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ABSTRACT

Transfer has become a significant pathway for obtaining a bachelor's degree from four-year institutions. As a result, higher education institutions are faced with an increasing population of transfer students with varied academic backgrounds and readiness levels. Determining the placement of transfer students in the appropriate introductory-level mathematics course presents a distinctive challenge, and has not been the focus of many studies. In response, this article offers an analysis of the difficulties associated with the placement of transfer students and of the variety of practices regarding placement across select institutions. A narrative describing the placement system for transfer students adopted at a public four-year university in Massachusetts, as well as recommendations for other institutions for the implementation of a smooth, efficient and transparent mathematics placement system for transfer students, is provided.

INTRODUCTION

For many years there has been an upward trend in student mobility in higher education. The ability to transfer between different colleges and universities enables students to respond to their evolving needs and interests, and to appropriately choose an institution that fits those goals. However, many receiving higher education institutions are faced with an ever-increasing population of transfer students with varied academic backgrounds and readiness levels. As a result, addressing these students' unique needs with the standard practices employed for first-time students presents a distinctive challenge.

Transfer has become a significant pathway for obtaining a bachelor's degree from four-year institutions. A nationwide study, conducted by the US Department of Education, showed that "the majority (59%) of 1999–2000 first-time bachelor's degree recipients attended more than one institution during the course of their undergraduate enrollment" (Peter, Cataldi, & Carrole, 2005, p. 33). The same study showed that, of those bachelor's degree recipients who started at a public four-year institution, 48.3% had enrolled in more than one institution over the course of their degree. Additionally, 42% of the students who began in 1995-1996 at a public two-year institution transferred to another institution by 2001 (Peter, Cataldi, & Carrole, 2005).

The performance of transfer students has garnered widespread attention in the literature in recent years. Particularly, several studies have identified a temporary dip in the academic performance of transfer students during their first semester at the receiving institution, commonly referred to as to as *transfer shock* (Cejda, Kaylor, & Rewey, 1998; Hills, 1965; Keeley & House, 1993). This gap in achievement can be attributed to many factors. Ferren and McCafferty (1992) identify correct placement in introductory mathematics courses as an important factor for improving student success rates, saying that "misplacement can lead to high dropout and failure rates" (p. 5). Thus, the placement of transfer

students into courses tailored to their abilities is essential for ensuring academic success of these students.

Placement in the appropriate mathematics course is especially important when a course or a sequence of courses is a gateway into a specific major. This is particularly true for transfer students in Science, Technology, Engineering and Mathematics (STEM) fields. Li (Winter 2010) found that across all STEM fields, 44% of all graduates of four-year institutions attended a community college. Moreover, Packard, Gagnon, LaBelle, and Jeffers (2011) found that, for STEM fields, "more than 50% of students use community colleges as their entry point to higher education" (p. 3), with a higher incidence amongst women and minorities (Hagedorn & DuBray, 2010). Consequently, transfer is a critical pathway to bachelors' degree completion in STEM fields, and a strong emphasis should be placed on ensuring the appropriate placement of these transfer students.

Determining the placement of transfer students in the appropriate introductory-level mathematics class remains one of the most difficult dilemmas that higher education institutions face, given that, unlike first-time students, most transfer students have already taken a placement test, as well as mathematics coursework at the previous institution. Due to the lack of curriculum uniformity across higher education institutions and the absence of transparency of individual placement tests, finding the appropriate mathematics placement, corresponding to each transfer student's readiness, is a difficult endeavor.

While the placement of first-time students has been the object of study in many articles, far fewer efforts have been exerted to study current practices for the placement of transfer students in introductory level mathematics courses. Flagel (2008) acknowledges the existence of a gap in the literature regarding the transfer admission process, and so this article attempts to offer an analysis of the difficulties associated with the placement of transfer students and of the variety of practices regarding placement across select institutions in the US. Moreover, we provide a narrative regarding a placement system for transfer students adopted at a public four-year university in Massachusetts, and offer recommendations about designing and implementing a placement system which ensures smooth transfer and is in accordance to the student's level of preparedness.

