

Response to Program Review Standards Mathematics Program

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College of Arts and Sciences
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Executive Summary

The Mathematics Program is an integral part of Western Carolina University’s mission to “sustain and improve individual lives” in our region and in our state. A principal part of the program’s mission is to improve awareness of the essential role mathematics plays in society and to hone students’ critical thinking and problem-solving skills in preparation for a future that will demand a highly skilled labor force. The thirteen tenure-line faculty members in the program embrace their roles as teacher-scholars, as evidenced by both strong instruction in the mathematical sciences and prolific scholarly output.

The program shares a department with the Computer Science Program. The two disciplines share the same fundamental core values in deductive reasoning and analysis, and the programs are symbiotic, sharing an inviting physical workspace as well as resources for computation and instructional technology. The mathematics faculty works together with the four computer scientists to cultivate an environment of student-centered learning, and we collaborate to encourage faculty-student interactions through shared social activities.

The mathematics curriculum is versatile and relevant, aligning well with the mission of the College of Arts and Sciences and with Western Carolina University’s vision of higher education. Students majoring in mathematics choose between three options: Applied, Traditional, and Mathematics Education. These options share a common core of courses, but each offers a menu of upper division coursework that furthers our students’ profound understanding of mathematics while preparing them for mathematics-related careers. In the Applied and Traditional Options, students are required to pursue a minor or program of study outside of mathematics, and some students pursue a second major. The Mathematics Education Option is set up to allow students to obtain dual degrees in both mathematics and secondary education, making them highly desirable as teachers.

Another strength of the program is our engagement with students. Faculty advisors mentor students not only to navigate an academic path but also to seek opportunities that pair well with the academics to build a strong and well-rounded foundation. Faculty members engage with students in research and encourage their participation in extracurricular disciplinary activities, such as contests and conferences. We work closely with students to improve their problem solving and their mathematical communication, and we offer them opportunities for service learning.

The review of the program at present comes at a time of substantial change for the program. As a consequence of an institution-wide program prioritization, all advanced degrees in mathematics (M.S. Applied Mathematics, M.A.Ed. Comprehensive Education – Mathematics Concentration, and M.A.T.

Comprehensive Education – Mathematics Concentration) have been eliminated. The M.A.Ed. and M.A.T. have been shuttered, and our last remaining cohort of M.S. students will graduate in Spring 2015., These graduate programs provided venues for student-faculty connections through both teaching and research and served to incubate future secondary and higher education mathematics faculty, as well as industry-ready professionals, such as actuaries and analysts. They collectively served as a regional economic engine, as evidenced by the large number of secondary education faculty and faculty in two-year colleges who are alumni of these programs. As we move forward in our strategic planning, we are tasked with refocusing our energies towards providing similar venues, opportunities, and engines suitable for a quality, undergraduate-only Mathematics Program.

As part of our planning for the future, we must address issues such as recruiting and retaining students both in our “gateway” service courses and in the major and minor. In the lower division we must carefully consider a strategy to place entering students into the appropriate courses. In our upper division we should revisit course content, especially in courses that were cross-listed undergraduate/graduate, and we must devise recruiting tools to replace the 4+1 BS/MS plan. Just prior to the program review in 2009 we had created the Actuarial Option, which had potential to be a powerful recruiting device, but it was soon eliminated and merged into the Applied Option. The actuarial coursework remains popular but the Applied Option is not ideally suited for those students, which motivates us to seek a better solution.

To address the tremendous enrollment growth that the university has experienced, we must respond with appropriate levels of instructional staffing as well as strategies to handle the surge. Logistically, the loss of the graduate assistants will result in a reduction in mathematics instructional staffing by three to six sections per semester and will heavily impact the Mathematics Tutoring Center. At the same time, the growth in partner disciplines with substantial mathematics requirements such as the B.S. Engineering will place a greater demand on the tenure-line faculty unless we recruit and retain permanent faculty to match the increased demand.

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

The Mission of the Mathematics Program in its teaching, scholarship, and service activities (Appendix 1.4) is to (1) foster an appreciation of mathematics and an awareness of the vital role it plays in society; (2) develop in our students critical thinking and problem solving skills within the context of mathematics; (3) guide our students to actively integrate, communicate, and utilize what they have learned in a variety of intellectual contexts; (4) prepare our majors for productive futures in education, industry, academia, and business as engaged members of society; and (5) contribute to the discipline and practice of mathematics by preparing motivated students for graduate studies, producing notable scholarship, and meaningfully engaging in institutional, regional, and professional communities.

The Mission of the College of Arts and Sciences (Appendix 1.3) is to provide “students with a liberal arts foundation where they are taught to think critically, grow academically, and communicate effectively. We prepare our students to be intellectually, socially, culturally, and professionally engaged citizens and leaders who contribute to and promote the sustainability of local and global communities.” Mathematics is fundamental to a liberal arts education, and the Mathematics Program plays a critical role in the University’s Liberal Studies Program, as a key component of the Core Liberal Studies Curriculum required of all undergraduate students. Critical thinking, the college’s first goal, is central to the practice of mathematics and our program mission. The Mathematics Program fosters both critical reasoning and effectiveness in communication through our C2 Liberal Studies courses, which require individual projects that specifically engage students creatively and promote communication of mathematical ideas. Critical thinking pervades the mathematics curriculum, and we cultivate mathematical communication skills by providing many opportunities for our students to convey their work to their peers, the department, and regional and national conferences. By introducing students to the history of mathematics, we encourage them to realize that mathematics is a universal endeavor that is essential to the human experience, and by applying mathematics in larger contexts we demonstrate how a mathematical training can contribute to the greater good.

