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

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Overview

- Introduction
- Types of course repetitions
- Research questions
- Methodology
- Descriptive findings
- Findings from regression analyses
- Discussion and implications
- Limitations and future research
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 college-level 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).

![Bar chart showing vertical repetition rates]

- Repeaters: 17%
- Non-repeaters: 83%
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.

![Vertical Repetition Chart]

[Community College: 8.3%] [University: 9.5%]
Descriptive patterns: Relationships between course repetition and outcomes
Cumulative GPA by Repetition Patterns

<table>
<thead>
<tr>
<th></th>
<th>Horizontal Repeaters</th>
<th>Non-horizontal Repeaters</th>
<th>Vertical Repeaters</th>
<th>Non-vertical Repeaters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative GPA</td>
<td>3.36</td>
<td>3.34</td>
<td>3.23</td>
<td>3.39</td>
</tr>
</tbody>
</table>

- 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 non-horizontal repeaters.

- While 63% of non-vertical repeaters earned a bachelor's degree within seven years, only 53% of vertical repeaters did so.
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.

<table>
<thead>
<tr>
<th></th>
<th>Excess Cumulative Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal</td>
<td>17</td>
</tr>
<tr>
<td>Non-horizontal</td>
<td>14</td>
</tr>
<tr>
<td>Vertical</td>
<td>20</td>
</tr>
<tr>
<td>Non-vertical</td>
<td>14</td>
</tr>
</tbody>
</table>
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)

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

**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

*Significance levels: *p* < 0.05, **p* < 0.01, ***p* < 0.001
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)

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

**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

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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

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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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