

## Math Focus Group Study

For some years American leaders and educators have noted the decline in the degree production of the so-called STEM disciplines, sciences, technology, engineering, and mathematics. Indeed, as one article suggests, China and other developing countries may be producing more graduates in the STEM disciplines than the United States. Over the long-term the decline could jeopardize American leadership in research and development, with further ramifications regarding our global competitiveness and standard of living.

Introductory college Math courses may pose a particular barrier to graduation in the STEM disciplines. College level algebra, trigonometry, and calculus courses are often considered as “gateways” to bachelors and higher level course work in these four disciplines. Unfortunately, numerous studies have shown that students coming to college are poorly prepared to succeed in introductory Math courses such as algebra. Nationwide, success rates in introductory Math courses are notoriously low. Many who fail these courses refuse to re-take, and move off into other majors and programs which have little or no Math component. Still other students delay taking these gateway Math courses until later in their college careers, delaying progress toward a STEM or other degree requiring some Math.

At the College of the Sequoias MATH-360 is the barrier course for most students. This course is entitled “pre-algebra.” It is four units or credit hours in scope. If passed, the units earned are not associate degree applicable. Upon successful completion of MATH-360 (with a “C” or better) or eligibility determined by COS placement exams, the student may then take MATH-200 or MATH-205, “elementary” and “beginning” algebra courses.

Table 1 below shows the placement rates for “first time” students at the College of the Sequoias. (First time students are those who, upon admission, indicate that they have not attended college before.) For each of the terms approximately 75% of the students who took the Math placement test tested into a pre-college-level mathematics course or were “required to see a counselor.” Only 25% of the students placed into intermediate Algebra or above. (Note: students entering a number of vocationally-oriented certificate programs are not required to take the placement test.)

Table 2 below shows the rates of success in two Math courses, Math-360 and Math-200 over several semesters. (Students who earned a “C” or better in the courses are considered successful.) In Fall, 2005, 47% were successful. In both the Fall 2006 and Fall 2007, however, only 35% of the students who attempted Math-360 were successful, underscoring the notion that Math-360 is a barrier to future Math success.

Planning and Research conducted a mini-study to determine if students unsuccessful in Math-360 persisted and enrolled in a higher level Math later in their college careers. Table 2 shows that 363 students were unsuccessful in Math-360 in Fall, 2006. Of this number only 61 enrolled in a higher level Math class over the next five semesters, a rate of less than 17%, as shown in Table 3.

**Table 1 – Placement Tests Results in Math**

	<u>Fall, 2006</u>		<u>Fall, 2007</u>		<u>Fall, 2008</u>		<u>TOTAL</u>	
See Counselor	82	4%	85	4%	85	3%	251	4%
Math 360, 361, or 365	884	42%	889	41%	950	38%	2,691	40%
Math 200, 201, or 205	637	30%	631	29%	772	31%	2,004	30%
Math 230 or 235	275	13%	324	15%	365	15%	937	14%
Math 21, 45, 110, or 154; or Bus 20 or 19	184	9%	194	9%	256	10%	609	9%
Math 61 or 75	29	1%	31	1%	36	1%	91	1%
Math 70	26	1%	30	1%	53	2%	102	2%
<b>Total</b>	<b>2,117</b>	<b>100%</b>	<b>2,184</b>	<b>100%</b>	<b>2,517</b>	<b>100%</b>	<b>6,685</b>	<b>100%</b>

**Table 2 – Success in Key Math Courses**

	<u>Fall, 2005</u>		<u>Fall 2006</u>		<u>Fall 2007</u>		<u>Fall 2008</u>	
	Success	No S.	Success	No S.	Success	No S.	Success	No S.
Math-200	403	449	317	459	361	457	357	539
%	47	53	41	59	44	56	40	60
Math-360	234	308	191	363	180	287	197	337
%	43	57	34	66	36	64	37	63
Total	637	757	508	822	540	744	554	876

**Table 3 – Unsuccessful Math-360 Students in Fall, 2006 Who Attempted Higher Level Math Classes in Subsequent Terms**

	<u>Spring 2007</u>	<u>Summer 2007</u>	<u>Fall 2007</u>	<u>Spring 2008</u>	<u>Summer 2008</u>	<u>TOTAL</u>
MATH 230	0	3	9	13	4	20
MATH 205	1	0	1	0	0	2
MATH 200	35	8	21	16	6	59
MATH 021	0	0	1	1	1	3
MATH 010	0	0	0	1	0	1
<b>Total</b>	<b>36</b>	<b>11</b>	<b>29</b>	<b>30</b>	<b>11</b>	<b>61</b>

Despite this gloomy picture, students are testing into Math-360, taking it (often more than once), ultimately successfully passing it, and taking higher level Math classes. What can we learn from their experiences which might raise the success rate? What has helped these students to succeed?

