Response to Program Review Standards

Mathematics Programs
Department of Mathematics and Computer Science
College of Arts and Sciences
Western Carolina University

December 15, 2008

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Preface to Mathematics Response to Program Review Standards

This report describes the Mathematics Programs in their current forms. For the purpose of this document, “Mathematics Programs” will refer to the undergraduate program (with three concentrations subject to this review), the undergraduate Liberal Studies and service offerings, the MS in Applied Mathematics and the MAEd in Two-Year College/Community College Mathematics Teaching. Recent changes in the programs include a new Actuarial option to the BS Mathematics degree and reorganization of the MS degree program. We are currently conducting searches to hire two statisticians, two mathematicians, one mathematics educator, and a department head.

With this external review, we are seeking constructive feedback on issues fundamental to any program review: Are we serving our students and mission as best we can? Are our degree options and curriculum viable? Are we effectively using our faculty, facilities, and regional resources? Are we prepared to meet the demands of the institutional Quality Enhancement Plan? To help focus the review, a summary of strengths of the programs and concerns of our faculty are below:

Strengths of the Mathematics Programs:

- Alignment with University mission and UNC Tomorrow
- Diverse and interdisciplinary faculty
- Traditional, Actuarial, Applied and Mathematics Education undergraduate degree options
- Double majors, including interesting combinations outside the discipline
- Role in Liberal Studies, including First Year Seminar offerings and service classes for other majors
- Inviting atmosphere in a newly-renovated building with the Mathematics Tutoring Center and commons areas located near faculty and graduate student offices providing opportunities for collaboration among students
- New instructors (tenure track and fixed term) provided with a senior faculty mentor
- Sponsorship of and student participation in the annual Smoky Mountain Undergraduate Research Conference on the History of Mathematics (SMURCHOM)
- Student engagement through participation in the problem-of-the-week activity, the Virginia Tech Regional Math Contest, the COMAP mathematical modeling contests, and the Putnam Math Competition
- Student participation in the University Undergraduate Research Expo, the Graduate Research Symposium, and the regional Mathematical Association of America conference
- Crum and Milton Scholarships available to students in the Department
• Regular colloquium series focused on presentations accessible to undergraduate majors
• Attracting students with the highest SAT scores on campus
• More incoming freshman expressing interest in mathematics

Concerns of the Mathematics Programs:
• Continued need for effective recruiting of more majors
• Curricular staffing issues, particularly in statistics
• Low number of tenure-track faculty
• Assigned classrooms often located at a distance from the Department
• Limited office space for graduate assistants
• Relatively high DWFI rates in many entry-level math courses
• Recruitment efforts hampered by barely competitive graduate assistantships

Please note, although the MAEd Two Year College Mathematics Teaching program is included in this study it will not be subject to a Mathematics Program Review in the future. As a result of program reviews conducted earlier in the Fall 2008 semester, all MAEd Two Year College Teaching programs will be consolidated into one degree program with multiple concentrations, one of which will be Mathematics Teaching.
Institution Setting of University and Department: Western Carolina University (WCU) enrolls about 9000 students, is a Regional Comprehensive University, and a member of the University of North Carolina System. The Department of Mathematics and Computer Science is housed within the College of Arts and Sciences and offers a variety of Mathematics Programs.

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Standard 1. The purpose of the program reflects and supports the mission and strategic vision of Western Carolina University and the mission of its College.

The Mathematics Programs' goals are directly related to the University’s and College’s missions of teaching and learning in a community of scholarship, reflecting the highest standards of knowledge and practice. The study of mathematics is at the center of the skills of critical thinking, problem solving and technical knowledge, which are stated university goals for all graduates. The primary purpose of each of the Mathematics Programs is to provide quality education and sound scholarship in the discipline of mathematics appropriate to the level and comparable to national standards of such programs. The MAEd program, in addition, provides advanced course work in appropriate education courses as part of a professional component preparing students to teach high quality mathematics at the Two Year College level.

The programs engage in service activities internal and external to the university, including instruction in the Liberal Studies program and in support of other disciplines, student advisement, sponsorship of student activities, leadership in professional organizations, and problem solving services to other departments and regional entities. Faculty research and service activities that directly involve students are in line with the University’s Quality Enhancement Plan, for which “the overarching learning goal ... is one where students will synthesize knowledge and skills from their academic and co-curricular experiences to become intentional participants in their own learning” (www.wcu.edu/sacs/QEP/QEP-2-7-07-revised.pdf). Equipped with interdisciplinary problem solving skills, many of our graduates go on to pursue careers in government, industry, and education in the NC high school and community college systems. Our on-line, broadcast, and “4+1” programs make higher education more accessible, especially for first-generation college students and people with lower incomes or full-time jobs, and our recruitment activities provide enrichment opportunities for citizens and schools of Western North Carolina.

