Graduate Program Review
Mathematics and Statistics - Spring 2010

Introduction

The 6-year review for graduate programs in the Department of Mathematics and Statistics (Hereafter, simply “M&S”) was begun in the Fall of ’09 and finished in the Spring of ’10. An internal Texas Tech committee consisting of faculty outside M&S was constituted. The members are

- Dr. Peter Westfall, Chair (Information Systems and Quantitative Sciences)
- Dr. William Lan, (Educational Psychology and Leadership)
- Dr. Jordan Berg (Mechanical Engineering)

In addition, three outside reviewers participated:

- Dr. Raymond Carroll, Distinguished Professor, Department of Statistics, Texas A&M
- Dr. Charles Moore, Associate Professor, Department of Mathematics, Kansas State
- Dr. Roger Berger, Professor and Director, Division of Mathematical and Natural Sciences, Arizona State

Dr. Carroll and the internal committee met with M&S groups and individuals Monday, March 1.

Drs. Moore and Berger and the internal committee met with M&S groups and individuals Tuesday-Wednesday, March 2-3.

All members of the review team received the Graduate Program Review binder provided by M&S.

This report contains the conclusions of the internal committee, based on the materials provided by M&S, based on interviews during the three day review process, and based on reports of the external reviewers.

Overview of Report and Recommendations

The M&S department is, in many ways the backbone of Texas Tech. They provide an enormous teaching service to the university, more than any other department. Their research programs support the universities aim toward Tier One status: Mathematics and Statistics are the language of science, and the faculty are engaged in numerous projects that directly and indirectly support research campus wide. A main recommendation of the committee is that resources be made available at the university level to support our proposed changes. M&S will not be able to make these changes without university support, and without these changes the department will suffer, taking down research and teaching services to the university in the process.

The university is moving toward a “Responsibility Center Management” (RCM) model that encourages some of the policies of the Department that have detrimental effects. Many of our recommendations involve discontinuing these policies, and will hurt the Department under the RCM model without
university support. We suggest that, in light of the extreme need for Mathematics and Statistics to support the infrastructure needed for TTU to achieve Tier I status, that special accommodations over and above those of the RCM program be given to the Department to allow them to maintain and increase their presence campus-wide.

The following grading scheme was used to evaluate each of the five stated dimensions of performance in delivering graduate education:

A = Excellent  
B = Acceptable  
C = Acceptable with Concern  
D = Deficient  
F = Unacceptable

Detailed analysis is provided later in the report. First we assign grades and recommendations.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Overview and Vision</td>
<td>B</td>
</tr>
<tr>
<td>Faculty Productivity</td>
<td>A</td>
</tr>
<tr>
<td>Quality and Quantity of Graduate Students and Graduates; The Graduate Student Experience</td>
<td>C</td>
</tr>
<tr>
<td>Curriculum and Programs of Study</td>
<td>C</td>
</tr>
<tr>
<td>Facilities and Resources</td>
<td>B</td>
</tr>
</tbody>
</table>

Recommendations:

1. **Reduce the teaching load on graduate students.** The two course load puts Texas Tech at a disadvantage in terms of allowing time for quality research, and it also harms recruiting. Seek ways to increase number of students with a one course load. We recommend that the department put a plan in place to reduce the teaching loads, and that the University give support for the plan.

2. **Eliminate the 13 credit/semester requirement.** Students feel that these are empty hours for which they must pay. The unit requirement is 3-4 credit hours more than is standard, and it places extra burden costs extra and removes incentives for broadening education beyond the M&S boundaries. In addition, it harms recruiting. We recommend that the department put a
plan in place to reduce this requirement to the standard of nine credit hours per semester for a full-time graduate student, and that the University give support for the plan.

3. **Allow greater autonomy of groups within the department.** There are three main groups, Applied Math, Pure Math, and Statistics; and one emerging group, Math Education. Allow greater autonomy within groups to set degree plans, to determine appropriate qualifying examinations, and to enforce thesis advising policies. We recommend that defined committees, with committee chairs, be identified for all groups, that the groups provide mission and vision statements for their programs, and that the department as a whole be flexible and accommodating in honoring these requests.

4. **Improve space for faculty and students.** As enrollments increase, the department will quickly run out of space. Quarters are already tight. We recommend that the department put a plan in place to increase space, and that the University give support for the plan.

