

Course Repetition Patterns in College-level Mathematics Courses among Community College Transfer Students

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Introduction

• GOAL

- To examine the course repetition patterns in college-level math courses among community college transfer students
- WHY this study matters
 - Taking excess credits is not good for students, institutions and the state.
 - Avoiding unnecessary credits
 - Inform institutional practices
 - Advising
 - Institutional research
 - Guided pathways implementation



Types of Course Repetition



• Horizontal repetition (redundancy)

- Taking additional gateway college-level math course even after already passing another introductory college-level math
- For example, a student takes college algebra after passing quantitative reasoning

• Vertical Repetition

- Taking the same or lower level course after passing any collegelevel 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





Figure 1: Horizontal and Vertical Course Repetitions in Mathematics





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 six-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
- ERC (Education Research Center)
- Student-level transcript (course-taking) data from THECB
- METHOD
 - Descriptive analysis and regression results
- SAMPLE
 - Those who transferred to a university within six-years of matriculation
 - Those who successfully *took and passed a* college-level math course at CC
 - First-time community college starters in 2011-2012 and 2012-2013 in Texas



Methodology

Two analytic samples

- Horizontal repetition (n=33,205)
 - includes students *eligible* for horizontal repetition: students who took and passed at least one of the four introductory college-level courses (college algebra, elementary statistics, quantitative reasoning, and business for math) at a community college
- Vertical repetition (n=36,079)
 - includes students *eligible* for vertical repetition: students who took and passed *any* college-level math course at a community college



Four patterns of course repetitions

			Community College	University
Vertical repetition sample: students passed any college-level course from 12 categories	Ever-vertical repeaters	Pattern 1	Passed college algebra and retook college algebra	-
		Pattern 2	Passed college algebra	Retook college algebra
	Never-vertical repeaters	Non-repeaters	Passed college algebra	
Horizontal repetition sample: students passed at least one of the four gateway math courses (college algebra, elementary statistics, quantitative reasoning and business for math)	Ever-Horizontal Repeater	Pattern 3	Passed college algebra and then took quantitative reasoning	-
		Pattern 4	Passed college algebra	Took quantitative reasoning
	Never-horizontal repeater	Non-repeaters	Passed college algebra	



How common is horizontal repetition?



- Two-fifths of students (40.6%, n=13,489) took additional introductory college-level math coursework after passing an introductory college-level course (i.e., they took more than one type of gateway math course).
- Transfer students are more likely to repeat those courses at a community college (29.1%) compared to at university (14.1%) (note that some students – about 2.5% – experienced horizontal repetition at both the university and community college level).
 - At the community college level, 87.3% of horizontal repetition occurred within the same community college **Texas Success Center**

How common is vertical repetition?



- 17% of transfer students retook the same level or a lower-level course within the specific sequence.
- Vertical repetition also occurred more frequently at the community college level (11%); 8% occurred at the university level (with some students experiencing it at both)
 - At the community college level, 87.6% 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



- Ever-horizontal repeaters had marginally higher GPAs than never-horizontal repeaters (3.32 versus 3.31).
- Never-vertical repeaters had higher GPAs (3.36) than ever-vertical repeaters (3.18 GPA).



Texas Success Center

Bachelor's Degree Attainment by Repetition Patterns



- Similar percentage of everhorizontal repeaters (39%) finished a bachelor's degree within six years compared to never-horizontal repeaters (37%).
- While 40% of never-vertical repeaters earned a bachelor's degree within six years, only 30% of ever-vertical reperformed a conter

Time to Bachelor's Degree by Repetition Patterns



- Among students who earned a bachelor's degree, ever-horizontal repeaters took them a little bit longer to finish a bachelor's degree (14.9 semesters versus 14.8 semesters).
- Among students who earned a bachelor's degree, never-vertical repeaters took less time to complete (15 semesters versus 14.8 semesters).



Excess Credits by Repetition Patterns



• Also, both everrepeaters accumulated more excess credits (beyond 120 requirement) than their never-repeater peers (about 3 credits for horizontal and 7 credits for vertical).



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 Six-years, Time to Bachelor's Degree (Semesters) and Excess Credits)

	(Model 1)	(Model 2)	(Model 3)	(Model 4)
Variables	Cumulative GPA	BA Attainment within 6-years	Time to Degree (Semesters)	Excess Credits
Ever-Horizontal Repeater	<mark>-0.001</mark>	<mark>0.005</mark>	<mark>0.101**</mark>	<mark>3.593***</mark>
(reference=never-repeaters)	<mark>(0.006)</mark>	<mark>(0.005)</mark>	<mark>(0.035)</mark>	<mark>(0.290)</mark>
Student Backgrounds	Х	Х	Х	Х
College Experiences	Х	Х	Х	Х
Cohort Fixed-Effects	Х	Х	Х	Х
Observations	29,675	29,675	11,942	11,942
R-squared	0.099	0.150	0.287	0.203



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 Six-years, Time to Bachelor's Degree (Semesters) and Excess Credits)

3 ()	(Model 1)	(Model 2)	(Model 3)	(Model 4)
Variables	Cumulative GPA	BA Attainment within 6-years	Time to Degree (Semesters)	Excess Credits
Ever-vertical Repeaters	<mark>-0.161***</mark>	-0.065***	<mark>0.164***</mark>	<mark>5.290***</mark>
(reference=never-repeaters)	<mark>(0.007)</mark>	<mark>(0.007)</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	32,334	32,334	13,346	13,346
R-squared	0.111	0.154	0.288	0.215



Discussion

- Math course repetition appears to have consequences for students
 - Some evidence that it lowers probability of earning bachelor's degree (vertical repetition)
 - Also seems to increase time and credits to degree (horizontal and vertical)



Implications for Colleges

- Importance of aligning students' first college-level math course with meta majors
- Developing advising strategies
- Develop data analytics tools to identify course repetitions
 - Early warning system
- Use disaggregated data to examine course-taking patterns



Future Research and Limitation

- Another study with post-guided pathways data
 - Compare post and past
 - Causal study
 - colleges started to implement mathematics pathways different times
- Include all community college students



Thank you!

Questions?

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