Math Remediation in the US: Recent Results

AMATYC Pre-Conference Workshop:
Entering College Without Mathematics Pre-Requisites
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Outline

What do recent studies tell us about math student remediation in the US?
Overview of 7 studies, that look at student remediation in mathematics

Different foci:
Students, institutions/departments, teaching, learning
New Evidence on College Remediation, Attewell et al. (2006)

Research Question:
• Do students who complete some remedial coursework have superior prospects of graduating than students who don’t?

Method
• Sample: All students in NELS 88 who participated in all waves, had HS and college transcripts (N=6,879) representing 2,000,732.
• Outcome variables: Graduating with degree, Interrupted college (1+ semester), Earned 10+ credits, Time to bachelor’s degree
• Controls: Individual-academic skills and achievement (8th & 12th grade math and reading test scores, curricular intensity, math in HS), orientation to academic work, race, SES; Context: (% students who graduated, free lunch, location); Type of college
• Logistic regression
Findings, Attewell et al. (2006)

- 2-YCs are considerably more likely to place a student in remedial courses than 4-YCs (11%), even for students with equivalent academic skills and background.
- African American students are more likely to enroll in college remedial courses than White students (11%) with the same academic skills and preparation and social background.
- At 2-YCs, students taking remediation courses have similar graduation rates than students who do not need remediation.
- There is no statistically significant difference between students who took and did not take remedial courses in terms of taking time out of college and receiving a degree.
- On average students with remediation took between 2 and 3 extra months to complete their degree than students with no remediation.
- Taking multiple remedial courses at 2-YCs does not reduce students’ chances of graduation.
- Students who took two or more remedial math courses in 4-YC had the same probability of graduating than students who didn’t, but it reduced their chances by 3% in 2-YCs.
Does Math Remediation Work?
A comparative analysis of academic attainment among community college students, P. Bahr, 2008
Research Question:
• Does remediation in math resolve the academic disadvantage faced by mathematically underprepared students?

Method
• Sample: Fall 1995 cohort of all first-time college freshmen who enrolled in any of California’s 107 semester-based community colleges (N = 202,484) followed through Spring 2001/3 (N = 85,894)
• Outcome variable: Academic Attainment (credential)
• Groups: College math Completer, College math Non-completer, Remedial math Completer, Remedial math Non-completer.
• Controls individual (e.g., sex, race, age, SES, enrollment pattern, academic goal, English proficiency, interaction with advising services) and college (e.g., size, math competency, college goal orientation)
• Logistic regression
Findings: Bahr (2008)

- Students who remediate successfully experience outcomes that effectively are equivalent to those of students who do not require remediation indicating that math programs are highly effective at resolving skill deficiencies
  - Typical completers (with and w/o remediation) have nearly 65% chance of transferring and 30% chance of neither completing a credential nor transferring
  - Typical non-completers (with remediation) have 10% chance of transferring and 83% of neither completing nor transferring
- The majority of remedial math students do not remediate successfully and the outcomes of these students are not favorable
  - Typical non-completers (w/o remediation) have 21% chance of transferring and 73% chance of neither completing nor transferring
Revisiting the efficacy of postsecondary remediation: The moderating effects of depth/breadth of deficiency, P. Bahr, 2010

Research Question:

• To what extent does depth and breadth of underpreparation at college entry moderate the effect of successful remediation on academic attainment?

Method

• Sample: Same as Bahr, 2008, but narrowed down to students who also took a substantive English course, but were not ESL students.
• Outcome variable: Academic Attainment (credential)
• Groups: Level of skill at college entry, level of skill attained
• Individual Controls: sex, race, age, SES, enrollment pattern, academic goal, grade in first English course, and grade in first math course.
• Two-level hierarchical multinomial regression
Findings: Bahr (2010)

• The severity of English and math deficiencies are correlated.
• The greater the number of initial deficiencies a student has, the less likely a student is of attaining college-level skills.
• Students that achieve college-level competency in English and math, regardless of the depth or breadth of their incoming deficiencies, have similar levels of attainment as those without deficiencies.
Remedial/developmental education and the cost of community college transfer: A Los Angeles County sample, T. Melguizo, L. Hagadorn, S. Cypers, 2008

Research Question:

• What were the actual monetary costs and actual costs in terms of time of transferring for individuals with different remediation needs?