5. **Hire 1 to 2 additional statistics faculty.** With one of the existing faculty mostly in administration, and another having recently left the university, the department desperately needs additional FTEs in this area. We recommend that the department immediately begin to recruit and hire statistics faculty.

6. **Improve documentation and consistency of advising.** There is concern among students that rules are not clear and procedures are not standardized. We recommend that clear, consistent guidelines be produced and followed in advising graduate students.

What follows are detailed discussions of the five dimensions of graduate education delivery that have led us to make these recommendations.

**Program Overview and Vision**

The Graduate Program Review binder contains an overview of the M&S administration, service to the university, degree programs, faculty, and teaching assistants. It is apparent that the department provides a great deal of service to the university, having the “largest teaching load of any department at Texas Tech.” It also notes that graduate student enrollment has remained steady, despite declining national trends.

While mission and vision statements were not provided with the binder, a web search finds 2006 mission and vision statements. These are unchanged from those reported in the 2004 graduate program review for M&S:

**Mission:** The faculty, graduate students, and staff in the Department of Mathematics and Statistics are committed to excellence in teaching, research and service. We provide a foundation of mathematics for all undergraduate students as well as specialized programs for mathematics majors and graduate students. We discover, develop, apply and disseminate mathematics and statistics.
Vision: The Department of Mathematics and Statistics aspires to the highest standards of excellence in all aspects of teaching, research and service. The department will build and maintain nationally and internationally recognized expertise in core, as well as emerging, areas of mathematics and statistics. We will actively promote multidisciplinary scientific activity and partnerships as we develop our national and international reputation as a leader in interdisciplinary research and outreach.

It is a concern that the mission and vision statements have remained static. In line with the above recommendations to improve autonomy within subgroups, with each subgroup providing mission and vision statements, it is also reasonable to suggest that the department as a whole revise their mission and vision statements to reflect changes.

**Faculty Productivity**

Since the last review in 2004, the faculty roster of the Department of Mathematics and Statistics contains about the same number of the tenured and tenure-track faculty members (43 and 44 for 2004 and 2009, respectively), non-tenure track faculty member (14 and 16 for the two years), and GPTI’s (64 and 60). However, the number of TA’s working for the department has dramatically increased from 9 in 2004 to 25 in 2009. The percentages of tenured and tenure-track faculty members at the ranks of professor, associate professor, and assistant professor in 2009 are about the same as five years ago. Compared to other BIG XII universities, such as Oklahoma State University, University of Kansas, and University of Oklahoma, the Department of Mathematics and Statistics at Texas Tech seems to have relatively larger number of full-time faculty members.

During the last six years, the department faculty members were recognized for their outstanding performance in teaching and research and selected as recipients in university and college award competitions, including Barnie E. Rushing, Jr. Faculty Distinguished Research Award, Arts & Sciences Outstanding Researcher Award, Professing Excellence Award, Phi Beta Kappa Professor of the Year Award, Hemphill-Wells New Professor Excellence in Teaching Award, Honors College Outstanding Faculty Member Award, and the President’s Excellence in Teaching Award for three times. The department had three Paul Whitfield Horn Professors, the most prestigious honor for faculty members at Texas Tech University, during the period from 2004 to 2006 and two during the time from 2007 to 2009. One faculty member was appointed as the Dick and Martha Brooks Endowed Professor.

In terms of scholarly productivity, the department faculty has collectively published an average of 66 articles each year during the past six years in refereed journals, representing approximately 1.5 publications per core faculty member per year. The department faculty has also produced an impressive record of securing external grant support from federal agencies. Since 2004, the department has averaged $1,543,852 in new funding each year, which is a significant improvement from the average of $860,943 in the previous review period reported in the 2004 report. It worth noting that the department faculty served as PI’s in 18 of 97 NSF grants awarded to Texas Tech University during the fiscal years of 2004-2009 and served as Co-PI’s in other two grant projects. The departmental research expenditures were $1,543,853 in the fiscal year of 2007-2008, which is significantly higher than other
BIG XII Universities of University of Kansas ($610,818) and University of Oklahoma ($129,000) listed for comparison.

Due to the excellent performance in teaching and research, the department was classified as a Group II mathematics department as determined by the American Mathematical Society based on data provided by the National Research Council. Other Big XII universities that belong to the Group include Iowa State University, Kansas State University, Texas A&M University, University of Missouri, University of Nebraska, and University of Oklahoma.

