular focus of postsecondary programs towards mathematics that is more relevant to student learning needs such as statistics, modeling, and quantitative reasoning.[13]

Minnesota State has begun a multi-year project encouraging institutions to adopt the most promising solution to the inequities perpetuated by traditional developmental education: mathematics pathways with corequisite supports. Mathematics pathways offer students modernized, relevant mathematics curriculum aligned to their programs of study. Instead of the "one size fits all" approach of funneling all students through a college algebra course, which was designed to prepare students for calculus, mathematics pathways allow students whose programs of study do not require calculus to complete their core mathematics requirements through courses such as statistics, modeling, business math, and quantitative reasoning.

Corequisite supports replace traditional prerequisite developmental education by placing students directly into a credit-bearing mathematics course with embedded supports. Rigorous, causal evaluations in a variety of contexts demonstrate that these strategies dramatically improve the odds of students' completing gateway mathematics and English courses, and contribute to the elimination of inequities on course completions.[14]

As Minnesota State works towards the Equity 2030 strategic plan with reform efforts such as corequisite supports and mathematics pathways, it must simultaneously address barriers to student transfer that may emerge as new structures are established.

The lack of predictability in the transfer of credits poses substantial barriers to the scale and sustainability of corequisite supports and mathematics pathways in states that previously engaged in these efforts.[15] Because college algebra served as the default entry-level math course for decades, many stakeholders perceive that this is the only course that will predictably transfer between institutions. As such, advisors and faculty members are reluctant to place students into other entry-level mathematics courses out of concern that the credit from those courses will not apply to their degree programs after transfer. While some courses other than college algebra may be transferable on a case-by-case basis, the lack of consistent and systemic policy on the transferability of courses outside of the traditional pathway to calculus presents a significant barrier to institutions that offer new mathematics pathways.

Although Minnesota State has been working diligently to respond to legislative mandates to increase student degree completion by reforming the developmental education and transfer policies and practices, much work remains to be done.[16] Simply put, the system will not achieve the Equity 2030 goals without bold action to support its transfer students.

[11] Bailey, Jeong, & Cho, 2010; Chen, 2016.

[12] Bressoud, 2021.

[13] Burdman, 2015, 2020; Saxe & Braddy, 2016.

[14] Logue, Watanabe-Rose, & Douglas, 2016; National Academies of Sciences, Engineering, and Medicine, 2019; Ran & Lin, 2019.

[15] Ganga & Mazzariello, 2018; Kazis & Cullinane, 2015.

[16] Minnesota State, 2018a.

Recent data from the Minnesota Education Equity Partnership[17] make this point clearly:

> "The group with the third lowest rates of graduation across all institutional types . . . are transfer students, followed by part-time transfer students.
>
> "In general, students who attend part-time, receive the Pell grant, and have transferred from another institution have among the lowest eight-year graduation rates across all institutional types compared to their peers. POCI [People of Color and American Indian and/or Indigenous] students are represented in all of these categories at significantly higher rates than their White peers and face these additional barriers to successfully pursuing a higher education degree and completing college."

Barriers and Recommendations

Large-scale change in higher education, such as Equity 2030, cannot happen on an institution-by-institution basis because that is not how students experience postsecondary education in Minnesota. The majority of Minnesota State's students experience college as a system through their transfer journeys, with many attending two or more institutions on their paths to a bachelor's degree. Each college and university in Minnesota State has a unique history, mission, population, and focus that should be honored in any cross-institutional change process, including improving equitable access, outcomes, and experiences for transfer students. At the same time, it is important for two- and four-year institutions to coordinate closely on reform design and implementation and to share equal responsibility for transfer students whom they collectively serve.

Similarly, policymakers across the state, system, and institutional levels have a responsibility to create a policy environment that promotes cross-institutional collaboration and enables conditions necessary for sustainable and equitable reforms. Rigorous evaluations from states and systems across the country have found that corequisite math pathways can improve outcomes in course completions, but these initiatives only achieve equitable outcomes at scale when embedded within a seamless transfer environment. Various existing tools and resources support leaders across all levels of the education system from state legislatures and system leadership on issues of transfer,[18] to scaling math pathways,[19] scaling corequisites,[20] and K–12 coordination.[21]

As institutions in Minnesota continue to pursue the goals of Equity 2030, three transfer barriers should be considered.

1. Misalignment of default math courses for programs

While ***transfer*** refers to the movement of students and credits between institutions, ***applicability*** refers to whether the course credits count towards core curriculum and degree-specific graduation requirements. Transfer policy should focus on the predictable applicability of credits so that students can enroll—and advisors and faculty can confidently place students—into the most relevant math course.