Mathematics plays a critical role in the University’s Liberal Studies program, as one of the key components of the Core Liberal Studies Curriculum required of all undergraduate students. Most entry-level Mathematics courses and the first Mathematics course for elementary teachers satisfy the Liberal Studies mathematics requirement for applications of mathematics at the university level that go beyond basic skills into higher-order reasoning and analysis. All Liberal Studies Mathematics courses require an individual project that specifically engages students with college mathematics in a creative and communicative way. The Mathematics Program also offers three First Year Seminar courses in the Liberal Studies Curriculum.

Mathematics Programs support students and disciplines across the University. Other programs are careful about selecting mathematics courses that serve the needs of their students, and many programs require multiple Mathematics courses. The Mathematics Faculty members have developed courses specifically for some client degree programs (business, engineering and technology, science, and education). Because all
students are required to take a Mathematics course as a Liberal Studies requirement and many degree programs require their students to take additional Mathematics courses, all undergraduate students are served by the Mathematics Programs.

As STEM (Science, Technology, Engineering, and Mathematics) programs, the Mathematics Programs produce graduates who are exactly what the state and the nation need to remain competitive in today’s world. Recent revisions in the programs are based upon feedback from an Advisory Board and enable our students to possess the skills and tools that professionals in industry, government, community college education, and doctoral programs indicate are needed. Our broadcast and “4+1” programs make higher education more accessible, especially for first-generation college students and people with lower incomes or full-time jobs. Our recruitment activities provide enrichment opportunities for citizens and schools in western NC, thus contributing to WCU’s mission of creating engaged opportunities through distance education.

The University’s mission includes the statement that “the commitment of the community (of scholarship) to service, research, and creative activities complements the central mission (of teaching and learning) and extends the benefits of scholarship to society” (Appendix 1.3). To that end, the Mathematics Faculty members provide regional and statewide service to public schools and professional organizations. Examples include the sponsorship of the regional high school mathematics contest, a high school speaker’s program, and active social clubs for majors, closely tied to student affiliates of professional organizations which include required service activities and presentations by both faculty and students at regional, state and national conferences.

Strengths of the Mathematics Programs include a faculty of whom half of the tenured or tenure-track members have been nominees or recipients of distinguished teaching awards, indicative of our commitment to teaching and learning. The undergraduate Mathematics Program encourages students to double major and supports interesting combinations of disciplines (mathematics with biology, engineering, accounting/finance, computer science, computer information systems, chemistry, construction management). There are four undergraduate specialization options: mathematics education, actuarial sciences, traditional mathematics and applied mathematics. The undergraduate programs offer a “4+1” option for students to complete a master’s degree with one additional year after taking graduate level courses during the senior year. The variety and flexibility of course offerings through independent study work and the small class size are definite strengths of the Mathematics Programs in reaching out to all students.

There are numerous opportunities for collaboration among and between students, facilitated by the newly-renovated facilities in Stillwell, which include office space for graduate students, and the presence of the Mathematics Tutoring Center located within the department complex. The Mathematics Tutoring Center offers employment opportunities for students that create interaction between students and faculty as well as between lower and upper division students and graduate students.
The department sponsors the annual Smoky Mountain Undergraduate Research Conference on the History of Mathematics, the only undergraduate conference of its kind in the country. Student engagement is promoted through participation in a departmental problem-of-the-week contest, participation in the Virginia Tech Regional Mathematics Contest, the COMAP mathematical modeling contests, and the Putnam Mathematics Competition. In addition, mathematics students participate in ongoing faculty research programs, the Undergraduate Research Expo on campus, the WCU Graduate Research Symposium, and the regional MAA conference. A regular colloquium series brings faculty from neighboring institutions to present research talks that are readily accessible to undergraduate students. The Mathematics Program’s commitment to serving the region is evident when looking at the number of alumni who find employment close by, as well as the success of the Visiting Speakers Program for Middle and High Schools.

The MS in Applied Mathematics Program has many distinguishing features, such as its small size that allows for student-faculty interaction that is often lacking in larger PhD granting institutions. Students get individual attention both inside and outside the classroom. The thesis/project requirement entails individual student learning in a non-course setting, providing an environment that the student will encounter in professional life. The “4+1” program is distinctive in allowing strong undergraduate students to take “advanced placement” courses during their senior year that fulfill undergraduate requirements and also count towards requirements for the MS degree. In addition, our “4+1” program is one of only two such programs of its nature among our peer institutions.

Weaknesses of the Mathematics Programs stem from curricular staffing issues, including a current shortage in the area of statistics. There are presently seven faculty searches underway for statisticians, mathematics education faculty, general mathematics faculty and a department head. Successful searches will also help with the low number of tenured and tenure track faculty compared to the service course load of the department.

Classes are often taught in classrooms that are distant from the department, limiting the use of hands-on manipulatives and technology in class activities. This can be partially remedied if we were allowed to apply the Mathematics Manipulatives room attribute preference to more near-by classrooms in the classroom assignment system (R25). Decentralized location of classrooms also diminishes the students’ sense of community, inhibiting them from bonding with the programs' faculty and students.