Despite the positive indicators of faculty productivities, there are two concerns that warrant attention of the administrators of the department, college, and the university because the concerns are detrimentally affecting morale of faculty members in the statistics program and those who are engaged in mathematics education. The statistics faculty members think the program has lost its autonomy as an academic program. From interviews with the faculty and the department administrators, the problem has had more than 30 years of history since 1978 but not much progress has been made to resolve the problem. For a small number of faculty members who devote their academic interest in mathematics education, a concern is that the department does not have clear guidelines to define and recognize their scholarly productivity. As the department is developing Math Education as a separate program, this group of the faculty hopes criteria for promotion (and tenure for future junior faculty members of the program) will be clearly defined to guide their effort for professional growth.

**Quality and Quantity of Graduate Students and Graduates; The Graduate Student Experience**

**Graduate Student Support**

The percentage of graduate students supported as RAs, TAs, or GPTIs, has climbed slowly but steadily from 80% in 2003–2004 to 85% in 2008–2009 (p. 38). The number of full-time students supported is higher, averaging 94% over the same span (p. 47). Thus it seems that the Department is doing well in providing financial support to most of its graduate students. Despite the high percentage of students receiving support, the distribution and conditions of that support is of concern. No more than 7% of supported students receive RAs, and TAs are required to teach two courses per semester.

This TA teaching load is a tremendous burden on the graduate students. Both the students and the faculty mentioned it repeatedly as a major concern. The time required for classroom teaching is time away from research, or from taking an advanced graduate mathematics course.

It seems that relaxing this requirement to one course per semester would benefit the students, the faculty, and the M&S program in several ways:

In terms of the graduate student experience, students would be able to spend more time learning advanced mathematics and pursuing original inquiry—presumably the reasons they came to graduate school to begin with. They should also be able to complete their degree faster. Graduate students might feel more like respected partners, and less like hired hands.
In terms of the quality of the faculty research, graduate students would have more time to spend on their research, thus increasing their adviser’s productivity. Students would be able to take more high-level courses, better preparing them to make significant research contributions. Also, it is difficult to imagine that the current conditions of support do not discourage good students from enrolling in the program. Relaxing the requirement should help in recruiting stronger students.

In terms of the program, more faculty research output, more results around which to form new proposals, and stronger incoming students should all improve the Department’s reputation and funding.

In order to accomplish this, the Department will need support from the University. If all TAs halved their teaching load, and the faculty maintained theirs, the undergraduate service load would not be met. Clearly it is counter-productive to increase the faculty teaching load, and none of the desirable outcomes above would be realized by doing so. So the Department will need more resources, either to hire more graduate students, or to hire instructors for lower-level courses. The University should recognize the multiple benefits that this investment would bring.

Another condition of Departmental support is that students must take 13 credit-hours per semester. (One hour is for seminar.) Because these hours may be taken as Research (Math 7000) this requirement does not have the same dramatic impact that the teaching load does. However it does impose a financial burden on the students. In discussions with students it appears that this requirement also damages student morale. Since the Department is paying students, then requiring they give a large portion of their salary back in tuition, it seems this is a cynical means of essentially cutting student salary and shifting the resources back to the Department. The University should recognize the financial situation that requires the Department to enact this policy, and work with the Department to correct it.

Again, it seems that this is an issue that must hurt recruiting. Remedying it would accrue many of the same benefits as reducing the teaching load.

**Graduate Student Resources**

There are 104 RAs/TAs/GPTIs in 5,036 sq. ft. These are tight quarters, even though the students didn’t complain in the survey or in interviews.

**Outcomes**

Student outcomes historically seem to be adequate. No graduates seem to be going to top-tier university programs as post-docs or faculty, but they are finding faculty positions. Some master’s students are moving on to excellent programs as doctoral students, others are taking instructors positions at secondary schools and junior/community colleges. It would help here to distinguish between M.A. and M.S. students. All master’s-level students are grouped as “M.S.”
**Curriculum and Programs of Study**

**Degree Plans**

The M.S. in Mathematics thesis option requires 24 hours of coursework, plus 6 hours of thesis work, for a total of 30 hours. It seems to be reasonably standard practice around campus to require only 30 hours for a thesis Master’s and 36 hours for a report or course-only option. However, there is a significant discrepancy between the Math requirements and the Statistics requirements. In particular, both the thesis and report options for the M.S. in Statistics are 36-hour programs. Furthermore, the M.S. in Math options allows a 6- or 9-hour minor in an area outside of Math (for thesis or report, respectively), while the M.S. in Statistics allows at most 3 or 6 hours (for thesis or report, respectively) to be taken outside the Department. The Statistics faculty do not seem aware of these differences. It seems worthwhile for the Statistics faculty to meet as a group and discuss the possible impact their M.S. requirements may have on their recruiting and retention.