With the support of the President and Math Department, the Office of Planning and Research undertook a qualitative research project to help determine the answers to these questions, from the perspective of our students. An overview of the project process and findings of the project are below.

Project

In March, 2008, the Office of Planning and Research conducted a search of the student database to identify students who met the following criteria:

1. The student tested/placed into MATH 360;

2. The student “passed” Math 360 with an A, B, C, or D;
3. The student later enrolled in either Math 200 or 205 and passed in that class; and
4. The student was enrolled at COS during the Spring Semester, 2008.

Two hundred and fifty four students met the criteria.

The Office of Planning and Research then attempted to contact via email or telephone all 254. Approximately 80 students meeting the criteria initially expressed interest in participating in a focus group about their “success in Math 360.” Each of the 80 gave to Planning and Research a “preferred” ranges of times and days for focus group participation, considering their class and personal schedules.

Working with these preferred times and days, Planning and Research scheduled six focus group meeting times, each with nine to 12 prospective participants. The meeting times were in the afternoons over a two week period in late April, 2008 and early May, the last beginning at four pm. Early afternoon times were most convenient for those attending day classes, with evening students preferring the four pm start. When the scheduling would allow, effort was made to balance the group composition based on age, gender, and ethnicity.

When telephoned that their focus group had been scheduled, some of the 80 declined to participate. Several cited new conflicts with the specific hour and day of their focus group. Others indicated they had second thoughts about the focus group format and were reluctant to participate.

Planning and Research took two additional to help attendance. First, the Office arranged for students who did participate to receive a \$25 voucher card at the college bookstore. The voucher could be used for books and other supplies.

Second, Planning and Research made “night before the focus group” reminder telephone calls. Despite the number of previous contacts, many participants said over the telephone that they had forgotten about their focus group the next day.

From six to 10 students appeared and participated in each of five focus groups. Unfortunately, despite the number of contacts made, only two or three students appeared for the sixth session. Since this number is not sufficient for focus group dynamics, the three were thanked and assured that they qualified for the voucher card.

### Focus groups

The five focus groups sessions were held in a quiet, out-of-the way conference room in the college’s Learning Resource Center. Each session lasted one hour. A staff member of Planning and Research was present at each session and recorded it, but sat away from the others and took no active role.

The “facilitator” always plays a key role in focus group success. After greeting and seating participants, our facilitators introduced the central topic to be discussed, “What does it take to pass MATH 360?” Next the facilitator underscored four ground rules to guide the discussion:

1. Everyone is expected to contribute to the discussion;
2. Focus on what helped in Math 360...stay positive;
3. Do not mention faculty or other names at any time;
4. What is stated in the focus is not to be repeated later.

The topic “success in Math 360” is a broad one. Realizing this, the Office of Planning and Research and the Math Department developed four “sub-questions” to assist the facilitators and participants to pace the discussion through the hour:

1. What one thing did you do personally which helped you succeed in Math 360?
2. What one thing did a Math 360 instructor do which was instrumental to your success?
3. What role, if any, did the Math lab play in your success?
4. What one thing would you recommend to MATH 360 students in order to succeed?

Often the facilitators chose to use the four “sub-questions” to divide the hour long sessions into 15 minute segments, the last question becoming a wrap-up.

#### Analyzing the data

The Office of Planning and Research analyzed focus group success and the data in two ways. First, several days after the final focus group session, the facilitators and the Planning and Research staff met for a morning to “debrief.”

By all accounts the focus groups were successful. Those at the debriefing felt participants appeared to freely state their views, respect other views, and address the topic and the sub-questions in a forthright manner. Many participants shared quite personal moments of success and break-through. At no time in any of the sessions were names mentioned, all contributed, and the sessions were positive in tone.

At the debriefing the facilitators and staff then took time to organize the focus group discussions into themes or theme-areas. For example, in each of the focus groups there were numerous comments about “homework” and its importance to Math 360 success. Other theme-areas included scheduling, the role of study groups or study “buddies,” how a class session is organized, and the importance of “flexibility” to success.

Finally, the facilitators and staff reached consensus perspectives on each theme-area, and a consensus on the project’s central finding. These are discussed below.

As a second analysis step, the staff of the Office of Planning and Research transcribed each of the five focus group sessions from the recordings. This was an extremely time-consuming, labor-intensive task. Because of audio quality, length of statements, and other factors, the transcriber sometimes had to “interpret” and paraphrase the student on the tape as best possible.