Typically, almost all courses will transfer, but if the courses are not identified as counting for specific program credit, they may only transfer as an elective. As a result, many students lose program credit in the process.

[17] Minnesota Educational Equity Partnership, 2020, p. 16.

[18] Ganga, Mazzariello, & Edgecombe, 2018; HCM Strategists, 2021.

[19] Bickerstaff, Chavarín, & Raufman, 2018; Bickerstaff & Moussa, 2020.

[20] Richardson, 2021.

[21] Martin, 2021; Martin & Krueger, 2020.

In this context, ***alignment*** refers to the degree to which similar programs of study across institutions have relevant and comparable math requirements. For example, for most STEM programs, calculus would be the most relevant mathematics, whereas for social sciences, statistics would be preferable, and for liberal arts or humanities, a quantitative reasoning course may be preferred.

While there is a great deal of alignment across institutions in terms of defining the relevant mathematics for programs of study, many exceptions exist. For example, across the seven universities in the system, no two accounting degree programs have the same mathematics requirement. On the other hand, all of the institutions in the system allow psychology majors to complete the degree with any course that meets "Goal 4" core curriculum requirements; only Southwest Minnesota State specifically requires college algebra. A bachelor's degree in social work also has variability, with three institutions requiring statistics, three requiring any core math, and one requiring college algebra.

While some variation is expected to meet the specific needs of programs and student populations, dramatic differences for comparable areas of study are unwarranted. When there are exceptions, programs tend to default to using courses such as college algebra, even for degrees that do not require calculus or additional mathematics. Consequently, even for programs that have aligned mathematics, transfer students do not have assurances that their courses will apply to their specific degrees. Moreover, requiring courses such as college algebra and calculus for degree programs that do not require the depth of algebraic or calculus competencies taught in these courses in subsequent coursework (or career advancement) risks reinforcing the use of mathematics as gatekeeper to higher education, as opposed to a springboard for learning.

Related to the variability in math requirements for a program of study is the issue of hidden prerequisites. As institutions move away from the traditional "college algebra for all" model, they must be mindful of the ways that college algebra—and its developmental counterpart of intermediate algebra—may present barriers in the form of hidden prerequisites.

In the Minnesota State system, many universities use intermediate algebra and/or college algebra as a prerequisite to other mathematics courses such as statistics, or courses outside of the mathematics department such as general chemistry, psychology, and other gateway STEM and social science courses. Unnecessary algebraically intensive prerequisites are also a transfer issue, as students who complete corequisite mathematics courses without an intermediate algebra or college algebra prerequisite may be denied course credit in transfer, or may be denied access to courses in other disciplines. This is particularly true in the context of corequisite mathematics, where students may no longer be taking college-level courses that require algebra-intensive learning outcomes, such as statistics and quantitative reasoning.

Recommendation 1: Scale and systematize the meta-majors framework. Despite some variability in math requirements across the state, a relatively common set of course requirements exists when viewed from the perspective of broad program groups. Katie Smieja, a mathematics instructor at St. Cloud Technical and Community College, studied the math requirements for bachelor's programs in the Minnesota System and identified promising patterns of common mathematics course requirements across programs.[22] Clustering these programs by meta-majors reveals a high degree of consistency in degree requirements. This model can be used to advance policy aimed at improving the transfer and applicability of courses.

[22] Smieja, 2020.

Emerging Minnesota Meta Majors

Meta-Major		Math Requirement (and Exceptions)
Communication, Arts, and Humanities • Communication Studies • Liberal Arts and Humanities • Fine and Performing Arts • Non-STEM Secondary Education • Social Sciences (some) • Health Studies (some)		**Any Goal 4 (~75 majors, ~15 exceptions)** (default: Quantitative Reasoning) (e.g., College Algebra required or Statistics required)
Social and Health Sciences • Health Sciences • Social Sciences (most)		**Statistics (~15 majors, ~8 exceptions)** (e.g., any goal 4 course, College Algebra required instead)
Business		**College Algebra and Statistics (~22 majors, ~10 exceptions)** (e.g., Finite allowed to replace College Algebra, Statistics not required, Calculus required, College Algebra not required)
Education (Special, Elementary, and Early Childhood)		**Math for Teachers (3 majors, 3 exceptions)** (e.g., additional goal 4 course, College Algebra, only one course required, any goal 4)
STEM	• Environmental Science • Medical Sciences (some) • STEM-related	**College Algebra (~17 majors, ~9 exceptions)** (but no Calculus – except when required, Statistics required for some exceptions)
	• Medical Sciences (some) • Construction Management • Technology • Earth Science	**Precalculus (~8 majors, ~2 exceptions)** (but no Calculus except when required)
	• Mathematics and Statistics • Physical Sciences • Life Sciences (most) • Medical Sciences • Engineering	**Calculus (~33 majors, ~14 exceptions)** (e.g., additional Statistics requirement)
	• Computer-related Majors	**Various Combinations of College Algebra, Statistics, Calculus, and Discrete Math (~7 majors, 7 exceptions)**