The Mathematics Program needs to continue to explore effective strategies for recruiting more students to become majors in the program. As is often the case in mathematics programs in higher education, there is a higher than typical rate of D/W/F/I grades in many lower division mathematics courses, particularly those courses that serve other departments and programs. The Mathematics Tutoring Center is exploring some different academic assistance strategies to continue to address this issue. The limited resources in
assistantships for attracting graduate students also make it difficult to recruit at the graduate level, especially from the pool of out-of-state or international prospective students.

**Standard 2. The program engages in ongoing, systematic planning that is reflective of the University’s strategic priorities.**

The Department’s last formal strategic vision statement and action plan were developed during the 2003-2004 academic year and reviewed by the Dean in April 2008 (Appendix 2.1). At that time the Department of Mathematics and Computer Science's current mission statement was developed, and strategic goals for the department were outlined in the areas of: (1) enrollment, (2) teaching effectiveness, (3) retention and graduation, (4) quality improvement and program assessment, (5) engagement, outreach, applied research, and regional service, and (6) scholarship and sponsored programs (Appendix 2.1, pp. 11-16). Goals for the individual Mathematics Programs were woven into the strategic goals for the department, either as part of a universal goal for the department or as a specific goal for the program under the umbrella of the departmental goals. We revised our department and program goals most recently in Spring 2008 when the Dean asked each department to develop a Proactive Plan that identified current strengths/niches, five-year goals, and the approaches needed to achieve those goals (Appendix 2.2).

Strategic goals for the Mathematics Programs include: (A) sustaining growth in undergraduate and graduate degree programs, (B) maintaining commitment to high quality instruction in the undergraduate and graduate degree programs, (C) increasing the number of full-time mathematics faculty to support undergraduate and graduate degree programs in mathematics and mathematics education, service courses, and liberal studies, (D) offering courses to meet changes in content and technology to support liberal studies and degree programs in other departments throughout the university, (E) maintaining program assessment, (F) continuing sponsoring high-school level contest in mathematics and consulting for businesses and schools, (G) continuing to participate in scholarly activities as a unit and as individuals, and (H) continuing to offer support to our undergraduate majors and graduate students (advising, recognizing student achievement, clubs, computing facilities, orientation, assistantships, encourage student identification with the department, etc.). As described in Standard 1, our program goals are in line with the Department and University’s missions, with WCU’s Quality Enhancement Plan (QEP), and with the UNC Tomorrow’s system-wide goals, and they reflect the teacher scholar model embodied by our mathematics faculty.

Program goals and planning are typically initiated in and researched by the Mathematics Curriculum Committee, the Mathematics Education Committee, and the Graduate Committee, with committee resolutions coming to the entire faculty in regular Department meetings for discussion and voting. The Graduate Committee also utilizes the Advisory Board it established, made up of professionals from industry,
government, and academia, for suggestions and feedback on program goals, objectives, and direction. Large-scale changes have been self-motivated (in the case of the significant revision of the MS graduate program first included in the 2008 -- 2009 Graduate Catalog and the creation of the actuarial science concentration initially published in the 2007 -- 2008 Undergraduate Catalog) as well as in response to the needs of our client disciplines (in the case of undergraduate curriculum revision for business and engineering programs). The process for developing and modifying our degree/course requirements is largely on-going through regular committee meetings where issues are discussed, researched, and refined.

To date, the Mathematics Programs have made very good progress with Strategic Program Goals relating to high quality instruction (B and D), engagement (F), scholarship (G), and student support (H), have made some progress with relating to enrollment (A) and assessment (E), and have had difficulty with increasing tenure/tenure-track faculty numbers (C). While we have made progress in almost all areas, we have had setbacks in our goal to increase the number of mathematics faculty, many due to circumstances out of our control. In the past three years, we have lost five tenure track faculty for family reasons, and two of our faculty searches, including the department head search, have been unsuccessful and are currently reopened. For this reason, we have a significantly high percentage of non-tenure track faculty members whose only responsibility is teaching, leaving a smaller number of people to share the workload necessary to run a quality program. In response, we have established a mentor program for our new faculty, both tenure track and non-tenure track, and have been proactive in improving our current faculty searches. We have worked with administration to request an accelerated timetable for our searches and have received specific charges for the search committee from the Dean in order to help increase the chances of successful faculty searches.

Growing enrollment has been challenging, but all of our programs are currently on an upward trend. Mathematics BS majors decreased by 15% (6 students) between Fall 2005 and Fall 2006, but as of Fall 2008 we have 22.5% more (9) students than we did in Fall 2005. Enrollment in the MAEd program in Two Year College Teaching has been traditionally low, but plans to restructure this program as a concentration in a general Two Year College Teaching degree and the strong need for mathematics and science teachers should bode well for this fledgling program. The Applied Mathematics MS program also experienced a brief dip in enrollment between Fall 2006 and Fall 2007, but our numbers are again on the rise and we are getting a steady increase of “4+1” applications from top-notch students in our BS Mathematics Program which will result in a continued increase in graduate enrollment within two years time.

