

Comprehensive Program Review for Mathematics at Southern Polytechnic State University

Math Academic Program Review Committee

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The Math Academic Program Committee reviewed the Math self-study⁽¹⁾ and examined syllabi from the program's upper division courses along with student evaluations and exit interviews from graduating seniors. The committee also interviewed math majors and faculty. Comments from students and faculty are given in an appendix of this report. This report summarizes the committee's discussions about the information in those sources. The report will first address the reasons for the review, then look at the strengths and weaknesses of the program, and end with a discussion of opportunities that exist to improve the program's quality and productivity.

Reason for Review

A reason for this particular program review is the number of math degrees conferred by Southern Polytechnic State University (SPSU) in recent years. University System of Georgia Board of Regents policy requires review of a degree program when the average number of degrees conferred during a three-year period is less than ten. According to the math self-study⁽¹⁾ 7, 5, and 5 math degrees per year were awarded in 2003, 2002, and 2001, respectively, with an unknown amount of minors awarded. According to the American Mathematical Society Undergraduate Majors Profile⁽²⁾, math major enrollment trends have been stable from 1992 to 2001, somewhat in line with the math degrees awarded at SPSU from 1997 to 2003.

As of spring semester 2003, 16 Junior/Senior students declared math as their major at SPSU. According to the last American Mathematical Society Undergraduate Majors Profile⁽²⁾ there were 28,700 Junior/Senior math majors in the 1025 mathematics departments granting only baccalaureate degrees, giving an average of 28 Junior/Senior students per department. This disparity between SPSU and the national average is very misleading for two reasons :

- (1) At least 260 of the 1025 departments in the profile study also offer a computer science program in addition to a mathematics program (The computer science

program at SPSU is in a separate school). Some of the computer programs account for a major fraction of the department's majors.

(2) We know of no way to determine how many students are working on dual degrees (e.g. Physics/Math) that include math as their second degree or are working on a math minor.

As pointed out in the study-study document⁽¹⁾, when one looks at the ratio of total math majors to the total student population at a given school, SPSU is right around the average for Georgia's state universities. In terms of cost effectiveness, data supplied by the department indicates that the per student cost associated with maintaining the degree programs in mathematics are no greater than those arising from other upper division programs.

Strengths of Program

The math program at SPSU has a number of strengths. As noted in the comments transcribed in the appendix, everyone seems to agree that the regular mathematics faculty members are well trained and overwhelmingly caring and effective, student oriented teachers. Words such as "enthusiastic" and "helpful" were often used by the students to describe that group. Student exit interviews and opinion surveys convey the same message.

According to the SPSU data⁽³⁾, math graduates from SPSU earn salaries comparable to other majors. They also train people for jobs in high demand (e.g. high school teachers and actuaries). To reiterate what was stated in the conclusion of the math self-study, there will always be a need in a technological society for trained professionals who have the mathematical know-how to make things work.

Weaknesses of Program

A large number of faculty members have retired recently, and have not been replaced. (This may be the result of budget decisions based on other than academic considerations.) The result has been a significant increase in the use of part-time faculty. The concerns over the rising number of part-time instructors and the loss (or potential loss) in consistency of teaching performance corresponding to this was a huge concern. Not only does this raise questions about the quality of instruction, but would also seem to run counter to the University administration's desire to increase the amount of research funding generated by members of the faculty.

In terms of curricula and course offerings, the department's decisions seem to be too conservative. Rather traditional course offerings impact only a small number of math majors. As indicated, while the mathematics majors interviewed expressed an

unusually high level of satisfaction with their classroom experiences, several did indicate a desire for a wider variety, and more frequent offerings of, advanced courses. Most realized, however, that current enrollment levels would make this difficult.

There are some indications, however, that while extremely dedicated to their teaching, perhaps too few of these faculty members feel much responsibility for involving themselves in the affairs of the department or of the broader mathematical community. That leads to a perceived lack of vision. There seems to be a need for some faculty with a vision of what the department might become and a willingness to work for that goal. A feeling that they have just been trying to tread water seems to exist. One exception is their common concern over a growing dependence on part-time faculty.

Opportunities for Improving Program

It is true that the number of mathematics majors is small. This is the case at nearly every university. Nonetheless, the presence of a cadre of mathematics majors, even if relatively few in number, serves to enrich the institution as a whole, and especially the mathematics department. The courses provided for them also benefit other students by, for example, making minor programs in mathematics possible. Certainly there is a concern over the small number of majors, but a carefully restructured major might allow more courses for physics, biology and CS students, thus helping populate a few of their upper courses. Even a couple extra bodies would help.

New tenure track faculty must be hired not only for teaching but to stimulate undergraduate research. The department may also want to consider hiring full-time, non-tenure-track faculty with master's degrees to teach the lower division courses and take some load off regular faculty.

Other opportunities for improvement that arose in the committee's discussions that the math faculty might find useful are:

- Continued use of technology in the classroom.
- Tap into local industry as a resource.
- Have better connections to local high schools.
- Explore the possibility of an interdisciplinary master's program to further enliven the department.