DIFFICULTIES ASSOCIATED WITH THE PLACEMENT OF TRANSFER STUDENTS IN MATHEMATICS

Placement in introductory level mathematics courses can strongly impact the academic performance of students. Ferren and McCafferty (1992) state that "placing students into courses tailored to their abilities is essential to improving success rates" (p. 4). In a study at a four-year institution in Pennsylvania, Parker (2005) found that the initial score on the mathematics placement of a first-time student strongly impacts that student's timely progress towards a four-year degree. Pedersen (2004) also identifies the mathematics placement score as one of the four variables that are a significant predictor of a student's success. Given the importance of correct placement in mathematics courses for a student's academic achievement, it is critical for higher education institutions to also give priority to the placement of transfer students.

When determining the placement of transfer students, the receiving institution has a variety of tools at its disposal. Ferren and McCafferty (1992) state that when given the choice, students place themselves in courses beyond their ability, and consequently more objective criteria need to be used to identify a student's level of preparedness. Along with the ability to administer their own placement test at matriculation, the institution can also take into account a transfer student's scores on standardized achievement tests, as well as previous placement scores and relevant coursework from the sending institution.

When considering the best way to determine the correct placement of transfer students in introductory level courses, administering a placement test at admission, as is the case for first-time students, is arguably the simplest and most objective approach. However, a seamless transfer requires that receiving institutions recognize the set of knowledge and skills the student acquired at their institution of origin, and so, re-administering the placement test would create a barrier in the transfer process. This is especially important in the context of partnerships between two and four-year colleges, where program and articulation agreements are in place. In these cases, re-administering a placement test at the four-year institution could signal distrust between the two institutions.

Furthermore, while for first-time students the placement test may appropriately reflect their level of preparedness, Ferren and McCafferty (1992) report that often for transfer students there is a significant time lapse between their last mathematics class and their admission at the receiving institution. Consequently, when transfer students are re-tested, the placement scores may not accurately reflect their level of preparedness. This may inadvertently lead the receiving institution to place a student in a course below their readiness level, despite the student's ability to succeed in a higher course upon completion of a brief refresher. Moreover, at many institutions transfer orientation sessions take place over the course of a single day near the beginning of the semester, which creates many logistical problems with administering a placement test on campus to a large body of students, during a short time frame.

While the use of placement tests in determining the appropriate mathematics course for a transfer student presents many issues, the placement of these students based solely on their transfer records also poses many challenges. Often, students' grades from relevant prerequisite courses taken in their last semester at their sending institution are not available upon admission. This is supported by a report published by the Massachusetts Board of Higher Education (June 2008) that identified a significant delay in sending and receiving of students' transcripts between institutions in the state. The receiving institution is therefore faced with the conundrum of possibly accepting a course as a prerequisite for which the student received a failing grade at the previous institution and hence placing this student in a course which is above their readiness level.

However, the hardest problem to overcome in the placement of transfer students stems from the many difficulties associated with aligning the curriculum between different institutions. Lipka (2010) reports that even amongst institutions within the City University of New York (CUNY) system, transferring of mathematics courses is linked to many inconsistencies. For example, the Technical Mathematics I course at Bronx Community College would transfer to John Jay College as equivalent to Modern Mathematics, which "if transferred back to Bronx, would count differently, as Trigonometry and College Algebra" (p. 4).

These disparities emerge commonly when aligning the curriculum of a two-year college with that of a four-year institution. For example, Bristol Community College, a public two-year community college in Massachusetts, has 12 credits of courses leading to Pre-calculus, while a typical public four-year university in the state offers only three such credits. Given that many transfer students do not complete the full 12 credits required as a prerequisite for Pre-calculus at the two-year college prior to their transfer, the receiving institution is left with the difficulty of deciding whether to place students with partial completion of the prerequisite sequence in its remedial, non-credit bearing, mathematics course or directly in Pre-calculus. For example, the institution might face the inequitable choice of either placing a student having completed 6 credits at the community college in the remedial course, possibly alongside students with no prior transfer credits, or in Pre-calculus, with students who completed the full 12 credits of prerequisite courses.