## Central Findings

Some 18 to 20 year old students attending college have the experience and self-discipline necessary to succeed in a relatively unstructured collegiate environment. They attend class, take notes, study those notes, do homework on their own, go to the library well before an assignment is due, study for exams, and organize. Although it might be vague, these students each have a view of their future; hence has a semblance of a plan for their academic careers.

Often older students returning to college bring with them a confidence and discipline stemming from their work and home experiences. These students may lack some self-confidence having been out of the educational environment for a period of time. However, responsibility gained from holding a job, managing a budget, raising children, and organizing daily time and tasks, often compensate for the lack of academic self-confidence.

If the 42 students participating in the focus groups are representative, many students enrolling (and often re-enrolling) in Math 360 at COS are not the “mature,” self-disciplined learners described above. In fact, many of those participating in the focus groups had failed or dropped the course at first, only to come back for another try. The important, underlying theme evident in the focus groups was the need for structured learning. Students felt they succeeded when:

- The class syllabus was clear, and there were no deviations from the schedule day-to-day;
- The class hour was structured the same every day. (For example, the first 15 minutes for reviewing and grading the homework and answering questions, the second fifteen... and so on);
- Time and time again students mentioned that problems (and problem-solving) need to be broken down into steps;
- Homework should be mandatory, reviewed in class, and graded, otherwise students will not do it;
- Conversely, providing options and alternates – while it may be appealing to a mature learner -- apparently may not lead to success in Math 360:
  - Providing a variety of ways to solve a problem may confuse, rather than help, a number stated;
  - If attendance is not taken students do not feel the need to come;
  - If the Math lab is not required or attendance enforced, many students do not use it.

In summary, the Math 360 focus groups held during Spring, 2008, indicate that many students entering the class are not self-disciplined learners. Instructors can help their students succeed by provide the discipline and structure needed.

## Theme Statements

The Office of Planning and Research selected some of the representative statements in the recordings and organized them by theme. These theme statements are below:

### Syllabus and class schedule

- “The instructor I had in Math 360 the second time followed the course outline straight. This helped me to stay on course.”
- “What helped me the most is that the instructor did the same thing every day in class." First, we reviewed the homework and passed it in. Second, she did ....”
- “I felt I could ask questions at any time, but there also was a set time to ask them.”
- “My best 360 teacher took attendance and never would let us miss class.”
- “I very much prefer having many shorter classes each week. That way I can master one thing at a time, and not have to wait four or five days for the next. You forget.”
- “Up front the instructor explained how each class session would be organized, and what I would have to do to pass each day and the class. It never changed.”

### Homework and drills

- “If a Math 360 instructor thinks his students can pass the course without mandatory, reviewed, and graded homework every day, he is crazy. The students just don’t do ‘recommended’ homework.”
- “Having drills in the class every day covering the materials, was a life saver for me.”
- “As soon as I got home, I rewrote my class notes so I could go over them again and re-learn them.”
- “Most students really got helped doing practice tests before the real tests.”
- “Upfront the teacher has to explain how much time the student has got to spend on homework to pass the class. Ask the students every day how much time they spent.”

### Problem solving methods

- “Though it got boring, my teacher taught us one way to solve the problem and drilled on it. I finally passed.”
- “Other teachers taught other students different ways to solve a problem, so when I tried to get help from my friends I got confused.”
- “I finally passed when my teacher broke problem-solving into the same little steps, and I knew then where I got confused.”

### “Winning at Math”

- “This book should be discussed in every Math 360 class, especially right at the beginning.”
- “This is good for both boys and girls, and those who are older and have no confidence.”

#### Group work

- “My mother took 360 at the same time. We couldn’t study together much, though, because her teacher taught her differently and we studied different things at different times.”

#### Math Lab

- “Teachers could make the MATH lab mandatory, but it is really best if the students learn the stuff in class.”
- “I found several of the software programs helpful, but the tutors taught different ways to solve problems. That confused me more than helped.”

#### Time to study

- “After flunking MATH 360 two times, I realized I could not pass it without setting aside two hours every night to study – in a quiet place where I would not be disturbed. I studied from 12 midnight to 2 am. Now I can pass anything.”
- “360 instructors must tell the students that they have to set aside time every night to study. Otherwise students think they can play. This isn’t high school.”

#### Dealing with troublemakers

- “What helped me was the teacher throwing disruptive students out of class and dropping them. It gave the rest of us time to review the homework.”
- “What every Math 360 teacher should do is have someone who passed MATH 360 come talk to the class about what to do, how to study and spend the time. I would do it. I would tell the bums just to drop out right now and come back and take it when they were older.