⁽¹⁾ Academic Program Review Self-Study , Mathematics, Southern Polytechnic State University , November 2002

⁽²⁾ Survey of the Mathematical Sciences (Third report), Don O. Loftsgaarden, James W. Maxwell, and Kinda Remick Priestley, Vol. 49, Number 8, Sept. 2001

⁽³⁾ Fact Book 2001, Southern Polytechnic State University, Office of Institutional Research

Action Plan in Response to the Comprehensive Program Review for Mathematics at Southern Polytechnic State University

1. Continue to offer the Math major. Despite relatively low numbers of students majoring in mathematics, there is nothing in the self-study or APRC report to indicate any benefit in discontinuing the math major. There is no financial benefit to discontinue the program, since displaced students would either move into majors which, on the average, are less cost effective, or worse, leave the University altogether. The disadvantages of discontinuing the math major are many, including:

- ignoring an important facet in SPSU's mission
- reducing options for students not interested in an ET degree
- lowering the morale of the math faculty
- increasing the relative cost of offering the math minor

My recommendation is to retain the math major, even if enrollment cannot be increased above the current level (however, see below).

2. Students and faculty alike cited a paucity of upper level math offerings as a weakness. I recommend that the math faculty develop four new upper level courses, to be taught on a rotating schedule of one per semester over a two-year cycle. The cost of offering these new courses will be partially offset by examining the current math curriculum and offering less popular courses less frequently (say every three semesters instead of every two semesters). If and when enrollment improves, the frequency of offering of all advanced courses can be adjusted.

An area which should be considered is collaborative courses with programs that include a substantial computational content, such as computer science, physics, or the bioinformatics track in biology. Upper level courses developed to address needs in those areas will benefit from enrollment of non-majors.

3. Although the APRC report does not cite low enrollment as a concern, it is true that the low number of students contributes to the paucity and low frequency of upper level offerings. Increasing enrollment in the math program must be a high priority for all math faculty. Program head Steve Edwards has done a good job creating an attractive and interesting "storefront" at the open house events, but since most of the students attending these events are already interested (or worse, sold) on other programs, these efforts have not translated into many new majors.

What is required is a new initiative involving most, if not all, of the math faculty, working with Student and Enrollment Services, to attract students to SPSU who would normally not consider us for an undergraduate degree in math. The math faculty should be charged with the creation of a detailed plan that provides specific details on how to achieve this. All prospects generated by this effort should be followed up with personalized letters and phone calls.

Every degree program in the School of Arts and Sciences suffers from low enrollment, and it will be a priority in each program to step up recruitment efforts. Each program's success will have a synergistic effect on the other programs, as SPSU becomes better known in the area as an institution with strong programs in the School of Arts and Sciences.

4. Several faculty were concerned about the increased reliance on adjunct faculty and the inability to hire new tenure-track faculty. Although this is a weakness of math-the-service-program more so than math-the-degree-program (the number of tenured faculty are more than adequate to meet the needs of the math major program), it does affect the morale of the program and the ability to schedule upper level classes. Math does use a high number of adjunct faculty (as do many other programs at SPSU). Because of the high number of retirements in recent years, there is a fear that the program is being allowed to atrophy through neglect. I recommend the following:

- First, begin a search immediately Fall semester for one math lecturer and one math assistant professor. Don't wait until the budget for AY05 is settled before starting this search. The two math hires must be a top priority for the institution. Preference should be given to hiring a tenure-track mathematician who can develop a research program which can involve upper-level math majors. A third position (tenure-track) should be considered, within the framework of budget constraints and University hiring priorities.
- Second, hire a full-time temporary math instructor for AY04. If additional funding comes available, a second temporary position should be considered against other University priorities.
- Third, until the use of adjunct faculty in math is brought down to a reasonable level, participation in faculty development programs involving a significant amount of reassigned time will receive careful scrutiny.

5. Involve undergraduate majors in research projects with mathematics faculty. The math faculty are doing a good job in meeting the campus expectations in the area of Academic Achievement (note that three math faculty were promoted to Professor over the past two years, in part because of the quality of their accomplishments in that area), however, few opportunities for involvement of undergraduates exist currently.

Within the other programs in A&S, it has been the case that an infusion of young faculty has resulted in an increase of activity in the area of Academic Achievement. Math has gone many years without a new hire. Hiring new faculty is important for the reasons noted above; it is also important because it will foster growth in the research productivity of the department.

6. The Math APRC report cited a perceived lack of responsibility for involvement in the affairs of the department or of the broader mathematical community, and a perceived lack of vision.

This is not a problem isolated within the math program. To some extent, it has to do with the involvement all programs have in campus planning and setting strategic goals. Some programs (HTC, for example) take a very active role in determining their own goals and strategies by holding an annual retreat. By inviting the dean, they can ensure buy-in of their plans and avoid wasting time spinning their wheels on blue-sky projects.