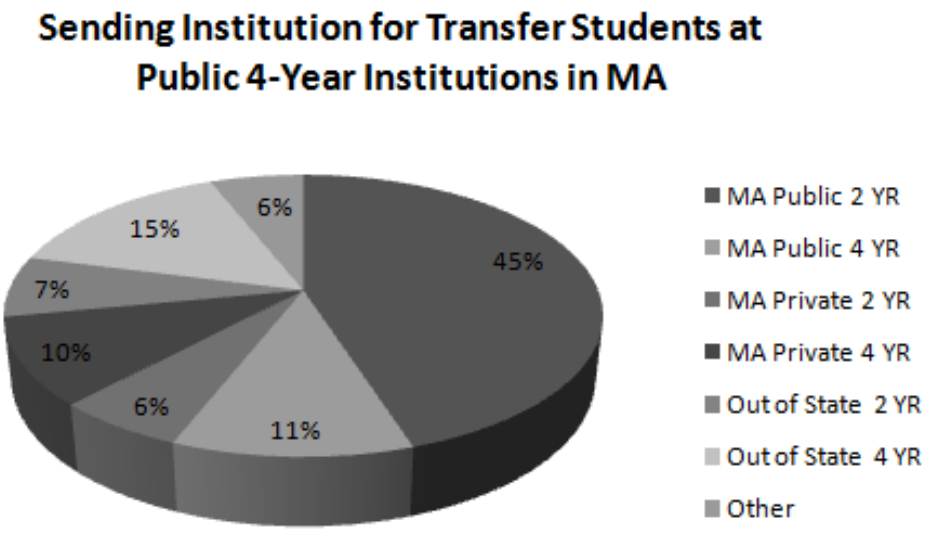
These difficulties are exacerbated by the increasing number of transfer agreements between institutions, which can be challenging to navigate. Porr and Acar (Nov 2010) report that a 1999 survey of 1,172 colleges identified the existence of over 9,000 partnerships between two-year and four-year institutions. A more recent study would reveal that the number of such agreements between institutions would be much higher today. Moreover, the trend in student mobility is no longer simply vertical between two-year and four-year institutions, in that today transfer is multidirectional across institutions. A 2008 report published by the Massachusetts Board of Higher Education (June 2008) illustrated the considerable diversity of the sending institution within the public college system in Massachusetts (see Figure 1). With 22% of the transfer students coming from out of state, 51% from in state two-year colleges, 21% from in state four-year institutions and more than 16% from private institutions, the typical four-year public institution in Massachusetts is faced with assessing the equivalency of a vast number of transfer courses. Given that a third of the incoming students at public four-year institutions in Massachusetts are transfer students (Massachusetts Board of Higher Education, June 2008), identifying transfer equivalencies of courses between institutions

for all incoming transfer students is quite an extensive task.

Given the many difficulties associated with the placement of transfer students, there is a plethora of placement systems used across different institutions in the US. A survey conducted by Ferren and McCafferty (1992) revealed that "placement procedures vary widely in how preparation is measured, and who makes the placement decisions" (p. 88). Even within the Massachusetts public system of four-year universities, institutions have adopted a wide spectrum of placement procedures for transfer students. Our investigation found that Fitchburg State University (2012) administers a placement test to all incoming transfer students required to take a mathematics class, unless they transfer a Calculus I course or higher, or they passed the state-mandated placement test within the past year at their previous institution. On the other hand, Framingham State University (2012) accepts a passing score on a previous placement test, without any time restriction, as well as exempts transfer students from taking a placement test, provided they have transferred in a college-level mathematics course. Moreover, the University also exempts students who have received a C- grade or better in non-credit bearing developmental mathematics courses from certain regional institutions. Finally, at the other end of the spectrum, Worcester State University (2012) requires all incoming transfer students to take the placement test, regardless of their level of mathematics coursework at their previous institution.