Method

• Sample: 5,011 students enrolled in the nine Los Angeles Community Colleges, focus on a subsample of 411 students who fully participated in a survey and successfully transferred to a 4-year institution.
• Outcome variables: Time and cost to transfer
• Groups: Level of skill at college entry
• Individual Controls: Gender, SES, race/ethnicity, age, English placement score, math placement score, cumulative GPA, determination index, and academic integration index
• Regression analysis
Findings: Melguizo et al. (2008)

- The more a student needs remediation, the more the cost to transfer will be, both in terms of money and time.
- Students who started at the lowest level of remediation, holding all else constant, spent an additional half of a semester before transferring.
- States that the problem will exist until there is a “major overhaul of the educational system” and the short term solution is to improve secondary education.
Strengthening Pre-collegiate Education in Community Colleges (SPECC), The Carnegie Foundation for the Advancement of Teaching (2008)

Purpose:
• To increase student learning in developmental—or basic skills—classes, through faculty inquiry
• Help campuses build capacity for ongoing improvement

Method:
• Sample: 11 community colleges in California already engaged in change (Cerritos, Chabot, City San Francisco, C. Desert, C. Sequoias, Glendale, Laney, Los Médanos, Merced, Pasadena, West Hills C. Dist)
• Action Research strategy: each campus defined interventions based on their local needs, strengths, and constraints (e.g., learning communities, instructional technology, reading instruction, supplemental academic support, Faculty Inquiry Groups)
• Findings (Carnegie Foundation, 2008)

• Designs for Learning: High structure, high challenge, intensity, intentionality and learning how to learn, inquiry and assessment to make learning visible

• Faculty learning and development: Connected to a vision of student learning, curriculum and assessment, ongoing, collaborative, rooted in inquiry and evidence about learning

• Evidence has a role in improving student learning: institutional level, classroom level (think aloud, portfolios), gathering evidence to support claims about change

• Specific recommendations at the Faculty, College, and System level: Professional development, institutional research, design of measures of student learning, strengthening connections to share innovations
Similarities and differences in classroom interaction between remedial and college mathematics classrooms in a community college, Mesa (accepted)

Question:
• What similarities and differences can be observed in the teaching of remedial and STEM preparatory college mathematics classrooms taught at a community college?
• What expectations about mathematics are evident in the classroom activities in both remedial and STEM preparatory college mathematics classrooms?

Method
Sample: 51 lessons from 10 instructors, 5 teaching remedial courses (arithmetic, algebra), 5 teaching STEM prep courses (college algebra, trig, pre-calc)
Data: audio recordings, interviews, class observations
Analysis: Questioning practices, Cognitive complexity of mathematical activity
Findings, Mesa (accepted)

• The classes observed were highly interactive, with similar number of turns (105 vs. 96), and similar number of student turns (6 vs. 4) in each type of course, after controlling for class length and number of students in class.

• Teachers posed a large number of questions (~162), with teachers in remedial courses asking more questions that require an answer than teachers in preparatory stem courses (51% vs. 14%).

• Teachers in prep-STEM courses asked more questions that did not require an answer (58% vs. 27%).

• In both types of courses teachers and students solve very few activities with advanced processes with either type of knowledge.

• Teachers in remedial courses use a larger proportion of activities that demand application of procedures (55% vs. 40%) and a smaller proportion of activities that demand attention to concepts (10% vs. 19%) than instructors in STEM.

• In STEM preparatory courses there is a larger proportion of activities that use conceptual knowledge than in remedial classes and a larger proportion of activities that require remembering and recalling than in remedial classes.
What community college developmental mathematics students understand about mathematics, J. Stigler, K. Givvin, B. Thompson, 2010

Research Questions:
• What do students understand about mathematics concepts that underlie the topics they have been taught?
• Is there evidence that students used reasoning in answering math questions?

Method
• Sample: 5,830 students from one year at one college/784 developmental students from 4 community colleges
• Data: responses to a Mathematics Diagnostic Test, shorter survey of 23 questions based on common errors of the MDTP
• Groups: arithmetic, pre-algebra, algebra
• Descriptive analysis of incorrect responses and comparison of percent correct responses
Findings: Stigler et al. (2010)

- Students are relying on procedures rather than number sense or reasoning, which are being carried out incorrectly or inappropriately.
- Students lack a basic fluency in the representation of decimals, fractions, and percents.
- In the written survey students who place in algebra do not seem to vary from those placed in arithmetic or pre-algebra in terms of conceptual understanding; the main difference is in their ability to correctly carry out procedures.
Concluding Thoughts

Higher education studies: more global, attending to impact of remediation, larger samples, quantitative methodologies → remediation when successful fulfills its purpose; still unsuccessful remediation is a problem

Math education studies: local, specific questions about teaching and learning in the context of remedial courses → guided inquiry into teaching and learning can improve practice
References


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