Source: Smieja, 2020. Used with permission.

Recommendation 2: Utilize and expand existing regional partnerships and infrastructure to design and implement regional solutions. Most student transfer occurs within a relatively confined geographic area. Minnesota State should analyze data to identify the most common patterns and prioritize institutional partnerships that will have the greatest impact on the greatest number of students. In instances where system or state policy change is either inappropriate or unlikely, regional agreements can support policy change on priority issues. The most recent Minnesota State Math Pathways Project utilized regional coordinators, who are local faculty with deep knowledge and relationships with institutions in their geographic area, to serve as trusted communication conduits between transfer partners. The regional coordinators developed an infrastructure for supporting conversations and actions to improve student transfer. Their momentum could be continuously supported to ensure ongoing improvements.

2. Lack of common course numbering and transparent degree applicability information

Although there are numerous examples of aligned and relevant mathematics courses, the Minnesota State system is still highly complex, and variation in course terminology is not student friendly. For example, Minnesota State does not have common course names or numbers nor any student-facing system for identifying the applicability of credits for degree programs. Existing tools, such as Transferology, only show students which courses are counted as equivalents; however, they do not show which courses will be applicable for core curriculum or specific degree requirements. When attempting to document existing math requirements across the system, Smieja shared:

> "It was extremely difficult to gather this information. Websites are not user-friendly, and requirements are not always clear. Some schools have multiple documents with conflicting information for the same major. Many schools just list course numbers, not titles, so it takes a lot of digging to find out what is required. Very few schools had a document or website to guide students into the right math course by major interest. If this information is hard for three faculty members with years of experience as students and faculty in higher education, this information is not nearly accessible enough for current and prospective students."[23]

Resistance to common course numbering in the Minnesota State system is due to a concern about "canned curriculum" and "one size fits all" approaches. The complexity of the current system, however, ensures that the vast majority of students remain enrolled in college algebra courses, regardless of whether that content is relevant to their majors. Indeed, a recent report from Student Ready Strategies identified the complexity of curricular systems as a smokescreen for inequities in higher education: "The lengthier and more complex the curricular system that a student experiences, the harder it is to identify systemic racism, the more attrition points students need to overcome, and the more difficult it is for advisors or faculty to accurately guide them."[24]

Recommendation 3: Strengthen policies that ensure course transfer based on student learning outcomes. Developing a framework to evaluate the comparability of courses across the system, instead of leaving the determination of comparable courses as a case-by-case decision at the institution level, will promote greater equity and consistency. If a course is deemed "equivalent" in transfer, it should predictably apply to a student's program of study. The system could establish a process to clarify shared learning outcomes and ensure course applicability to degrees.[25] Ultimately, the goal is to shift from parochial concerns about course titles to focus instead on essential content that students need to know to succeed in their programs.

[23] Smieja, 2020, p. 12.

[24] Student Ready Strategies, 2021, p. 3.

[25] Krueger, 2017.

For example, if a university requires introductory statistics knowledge for a program, then comparable learning outcomes from math courses such as quantitative reasoning, modeling, or data analysis should be permitted to apply to that requirement. Additionally, the adoption of common course names and numbers would be more helpful to students and would facilitate the identification and transfer of comparable courses.

3. Limited mechanisms for confirming course equivalency or updating transfer guides

The system policy for determining course equivalency states that the standard transfer equivalency is "75 percent comparability of course content."[26] The policy does not specify how the comparability is determined or which part of the content is reviewed, nor does it provide a current list of examples of comparable courses.[27] The lack of specific guidelines further contributes to the opacity of the system and leaves institutions to decide, on a case-by-case basis, which courses will be accepted for specific degree requirements.

There does appear to be a mechanism for students to appeal a decision when their courses are denied in transfer, but the majority of students are unaware of this option, placing the burden of proof on them instead of on the system that should be ensuring transfer and applicability.[28] In the context of mathematics pathways, faculty in disciplines other than mathematics are determining the equivalency of math courses, not math faculty themselves.