Another very important factor to take into consideration regarding the placement of transfer students is that non-credit bearing, developmental courses do not typically transfer between institutions. Hagerdon and DuBray (2010) report that many students take developmental mathematics courses each year, but only few continue to a transfer-based, mathematics course. A study conducted by Adelman (2004) found that 41% of students at a two-year institution and 20% at a four-year institution enroll in at least one remedial course. Often these students do not advance through the course sequence towards the transfer-based, mathematics courses and so they

Figure 1
Diversity of the Sending Institution of Transfer Students at State Universities in Massachusetts



Adapted from Massachusetts Board of Higher Education (June 2008). *Final Report from the Commonwealth Transfer Advisory Group*. Retrieved from http://www.mass.edu/library/Reports/CTAGReport.pdf on 4/4/2012.

are faced with a "developmental climb" (Hagerdon & DuBray, 2010, p. 38) before they can complete a mathematics course that will transfer to another institution.

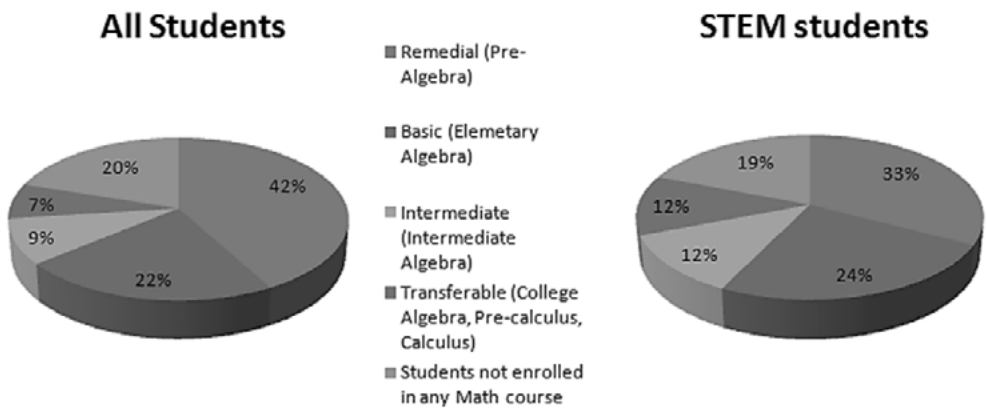
In a study conducted at two-year institutions in Los Angeles, Hagerdon and DuBray (2010) classify the mathematics course offerings at these colleges into the four categories (see Figure 2): *remedial* (Pre-algebra, Math Fundamentals), *basic* (Basic Elementary Algebra, Introduction to Algebra), *intermediate* (Intermediate Algebra), *transferable* (College Algebra, Pre-calculus, Calculus). The study finds that as many as 42% of transfer-hopeful students, and 33% of transfer-hopeful STEM majors, placed in the lowest category of developmental mathematics courses, requiring them to take four courses in order to be able to complete a college-level course that would transfer to the receiving four-year institution. Given this steep "climb" students at two-year colleges face, not many succeed in reaching the level of transferable coursework, and thus, are faced with the likelihood of having to retake a developmental mathematics course at the receiving institution.

It is now apparent that the decisions related to the placement of transfer students are complicated, and have been addressed in different ways by various institutions in the US. In the following, we present a narrative describing a placement system for transfer students adopted at a public four-year institution in the greater New England area, in collaboration with partner two-year colleges, that addresses many of the difficulties presented above, and offers practical implications for other institutions.

THE CASE STUDY

The focus of our case study is the placement system adopted for incoming transfer students at a large public four-year university in Massachusetts. Transfer is a significant pathway to obtaining a bachelor degree at this institution, with over a third of the incoming student population transferring from both two and four-year institutions across the New England area. Given the high density of higher education institutions in the region, the variability of the placement practices and the curriculum of the sending institutions is quite high. Although there are regional partnerships which seek to create seamless transfer between institutions, the task of evaluating the applicability of previous coursework for all transfer students is daunting due to the large number of sending institutions. Thus, the university is faced with the challenging task of as-

Figure 2
Initial Math Enrollment of Transfer Hopeful Students at Community Colleges



Adapted from Hagedorn, L., & DuBray, D. (2010). Math and science success and nonsuccess: Journeys within the community college. *Journal of Women and Minorities in Science and Engineering, 16* (1), 31 – 50.

sessing the readiness of an increasing population of transfer students from a multitude of institutions, with varied placement tests and introductory mathematics curricula.