We have worked on Goal E, to improve program assessment, by establishing an Advisory Panel for the Applied Mathematics MS program and increasing contact with alumni, several of whom have returned to campus to participate in panel discussion for Career Week on campus. We plan to establish an advisory panel for our undergraduate programs and continue to strengthen our ties with our alumni. As we evaluate how to
best implement the university’s Quality Enhancement Plan in our Mathematics Programs, we will also investigate appropriate methods for assessing this more experiential style of teaching and learning.

**Standard 3. The program provides and evaluates a high quality curriculum that emphasizes student learning as its primary purpose.**

The BS Mathematics Program curriculum includes standard mathematics-degree requirements (see Appendix 3.1), a senior capstone requirement, and a wide variety of elective courses that are chosen based on four different mathematics degree options: Actuarial, Applied, Traditional, and Mathematics Education. Similarly, the MS Applied Mathematics Program curriculum includes a set of core courses that offer students breadth, a project or thesis requirement, and a variety of elective courses from the modeling, analysis, algebra, numerical analysis, and statistics subdisciplines. The MAEd Two Year College Teaching curriculum includes a professional core approved by a higher education program advisor, and an additional 18 hours selected from at least three different areas (algebra, analysis, applied, statistics, or geometry and history) approved by the Mathematics Program Advisor. The curriculum is designed to meet content, skills, and competencies goals, identified by the Mathematics Faculty, that best serve graduates with a degree in mathematics. These learning goals are divided into program goals and student learning outcomes that are incorporated across our curriculum (see the Assessment Plans in Appendix 3.6). In addition, our program serves the university by working with client departments to offer courses that meet the needs of their majors, teaching courses that count as part of the Core Liberal Studies Program, providing three interdisciplinary First Year Seminars, and offering two upper level Liberal Studies Perspectives courses.

The Mathematical Association of America’s Committee on Undergraduate Program in Mathematics (CUPM) created a Mathematics Curriculum Guide in 2004 ([http://www.maa.org/CUPM/curr_guide.html](http://www.maa.org/CUPM/curr_guide.html) and on CD) that provides recommendations for undergraduate mathematics programs – both for majors and non-majors. Our undergraduate program requirements are aligned with these recommendations. For undergraduate mathematics majors, the CUMP curriculum guide recommends:

- **C1.** Developing mathematical thinking and communication skills.
- **C2.** Developing skill with a variety of technological tools.
- **C3.** Providing a broad view of the mathematical sciences – students should see continuous and discrete, algebraic and geometric, deterministic and stochastic, theoretical and applied topics.
- **C4.** Requiring study in depth, in particular on a senior level project.
- **C5.** Creating interdisciplinary majors.
- **C6.** Encouraging and nurturing mathematical science majors.
Our BS Mathematics Program meets these guidelines. For C1, all of our courses are designed to help students develop mathematical thinking skills, with the level of skills learned increasing from freshman to senior level courses. Our students are encouraged to collaborate with each other and participate in classroom discussions to improve their mathematical communication skills. By the time they are seniors, they complete a capstone project and present their project to the departmental community. Many students also present projects at the regional Mathematical Association of America conference. C2 is addressed by our required CS 340 course which has been developed to introduce students to a variety of mathematical software packages like Mathematica, MATLAB, Maple, LaTeX, Vensim and C in the context of mathematical problem solving and simulation. In addition, most of our courses incorporate the use of hand-held graphing calculators and other technological tools. C3 is clearly addressed in the structure of the major. Between the core courses and the electives chosen from the required categories, students experience the broad view of mathematical sciences described here. C4 is satisfied by our senior capstone course which is required of all majors. We meet the interdisciplinary goal of C5 in the options available within the BS major. Many students choose to major in our Applied Mathematics option which requires a double major or a minor in a field of study which uses mathematics. Six of our majors graduating this year have chosen the following combinations with their applied mathematics option: double majors with biology, electrical engineering, computer science, and computer information systems, and minors in chemistry and accounting. In addition, our newly developed Actuarial option is interdisciplinary by design, utilizing the resources available in the College of Business. Finally, we excel in guideline C6. We have a strong and increasing record of student participation in conferences, national and international mathematics contests, and problem solving sessions. We have a very strong advising program and provide numerous opportunities for student engagement as specified in Standard 6.

As no standard curriculum guide exists for graduate mathematics programs, the Graduate Committee conducted a thorough program analysis in 2005 and 2006, comparing its graduate curriculum to those of 79 other Applied Mathematics master’s programs. Based on this comparative analysis and dialog with its Advisory Panel, the committee designed the curriculum currently in place. The MAEd in Two-Year College Mathematics Teaching, with a requirement of 24 hours of Graduate Mathematics courses, covers more than the minimal preparation for Two-Year College Mathematics Instructors described in the Guidelines for the Academic Preparation of Mathematics Faculty at Two-Year Colleges provided by the American Mathematical Association of Two-Year Colleges (AMATYC).