I recommend that the Math department conduct a planning session or series of meetings to discuss implementation of the program review action plan. This should include all full time math faculty (including any lecturers and full-time temporary instructors) and the dean. Part of this session should be dedicated to establishing departmental goals, and establishing strategies for meeting those goals. There should also be more opportunity for math faculty to interact with each other (and with the dean) socially. Many departments schedule periodic department lunches off campus. I recommend that the math department adopt this practice.

Appendix: Math Program Review

Southern Polytechnic State University

Students/Faculty Comments

Students

a) What do you think the strengths of Southern Polytechnic's math program are?

- The ability of the professors and the dedication of the students.
- Regular faculty members are helpful, effective, student-oriented.
- The professors love what they do and are good at it. For a small school, there is a decent selection of courses available
- I think the flexibility of the Math degree is its greatest strengths. Students can dual-degree, double-major, or minor in mathematics. I am currently pursuing the dual-degree option with majors in Computer Science and Mathematics.
- The math faculty here at SPSU are extraordinary. Faculty are always available and eager to help students. Professors are very knowledgeable in the subjects they teach.
- Extra help provided to students taking lower level math courses (i.e. help sessions, tutoring, recitation sessions) are not found in most schools. This gives these students not majoring in Math the ability to pass their required math courses for their degree.

b) What do you think the weaknesses of Southern Polytechnic's math program are?

- The low number of math majors and the inability to schedule more major classes due to the lack of math major students.
- Would appreciate a wider variety of advanced courses, more frequent offerings.
- Being that it is a small school and there is no math graduate program or larger selection of math courses as with larger schools, I think the program leaves a bit to be desired in preparing math students adequately for grad school.
- The variety of courses offered at most schools are not found here. Courses relating to specific areas in industry are offered at bigger schools. Also, courses are not offered very much because of the few people who take the upper level math courses.

c) What opportunities do you think exist for Southern Polytechnic's math program?

- The opportunity to grow and flourish with new students. I also believe if we worked closely with Kennesaw, we may be able to up the availability of classes offered, therefore making the math major a more "complete" and attainable (in a reasonable period of time) major option for incoming students.
- Anything and everything. Math can be applied to almost anything.
- Graduate school, government industry employment, financial industry employment, computer industry research.

d) What threats do you think exist for Southern Polytechnic's math program?

- There is always the threat of having no participants, especially if the number is always low. Also, the lack of students in the program presents a semester issue of not having enough students to hold a class to make it worthwhile to the professor. However, things like this can be avoided if we as an "education community" work together to answer all questions for incoming students and "advertise" the math program and show the rest of the students that getting a math major means you have to become a teacher. A large misunderstanding among the student body (and I witness it when I reveal my major choice) is they believe the mathematics field is an extremely limited field. If we can repel those thoughts in students and parents, alike, then we may be able to enhance and grow the math program.
- None. Math is a foundation for most of the majors on campus. In my opinion, there is no department more important than the math department.
- Not enough majors to continue offering the degree.

e) Do you have any other thoughts or comments on the program?

- Even though one can do much more than teach with a math major, my first career route is to become a secondary math teacher. My mother has often asked me and wondered why we can't work with Kennesaw, who has a teacher certificate program, to achieve goals that students have, such as completing the teacher's certification and my math major at the same time. I think that it would be beneficial for both schools if we thought more about working together for the sake of students and the field other than restricting due to "rules" or rivalries. I think that's what I mean.
- Would like more interaction with the department not related to specific courses. Info on career options, use of technology, research.
- It should be expanded as much as possible.
- I think the basis of degree is exceptional. I think that research could be done however to find out other math courses that students would be interested in taking. For example, as a major in computer science and mathematics, I wish more courses were offered by the math department that explored the mathematics in computer science. Mathematics is highly used in computer science -- from graph theory to the modern algebra used in 3D graphics. More courses could be offered that explore these applications in mathematics along with other applications courses related to engineering.

Faculty

a) What do you think the strengths of Southern Polytechnic's math program are?

- We have very well-qualified faculty. We have slowly been getting better

and better students, and we now have several outstanding students.

- High regard for fellow regular faculty members.
- We have a solid curriculum for math majors, a particular strength being the capstone course that majors are required to take. This is a course that is built around projects designed to force our students to draw together what they have learned in several different courses to solve problems in applied math. I think that gives our majors a feeling for what it's like to use mathematics and to do research in mathematics. In both instances, one is often forced to machine new tools and to use old tools to new ends. This is the heart and soul of mathematics, to my mind, and not every program offers majors an opportunity to develop skills that go with this sort of application in a structured setting.
- It is a sound program of study, modest by comparison to those offered by Ph.D. granting departments at the State University/State Engineering School level, but nevertheless sound. It is taught by well qualified faculty who are good teachers, lecturing, for the most part, in their specialties.
- Over the years Simon Stricklen put together an excellent group of very dedicated mathematicians and mathematics teachers. There is not a "fake" to be found. All have a real appreciation of what good mathematics is. As the level of our mathematics majors improves (and it is improving) the abilities of the faculty in our department will be a big plus. I especially commend Joel and Steve for the great job they have done as department heads.

b) What do you think the weaknesses of Southern Polytechnic's math program are?