Generally the division between Mathematics and Statistics requires attention from a curriculum point of view. There are dramatic differences in the number of required courses, and the relevance of the preliminary exams.

Six different Mathematics master’s degree options seems to be high for the average of 35 students per year enrolled. The distribution of students opting for the different master’s programs within Mathematics was not broken out in the self-study report. This would have been useful in determining whether all degree options are reaching their target audiences. It could also be more clearly articulated exactly who those target audiences are. It is not obvious, for example, what specific advantages are represented by the M.S. in Math with emphasis in C.S. over an M.S. in Math report option with a 9-hour C.S. minor. Also, should the student wishing to best prepare for a career in secondary school or junior college mathematics instruction follow the M.A. or the M.S. plan, which both claim to prepare graduates for these fields?

The committee did not hear much about the M.A. program. Apparently it is quite separate from the M.S. and Ph.D. options, with its own administrators, and courses taught mostly in the evening to working teachers. The committee was not informed about the existence of this program, nor was it given the chance to meet with the faculty members responsible for running it.

**Courses with Fewer Than Ten Students**

Over the period reported, Math 5332 has been poorly attended, and Math 5333 was only offered once. This should be a two-course core PDE sequence, and the lack of interest is of concern. PDEs are in many ways the foundation of applied mathematics. These courses should be among the strongest, attended by Applied Math majors, as well as students from engineering, physics, and the more theoretical branches of chemistry.
Several of the Statistics courses listed as required for the M.S. in Statistics, or Ph.D. with a Statistics concentration have not been offered in several years. The committee was told that the Academic Advisor would waive courses that weren’t offered, or find substitutes. The Department should make sure the courses are offered, or stop requiring them.

Preliminary Exam

Several of the committee members with expertise in statistics mentioned that the preliminary exams were unsuitable for a doctoral student concentrating in statistics. More preliminary exams should be offered in a wider variety of topics relevant to statistics.

Standards of Instruction

One of the syllabi presented for cross-listed Grad/UG courses was of concern. A guaranteed grade of B+ for nothing more than 85% attendance devalues the grading and credit system. Discussion with the faculty revealed that this was a symptom of a widespread problem, namely that there is intense competition among faculty to attract a small pool of students to their higher-level courses. Apparently if students think the course will be overly demanding, they do not register, and the course doesn’t make. So faculty must essentially guarantee an A in advance, or they will never get the opportunity to teach advanced topics in their area. The Department should address this problem, and bring their standards of instruction and of grading back under control.

Facilities and Resources

Compared with the report of 2004, a major improvement in facilities used by the department was the relocation of the Southwest Collection that used to share the space with the department. The space that previously occupied by the Southwest Collection has been converted into spaces into cubicles used by graduate teaching assistants, lecturers, and the Missouri Club where the department provides tutoring service to students. The department also hired an extra technology staffer to assist faculty members in handling computing hardware and software. Therefore, the problem identified in the previous report that repairing and upgrading of computing capacity could not be done in a timely manner has been improved.

Other space problems identified in the report of 2004, such as crowded TA offices, lack of funding to implement an approved renovation plan, and needs for lecture classrooms with the capacity of 200 students, have not been addressed or improved. Faculty members’ concerns over the facility are reflected in their responses in a faculty survey, in which their responses to statements such as “the facilities and equipment available to teach graduate courses are adequate” (M = 3.80 on a 5-point scale), “the quality and availability of departmental graduate student office space is adequate for my needs” (M = 2.61), and “teaching resources (faculty, teaching assistants) are adequate to my needs (M = 3.23)” were not very positive.
The department experienced cuts of operation cost in the past five years. The data reported by the department show the operating cost peaked at $408,035 ($6,689/faculty & staff) in fiscal year of 2003-04 and declined to the lowest amount of $208,228 ($2,892/FS) in fiscal year of 2007-08. Therefore, the proposed increase of TA’s stipend in the 2004 report has not been realized. The department had to use course fees to hire additional TA’s (from 9 in 2004 to 25 in 2009).