The introductory level mathematics curriculum of the university consists of two separate tracks calling for different levels of algebraic skills. Students in the humanities and social sciences are on the non-calculus track, and are required to take the Liberal Arts Mathematics or the Elementary Statistics course to complete their mathematics requirement at the institution. On the other hand, students in business or the STEM fields are on the calculus track, which consists of an algebra intensive Pre-calculus course that leads to Calculus. For first-time students, placement in these courses is assessed using an adaptive, standardized, multiple-choice test mandated for all public institutions by the Massachusetts Department of Higher Education (Massachusetts Department of Higher Education, 2012). If students fall short of the cut score on the placement test, they are placed in a non-credit bearing, remedial mathematics course, prior to entering college-level mathematics coursework. For direct placement into Calculus, a second placement test is administered to those students who exceeded the cut score on the first test.

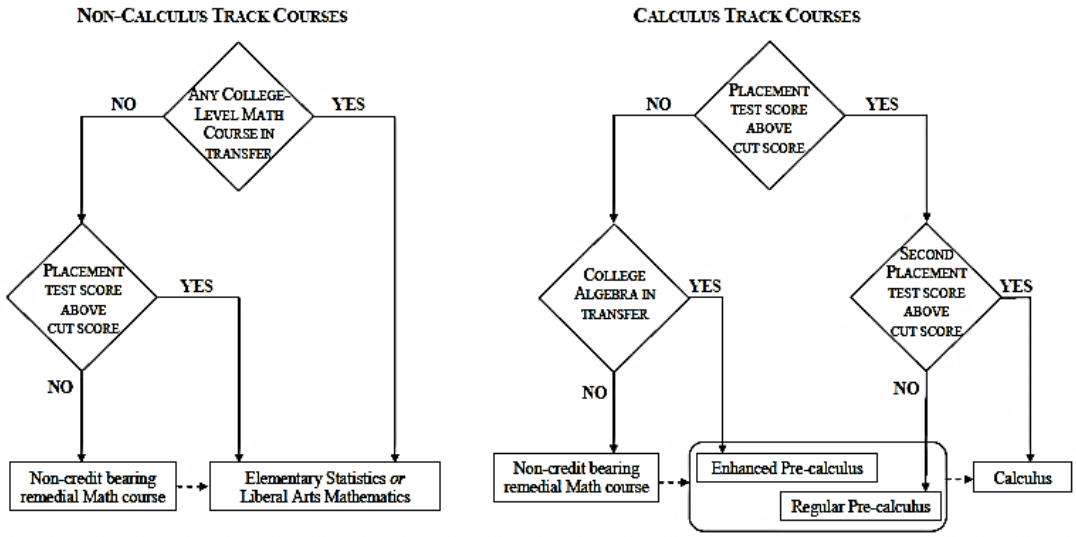
An analysis of the student performance at this institution revealed that the placement test accurately assessed the readiness of first-time students for different introductory level mathematics courses. However, the grades of transfer students in these introductory courses followed a bi-modal distribution, in that the achievement of one group of transfer students was quite poor, while the other group was performing well. This motivated the institution to undergo a self-study of its placement system for transfer students with the goal of diagnosing the reasons for the low achievement of this population of students. It was determined that, in the absence of administering the placement test to transfer students at admission, the other criteria used by the institution to determine placement were not adequately assessing the readiness of the transfer student population. Interestingly, for students on the calculus track, the introductory level mathematics courses completed at the sending institution were not a good predictor for their success in Pre-calculus. In particular, students having completed College Algebra, or the equivalent college-level prerequisite course for Pre-calculus, prior to transfer were also distributed bi-modally in the Pre-calculus course. Finally, time elapsed since the completion of a student's last mathematics course was found to be a good predictor of a transfer student's success in introductory level mathematics courses.