- Five faculty have retired and no replacements hired. Around forty percent of our classes will be taught by part-time faculty in Fall 2003. This is a perilous situation for the university, the department, and the degree program.
- Over dependence on part-time faculty.
- Budget decisions not always made by academic officers
- Relatively little faculty involvement in departmental affairs.
 - It is difficult for us to run courses that are not currently seen as
 - absolute, meat-and-potatoes major courses, just because of the limits
 - imposed by an institution with the size and priorities of SPSU. Example:
 - all of our majors should have access to courses in topology and in complex
 - variables. We are now down to twelve regular full-time faculty and we carry

- many student credit hours at the low end. This means that we have to be
 - very careful about offering major courses with low enrollments. Net result:
 - courses like topology and complex variables are offered very rarely, every
 - few years or so, and then as special topics courses. The majors end up on
 - the short end of the stick. They view the material we offer in courses like
 - this as marginal, or maybe they don't know what the special topic will be
 - when they see it offered, or maybe they miss out altogether because of the
 - timetable they have.
- The program is somewhat basic and taught at a lower level of expectation than, say, Georgia Tech, because, with rare exceptions, our students are, for students of mathematics, somewhat weak, both in talent and in the preparation they have received in their first two years.
- I'm not aware of any significant weaknesses.
- c) What opportunities do you think exist for Southern Polytechnic's math program?
- We have a growing number of students who are interested in math as a major, as a second major, or as a second degree. If the number of computer-related majors continues to grow, we will probably have a corresponding growth in mathematics majors.
- This is an excellent time to hire strong, recent PhDs in mathematics. If
 - the SPSU administration could recognize that, we could get new blood in the
 - department that would revitalize us and our major program. We have not had
 - a hire in over eleven years, but because we have had several retirements
 - lately and are slated for several more in the next few years, we should be
 - in line to hire new faculty. Several recent retirees were not PhDs in
 - mathematics and were not particularly interested in research or recent
 - applications of mathematics. This is a great time to get young people
 - teaching our young math majors and inspiring them with tales of new things
 - in mathematics. Like any discipline that thrives on new ideas, mathematics
 - is driven by younger people and we could begin to tap that resource now.
- The meaning of this question is not clear to me. Does it mean opportunities for graduates in mathematics? If so, I must say that I am uninformed about this. I have the general impression that numerous companies and government agencies are interested in holders of degrees in mathematics for their general analytical skills and outlook. For a select few, there is the hope of graduate school and a professional career.

- As time goes on, I would like to see more special topics courses for our math majors.
- d) What threats do you think exist for Southern Polytechnic's math program?
- Our administration's failure to hire new faculty. Our last hire was in 1992.
- I worry that SPSU's upper administration is unaware of the fact that our department is peopled by faculty who are overworked, underappreciated, and aging fast. If we fail to hire younger faculty members, I think the threat to the program is considerable: ultimately, we will not be able to offer enough upper division, low enrollment courses to satisfy a proper major program. Since we have lost one third of our faculty in the last three years, and we have not had a hire in over eleven years, this is a serious concern, a genuine threat to the program, and ultimately the University.
- In my opinion, the chief threat would lie in misguided attempts by non-mathematicians to compare it, on the one hand, to either 4-year college programs, almost all of which run at a significantly lower level whatever their catalog may suggest, or, on the other, to programs with significantly more talented students. The efforts of uninformed persons to improve it would be very dangerous. Amateurs should do their own dental work.

A second threat is the lack of hiring new Ph.D. faculty to replace the five members who have recently retired. There are others who are not far from retirement. In the nature of things, we will not be so fortunate as to hire only persons who will prove desirable tenured faculty, nor be able to keep all of those we would like to keep. So if we are actually to strengthen the department while maintaining its enviable congeniality we need to start building for the future.

Finally, there are the increased burdens on faculty time due to the present policies of the administration. This adversely affects faculty performance and morale. As all great universities know well, it is through increased time for thought, reflection, and innovation that new knowledge and new methods arise.
- We really need to hire some more full time tenure-track faculty to make up for some of the recent retirements.
- e) Do you have any other thoughts or comments on the program?
- Majors no more expensive than those in other upper division programs.
- Could consider - an MS program, concentration in statistics geared to actuarial preparation, wider use of the web.
- I have grave concerns that the administration at SPSU does not appreciate

- the place of a mathematics program in a university dedicated to technically
- oriented disciplines. Recently, the mathematics faculty has come under
- pressure to justify the low success rate in our core courses. The unspoken
- threat, though, is to the major program: maybe if we fail too many
- students--- many of whom exhibit dismal performance on a seventh grade exam,
- namely, the MAT--- then we must put all our eggs into the core curriculum
- basket. We must pass these students and forget about our major program!
- But if you undermine a major like mathematics at a so-called engineering
- school, you deprive students of an obvious second major, as well as a more
- versatile alternative to engineering curricula, several of which put
- students in the impossible situation of ineligibility to take licensing
- exams. Mathematics is important, to all of us, for many reasons. I would
- have a more relaxed attitude towards life if I knew that the administrators
- who make decisions at SPSU appreciated its importance .
- It is a modest, but respectable, degree, particularly in the hands of the present
- faculty.
- No additional comments.

