Institutional Analysis, Assessment & Reporting

The Relationship of Grade and Instructor in First Math Course and Performance in Second Math Course
Research Report 2006-04

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April, 2006

Abstract

This study followed new freshmen from their first math course enrollment to the second time that they took math. Grades in the first math course were related both to re-enrollment in math and to grades in the second course. Students who were most likely to perform poorly in a second math course were "C" students who moved to the next level of math and "F" students who re-took the same course. The instructor of the first-course also played a large role in predicting how students would perform in their second math course, though the hypothesis that easy graders would disadvantage their students and hard graders would help their students in the second math course was not confirmed.

Previous research[1] found that a large percentage of freshmen were performing poorly in their first math course and that the instructor significantly impacted student grades in the course. This study followed new freshmen from Fall 2003 and Fall 2004 though Fall 2005 to their second enrollment in mathematics, whether it was the same course or the next course in the math sequence. The questions of interest were:

- Did the grade in the first math course influence enrollment in the second math course and the grade received in that course?
- Did the instructor that students had in their first math course influence the grades received in the second course?

Enrollment and Grades in the Second Math Course

Since about 60% of new freshmen enrolled in either MATH 25 or MATH 108, we tracked enrollment and grades in a second math course only for this group of students (other data available upon request). Table 1 displays the findings for MATH 25, while Table 2 covers MATH 108. Note that the percentage of students who continued to enroll in math through Fall 2005 dropped precipitously as the grade changed from "A" to "F". In addition, about two-thirds of the students in MATH 25 who received a grade of "C" and moved to MATH 108, performed poorly in the second course. Students who had a "C" in MATH 108 and moved to MATH 143 did somewhat better with about 40% receiving a grade of "D" or "F" in the second course. Students who failed either MATH 25 or 108 were at special risk; only 23% of the students who re-enrolled in MATH 25 passed the second time, while only 30% of MATH 108 re-takers passed. In addition, only 37% of students who initially failed MATH 25 and 43% of students who initially failed MATH 108 had re-enrolled in a math course by Fall 2005.

[1] See *The Relationship of Grades in First Math Course and Tests Scores for Fall 2003 and Fall 2004 First-Time-in-College Students,* available through the office of Institutional Analysis, Assessment, and Reporting

Table 1. Math 25 Grades and Further Enrollment
Number Enrolled: 806

First Grade	A	B	C	D	F, W, CW
# Who Received 1st Grade of:	31	104	147	106	418
% Who Received 1st Grade of:	3.85%	12.90%	18.24%	13.15%	51.86%
# Enrolled in 2nd Math Course	25	86	103	63	145
# Not Enrolled in 2nd Math Course	6	18	44	43	246
% Who Continued	80.65%	82.69%	70.07%	59.43%	37.08%
For 2nd course, # Enrolled in:					
Math 15	0	0	0	1	19
Math 25	0	0	0	53	117
Math 108	23	65	78	9	5
Math 124 or Higher	2	21	25	0	4
In 2nd course*, # Receiving Grade of:	Math 108	Math 108	Math 108	Math 25	Math 25
A	5	1	0	1	10
B	14	17	7	13	7
C	2	24	20	20	20
D	0	14	24	8	10
F, W, CW	2	9	27	11	79
Total:	23	65	78	53	117
% Successful in Second Math Course (C or Better)	91.31%	64.61%	34.61%	64.16%	23.48%

* Based on the second course that the largest number of students enrolled in

Table 2. Math 108 Grades and Further Enrollment
Enrolled: 875

First Grade	A	B	C	D	F, W, CW
# Who Received 1st Grade of:	**34**	**88**	**159**	**153**	**441**
% Who Received 1st Grade of:	**3.89%**	**10.06%**	**18.17%**	**17.49%**	**50.41%**
# Enrolled in 2nd Math Course	**25**	**61**	**107**	**103**	**188**
# NOT Enrolled in 2nd Math Course	**9**	**27**	**52**	**50**	**253**
% Who Continued	**73.53%**	**69.32%**	**67.30%**	**67.32%**	**42.63%**
For 2nd course, # Enrolled in:					
Math 25 or Lower	**0**	**2**	**1**	**0**	**8**
Math 108	**0**	**0**	**1**	**68**	**159**
Math 124	**1**	**2**	**3**	**10**	**12**
Math 130	**0**	**0**	**2**	**3**	**4**
Math 143	**7**	**41**	**68**	**8**	**3**
Math 147 or Higher	**17**	**16**	**32**	**14**	**2**
In 2nd Course*, # Receiving Grade of:	**Math 147**	**Math 143**	**Math 143**	**Math 108**	**Math 108**
A	**11**	**5**	**3**	**2**	**4**
B	**3**	**12**	**14**	**17**	**12**
C	**2**	**16**	**23**	**36**	**32**
D	**0**	**4**	**12**	**9**	**28**
F, W, CW	**0**	**4**	**16**	**4**	**83**
Total:	**16**	**41**	**68**	**68**	**159**
% Successful in Second Math Course (C or Better)	**100%**	**80.49%**	**58.82%**	**80.88%**	**30.2%**