(http://www.amatyc.org/documents/Guidelines-Position/GuidelinesforAcademic.htm)

Therefore, we believe that our students, upon completion of our programs, will be competitive in the workforce and in further education. Syllabi for our courses offer a more detailed view of our curriculum and can be found on the supplemental CD.
Most undergraduate students who enroll at Western as mathematics majors in their freshman year complete their degree in four years. However, as the data indicates, we do have some students who finish in five or six years. In most cases, this is because students have declared mathematics as their major after their freshman year, and only then begin the calculus sequence. Those students are advised about the situation as soon as they meet with their advisors, and they know that their graduation may be delayed. Graduate students in the MS Applied Mathematics Program typically finish their degree requirements in three to four semesters, and “4+1” students are able to complete their master’s degree in as little as two semesters. As most of our graduate students have some sort of financial aid or assistantships, they are able to focus on their studies; only one student in the past five years, a part time student who switched degree programs after several years of study, has required more than four semesters to complete his MS degree. The typical MAEd Two Year College Teaching student works full or part time and is unable to be a full-time residential student. For this reason, the time to complete the MAEd has a higher average than other residential programs.

The undergraduate Mathematics Program includes courses within the curriculum that are found in “traditional” Mathematics Programs as well as courses with interdisciplinary or applied focuses. The Mathematics Faculty sought advice from graduate schools regarding the criteria they look for in accepting students and companies who hire our students to assure we produce individuals who will be competitive with peers. Based in part on this feedback, we developed our BS program to have four concentrations: Actuarial, Applied, Traditional, and Mathematics Education, each of which has interdisciplinary components as described above. By its nature, the MS in Applied Mathematics Program promotes interdisciplinary work and studies. Graduate students have chosen interdisciplinary topics for their master’s thesis or project, have had advisory members from other disciplines, and have presented their work at interdisciplinary venues. Graduate students are encouraged to take graduate courses in other science programs, and technology and science graduate students have used our courses to enhance their own studies. Finally, even though we are not reviewing the education option in this report, we will mention that because of the Mathematics Education option in the BS degree and the interdisciplinary nature of the MAEd Two Year College Teaching program, we work very closely with the College of Education and Allied Professions.

Though the alignment of the Mathematics Program's curriculum to meet the University’s mission and needs was addressed in Standard 1, we would like to identify a few specific examples of the Mathematics Program's effort to meet the needs of the university and the region. Several years ago we developed Math 135 to meet the needs of the College of Business, and this semester worked with them to find courses that meet their changing needs. We modified Math 146 to include topics from Math 145 to help students in the sciences and engineering enroll in the calculus sequence more quickly. We changed the prerequisites for and scheduling of our differential equations course to make it possible for engineering majors to take the course in a semester that works better for their degree program. We have also just started offering Math 101 on-line to
accommodate students in other programs who take most of their courses on-line. In addition, we offer Math 400/500 (History of Mathematics) online in an effort to accommodate high school teachers who are working on their master’s degree and find it difficult to come to campus for the face to face course. In a similar fashion, our graduate programs offer distance courses, either in Asheville or via broadcast, to meet the needs of our non-residential and non-traditional students.

All curriculum changes are handled by one or more of the three curriculum/program committees: the (Undergraduate) Curriculum Committee, the Mathematics Education Committee, and the Graduate Committee. Requests or suggestions for curriculum modifications are typically generated internally and handled by the appropriate committee. After the committee discusses and investigates the proposed change it forwards its recommendation to the Department of Mathematics and Computer Science as a whole for discussion and voting. Once approved by the department, proposed curriculum changes proceed through the approval process outlined at the Office of the Provost’s web page (http://www.wcu.edu/10853.asp).

Mathematics Program assessment procedures are in Appendix 3.6. Content goals and skills are incorporated across the mathematics curriculum and are used, in part, to help adjust course content and offerings. Program Assessment Reports are submitted to the University Assessment and Planning Office on a yearly basis (Mathematics Annual Assessment Reports are in Appendix 3.7 and on CD). In addition, we use exit interviews for graduating students to collect information about our curriculum.

Standard 4. The program has sufficient faculty resources to meet its mission and goals.