CPR Findings and Plans for the Bachelor of Science in Mathematics at Southern Polytechnic State University

1. Summary of the Findings of the Math Academic Program Review committee

According to the math self-study 7, 5, and 5 math degrees per year were awarded in 2003, 2002, and 2001, respectively, with an unknown amount of minors awarded. For spring semester 2003, 16 Junior/Senior students declared math as their major at SPSU. According to the last American Mathematical Society Undergraduate Majors Profile, the average for mathematics departments granting only baccalaureate degrees is 28 Junior/Senior students per department. This disparity is misleading for two reasons :

- (1) At least 260 of the 1025 departments in the profile study also offer a computer science program in addition to a mathematics program (The computer science program at SPSU is in a separate school).

- (2) Students working on dual degrees (e.g. Physics/Math) or a math minor are not included in SPSU's figures

When one looks at the ratio of math majors to total student population at a given school, SPSU is about average among Georgia's state universities. In terms of cost effectiveness, data indicate that the per student cost associated with maintaining the degree programs in mathematics is no greater than those arising from other upper division programs.

Strengths of Program

Mathematics faculty members are well trained and overwhelmingly caring and effective, student oriented teachers. Math graduates from SPSU earn salaries comparable to other majors.

Weaknesses of Program

A large number of faculty members have retired recently, and have not been replaced, resulting in a significant increase in the use of part-time faculty, and raising concerns over the loss (or potential loss) of consistency in teaching performance. Mathematics majors interviewed expressed an unusually high level of satisfaction with their classroom experiences.

The department's curriculum and range of course offerings decisions seem to be too conservative. Mathematics majors interviewed indicated a desire for a wider variety and more frequent offerings of, advanced courses.

There are indications, that few faculty feel responsibility for involving themselves in the affairs of the department or of the broader mathematical community. There seems to be a need for some faculty with a vision of what the department might become and a willingness to work for that goal.

Opportunities for Improving Program

New tenure track faculty must be hired not only for teaching but to stimulate undergraduate research. Other opportunities for improvement are:

- Broader use of technology in the classroom.
- Exploring funding opportunities for the training of undergraduates.
- Tapping into local industry as a resource.
- Better connections to local high schools.
- Modernizing some classes with computational, algorithmic and/or applications.
- Exploring the possibility of an interdisciplinary master's program (e.g. computational science).

2. Proposed Action Plan

- Continue to offer the Math major.
- Develop four new upper level courses, to be taught on a rotating schedule of one per semester over a two-year cycle.
- Charge the math faculty with the creation of a detailed plan that provides specific details on how to attract students to SPSU who would normally not consider us for an undergraduate degree in math.
- Begin a search immediately Fall semester for one math lecturer and one math assistant professor, and hire a full-time temporary math instructor for AY04.
- Involve undergraduate majors in research projects with mathematics faculty.
- Conduct a planning session or series of meetings (to include the dean) to discuss implementation of the program review action plan, establish departmental goals, and devise strategies for meeting those goals.

3. Future Allocation of Resources

No extraordinary reallocation of University resources is called for in the proposed action plan. Math faculty will be hired to replace recent retirees as part of the established formula for determining faculty hiring priorities based on departmental workloads.

4. Plan For Increasing Program Productivity.

Program productivity is tied to increasing enrollment. This is a top priority not just for the Mathematics Department, but for the entire School of Arts and Sciences.

Academic Program Review Self-Study

Mathematics Southern Polytechnic State University November 2002

I. Strategic Vision

The mission of Southern Polytechnic State University is to provide the residents of Georgia with university-level education in, among other things, arts and sciences. The Mathematics program serves this mission by offering bachelor's degrees in Mathematics.

The Mathematics Bachelor's degrees are designed to prepare students for a variety of careers and post graduate studies. Some of our graduates have continued their education after leaving us by beginning graduate study in Mathematics, Computer Science, and Aerospace Engineering. Some of our graduates have gone on to teach high school, and quite a few have entered the actuarial field.

II. Curriculum

The Mathematics Program currently offers two degrees in Mathematics, the Bachelor of Science and the Bachelor of Arts.

Bachelor of Science

The BS in Mathematics consists of 120 credit hours, including: 60 hours of core courses, 28 hours of required Mathematics courses, 9 hours of elective Mathematics courses, and 23 hours of elective credit. Students are required to take two semesters of calculus-based physics for the BS. This degree option meets the needs of a large number of our majors who fall into two categories: first, students who transfer to SPSU after spending two years at a regional college, and second, students who decide in their sophomore year to change their major to mathematics.

