

How Far Does Computer Assisted Math Learning Take You?

- Report on Outcome Study of Tracking Academic Systems Math vs. Non-Academic Systems Math Courses

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Planning & Research Office, September 2003

Population Selected:

Math 254 courses taught in fall 2000 through spring 2002, excluding summer and winter sessions. This population was further subdivided into two comparison groups:

Comparison Group 1 (students who took Academic Systems math classes),
Comparison Group 2 (students who took non-Academic Systems math classes)

Math 154 courses taught in Spring 2001 through Fall 2002

Math 154 includes Math 154, Math 154A & B.

Definitions

Academic Systems classes are defined as those taught on Main Campus, but not the online sections (one class may have several sections). Non-Academic Systems classes (also called "Regular" math classes in this study) are defined as those taught as Math 254B, including off-site classes in Watsonville. Only the students enrolled in Math 254B were considered as part of Regular math students, regardless of their enrollment status in Math 254A.

Research Questions:

- 1) What are the baseline success rates of Academic Systems math classes and Regular math classes?
- 2) Is there a discernable difference in success rates of students from both types of math classes in their subsequent Math 154 classes?

Tracking method:

Tracking was conducted using enrollment records of those in both comparison groups who successfully completed Math 254 (Academic Systems and Regular math) courses and enrolled in a subsequent semester in Math 154 or Math 154A/B courses.

Counting all enrollment attempts and their grades, success or otherwise, is different from counting only the first instance of attempting Math 154. By either allowing multiple Math 154 attempts or denying it, the study provides two comparative outcomes of former Math 254 students. Both are discussed in this report in tandem. They are termed "First Enrollment Group" and "Multiple Enrollment Group", respectively. Since both Academic Systems students and Regular math students had instances of multiple enrollments in Math154, they are both designated by their enrollment records in the above two groups.

The study primarily relied on college data warehouse and BrioQuery 6. PRO conducted general queries with the math department to clarify a number of definitions (information is attached). BrioQuery 6 was used for database extraction, tracking and coding. All findings are entirely the results of OLAP (online analytical processing), with no statistical significance testing.

Findings

There is a distinct difference in success rates between students who took Regular math classes (Math 254B) and those who took Academic Systems math classes. In every semester, Regular math class students performed better than Academic Systems math students by a large margin. On average, it was a difference of 19.2 percentage points. Keep in mind, however, Regular math students included only those who took Math 254B after they completed Math254A.

Table 1. Success Rate of Academic Systems and Regular Math254 Students by Term:

	AcadSys	AcadSys	AcadSys	AcadSys	AcadSys	Regular	Regular	Regular	Regular	Regular
	CntSuccess	SuccessPct	CntForW	ForWPct	Total	CntSuccess	SuccessPct	CntForW	ForWPct	Total
FA 00	118	63.8%	67	36.2%	185	56	74.7%	19	25.3%	75
SP 01	96	58.9%	67	41.1%	163	111	78.7%	30	21.3%	141
FA 01	160	61.1%	102	38.9%	262	61	80.3%	15	19.7%	76
SP 02	128	51.4%	121	48.6%	249	101	76.5%	31	23.5%	132
Total	502	58.4%	357	41.6%	859	329	77.6%	95	22.4%	424

Legend:

- AcadSys: Academic Systems math classes
- Regular: Regular math classes
- CntSuccess: Count of success grades.
- SuccessPct: Percentage of success among all enrolled.
- CntForW: Count of all non-success grades.
- ForWPct: Percentage of all who received non-success grades.
- Success Grades = A, B, C, CR.
- Non-success Grades: D, F, IF, NC, W

After examining the upward moving behaviors (Tables 2a and 2b) of both groups of math students, the study found two distinct patterns. Students would enroll Math 154 in large numbers in the term immediately after they finished their Math 254 classes, and the numbers would taper off after that.

In the First Enrollment Group (counting their first instance of enrolling in Math 154 classes), the fall 2000 cohort had an enrollment rate of 78% (93/118). On average, 67% (338/502) of the former Academic Systems students who succeeded enrolled in Math 154 classes.

Table 2a. Academic Systems Students' Enrollment Pattern in Math 154 (First Enrollment Group).

	SP 01	FA 01	SP 02	FA 02	Total
	Count	Count	Count	Count	
FA 00	72	10	6	5	93
SP 01		29	16	8	53
FA 01			100	20	120
SP 02				72	72
Total	72	39	122	105	338

The fall 2000 cohort of the Regular math students had an enrollment rate of 75% (42/56). On average, the Regular math students' enrollment rate was 67% (219/329). Therefore, the rates of enrollment for both Academic Systems students and Regular math students were the same.