The Mathematics Faculty are active in both teaching and research as indicated by a review of the curriculum vitae (Appendix 4.4). Faculty members are devoted to continued excellence in teaching and scholarship promoted in Ernest Boyer’s model (see Ernest L. Boyer's Scholarship Reconsidered: Priorities of the Professoriate, Jossey-Bass, 1990) and recently adopted by the University. Faculty members have been active in scholarship. In the last five years over 20 refereed articles, chapters, or books were produced along with 85 abstracts presented at professional meetings, invited talks and workshops. In the same five-year period, undergraduate and graduate students were involved in student research with the members of the Mathematics Faculty and presented their work at regional and national conferences. For example, last year twelve undergraduate students gave oral or poster presentations at the Southeastern Regional Conference of the Mathematical Association of America. The Department of Mathematics and Computer Science hosts the annual Smoky Mountain Undergraduate Conference on the History of Mathematics where last year five of our undergraduate students gave talks and sixteen presented posters to participants from North and South Carolina, Georgia, Maryland, Oklahoma, and California.
Our Mathematics Faculty consists of 8 tenured, 2 tenure-track, 1 phased retirement, and 8 fixed term faculty with specialties ranging from Complex Dynamical Systems to Mathematical Biology and from Mathematics Education to the History of Mathematics, all with credentials consistent with SACS requirements. Additions to the Mathematics Faculty since the last review period have been made with three strategic goals in mind: (1) to provide a comprehensive education in mathematics, (2) to develop expertise in applied mathematics and statistics, and (3) to be actively involved in the graduate program. Since joining the department, Jeffrey Lawson, a graduate of NCSU at Raleigh who specializes in mathematical physics, has been involved in reorganizing the graduate program to better suit the needs of our students, directing six master’s projects (two of which are current), and supervising undergraduate research. He is involved in an interdisciplinary research project together with a colleague from the Department of Chemistry and Physics. Last academic year, Dr. Lawson won one of the five university-wide research grant awards from the Graduate School and the Research Administration Office. Risto Atanasov, a graduate from SUNY Binghamton, specializes in geometric group theory and has been actively involved with our undergraduate and graduate students on their research projects. He has coached our undergraduate students for several mathematical contests. Dr. Atanasov continues to work on research problems from his area and participates at various conferences and research oriented workshops. Axelle Faughn, a graduate of NCSU at Raleigh, specializes in Mathematics Education. In addition to her involvement with the Mathematics Education Program, Dr. Faughn conducts a teaching oriented seminar for our graduate students, preparing them for their duties as graduate teaching assistants and helping them to become better teachers. In the last five years, four additional faculty members were hired in tenure-track positions. The Mathematics Program benefited greatly from the expertise of Nicholas Koban, Lori Koban, Eric Heiny, and Yishi Wang.

Faculty members have an equitable distribution of teaching loads in terms of credit hours (Appendix 4.7). The current teaching load for the program is typically nine credit hours per semester for tenured or tenure-track faculty and twelve credit hours per semester for faculty holding a fixed term position. As a Director of the Summer Ventures Program, Joseph Klerlein teaches two classes per semester, as well as Julia Barnes and Jeffrey Lawson who serve as Interim Associate Department Heads. Our hiring over the last five years has been balanced in terms of gender and ethnic diversity (Appendix 4.1).

One concern with the current distribution of teaching loads is that there is no recognized release time to supervise individual undergraduate research projects and master’s projects/theses. Very often, in order to prepare our undergraduate or graduate students to do research on their own, we have to conduct independent study courses, which become overload courses. Also, faculty members do not receive load credit (either SCH or release time) for supervising undergraduate research projects or master’s projects/theses. In this case, the course runs as an independent study course, and it is an overload course for the faculty member and for the students. As more emphasis is put on generation of total student credit hours, the amount of time faculty
members will have to work with individuals or small groups of students will be limited. There is a tension between the engaged student learning emphasized by the Quality Enhancement Plan and the focus on our increased student credit hour generation. We are concerned that the push for numbers will hurt the quantity, variety, and quality of out-of-class opportunities that is fundamental to our program vision.

Our graduate students that receive assistantships are actively involved in the teaching process of the Mathematics Program. They work in the Mathematics Tutoring Center where they provide help to the undergraduate students of WCU with their mathematics classes and gaining their first experiences as teachers. After they complete 18 mathematics graduate credit hours, they may be teaching their own class, usually a lower level mathematics course. All of our graduate teaching assistants have mentoring and evaluation opportunities. They are required to take the Topics in Mathematics Education class where they discuss various teaching methods and get their, in most cases, first formal teaching experiences. The graduate teaching assistants that are instructors of record have an individual mentor and their teaching is observed by the Chair of the Graduate Committee.

Performance standards for faculty evolve to reflect our program vision and goals. The Mathematics Program recognized the value of a variety of types of scholarship prior to the university-wide adoption of Boyer’s model. A recent university push to streamline faculty evaluation criteria has led to the revision of the Departmental Tenure Promotion and Reappointment (TPR), Post Tenure Review (PTR), and Annual Faculty Evaluation (AFE) guidelines (Appendix 4.6). Until approval of our proposed documents, faculty evaluations by the TPR committee, AFE committee, and Department Head are based on review guidelines from last year (Appendix 4.5).