Bachelor of Arts

The BA in Mathematics consists of 120 credit hours, including: 60 hours of core courses, 28 hours of required Mathematics courses, 9 hours of elective Mathematics courses, 18 hours in the Foreign Language and International Studies Minor, and 3 hours of elective credit. The BA degree is newer than the BS. It appears that this degree is attractive to students who do not wish to take the physics courses which are required for the BS.

In addition to Calculus I and II, the following mathematics courses are required for both degree options:

Course Number	Course Name	Credit Hours
MATH 2306	Ordinary Differential Equations	3
MATH 2345	Discrete Mathematics	3
MATH 3312	Linear Algebra	4
MATH 3320	The Real Line	4
MATH 3321	Functions of a Real Variable	4
MATH 3256	Calculus and Linear Algebra	3
MATH 4440	Abstract Algebra	4
MATH 4451	Applications of Mathematics	3

In addition to the courses above, the following courses are offered at least annually for elective math credit:

Course Number	Course Name	Credit Hours
MATH 2335	Numerical Methods I	3
MATH 3261	Probability and Statistics II	3
MATH 3268	Probability Theory	3
MATH 3336	Numerical Methods	3
MATH 4406	Differential Equations II	3
MATH 4407	Vector Analysis	3
MATH 4417	Functions of a Complex Variable	3

Various faculty have offered special topics course for our majors from time to time. In recent years offerings have included Topology I, Topology II, Fundamentals of Abstract Mathematics, and Introduction to Differential Geometry.

Common to both degrees is a core requirement for 8 hours of computer science classes, CS1301 and 1302.

Math 3310, Introduction to Advanced Mathematics, will become a required 3 credit-hour course in Fall 2003 (see Outcomes Assessment, below).

The mathematics program instituted mandatory advising for its majors in 2001. In order to register for classes, students must first obtain an "alternate PIN", which the students get from their advisors. This practice has been successful both in ensuring that students make the right choice about which courses to take and in increasing contact between faculty and students. Prior to the institution of this advising practice, there was no mechanism in place to ensure that students were advised.

III. Outcomes Assessment

The primary tool used by the Mathematics Program for outcomes assessment is the exit survey.

One comment that has been made in various ways by students in exit interviews is that they would like to have a course that introduces them to theorem-proving and proof-writing techniques. In particular, students have indicated a need for a course "to fill the gap between calculus and analysis," or that Math 3320, The Real Line, should follow "a fundamental course in writing formal mathematical proofs." These comments have been taken to heart. For Spring 2002, a course to fit this bill, "Fundamentals of Abstract Math" was offered as a special topics course. For Spring 2003, we are offering a course along similar lines called "Introduction to Advanced Mathematics." The Mathematics program has submitted a proposal to the University Curriculum Committee to make such a course a regular part of our curriculum. Math 3310, Introduction to Advanced Mathematics, is a three credit-hour course that the Mathematics faculty has approved as an addition to the curriculum in the next academic year. This course will be a required course for both degree options.

IV. Student Enrollment and Cost Effectiveness

Below is data on Mathematics Bachelor's Degrees in recent years* awarded at SPSU and at other Regional Universities in Georgia. If the ratios of numbers of math majors to total student enrollment are compared, it can be seen that SPSU is in the middle of the group, and in fact right around average.

	2000-2001	1999-2000	1997-1998	Fall 2001 enrollment	Math graduates/enrollment
SPSU	5	3	5	3556	.0036
Albany State University	6	5	8	3456	.0054
Armstrong Atlantic University	8	10	9	5747	.0047
Augusta State University	5	5	1	5407	.0020
Columbus State University	5	3	3	5521	.0020
Fort Valley State University	7	5	8	2485	.0080
Georgia Southwestern State University	3	2	2	2535	.0027
Georgia College and State University	2	1	3	5079	.0023
North Georgia College and State University	7	10	11	3863	.0072
Savannah State University	4	10	10	2270	.0044

State University of West Georgia	6	2	9	9030	.0019
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*This data is from the National Center for Education Statistics website, www.nces.ed.gov and from http://www.usg.edu/usg_stats/enrollment/fall01.pdf.

Below are the Bachelor's degrees awarded and Minors awarded at SPSU by calendar year. Although there has been a dip in Mathematics minors earned in recent years, there appears to be a strong surge in interest in the minor of late. It is expected that there will be strong numbers of minors in the next few years.

Year	Mathematics degrees awarded	Minors earned
2003	5*	Unknown
2002	5	2
2001	5	4
2000	5	13
1999	6	6
1998	7	9
1997	3	9

*Five students have petitioned to graduate for Spring 2003, so apparently there will be at least five mathematics degrees awarded in 2003.