As previously mentioned, placing students into courses tailored to their abilities is an important factor for improving students' success rates (Ferren & McCafferty, 1992). In view of the analysis above, the university established a placement system that would differentiate between different readiness levels of transfer students, while simultaneously honoring transfer agreements with other institutions. In the paragraphs below, we present the placement system adopted by this institution, which is a balanced mixture of administering the placement test to some transfer students, while accepting a carefully chosen selection of courses completed at the sending institution as prerequisites for its introductory-level mathematics courses (see Figure 3).

The reformed placement system for transfer students implemented at this institution established criteria that clearly delineate between students required to take a placement test and those that are exempt from testing. Since many transfer students have already completed the mathematics requirement for their program of study prior to transfer, it is unnecessary to further test this category of students at admission. Furthermore, it is important to differentiate the calculus track from the non-calculus track students, as their success in the mathematics course required by their programs calls for more advanced algebraic skills. At the institution in our study, programs in the business and STEM fields require students to complete Calculus, while students in the humanities and social sciences are on the non-calculus track, and must complete non-algebra intensive courses. Given this clear division of the mathematics requirements by programs, the institution was able to use the declared major of the transfer students to easily delineate between the students on the calculus track and those on the non-calculus track.

For the students on the non-calculus track, the institution agreed to accept any college-level mathematics course in transfer as a prerequisite for Elementary Statistics and Liberal Arts Mathematics, and consequently only test those transfer students who have not completed a college-level mathematics course at another institution.

Figure 3
Reformed Mathematics Placement System for Transfer Students



The successful completion of such a mathematics course was considered a good indicator of a student's ability to succeed in another non-calculus track course, given that neither of these non-calculus track courses are particularly algebra intensive. It is worth noting that a student who has only completed a non-credit bearing remedial mathematics course at another institution will be administered a placement test to determine their level of preparedness. As a result, while a transfer student may be required to repeat a developmental non-credit bearing course, with adequate preparation, the student may be able to circumvent the aforementioned steep "developmental climb" (Hagerdon & DuBray, 2010, p. 38) that many students face at the two-year colleges.

On the other hand, the calculus track students require solid algebraic skills to successfully complete their mathematics requirement, and so the institution adopted more stringent standards for the placement of this population of transfer students. To avoid placing transfer students in courses above their level of preparedness, which offer few opportunities for remediation of poor algebraic skills, the institution decided to identify the students in need of remediation by testing all transfer students on the calculus track whose mathematics courses in transfer were below Pre-calculus.

To address the aforementioned issue of transfer students only partially completing the sequence of courses leading up to Pre-calculus at the sending institution, the university devised a new coding system that enabled it to recognize transfer courses that are not part of its own curriculum, as prerequisites for Pre-calculus. In the new system, the college-level course serving as prerequisite for the Pre-calculus course at the sending institution, commonly referred to as College Algebra, was designated as an appropriate prerequisite for Pre-calculus. That is, at a two-year college offering 12 credits of coursework leading up to Pre-calculus, only the final course in this sequence is recognized as a prerequisite for Pre-calculus at the receiving institution during transfer. This new policy ensures a seamless transfer process between the two institutions, as a student can enroll in the Pre-calculus course at the receiving institution simply by having met the prerequisite for this course at the sending institution.

However, as pointed out above, the successful completion of College Algebra at the sending institution was shown to be a weak predictor of the success of transfer students in Pre-calculus. Since all transfer students who completed College Algebra were required to take the placement test at admission, the institution was able to separate this population of students into two cohorts based on their readiness level. Thus, the university was able to target this population of transfer students who would have otherwise struggled in Pre-calculus, and offer a support system to help

them remediate their lacking algebraic skills. The institutions created special sections of Pre-calculus enhanced by a one-credit tutorial offering additional practice with algebra skills, which hosted the population of transfer students who transferred a College Algebra but fell short of the cut score for Pre-calculus. This solution enabled the institution to offer transfer students in need of remediation, who completed the prerequisite course for Pre-calculus at the sending institution, the much needed help, while still upholding the principle of seamless transfer between institutions.