Western Carolina University has a strong reputation for promoting faculty development, particularly in the area of teaching. The Coulter Faculty Center offers group and one-on-one development opportunities as well as financial support for faculty seeking pedagogical development from specialized activities. The Mathematics Faculty are extremely supportive of any faculty member’s desire to enhance his or her teaching and scholarship, sharing or co-developing course materials, serving as sounding boards for new research or teaching ideas, and recognizing and celebrating individual or group achievements.

**Standard 5. The program attracts, retains, and graduates high quality students.**

In general, enrollment patterns in our Mathematics Programs reflect national trends (Appendix 5.2). Undergraduate mathematics enrollments are slowly rising, and an increase in the number of high caliber students admitted to the “4+1” program in the past year points to an additional increase in MS Applied Mathematics graduate enrollment starting in two years. Although the number of majors in mathematics is as high as it has ever been, we struggle with quality and retention of students as does the university. The result of
increased enrollment standards for admission to WCU for the 2008-2009 academic year is already evident in
the increased caliber of our freshmen majors, many of whom declared mathematics majors early and placed
into sophomore level courses in their first semester. We are particularly encouraged by this year’s students,
including our new MS Applied Mathematics graduate students who are already expressing interest in pursuing
doctoral degrees, requesting independent studies and/or course overloads to get the most of their time at
Western, and identifying topics for master’s theses at least one semester earlier than their peers. Last year saw
an increase in high quality graduate applications and multiple requests to the graduate school for additional
assistantships and waivers to meet the demand and needs of our students. We anticipate these trends to
continue and look forward to an increase in the number and quality of mathematics students and the positive
results it promises for our students and our programs.

The lack of diversity in Mathematics Programs reflects the ethnic homogeneity of Western Carolina
University’s campus (Appendix 5.4). The majority of the students in these programs are white US citizens,
though we have always had a few majors from underrepresented groups during the period of this program
review. The lack of out-of-state tuition waivers and the limited number of graduate assistantships is a
hindrance to international students as well as out-of-state students.

The Mathematics Programs have established and maintained a reputation for high quality advising
founded on a commitment to advising as a partnership between student and advisor. Not only have we
established a strong technical advising strategy, but also we have created a collegial environment that enhances
the quality and timeliness of student advising. Students meet with their academic advisors formally at least
once a semester, informally more often. Effective check-sheets have been created and are maintained for each
of the undergraduate and graduate degrees, facilitating appropriate planning for each student (Appendix 3.1).
We are able to evenly divide students among the Mathematics Faculty, ensuring that no faculty members are
overwhelmed by advising responsibilities. In addition to having academic advisors, the Applied Mathematics
graduate students each have a thesis or project director with whom they work very closely. Colloquia,
seminars, and yearly panel discussions with practicing mathematicians and computer scientists set up by the
Department to ensure that our students have the most up-to-date information on mathematics, career options,
and alumni contacts. The Mathematics Programs have also worked closely with the Career Center, inviting the
Career Services Coordinator and Counselor to classes to speak to students about resume development,
interviewing, and career placement.

We have always provided students with opportunities to engage in enriching activities outside of the
classroom, such as taking students to professional conferences (last year we took 21 students to the regional
MAA meeting), offering independent studies to motivated students, and supporting academic honor societies
and student organizations (professional and social). In addition the Mathematics Programs have grown in the
number and types of engagement opportunities offered to the students during the review period. We have
recently instituted the ‘problem of the week’ contest in mathematics, offered regular problem-solving sessions for students seeking extracurricular challenges, and organized teams for the Virginia Tech Mathematics Competition and the Putnam Competition in the last two years (a new opportunity for our students). We have had multiple teams competing in the COMAP Mathematical Modeling and Interdisciplinary Modeling contests, four of whom have been recognized as honorable mention or meritorious. Seven of our graduate faculty members have directed seventeen master’s projects since 2004, and three have also directed undergraduate research projects. We employ students, both undergraduate and graduate, in the Mathematics Tutoring Center, providing training that strengthens their skills in communicating mathematics; promoting vertical integration from non-majors, to undergraduate majors, graduate students, and faculty; providing future mathematics educators with experiences to develop their teaching skills; and building stronger resumes for all students involved. The Mathematics Programs also use social activities such as the Math Murder Mystery, the Mathematical Scavenger Hunt, the Mathematical Movie night, the Halloween Progressive Dinner, the Departmental Christmas Party, and the spring and fall Departmental picnics to create an environment that promotes student engagement, connection and retention.

Our undergraduate students benefit from the Crum and Milton Scholarships, endowed by former Mathematics Faculty members and awarded to outstanding Mathematics and Mathematics Education students on a yearly basis. We have little evidence that we lose undergraduate students because of financial need. In contrast, inadequacy and unavailability of financial aid has had a direct impact on recruitment and retention of graduate students. Most of our students cannot afford to attend graduate school without some sort of financial assistance, and the assistantships we have to offer average less than our peer institutions and students still have to pay tuition and fees. This is particularly a hardship for our out-of-state and international students who have a significantly higher bill.

