The Relationship between Initial Math Grades and Subsequent Math Success at OIT

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Background and method

How motivated should OIT students be to get a high grade in their math classes? Does a grade of A--or even B--predict success in subsequent courses in the math curriculum? Does a grade of C predict success or failure? And, do the odds of passing a math course go down with multiple attempts? If so, how much?

The subjects in this study were first-time freshmen entering OIT from fall 2000 through fall 2004 who took math courses (N=1691). A data file was created which included students' grades in all OIT math courses from fall 2000 through spring 2005.

To answer the first research question (regarding the relationship between math course grades and subsequent math success), cross-tabulation tables were created which showed students' grades in specific math courses and their subsequent grades in succeeding math courses. For each table, the percentage of students earning passing grades (A, B, or C) was contrasted with the percentage of students earning non-passing grades (D, F, or W). In addition, data was analyzed to determine how many quarters it took for students with different math course grades to progress through Math 252 (or through the terminal math course for their major for students in majors which did not require Math 252). Our hypothesis was that students who earn higher grades in their initial math courses would complete their math studies in fewer quarters. For most of the above analyses, separate tables were created to distinguish among three groups of students: those students whose major required Math 252; those students in a major with a terminal math class of Math 112; and those students in a major with a terminal math course of Math 105/Math 111.

To answer the second research question (regarding the relationship between multiple math course attempts and subsequent math success), cross-tabulation tables were created to show how students who passed a given math class *in their first attempt* performed in their next math course. These tables were contrasted with tables showing how students *who had to repeat a given math course* performed in their subsequent math course.

Key findings

The relationship between first math course grades and subsequent math success

Tables One and Two show the relationships between first-attempt math grades (for Math 100 and 111, respectively) and Math 252 grades for students whose majors required Math 252.

Table One: Math grades for students whose major required M252 and whose first math class was M100

(entering 2000-2002)

	M252 Grade						
M100 Grade	A	B	C	D	F	W	DNA*	Pass %
A	3	14	10	2	0	0	12	66%
B	2	8	10	0	0	3	42	31%
C	2	4	5	5	0	2	27	24%
D	0	0	1	0	1	0	15	6%
F	0	0	1	0	0	0	16	6%
W	0	1	1	0	0	0	18	10%

pass= 62 DFW= 13 DNA*= 130

*Did not appear at any time on the course roster for Math 252

Table Two: Math grades for students whose major required M252 and whose first math class was M111

(entering 2000-2003)

	M252 Grade						
M111 Grade	A	B	C	D	F	W	DNA*	Pass %
A	14	20	10	0	1	2	8	80%
B	3	13	15	6	0	2	16	56%
C	0	5	8	1	4	2	15	37%
D	0	2	0	0	0	1	9	17%
F	0	0	1	0	0	0	9	10%
W	0	1	2	0	0	0	11	21%

pass= 94 DFW= 19 DNA*= 68

*Did not appear at any time on the course roster for Math 252

Some related data from other charts revealed:

For students who earned a C grade in their first attempt of Math 100:

- 88% of these students went on to earn a C or lower grade in Math 111
- 60% of these students went on to earn a D/F/W grade in their first attempt of Math 111
- Almost no one who earned a D, F or W in their first attempt of Math 100 ever made it to Math 252.

For students who earned a C grade in their first attempt of Math 111:

- 80% of students went on to earn a C or lower grade in Math 112
- 49% of these students went on to earn a D/F/W grade in Math 112

For students who earned a C grade in their first attempt of Math 112:

- 82% of these students went on to earn a C or lower grade in Math 251;
- 61% of these students went on to earn a D/F/W grade in their first attempt of Math 251

Across various groups and student majors, and regardless of what math course the student started with, similar relationships appeared. That is:

- Students who earned a grade of A in their first math course were quite likely to finish their math curriculum.
- Students who earned a grade of B were fairly likely to finish their math curriculum, though not as likely as the students who earned A's.
- Students who earned C's in their first math course were much less likely to go on to earn a passing grade in the final math course required for their major (or, in Math 252, for those students whose major required math beyond Math 252).

The relationship between math grades and the number of quarters to complete math requirements

Table Three shows the relationship between students' first grade in Math 100 and the number of quarters it took them to progress to Math 252 (only for students' whose major required Math 252).

