Texas Association of Community Colleges

Course Repetition in College-level Mathematics Courses Among Community College Transfer Students

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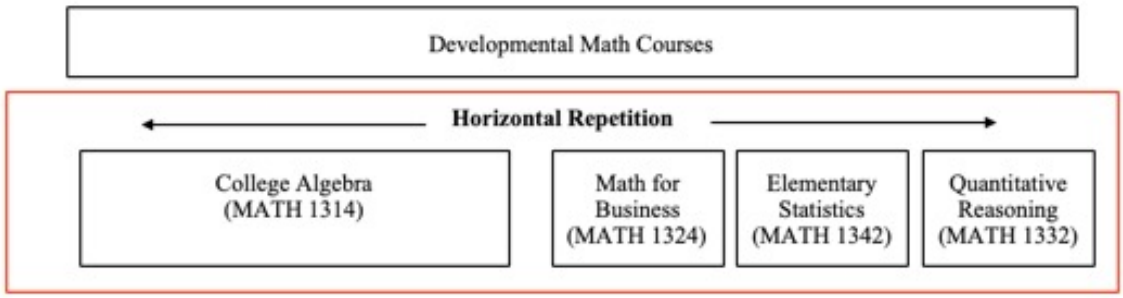
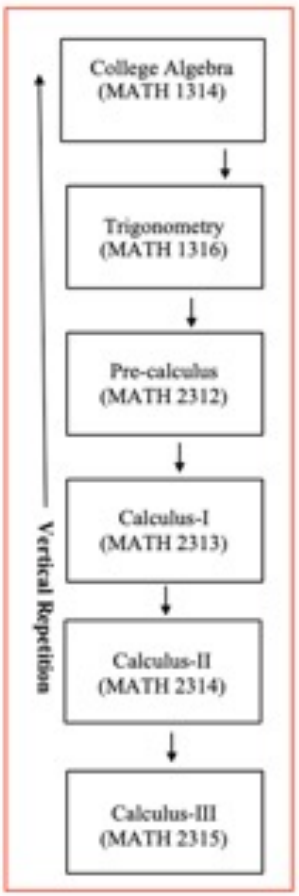
Course repetition in college is a complex phenomenon. Unnecessary repetition might discourage students from pursuing higher education and lead students to drop out of college. However, a student fails a course and repeats it, they may gain the benefit from more time with the content to earn a passing grade. One type of unnecessary course repetition occurs when students repeat a course even though they previously passed and earned credit in the course. When this type of course repetition is prevalent, it highlights systemic inefficiencies for students, colleges and taxpayers.

In this study, I use student-level state administrative data from Texas to examine how course repetition in math course-taking predicts transfer student outcomes, including grade point average (GPA) and baccalaureate (BA) degree attainment. Leveraging detailed transcript data, I examine two types of math course repetition: *horizontal repetition and vertical repetition*.

- Horizontal repetition occurs when students enroll in and earn credit for more than one different entry-level mathematics course (e.g., college algebra and quantitative reasoning).



- Vertical repetition occurs when students take redundant coursework within a given mathematics course sequence (e.g., repeat the same math course after earning credit or enroll in a lower-level course, like college algebra, after earning credit in a higher-level math course, like trigonometry).



In Texas, degree-seeking students need to take at least one introductory college-level math course (e.g., math for business). Some students need to finish a sequence of math courses leading to higher-level math (e.g., college algebra to calculus). In a well-designed system, one introductory math course should satisfy the first college-level math requirement for many majors. If there is evidence that students take and earn credit for more than one introductory course, there may be systemic issues to address within and across institutions. Similarly, in a specific math course sequence, students who earn course credit should take the next upper-level course. If there is evidence that students are repeating courses after earning credit or moving backwards to lower-level courses, it could indicate inefficiencies to examine. The prevalence of unnecessary course repetition among community college transfer students in Texas institutions of higher education is the reason I want to understand both vertical and horizontal course repetition.