Table 2b. Regular Math Students' Enrollment Pattern in Math 154 (First Enrollment Group).

	SP 01	FA 01	SP 02	FA 02	Total
	Count	Count	Count	Count	
FA 00	26	9	5	2	42
SP 01		53	20	5	78
FA 01			30	12	42
SP 02				57	57
Total	26	62	55	76	219

Chart 1 and Table 3 contain the success outcome information for the First Enrollment Group separated by Academic Systems students and Regular math students. Chart 1 contains more information than Table 3. From Table 3, it appears that although the individual semesters may experience variations, averaging five semesters resulted in the same success rates for both types of math students (55.3% for Academic Systems students and 55.3% for Regular math students).

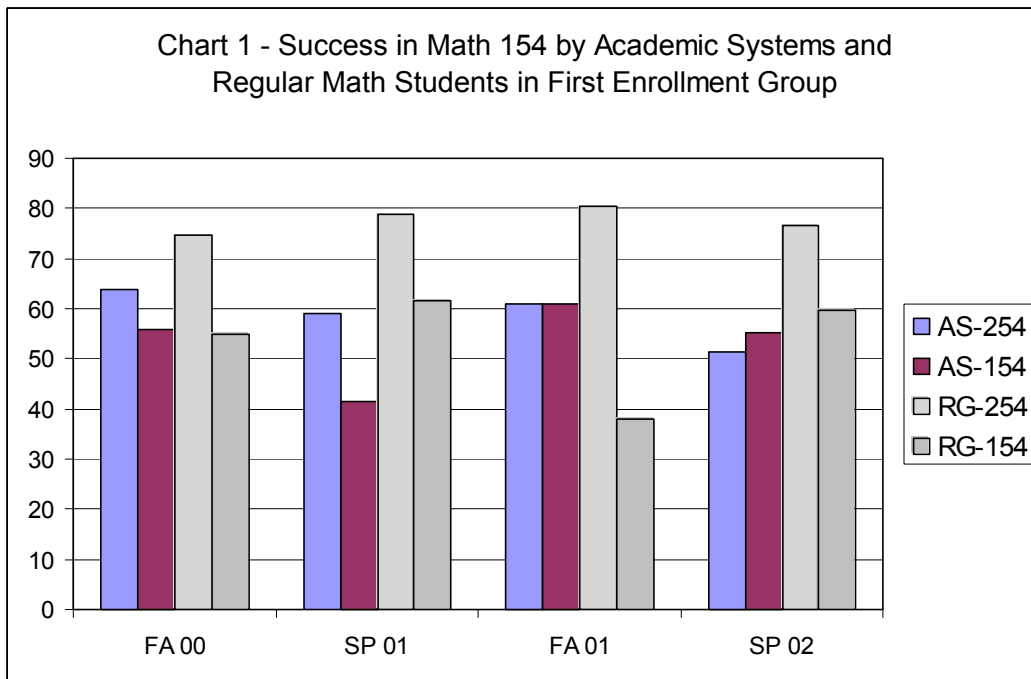


Table 3. Academic Systems and Regular Math Students' Success in Math 154 (First Enrollment Group).

	AcadSys CntSuccess	AcadSys Total	AcadSys SuccessPct	Regular CntSuccess	Regular Total	Regular SuccessPct
FA 00	52	93	55.9%	23	42	54.8%
SP 01	22	53	41.5%	48	78	61.5%
FA 01	73	120	60.8%	16	42	38.1%
SP 02	40	72	55.6%	34	57	59.6%

Total	187	338	55.3%	121	219	55.3%
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AcadSys: Academic Systems students
Regular: Regular math students
CntSuccess: Count of success grades.
SuccessPct: Percentage of success among all enrolled.
CntForW: Count of all non-success grades.
ForWPct: Percentage of all who received non-success grades.
Success Grades = A, B, C, CR.
Non-success Grades: D, F, IF, NC, W

Table 4a and Table 4b display the enrollment information of the Multiple Enrollment Group. The difference between the First Enrollment Group and this group can be calculated easily using the total columns. For example, for this group, there were a total of 129 counts of enrollment, which is a difference of 36 (129-93 = 36). Table 4c details the comparisons of both groups' multiple enrollments. On average, more former Regular math students tend to attempt more Math 154 compared to former Academic Systems students. Although this does not translate into "average of repeated enrollment", it is an indicator of the magnitude of students attempting Math 154. More repeated enrollment attempts tend to bring down the average success rate for the Multiple Enrollment Group.

Table 4a. Academic Systems Students' Enrollment Pattern in Math 154 (Multiple Enrollment Group).