Accordingly, College Algebra was added among the prerequisites for the enhanced sections of Pre-calculus. Courses that qualify under this designation were identified at sending institutions across the region and flagged in the system. While this solution greatly minimized the administrative labor required at admission for each transfer student, the list of courses designated as College Algebra must be updated periodically to reflect possible curricular changes at the sending institutions.

Since the above described placement system relies heavily on the declared major of the transfer student at admission, it also needs to account for those students who change their major. While under the adopted placement system, a transfer student changing from a calculus to a non-calculus track program requires no additional placement testing, the other direction may require that the student receives further testing. To ensure the proper advising of the rare students who change from a non-calculus track program to a calculus track one, the institution introduced a new change-of-major form requiring special advising for those transfer students changing majors from say History to Chemistry. Furthermore, since the time between mathematics courses was shown to have an important impact on students' success, the institution required transfer students to enroll in a mathematics courses suggested for their program of study in their first semester of transfer. It is worth noting that a similar academic policy is enforced for first-time students in their first semester at the university.

The success of transfer students in their first semester at the receiving institution has been shown to also be strongly influenced by the student's ability to predict the transition process at the new institution and adequately prepare for any upcoming hurdles (Packard, Gagnon, & Senas, 2012). For this reason, communicating the requirements for placement testing and of academic programs to transfer-hopeful students, well in advance of their matriculation, is a key factor in ensuring that upon transfer, students will successfully navigate the requirements of their new institution. Moreover, in an effort to avoid any unnecessary delays in a student's academic program, transfer students should be well-informed about the possible setback placement test results could have on students' timely progress towards the completion of their program of study, as well as be aware of the available options to retake the placement test, if students feel the results of the test do not accurately reflect their abilities (Packard, Gagnon, & Senas, 2012).

To ensure the transparency of the transfer process, the institution developed a website which provides future transfer students with an overview of the mathematics requirements for their academic program, and offers an interactive tool indicating placement in mathematics courses based on previous coursework prior to transfer and a student's score on upcoming placement tests at the new institution. Furthermore, the institution sent individual letters to transfer students prior to their transfer orientation, informing them of whether or not they will be tested, the importance of the placement score for their academic program, as well as offering students the resources needed to review for the placement test. As a result, providing clarity and transparency, in the otherwise highly complex transfer process, allowed transfer students to not feel lost in the intricacies of the system and enabled student agency.

Finally, actively collaborating with higher education institutions in the region is a key factor in improving the efficiency and effectiveness of transfer pathways. As a result, diagnosing institutional barriers and challenges with transfer can be the groundwork for creating a simpler, more transparent placement system for transfer students (Massachusetts Board of Higher Education, June 2008). The institution in our study recognized that communication with partner institutions is an essential component in the implementation of the new placement system, which requires a continuous flow of information garnered from partner institutions about the nature of mathematics courses at their institution. Involving these partner institutions in the trans-

fer process also ensured that students were adequately advised about the courses they needed to complete, prior to transfer to the new institution, which allowed students to make progress in their academic programs without any unnecessary delays. Thus, embracing a holistic approach to advising across institutions takes on a central role in ensuring seamless transfer for students.

The consequences of a poor placement system for transfer students can be wide-ranging, having an impact on both students and the institution. The lack of adequate placement of transfer students can lead to high failing rates in mathematics courses, unnecessary delays in programs of study for students, as well as changes of majors, often to non-STEM fields. Additionally, standards in introductory mathematics courses may be lowered, so as to not leave misplaced students behind, which can have a serious ripple effect on subsequent courses. Anecdotal evidence from this four-year public institution indicates a significant improvement in relation to these issues. Particularly, early data suggests there was a significant increase in the number of students who were able to successfully complete calculus-track coursework, which speaks to the benefits of accurately placing transfer students according to their readiness level.