Research Questions

1. What proportion of community college transfer students experience vertical and horizontal math course repetition? Which students are most likely to experience math course repetition and at which institution level?
2. What is the relationship between each type of math course repetition and college outcomes (GPA, BA attainment, time to a bachelor's degree, and excess credits)?

Data and Study Design

I created two analytic (though overlapping) samples:

- *Introductory college-level math completers*: transfer students who completed at least one of the four introductory college-level math courses (college algebra, elementary statistics, quantitative reasoning, and business for math) with a passing grade (D or better) at community colleges (N=10,059)
- *Any college-level math completers*: transfer students who completed any of 12 college-level mathematics courses with a passing grade (D or better) at community colleges (N=11,273)

For research question 1, I used descriptive statistics to examine:

- each type of math course repetition
- where it occurs (at the community college-level versus at the university-level)

For research question 2, I fitted OLS regression models to examine the relationship between each type of math course repetition (with separate regressions for horizontal and vertical repetition indicators) and each college outcome:

- cumulative GPA
- baccalaureate degree attainment
- time to a bachelor's degree
- excess credits for a degree

Findings

Prevalence of course repetition (RQ1)

- Horizontal repetition was prevalent among transfer students:
  - 42% of introductory math completers repeated at least one introductory college-level math course (n=4,188)
  - While 26% of horizontal repetition occurred at a community college, 18% of the same repetition occurred at a university.
- Vertical repetition was less common, but still quite substantial:
  - 17% of students who previously completed any college-level math course retook the same level or a lower-level course within the same math sequence (n=1,914).

- While 8% of vertical repetition occurred at a community college, 10% of the same repetition occurred at a university.

Relationship between course repetition and outcomes (RQ2)
Math course repetition appears to have consequences for students.

- Horizontal repeaters (introductory college completers)
  - are more likely to have higher GPAs,
  - are more likely to earn a BA within 7 years, and
  - earn 2.8 additional credit hours compared to non-repeaters, but
  - do not experience an impact on the time to degree.
- Vertical repeaters (any college-level math completers)
  - are more likely to have lower GPAs,
  - are less likely to earn a BA within 7 years, and
  - are more likely to take longer to complete a degree compared to non-repeaters,
  - with 5.4 additional credit hours.

My findings suggest that differentiating between types of math course repetition is necessary to fully understand the association between math course repetition and student outcomes.

Recommendations

As vertical and horizontal repetitions occurred at both the community college and university-level, reducing unnecessary repetition will require structural changes and interdisciplinary approaches from multiple stakeholders. Depending on the types of repetition, community colleges and universities have different roles to address this issue.

To reduce unnecessary course repetitions in math courses, colleges can:

- Align first college-level math courses within meta majors (clusters of programs that lead to similar career goals)
- Determine where vertical repetition occurs and review program maps and/or provide targeted supports at the course- and program-level to address vertical repetition
- Use the course repetition framework to develop analytical tools to identify course repetitions and associated supports
  - Examples: early warning systems that triggers advisor and faculty support, student outreach, and data-informed program mapping
- Use disaggregated data to examine course-taking patterns

Within any college, the intentional use of internal data analytics could decrease course repetition and reduce excess credits, Institutional research (IR) offices at community colleges and universities could use this study's repetition identification strategy and apply it to examine patterns at their institutions in multiple departments. I recommend that IR offices use data to identify critical courses that their students usually repeat, which will help them target courses and sequences that could be improved.

Future Research

In my study, I was able to identify the prevalence of math course repetition and its association with student outcomes. However, I was not able to determine why course repetition occurred and any additional impact it may have on students beyond my chosen outcome metrics. More qualitative approaches are needed to understand the experiences of students repeating courses to fully inform practice and policy aimed at reducing unnecessary repetition at community colleges and universities.

Full Report

The full report, including the methodology, outcomes, limitations, and description of future research is available at https://tacc.org/tsc.