	SP 01	FA 01	SP 02	FA 02	Total
	Count	Count	Count	Count	Count
FA 00	84	23	15	7	129
SP 01		46	21	11	78
FA 01			111	31	142
SP 02				72	72
Total	84	69	147	121	421

Table 4b. Regular Students' Enrollment Pattern in Math 154 (Multiple Enrollment Group).

	SP 01	FA 01	SP 02	FA 02	Total
	Count	Count	Count	Count	Count
FA 00	38	16	8	3	65
SP 01		72	30	8	110
FA 01			37	19	56
SP 02				57	57
Total	38	88	75	87	288

Legend:

CntSuccess: Count of success grades.
SuccessPct: Percentage of success among all enrolled.
CntForW: Count of all non-success grades.
ForWPct: Percentage of all who received non-success grades.
Success Grades = A, B, C, CR.
Non-success Grades: D, F, IF, NC, W

Table 4c. Multiple Enrollment Rate

	AcadSys			Regular		
	FEG	MEG	Rate	FEG	MEG	Rate
FA 00	93	129	28%	42	65	35%
SP 01	53	78	32%	78	110	29%
FA 01	120	142	15%	42	56	25%
SP 02	72	72	0%	57	57	0%
Overall	338	421	20%	219	288	24%

Legend:

AcadSys: Academic Systems students

Regular: Regular math students

FEG: First Enrollment Group

MEG: Multiple Enrollment Group

Chart 2 and Table 5 show the outcome of former Math 254 students who succeeded in Math 254 (Academic Systems or Regular) and enrolled in Math 154. Chart 2 contains more information than Table 5. According to Table 5, the overall success rate (averaging four terms under study) was 49.9% for Academic Systems students and 49.3% for Regular math students. They are almost the same (without statistical significant testing). Within a given semester, the success rates of both groups flip flopped in spring 2001 and fall 2001.

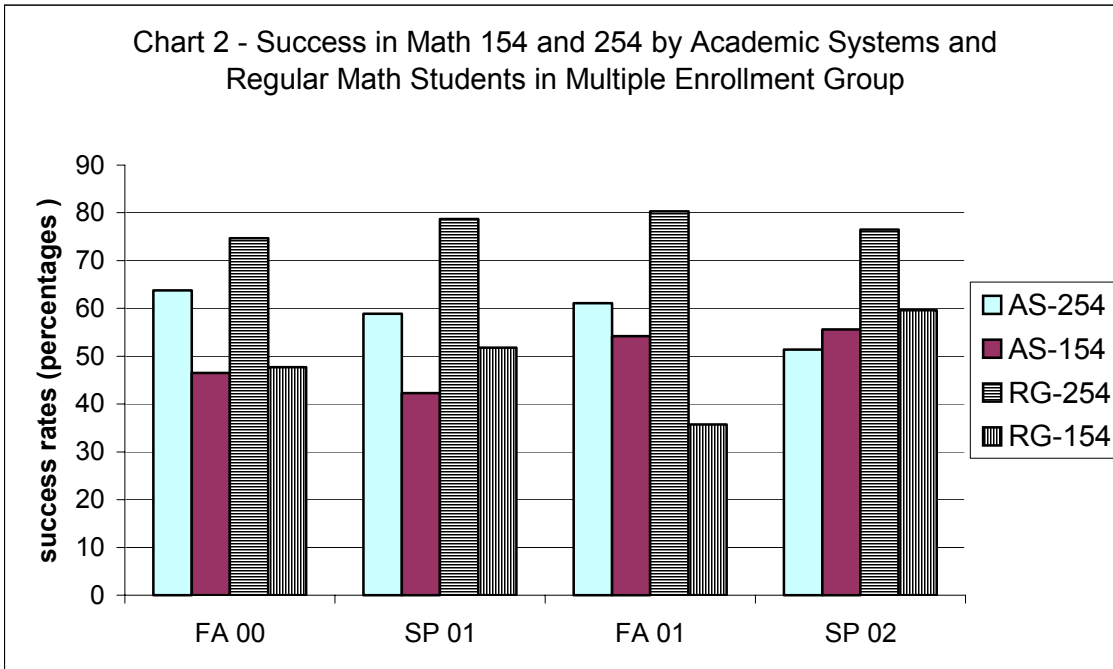


Table 5. Success Rates of Both Groups of Math 254 Students in Math 154 (Multiple Enrollment Group).

