

Repetition in College-level Math Courses Among Community College Transfer Students

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Overview

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Introduction

• GOAL

- To examine the **course repetition patterns in college-level math courses** among community college transfer students
- To examine how **math course repetitions** are related to student outcomes (GPA, bachelor's degree attainment, time to degree, and excess credits)
- WHY this study matters
 - Understanding course-taking patterns is necessary to inform practices and policies aimed at **student success**.
 - Can inform institutional practices such as:
 - Program planning
 - Advising and student support
 - Institutional research
 - Guided pathways implementation



Types of Course Repetition



- Horizontal Repetition (redundancy) among introductory level mathematics course completers
 - Taking an additional introductory college-level math course after passing another introductory college-level math
 - For example: a student takes college algebra after passing quantitative reasoning
- Vertical Repetition among any college-level mathematics course completers
 - Taking the same or lower-level course after passing any college-level course in a specific sequence (e.g., college algebra-calculus sequence or math for business-business calculus sequence)
 - For example: a student takes college algebra after passing trigonometry





Research Questions

- How common is math course repetition among community college transfer students?
 - Horizontal and Vertical Repetition
- Where does the course repetition occur?
 - Community college or university?
 - Within a single institution or across multiple institutions?
- Do college outcomes of students vary by students' course repetition status? [1) Cumulative GPA, 2) bachelor's degree attainment within seven-years, 3) time to a degree among those who earned a bachelor's degree, and 4) cumulative excess credits]
- How do course repetitions predict college outcomes of students?



Methodology

• DATA

- The Texas Common Course Numbering System for math courses and ERC (Education Research Center)
- Student-level transcript (course-taking) data from THECB (Texas Higher Education Coordinating Board)
- METHOD
 - Descriptive analysis and OLS regression
- SAMPLE
 - Those who transferred to a university within three-years of matriculation over 7 years
 - Those who successfully *enrolled and earned credit in a* college-level math course at community college
 - First-time community college starters in Fall 2011 and Fall 2012 in Texas



Methodology

Two analytic samples

- Horizontal repetition sample (n=10,059)
 - Includes students *eligible* for horizontal repetition:

Students who *enrolled and earned credit in at least one of the four introductory collegelevel math courses* at a community college

(college algebra, elementary statistics, quantitative reasoning, and business for math)

- Excludes students who enrolled and then dropped or failed a math course
- Vertical repetition sample (n=11,273)
 - Includes students *eligible* for vertical repetition:

Students who *enrolled and earned credit in any college-level math course* at a community college

• Excludes students who enrolled and then dropped or failed a math course



How common are horizontal repetitions?



• Two-fifths of students (41.6%, n=4,188) experienced horizontal repetition by taking additional introductory college-level math coursework after passing an introductory college-level course

(i.e., a student enrolled in and earned credit in more than one type of gateway math course).



Where do horizontal repetitions occur?



- Transfer students are more likely to repeat courses at community college (26%) compared to at university (18%).
- At the community college level, 92% of horizontal repetition occurred within the same community college.
- Some students about 2.9% experienced horizontal repetition at both the university and community college level.



How common are vertical repetitions?



• 17% of transfer students retook the same level or a lower-level course within the specific sequence

(i.e., a student enrolled in and earned credit in a math course and then repeated the course, like passing and retaking calculus; or a student enrolled in and earned credit in a math course and then took a lower-level math course, like passing calculus and then taking precalculus).



Where do vertical repetitions occur?



- Vertical repetition occurred more frequently at the university level (9.5%);
- 8.3% of vertical repetitions occurred at the community college level (with some students experiencing it at both)
 - At the community college level, 91% of vertical repetition (which took place before transfer) occurred within a single community college



Descriptive patterns: Relationships between course repetition and outcomes



Cumulative GPA by Repetition Patterns



- Horizontal repeaters had marginally higher GPAs than non-horizontal repeaters (3.36 versus 3.34).
- Non-vertical repeaters had higher GPAs (3.39) than vertical repeaters (3.23 GPA).



Bachelor's Degree Attainment by Repetition Patterns



- 62% of horizontal repeaters finished a bachelor's degree within seven years compared to 59% of nonhorizontal repeaters.
- While 63% of non-vertical repeaters earned a bachelor's degree within seven years, only 53% of vertical repeaters did so.