**Standard 6: The program has an administrative structure that facilitates achievement of program goals and objectives.**

Although all administrative responsibilities for the Department rest with the Department Head, all recommendations that come to him as advisory are formulated by appropriate departmental committees. These committees are appointed annually by the Department Head based upon faculty requests and needs. Under the direction of the Committee Chair, the Mathematics Curriculum Committee handles issues associated with the undergraduate mathematics curriculum, particularly the Traditional, Applied, and Actuarial Options. The MS in Applied Mathematics graduate program falls under the umbrella of the Graduate Committee, chaired by the Graduate Coordinator, who formulates all recommendations and decisions concerning the graduate programs prior to their approval by the Department and the Department Head. Responsibilities of the Graduate Committee include, but are not limited to, publicity, recruitment, screening of graduate applications, award of
admission and assistantships, overseeing and evaluating graduate assistants, curriculum development and review, and program assessment. The Mathematics Education Committee oversees both undergraduate and graduate programs in Mathematics Education and works in conjunction with the Mathematics Curriculum Committee and Graduate Committee to ensure the success of its degree programs.

Support and training opportunities are primarily covered by the normal budgetary process vested with the Department Head, and the University-wide funds available on a competitive basis. The Dean also has supported training opportunities on a discretionary basis.

Students have a voice in program and faculty evaluation. In addition to the Program Faculty welcoming informal student input, students give feedback through the student evaluations included in the faculty evaluation processes as required by the AFE, TPR, and PTR documents of the University. Students participate in the on-campus interviews for new faculty and provide feedback during exit interviews their senior year. Selected alumni serve on the Graduate Advisory Panel, an external committee who advises the Graduate Committee on curricular, recruitment and collegial matters.

Assessment, curriculum development and review are carried out by the Department Head, the Mathematics Curriculum Committee, the Graduate Committee, and the Mathematics Education Committee, as part of the Mathematics Programs’ continuing efforts to sustain and enhance the quality of their degree programs. Faculty review, tenure and promotion are the responsibility of the elected departmental TPR and AFE committees and the Department Head, as mandated by the procedures of the University and The UNC Code.

Evaluation of the Department Head is done under the umbrella of the AFE and TPR process, and the Dean conducts a separate Department Head Review by the faculty each year.

**Standard 7. The program has adequate resources to meet its goals and objectives.**

The Mathematics Programs share the Department operating budget with the Computer Science Program and the Mathematics Education Program. The total budget has been relatively stable for the last three years but with substantial changes in categories of expenses (see Appendix 7.1). Our return to the newly renovated Stillwell Building caused a large one-time expense for office furniture. More recently the amount needed for operational expenses has decreased as has the office furniture category thus allowing a sizable increase in faculty travel funding. Travel expenses can be augmented by University funds, such as the Chancellor’s Travel Fund, which will cover up to $1000 of expenses when presenting research at a professional meeting, and by Microgrants offered through the Coulter Faculty Center for Excellence in Teaching and Learning. Faculty search costs have increased partly due to increased advertising expenses, but also because of increased Homeland Security expenses.
Technology expenses have varied and have recently supported hardware and software used by the Mathematics Program. These expenses include service contracts for the software packages MATLAB, Mathematica, and TI SmartView, and purchase of an Active Board, a video camera, and other hand-held devices. During the last year there have been two significant changes in the Technology budget. First, the department now has an account separate from our operating budget which is funded from the Education and Technology fee. Second, the Office of the Provost has started to pay for software service contracts just as it has paid for equipment service contracts in the past.

Department funds for Program-related travel for Mathematics and Mathematics Education students are limited. Students attending and presenting at professional conferences have received additional travel support from the Honor’s College and other offices external to the Department.

In terms of facilities, the Department of Mathematics and Computer Science moved into a renovated wing of the Stillwell Building in Summer 2006. The wing includes classroom space well suited to program instruction, as well as space for the Mathematics Tutoring Center and faculty and graduate student offices. When the renovation of the other wing of Stillwell was completed in Summer 2008 the Department received one additional room which houses our new Active Board which is available for use in Mathematics and Mathematics Education classes. Standard classrooms in the renovated building have technology carts and digital projectors. The Department has a computer lab with ten client machines and two servers. The clients dual-boot Linux and Windows. Both servers run Linux. Upgrades to faculty computers are supposed to occur every fourth year but have been unreliable.

We have excellent library resources for a small university (Appendix 7.2) with campus-wide online access to the MathSciNet and JSTOR as a key resource. A small number of journals and magazines are also available in print. The University Library also provides significant funds each year to be used to acquire new books for their collection based on our recommendations.

In the past four years the number of full-time Mathematics and Mathematics Education faculty has decreased due to retirements and relocations. In particular, three years ago we had three statisticians on staff while today we have none. These positions are currently being filled by generalists in one year term positions.