Table Three	**Number of quarters taken to progress from M100 to M252, according to first grade in M100**					
	(entering 2000-2002)					
# of quarters	First Grade in Math 100					
M100 to M252	A	B	C	D	F	W
5	23	9	3	0	0	0
6	4	6	7	0	0	0
7	5	6	4	2	1	1
8	5	13	7	1	0	2
9	0	1	3	0	1	0
10	0	0	4	1	0	0
11	0	1	1	0	0	0
12+	0	0	2*	0	0	0
	* one took 14 qtrs. & finished with B in 252,					
	the other took 15 qtrs. & finished with D in 252					

Table Three demonstrates that students who earned an A in Math 100 (and this is the modal placement class for OIT students) were much more likely to go on to finish their math curriculum quickly, even when compared to students who earned a B in Math 100.

The relationship between number of course attempts and subsequent math success

Tables Four and Five show the relationship between the number of course attempts and subsequent math success.

Table Four **Math 111 first attempt grades for students who passed Math 100 on their first attempt**

(entering 2000-2004)

	M111 Grade						
M100 Grade	A	B	C	D	F	W	Pass %
A	74	58	38	6	2	12	89%
B	23	69	80	33	20	50	63%
C	1	25	64	36	37	62	40%

Table Five **Math 111 first attempt grades for students who repeated and passed M100**

(entering 2000-2004)

	M111 Grade						
M100 Grade	A	B	C	D	F	W	Pass %
A	3	3	2	0	1	2	73%
B	2	3	13	6	5	9	47%
C	0	3	14	4	12	23	30%

These two tables show that students who repeated Math 100 were less likely to earn passing grades in their first attempt of Math 111, when compared to students who did not have to repeat the course. This pattern was noted across math courses. Moreover, the percentage of students passing the course went down with each subsequent attempt. Interestingly, while there was a decline in the percentage of students passing courses with each subsequent attempt, there were still some students who were able to pass the course with each attempt. In other words, there did not seem to be a clear indication that students were consistently unsuccessful after a certain number of attempts.

Also, from these tables, it's interesting that students who repeated Math 100 and earned a grade of A had a 73% chance of passing Math 111 on their first attempt, compared to a 63% Math 111 pass rate for students earning a B in their first attempt of Math 100. In other words, an A in a *second* attempt of Math 100 was associated with a higher rate of success than a B in a *first* attempt. This was also true for Math 111 and Math 112, i.e., students who earned an A in their second attempt of these courses were somewhat more likely to pass their next math course, when compared with students who earned a B in their first attempt. However, when it came to Math 251, this situation was reversed: Students earning a B in their first attempt of 251 were somewhat more likely to succeed in Math 252 than students earning an A in their second attempt of 251. It should be noted that, in all these analyses, the numbers of students who repeated courses and earned A's was quite small, which could impact the validity of these findings.

Discussion

Previous research has shown a significant relationship between math success and graduation from OIT. The present research expands on those findings. Specifically, student success in initial math coursework has a strong relationship with students' ability to ultimately complete the math required for their major.

The current research demonstrated that not all passing grades are equal. A's predict success more than B's. Perhaps more important, C grades in math courses are not a setup for success--they are a predictor of future failure. This is true for students across majors, and regardless of the course they enter in. In addition, students who earn A grades in their first course are much more likely to get through their math curriculum fairly quickly. Students who get B's take longer to complete their math sequence, and students earning lower grades take longer yet.

The chance of a student passing a course goes down with each subsequent attempt of the course. Students who do pass the course on subsequent attempts will earn lower grades on average than their peers who pass the course in their first attempt.

The reader might be tempted to say, "So what? Isn't all this just what we expected? Brighter students do better in math!" To some extent, it is true that this study confirmed our intuitive sense of what should be true when considering math grades. But this study has implications for our practice with students.

The typical entering OIT student has a high school GPA of 3.5 or higher, while studying only 3-5 hours per week. This same pattern will not continue for these students at OIT. It is the responsibility of OIT faculty and staff to awaken students to the new reality of university mathematics: Specifically, mastery is what counts, and that A's (and to a clearly lesser extent, B's) indicate mastery, but C's do not. This message should be incorporated into new student orientation, faculty syllabi, classroom discussions, and other academic support interventions.

It may be helpful to pair this message with another message from this research: Achieving mastery is cheaper. Students will, on average, complete their math curriculum more quickly, saving themselves significant money, if they master material and pass courses on their first attempt. Given the historic financial vulnerability of OIT students, this message may increase students' interest in working harder to succeed.

Finally, advising systems and academic support programs need to closely monitor students who earn a C (or lower) grade in their first math class, as well as students who must repeat a math course. Students who earn a C in a math course may be well-advised to retake that course in order to enhance their chances of subsequent success. In fact, in many cases, students who retake math courses and get A's are more likely to succeed in subsequent courses that their peers who earn B's or C's in their first attempt of the course. Students attempting math courses multiple times should be a particular focus of advisors' attention.