	AcadSys	AcadSys	AcadSys	Regular	Regular	Regular
	CntSuccess	SuccessPct	Total	CntSuccess	SuccessPct	Total
FA 00	60	46.5%	129	31	47.7%	65
SP 01	33	42.3%	78	57	51.8%	110
FA 01	77	54.2%	142	20	35.7%	56
SP 02	40	55.6%	72	34	59.6%	57
Total	210	49.9%	421	142	49.3%	288

Legend:

AcadSys: Academic Systems students
 Regular: Regular math students
 CntSuccess: Count of success grades.
 SuccessPct: Percentage of success among all enrolled.
 CntForW: Count of all non-success grades.
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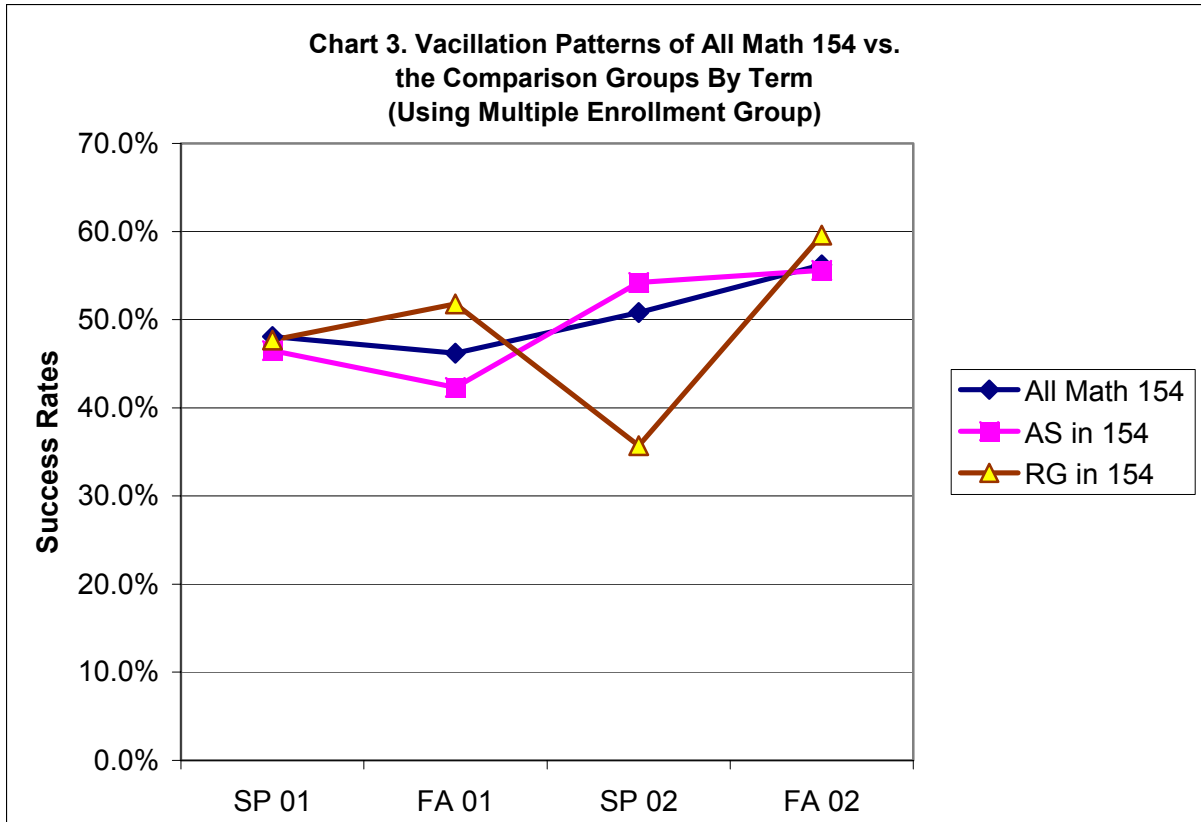
Tables 6 contains information on the success rate of Math 154 students. The population included students in the comparison groups in this study. Similar to the patterns of both Academic Systems and Regular math students, the success rates of all Math 154 students also appeared to be experiencing vacillation. Chart 3 illustrates the ups and downs of the success rates of all three groups: All Math 154, Academic Systems students and Regular math students by term. Chart 3 seems to suggest that had there not been a 15 percentage points dip in success in spring 02 among the Regular math students, the overall success rate of Regular math students would have been higher than Academic Systems students.

Table 6. Success Rate of All Math154 Students.