* Based on the second course the largest number of students enrolled in

Role of Instructor in First Course on Performance in Second Course:

We addressed the issue of the role of the first-course instructor in student performance in a second math course in two ways. In the first approach, we looked at the amount of variability in grades in the second course that was due to whom the students had instructors in the first course, their grade in their first math course, and their instructor in their second math course, i.e., we explored how well the grade in the second math course could be predicted based on knowledge of the student's instructors and the grade in their first math course. The results are shown in Table 3 below.

Table 3. Explaining Variability in Grades In Second Math Course Based On First Course Grades, First Instructor, And Second Instructor

Area:	Percent of Variance Accounted for in Grades in Next Math Course (Total R^2=.419)	
	Alone (not considering other areas):	After accounting for impact of other areas:
Instructor in First Course	15.0%	11.7%
Grade in First Course	21.2%	14.8%
Instructor in Second Course	13.2%	7.1%

Note that the grade the student received in the first math course was of greatest importance in explaining the grade in the second course. The results indicated that when only first-course grades were taken into consideration, over 20% of the variability in second-course grades was due to the grades students received in the prior course. This dropped to 15% when we accounted for the effects of the instructors in the first and second courses.

The instructor the student had *first*, however, was of greater importance in explaining the grade in the second course than was the instructor in the second course who assigned the grade! In fact, after accounting for the effects of first-course grade and first-course instructor, only 7% of the second course grade variance was due to how the second-course instructor graded. Note, however, that more than half of the variability in grades remained unexplained, even after knowing the instructors and grade in the first math course.

In the second approach, instructors in the first math course who gave grades that were significantly higher (N=2) or lower (N=39) than average were identified. We then looked to see how much difference this made in student grades in the second course (after eliminating the effects of how the second instructor graded). If the instructors with higher average grades were too easy, students who did well in that instructor's course should have performed more poorly in the next course because the grade did not reflect the amount of subject matter learned, so the impact would be negative. By comparison, if instructors with lower average grades were too difficult, "C" students from their course, for example, should perform better than "C" students who had instructors with more lenient grading practices, resulting in a positive impact.

Table 4 displays the results for the one instructor[2] whose grades were higher than average, the 39 instructors whose grades were lower than average, and the 30 instructors[3] whose grades fell within the average[4]. Students who had the one "easy" instructor in their first course also did better than the average in the second course. For the 39 difficult instructors, only 2 (or 5%) had a positive impact on their students compared to 5 out of 30 (or 17%) average instructors.

[2] One instructor had to be eliminated because the results in this case were not stable enough for interpretation.
[3] In all, an additional 11 first-course instructors were eliminated due to insufficient data on their students' performance in a second math course.
[4] Instructors were assigned to "high" and "low" categories based on whether their regression weights were considered statistically significant using a .05 alpha level. All other instructors were considered "average."

Table 4. Easy And Difficult Instructors And Their Impact On Student Performance In Their Second Math Course

Grades given in 1st course were:	Impact on grades in second course was:		
	Positive	Negative	Not significant
Higher than average (N=1)	1	0	0
Lower than average (N=39)	2	2	35
Average (N=30)	5	0	25

While we should be tentative in the interpretation of these results, it appears that the one "easy grader" that we found did not disadvantage his/her students in the next math course nor did "hard graders" necessarily provide their students with any advantage.

Conclusions:

Both the grades students received and the instructors that they had in their first math course made a difference in students' performance in a second math course. Performing well in their first math course (either MATH 25 or 108) was related to continued enrollment in math and better grades in their next math course. The students who were least likely to do well in their next math course were the "C" students who moved to the next level of math and the "F" students who retook the course.

First-course instructors also played an important role in preparing students for their next math course. When explaining the variation in grades in the second math course, their role was more important than that of the second-course instructor. This preparation did not appear to be related to whether the instructor was an exceptionally easy or hard grader.

It is recommended that any changes to math instruction should include the following steps:

- Identify those instructors who have an especially positive impact on student re-enrollment and performance in their next math course to see what they may have in common.
- Assign the best instructors using the best instructional methods to teach the math courses that new freshmen encounter first.
- Consider the meaning of a "C" grade in MATH 25 and 108. (Only 35% of students who had a "C" in MATH 25 also had a "C" or better in MATH 108.) Perhaps the MATH 25 curriculum needs to be better aligned or critical concepts identified that all students must know to succeed in MATH 108.
- Develop another way of instructing students who have previously failed MATH 25 or 108 since simply retaking the course does not seem to be effective.

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April, 2006