Because the Mathematics program carries a large service load of courses, determining the cost effectiveness of our degrees requires an isolation of costs that are attributable only to the mathematics degree. These costs arise from the offering of upper level mathematics courses that service only students seeking mathematics degrees. In 1998-1999 we staffed 25 hours of such courses, in 1999-2000, 25 hours, and in 2000-2001, 28 hours. By using the average mathematics faculty salary for these years, and assuming a 24 hour faculty load per year, we can compute the total cost of staffing the courses necessary for our mathematics degrees. This can then be used with the number of student credit hours in these courses, majors, and graduates to compute a cost per student credit hour, cost per major, and cost per graduate. We have the following for courses attributable only to the mathematics degree:

	98 - 99	99 - 00	00 - 01
Faculty Cost	\$55,167	\$58,152	\$69,956
Student Credit Hours	258	178	264
Number of Majors	28	25	30
Number of Graduates	6	3	5
Cost per SCH	\$214	\$327	\$265

Cost per Major	\$1,970	\$2,326	\$2,332
Cost per Graduate	\$9,195	\$19,384	\$13,991

To place these figures in perspective, they can be compared to the nine Southern Polytechnic degree-granting non-service programs. In 2000 - 2001, our cost per SCH is less than 4 of those 9 programs. Our cost per major is less than 8 of those 9 programs. Our cost per graduate is less than 7 of those 9 programs. It is clear from these figures that the mathematics program, though small in size, is very cost effective.

V. Faculty Contributions

The Mathematics faculty is professionally active, both in Georgia and nationally. Below is a selection of faculty publications, professional presentations, and grants awarded in the last five years.

Publications

- Dillon, Meighan, and Fadyn, Joseph. "Team Teaching Differential Equations with the TI-89," Proceedings of the Thirteenth Annual ICTCM, 2001.
- . "Team Teaching Second Semester Calculus with the TI-89", Proceedings of the Twelfth Annual ICTCM, AddisonWesley Longman, Inc., 2001.
- Fadyn, Joseph. "More Structured Maple Projects For Differential Equations", Proceedings of the ICTCM-XV, Addison Wesley Longman, Inc., 2003 (to appear).
- . "A Structured Maple Projects For Differential Equations," Proceedings of the ICTCM-XIV, Addison Wesley Longman, Inc., 2002.
- . "A Team Teaching Calculus II Using the TI-89", Proceedings of the ICTCM-XII, Addison Wesley Longman, Inc., 2000.
- . "Investigating Star Polygons with the TI-82," Proceedings of the ICTCM-IX, Addison Wesley, Inc., 1997.

Professional Presentations

- Dillon, Meighan. "Inner Ideals in Representations of Affine Lie Algebras," Informal Geometry Seminar, Georgia Institute of Technology, School of Mathematics, November 2001.
- Dillon, Meighan, and Fadyn, Joseph. "Team Teaching Differential Equations with the TI-

- 89," Invited Talk, ICTCM, November 2000.
- . "Team Teaching Second Semester Calculus with the TI-89," Invited Talk, ICTCM, November 1999.
- Edwards, Steven. "Miles of Tiles--Patterns in the Plane," Short Course at the Joint Southeastern Section MAA and Atlantic Section SIAM Meeting, Clemson, SC, March 2003 (accepted)
- Fadyn, Joseph, "More Structured Maple Projects For Differential Equations," 15th International Conference on Technology in Collegiate Mathematics, Orlando, Florida, Nov. 2002.
- . A Structured Maple Projects for Differential Equations,@ 14th Annual International Conference on Technology in Collegiate Mathematics, Baltimore, Nov. 6, 2001.
- Fowler, Joel. "The TI-89 in a (Semi)-Traditional Differential Equations Course," 15th Annual International Conference on Technology in Collegiate Mathematics, Orlando, FL, November 2002.
- . "The TI-89 in Calculus I:A Report from the Classroom," 13th Annual Conference on Technology in Collegiate Mathematics, Atlanta, GA, November 2000.
 - . "Ideas for Implicit Graphing in the Mathematics Curriculum," 12th Annual Conference on Technology in Collegiate Mathematics, San Francisco, CA, November 1999.
 - . "Statistics Programs for The TI 82," 11th Annual Conference on Technology in Collegiate Mathematics, New Orleans, LA, November 1998.
- Gordon, John. "A Taste of Cooperative Learning in College Algebra, Precalculus, and Calculus I," Joint Meeting of MAA and AMS, Georgia Institute of Technology, March 8, 2002;
- . "Should We Use the TI-89 in College Prep High School Math Classes?," Georgia Mathematics Conference, Rock Eagle, Ga, October 2001.
 - . "Dr. Thomas Angelo's Teachers' Dozen in Algebra and Trig," Georgia Mathematics Conference, Rock Eagle, Ga, October 18, 2001.
 - . "Let's Try to Find Ways to Use Research-Supported Ideas in the Learning and Teaching of Mathematics," National Council of Teachers of Mathematics Southern Regional Conference, Mobile, Alabama, March 2000.
- Kropa, James. "Dual Career of Teaching and Consulting," AMS-MAA meeting, Georgia Institute of Technology, March 8, 2002.
- . "Instructional Equilibrium for Differential Equations," Georgia Perimeter College Mathematics Conference, February 8, 2002
 - . "Using Interactive Mathematical Equations Software to Enhance Learning," ICTCM, November 18, 2000.
- Pace, Jack "Interactive Computation and Visualization of Geodesics Using Stereo Pairs", Southeastern MAA /AMS Meeting, Georgia Institute of Technology, March 2002.
- . "Visualization of Four-dimensional Objects," Southeastern MAA Meeting, Huntingdon College, March 2001.
- Ziegler, John. "Maple Illustrations of Key Topics from Vector and Multivariable Calculus," 14th International Conference on Technology in Collegiate Mathematics, Baltimore, November 2002.
- . "An Introduction to Maple 8," as a four-session In-Service Training Program for the Cobb County School System, September 2002.