	MATH-154	MATH-154	MATH-154	MATH-154	MATH-154
	CntSuccess	SuccessPct	CntForW	ForWPct	Total
SP 01	260	48.1%	280	51.9%	540
FA 01	288	46.2%	336	53.8%	624
SP 02	290	50.8%	281	49.2%	571
FA 02	390	56.2%	304	43.8%	694
Total:	1,228	50.6%	1,201	49.4%	2,429

Legend:

CntSuccess: Count of success grades.
 SuccessPct: Percentage of success among all enrolled.
 CntForW: Count of all non-success grades.
 ForWPct: Percentage of all who received non-success grades.
 Success Grades = A, B, C, CR.
 Non-success Grades: D, F, IF, NC, W



Discussion

The primary focus of this study is to determine the baselines as well as differential outcomes of both Academic Systems math classes and Regular math classes. The study achieved the first goal well. However, regarding the differential outcomes of the two types of math teaching modalities (Academic Systems math and Regular math), the findings of this study have brought more questions than answers.

It appears, one might agree, that both methods resulted in the same outcome (Tables 2, 3 and 5). It implies that much ado of maintaining computing facilities for Academic Systems did not make a discernable difference, i.e., increasing the success rate compared to those taught in Regular math classes. The data seemed to show that given the same number of students in each group, more students in the Regular math will be successful in Math 154. Suppose there were 100 students in Academic Systems and 100 in Regular math. Close to 60 (58.4%, Table 1) students in Academic Systems would succeed and close to 80 (77.6%, Table 1) in Regular math would as well. In the Academic Systems group, 40 (67%, Table 2a) students would move up to Math 154 and in the Regular math 54 (67%, Table 2b) students would. In the end, 22 (55.3%, Table 3) students would succeed in Math 154 from the Academic Systems group and 30 students (55.3%, Table 3) in the Regular math would.

On the other hand, one may argue, that given the high success rate of Regular math classes, it is disappointing to see the success rate in subsequent Math 154 classes not sustained. Would this have not been the case if the success rate in spring 02 for Regular math students in Math 154 did not have the dip (Chart 3)?

Students in Math 254A must co-enroll in Learning Skills classes taught by learning skills specialists. Students in Regular math classes also have longer period to complete their study. Students may opt to use an entire semester to finish Math 254A rather than doing so in the first half of a semester before they continue in Math 254B.

A question not asked in this study is whether or not Academic Systems classes benefit students who would otherwise not succeed in math. Would the differences between the two populations studied have impacted on their outcomes? Further drilldown of the data by gender, age, location, and even financial aid may reveal formerly undetected information.

Appendix

Clarifications with the Math Department

Per Judy's Research:

MATH COURSES USING ACADEMIC SYSTEMS AND COMPARABLE COURSES
NOT USING ACADEMIC SYSTEMS

Academic Systems (computers)

Math 254 - Essential Mathematics taught in rm.517 or Wats4550.

Comparable Non-academic Systems (no computers)

Math 254A sections that meet 1st 8 weeks of semester.

Math 254B sections that meet last 8 weeks of semester.

Note (Jing) Check DW over a few terms to see if 254 is either OL or Acd Sys.

Note (Jing) Check DW to find out 1) those who took 16 weeks to finish A or B and those who took 8 weeks and those who had a long delay in between.

ONLINE MATH COURSES AND COMPARABLE MATH COURSES TAUGHT IN CLASSROOM

Math 254 sections that are online courses.

compared to (non-computer assisted)

Math 254A sections that meet 1st 8 weeks of semester.

Math 254B sections that meet last 8 weeks of semester.

Math 154 sections that are online courses.

compared to (non-computer assisted)

Math 154 sections taught in classroom.

Math 12 - Elementary Statistics sections that are online courses.

compared to (non-computer assisted)

Math 12 - Elementary Statistics sections taught in classroom.*

*Per NAS division staff, there are very different methods of teaching this course in the classroom.

Subject: Re: Math 254
Date: Wed, 06 Aug 2003 17:11:34 -0700
From: joan mccarthy <jomccart@cabrillo.edu>
To: Judy Cassada <jucassad@cabrillo.edu>

I can't answer for sure, I can only guess. Wanda will be back next week and she can provide the absolute answer.

My guess is to give students as many choices as possible for this Essential Math class, as some students really do need "remedial" opportunities -- they have learning disabilities, math anxiety, or other disabilities such as dyslexia. If students can't keep up with the pace in a 16-week semester, they can take Math 254A in 16 weeks and Math 254B in 16 weeks, i.e., taking 32 weeks to do the same work as in Math 254 in 16 weeks.

And then they get another choice, taking 254A in 8 weeks and 254B in 8 weeks which = 16 weeks so that's a non-computer class that would be comparable to 254, the computer class, because they're both 16 weeks and covering the same material. You might also want to look at the entire course description for 254 and 254A/B in Fiesta because it includes the course objectives (like a syllabus).

Hope this helps. Call Wanda next week if you need more info –
Joan