Even when courses are identified as equivalents, there is no process for updating transfer guides or curriculum maps across institutions. The lack of a centralized hub at either the state or institution level for tracking transfer equivalents leaves the burden of checking for transferability on individual students, staff, and faculty.

Recommendation 4: Build on the Transfer Pathways initiative. The Transfer Pathways initiative lists a common set of course requirements for many of the most popular majors in the state.[29] Students who complete the full set of courses in a Transfer Pathway degree program are guaranteed that the courses will transfer as a block of credit and count for the full lower division requirements for a degree, regardless of specific variations at the receiving university. As the system currently reviews and revises these pathways, it should pay close attention to the math requirements to ensure the most relevant courses, including corequisite support options, are included in the Transfer Pathway degree.

There are, unfortunately, limitations to this initiative, primarily that very few students complete all requirements for an associate's degree prior to transfer. In Minnesota, only 24% of students who successfully transferred did so after completing an associate's degree.[30] For students who transferred without completing the full Transfer Pathway program, these courses were not guaranteed to apply to their desired bachelor's program. In addition, there were instances in which the math course recommended in the Transfer Pathway degree varied from the math course required for a bachelor's degree, which doubly disadvantaged transfer students because they were required to take the math course specified in the Transfer Pathway program, even if they knew it would not apply to their desired degree. For example, the Transfer Pathway for business degrees specifies college algebra and statistics, although some universities only require students to take finite math for a bachelor's degree in business.

[26] Minnesota State, 2011.

[27] Minnesota State, 2018b.

[28] Durand & Sachau, 2014.

[29] https://www.minnstate.edu/admissions/pathways.html

[30] Jenkins & Fink, 2016.

Thus, students, who followed the Transfer Pathway requirements but did not complete the associate's degree, will have credits for two math courses that will not count towards degree-specific math requirements at a university with a different default requirement for the program in question. It may be necessary to modify the Transfer Pathways initiative to address these limitations.

Additional Recommendations

Recommendation 5: Scale equity-based policies and practices based on recommendations of faculty, staff, and community partners who are leading this work on the ground. Transfer is difficult and complicated because it is inherently cross-institutional and relies on coordinated action across levels and systems. Faculty, staff, and community partners are on the frontlines of those efforts and need to be supported with resources and permissions to advance change. Analysis and recommendations from math faculty members included in other sections of this report have previously been communicated to administrative leaders, but have yet to manifest in policy change.

For Minnesota State to realize the ambitious goals of Equity 2030, bold policy action based on the experience of students and practitioners is essential.[31] Integrating initiatives for transfer students into the broader policy agenda regarding racial equity in Minnesota can also help prioritize reforms. For example, the Minnesota Education Equity Partnership issued strong calls to lawmakers to address "a true college completion crisis" for racially minoritized students in the state and recommended a set of policy actions, including specific focus on transfer students.[32] In particular, the organization noted that given the inefficiency caused by lost credits during the transfer process, many transfer students will become ineligible for state grants to fund their completion of a bachelor's degree.

Recommendation 6: Improve data access, including key performance indicators for transfer students. When conducting background research for this report, it was surprisingly challenging to identify publicly accessible data on transfer students in Minnesota State. Most of the data sources cited for transfer students herein come from research organizations outside of Minnesota State. Where some data do exist, the student-level information is typically not presented in a disaggregated form, which limits understanding the equity dimensions of transfer in the system.

Interactive dashboards and annual reports should be developed that include a specific focus on transfer students. These tools and resources should have the ability to disaggregate by key student variables such as race, gender, Pell eligibility, and first generation status, and should include important transfer outcomes such as credit accumulation, credit loss, degree completion, and time to degree.

Conclusion

Minnesota State education leaders are working diligently to respond to legislative mandates to increase student degree completion and to achieve the goals of the Equity 2030 initiative. Enacting the recommendations in this report would further leverage the initiatives already being implemented, allowing the state to make even more progress toward its goals.

Minnesota is not the only state addressing these, or similar, transfer challenges. Many states and regions, whether they have existing transfer agreements, would be well served to conduct a deep dive into the barriers that exist for transfer students and the applicability of math courses during transfer, including ways to change policy and practice to overcome those barriers.

[31] See reports cited in notes 27–30 for additional information.

[32] Minnesota Educational Equity Partnership, 2020.

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About this resource

About Charles A. 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–14 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.

For more information about the Dana Center, see www.utdanacenter.org.