- . "Maple Illustrations of Iterated Integrals," Joint Southeastern Sectional MAA/ Southeast Regional AMS Meeting, Atlanta, March 8, 2002.
- . "Selected Maple Graphics and Animations for Calculus," Seventh Annual Valdosta State University Mathematical Technology Conference, February 22, 2002.
- . "Maple and the Intersecting Cylinders," 80th Annual Meeting of the Southeastern Section of the MAA, March 30, 2001.
- . "Understanding Better by Seeing Better," Fifth Annual Valdosta State University Mathematics Technology Conference, February 24, 2000.
- . "Selected Applications of Maple Graphics to Vector Calculus," Fourth Annual Valdosta State University Mathematics Technology Conference, February 26, 1999.

Awards

- Dillon, Meighan. Principal Investigator, "Promoting Active Learning and Collaboration in Calculus with the Investigative Classroom," National Science Foundation Grant No. DUE-0126711, effective July 2002-June 2004
- . Principal Investigator, "Redesigning Sophomore Level Calculus Based Mathematics Courses," with Dr. Joseph Fady, University System of Georgia Teaching and Learning Grant, July 1999 through June 2000. Amount of award: \$24,000.

VI. Changes in the Field That Could Affect the Program

The pure mathematics content of an undergraduate degree has been relatively stable for quite some time. However, applications of mathematics and methods for doing mathematics are continually developing. Our increasingly technological society demands graduates that have a clear understanding of numbers and mathematics, that they can apply those ideas in a variety of settings, and that they think creatively to solve problems in new fields. The Southern Polytechnic Mathematics Program has always had a problem-solving, applied focus. Our upper division courses reflect a mixture of theory and application. Maintaining communication with fields outside of mathematics will be critical in keeping the program current.

The ability to manipulate symbols to get answers is becoming less important as the need to understand mathematics grows. The capabilities of newly-developed computer tools such as Maple and Mathematica, which can solve most manipulative mathematics problems, highlights the need for thinking mathematics graduates who are prepared to do more than plug into formulas. These computer algebra systems are changing the way that mathematics is used as well as the way it is taught.

The impact of technology can be seen most dramatically in lower level service courses. The existence of symbolic calculators such as the TI-89 and other computer tools are

bringing about a re-evaluation of algebra, pre-calculus, and calculus courses throughout mathematics programs. The TI-89, which represents the cutting edge of calculator technology, is a required part of Southern Polytechnic courses from Algebra through Calculus II. The TI-89 or Maple is also in use in some of our sections of Differential Equations, Probability and Statistics, and Calculus III. While the Mathematics Program has already incorporated technology into the content of its courses and instructional methods, these tools will continue to develop. The challenge in the future for the mathematics community in general, and the Southern Polytechnic mathematics program in particular, will be the continued assessment of the impact these new developments have on our field.

VII. Plans for the next 5 Years

Many universities, for example the Georgia Institute of Technology, have recitation classes for courses through Differential Equations. It would be worthwhile exploring the possibility of extending recitations from our present, minimal situation. Right now only College Algebra, Math 1111, has recitation classes. The results of such an extension would be twofold: first, students taking such courses would have the potential to improve many aspects of their learning in these courses, and second, this would be very good experience for our majors. At present, our number of majors is far from what would be needed to staff this activity. Another possibility is to use some of our students as graders in lower-level courses. This is also a common practice at many distinguished institutions. Again, we do not presently have sufficient students for this, but if such an activity were initiated, this would no doubt make our program more attractive to students, and it would improve the value of education that our students get in lower-level courses.

VIII. Conclusion

The Mathematics programs at Southern Polytechnic offer opportunities for our students to begin careers in teaching, actuarial work, and related fields, and they also offer opportunities for students to begin graduate study in mathematically-related fields. Our programs are cost-effective and average in size for Georgia. The faculty who teach these our Major courses are provided with stimulus for their professional development and scholarship.

In our increasingly technological society, there will always be a need for professionals who have the mathematical know-how to make things work. Our graduates play an important role in this.