Texas Success Center

Time to Bachelor's Degree by Repetition Patterns

Time to a Bachelor's Degree among Those who Earned a Bachelor's Degree



- Among students who earned a bachelor's degree, horizontal repeaters took a little bit longer to finish a bachelor's degree (15.2 semesters versus 15.1 semesters).
- Among students who earned a bachelor's degree, non-vertical repeaters took less time to complete (15.1 semesters versus 15.5 semesters).



Excess Credits by Repetition Patterns



 Both horizontal and vertical repeaters accumulated more excess credits (beyond 120 requirement) than their non-repeater peers:

• About 3 excess credits for horizontal and 6 excess credits for vertical repeaters.



Regression results: Relationship between course repetition and outcomes



Regression Findings for Horizontal Repeaters

OLS Regression Results Examining Relationship Between Horizontal Math Course Repetition and Various Student Outcomes (Cumulative GPA, Bachelor's Degree Attainment within Seven-years, Time to Bachelor's Degree (Semesters) and Excess Credits)

	(Model 1)	(Model 2)	(Model 3)	(Model 4)
Variables	Cumulative GPA	BA Attainment within 7-years	Time to Degree (Semesters)	Excess Credits
Horizontal Repeater	<mark>0.024*</mark>	<mark>0.020*</mark>	<mark>0.052</mark>	<mark>2.894***</mark>
(reference=non-repeaters)	<mark>(0.009)</mark>	<mark>(0.009)</mark>	<mark>(0.053)</mark>	<mark>(0.362)</mark>
Student Backgrounds	Х	Х	Х	Х
College Experiences	Х	Х	Х	Х
Cohort Fixed-Effects	Х	Х	Х	Х
Observations	10,059	10,059	7,132	7,132
R-squared	0.092	0.148	0.327	0.243

Student backgrounds: gender, race, international students and age

<u>**College experiences:**</u> FAFSA filing status, Pell grant recipients, enrollment patterns, stopout, associate degree earning status, major switcher, student meta major, developmental math credits, and GPA



Regression Findings for Vertical Repeaters

OLS Regression Results Examining Relationship Between Vertical Math Course Repetition and Various Student Outcomes (Cumulative GPA, Bachelor's Degree Attainment within Seven-years, Time to Bachelor's Degree (Semesters) and Excess Credits)

	(Model 1)	(Model 2)	(Model 3)	(Model 4)
Variables	Cumulative GPA	BA Attainment within 7-years	Time to Degree (Semesters)	Excess Credits
Vertical Repeaters	-0.138***	<mark>-0.048***</mark>	0.271***	<mark>5.370***</mark>
(reference=non-repeaters)	<mark>(0.012)</mark>	<mark>(0.012)</mark>	<mark>(0.047)</mark>	<mark>(0.390)</mark>
Student Backgrounds	Х	Х	Х	Х
College Experiences	Х	Х	Х	Х
Cohort Fixed-Effects	Х	Х	Х	Х
Observations	11,273	11,273	8,078	8,078
R-squared	0.099	0.146	0.328	0.247

Student backgrounds: gender, race, international students and age

College experiences: FAFSA filing status, Pell grant recipients, enrollment patterns, stopout, associate degree earning status, major switcher, student meta major, developmental math credits, and GPA



Discussion

- Math course repetition appears to have consequences for students
 - Horizontal repeaters (introductory college completers)
 - are more likely to have higher GPAs and
 - are more likely to earn a BA within 7 years compared to non-repeaters,
 - with 2.8 additional credit hours.
 - does not seem to impact the time to degree.
 - Vertical repeaters (any college-level math completers)
 - are more likely to have lower GPAs and
 - are less likely to earn a BA within 7 years compared to non-repeaters,
 - are more likely to take longer to complete a degree,
 - with 5.4 additional credit hours.



Implications

- Colleges can align first college-level math courses within meta majors (clusters of programs that lead to similar career goals)
- Colleges can determine where vertical repetition occurs and review program maps and/or provide targeted supports at the course- and program-level to address vertical repetition
- Colleges can 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



Limitations and Future Research

- While my study answered questions about math course repetition, I don't know why it occurs. A qualitative companion study would provide additional knowledge.
- I studied students from the Fall 2011 and Fall 2012 cohorts prior to guided pathways in Texas community colleges. A study with **cohort data after guided pathways implementation** would provide additional knowledge.
- A causal study to explore guided pathways implementation and math course repetition would provide additional knowledge.
- I chose only to include transfer students, but a study of **all community college students** would provide additional knowledge.



Thank you!

Questions?

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