PRACTICAL IMPLICATIONS FOR OTHER INSTITUTIONS

In a study conducted by Adelman (2005) attempting to draw a portrait of traditional-age students at community colleges across the US, the author emphasizes the importance of recognizing transfer as a significant pathway for obtaining degrees and institutionalizing this venue across higher education institutions.

> "In an era when nearly 60 percent of traditional-age undergraduates attend more than one institution, and in increasingly complex enrollment patterns, (...) it is important to mark transfer as a permanent change of venue, a migration that is formally recognized by system rules" (p.15).

Given that incorrect placement in introductory level courses negatively affects the academic success of transfer students, we strongly recommend administrative action towards implementing policies that place students in courses tailored to their abilities. To benefit from the experience of the case study presented above, we provide recommendations for designing a placement system for transfer students which offer practical implications for other institutions:

- Determining the placement of transfer student in introductory level courses should be a balanced mixture of using placement scores administered at admission to assess the readiness of the students, and accepting courses in transfer as prerequisites for courses at the receiving institution. The specifics of the placement system should be tailored to the curriculum of the receiving institution.
- Given the different algebra skills required to succeed in introductory level mathematics courses, the placement system should distinguish between students on the calculus track versus those on the non-calculus track, when determining the requirements for placement of transfer students into these courses.
- For the assessment of transfer students at admission, the institution should use the same placement tests available for the first-time students, and thus not impose standards on transfer students that are not in place for first-time students. This is especially practical, since the logistics for administering the placement test to a large group of students are already in place at the institution.
- Institutions should shy away from adopting a loose placement system that allows entry to transfer students into mathematics courses for which they are ill prepared. Placing students in courses at the appropriate level, corresponding to each student's readiness level, is a key factor for the retention and long term success of students.
- By developing enhanced sections of introductory-level mathematics courses that offer additional support to students, the institution can continue to honor other institutions' coursework as prerequisites for its own courses, while ensuring that transfer students are not placed in courses above their abilities.

- Since the design and implementation of such a complex placement system requires the involvement of both faculty members and administrators, collaboration between the relevant offices on campus is imperative. Additionally, coding courses from regional institutions commonly transferred by students in the administrative computing system of the receiving institution will greatly diminish the workload of administration offices such as Admissions and Registrar.
- The ability of transfer students to succeed in their first semester has been shown to also be strongly influenced by their ability to predict their transition process at the new institution, and so informing students of the requirements of the placement system in a timely manner should be a priority for the institution.
- Since a low placement test score could potentially set back students' academic progress, the institution should also share review materials with transfer students and clearly communicate the policies about retaking the placement test for students who feel the results do not accurately reflect their level of preparedness.
- Communication with partner institutions is an essential component of implementing a new placement system. Involving these institutions throughout the design and implementation stages of this process ensures that these institutions have their concerns addressed, increasing the likelihood that they will be supportive of the new placement system.
- To ensure seamless transfer, it is important to reach out to higher education institutions in the region and to take a more holistic approach to advising transfer students across institutions. This can potentially help avoid any unnecessary delays for students, by ensuring that they are advised to complete the mathematics courses relevant to their long term academic goals, prior to transfer.

Higher education institutions across the US have concentrated institutional efforts on ensuring the success of first-time students through various programs such as academic communities, freshmen seminars and comprehensive orientation and mentoring programs. Far fewer efforts have been exerted to ensure the retention and success of transfer students. In particular, the placement of transfer students in introductory level courses corresponding to their readiness level remains an institutional area widely ignored in the literature and subject to great variability in practice across the US. This issue takes on a primary role in the retention of STEM students, as the placement of a transfer student in a gateway course above their level of preparedness often leads to a change of major to a less mathematics intensive program. It is therefore important for the retention and success of transfer students that higher education institutions prioritize the correct placement of transfer students alongside seamless transfer, and direct their institutional efforts to this end. Given the continuous increase in the number of transfer students and the multitude of transfer patterns over the years, higher education institutions should take decisive administrative action towards designing and implementing a smooth, efficient, and transparent mathematics placement system for transfer students.

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