The mission of Western Carolina University (WCU) is “to create learning opportunities that incorporate teaching, research, service, and engagement through on-campus, off-campus, online, and international experiences. The university focuses its undergraduate and graduate academic programs, educational outreach, research, creative, and cultural activities to sustain and improve individual lives and enhance economic and community development in Western North Carolina and beyond.” (Appendices 1.1 and 1.2) To be consistent with our institutional vision “to be a national model for student learning and engagement” we intertwine teaching, research, service, and engagement in the learning opportunities we

provide. Several students conduct research with program faculty and disseminate their findings both at conferences and in refereed journals. We have a strong record of preparing and encouraging our students to participate in summer Research Experiences for Undergraduates (REUs) around the nation. The Capstone Seminar encourages students to engage in undergraduate research while helping them to prepare for their future careers. Many of our faculty members are heavily engaged with local schools and provide regional and statewide service to professional organizations. Examples include the sponsorship of the regional high school mathematics contest, a Math Teachers' Circle for middle school mathematics teachers, a speakers program that takes faculty into the schools to talk to students about mathematics, a mathematics club for majors, and student chapters of professional organizations which include required service activities and attendance at regional meetings.

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

At a retreat held in November 2012, the Department of Mathematics and Computer Science revisited our strategic planning (Appendix 2.3) and aligned our priorities with the newly developed 2020 Vision: Focusing Our Future – WCU Strategic Plan (Appendix 1.2). Subsequently the Mathematics Program has chosen the following four strategic directions: (1) Enhance the student experience in mathematics, (2) Create engagement opportunities for students, (3) Invest in the teacher-scholar model for faculty, and (4) Reach out to the university and community. These strategic directions (Appendix 2.1) and our strategic plan (Appendix 2.2) draw heavily from both the 2012 departmental strategic planning session and the 2008 Proactive Plan (Appendix 2.4), our response to the request from our college that each department develop a new vision document to identify current strengths and niches, set five-year goals, and determine the approaches needed to achieve these goals.

Program-specific goals and planning for the department are typically managed by individual program committees, namely the Mathematics Curriculum Committee, the Mathematics Education Committee, the Computer Science Committee, and, through the end of this year, the Graduate Program. Recommendations from these committees come to the entire faculty in the monthly department meetings for discussion and voting. The newly reactivated Departmental Steering Committee, consisting of leadership from each of the programs in the department, met at the start of the academic year to identify both short term (2014-2015) and long-term objectives that support our strategic planning (Appendix 2.5). The short term priorities include improving the academic and social culture of the department, supporting current student groups, promoting contests and events, delivering a balance of research and student-focused colloquia, recruiting and retaining majors and minors, and improving the departmental budget

process with quarterly reports of spending and a prioritization of expenditures. Long term goals include improving the departmental physical space in both use and aesthetics, incorporating longer term research projects in the mathematics capstone course as an option, revising content in the mathematics curriculum, reconsidering the frequency of offering 400-level courses, establishing course coordination for lower-division courses in mathematics, and revamping internal assessments of student learning outcomes.

The Mathematics Program's stated goals and initiatives (Appendix 2.2) are central to our curricular and programmatic activities, as they all support our primary activity, the teaching and learning processes that take place between students and faculty both inside and outside the classroom. Extracurricular and co-curricular activities fostering learning outside the classroom (supporting student participation in professional conferences and student club activities, directing undergraduate research, and mentoring students applying to internships and summer research opportunities, to name a few) have long been a part of the department's programming and are integral to our strategic goals and objectives. Enhancing student-faculty interactions and student experiences through recognition of student achievement at our annual departmental awards banquet is also a hallmark of our programs and in direct support of our strategic plans. We have continued to revise MATH 479 Capstone Seminar to better provide our upper-level students with projects and activities that require them to synthesize and apply knowledge they have developed over the course of their career at WCU. Instructors for the Capstone seminar in 2013 and 2014 have included a service learning component requiring in which the students mentor regional elementary and middle school students, most recently in WNC Build-it (formerly Lego Summit).

In addition to departmental committees, individual faculty members have initiated projects that support the department's strategic plans and goals. For example, Nathan Borchelt serves as the mathematics education representative and one of the organizers of the Western North Carolina P-16 Education Consortium, which hosted its first conference at the North Carolina Center for the Advancement of Teaching (NCCAT) and WCU campuses in September 2013. Sloan Despeaux and Nathan developed a proposal to create the Smoky Mountain Math Teachers' Circle, a professional development community for mathematics educators at all levels. The American Institute of Mathematics selected their proposal to be funded, and the initial session of the Smoky Mountain Math Teachers' Circle was held at WCU in October 2014.

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

The Bachelor of Science in Mathematics curriculum includes core mathematics degree requirements (Appendix 3.1), a senior capstone requirement, and a wide variety of elective courses in support of three different mathematics degree options: Traditional Mathematics, Applied Mathematics, and Mathematics Education. The curriculum is designed to meet content, skills, and competencies goals, identified by the mathematics faculty, to 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 3.7 and the Student Learning Outcomes in 3.9). In addition, our program serves the university by working with partner disciplines to offer courses that meet the needs of their majors, teaching courses that count as part of the Core Liberal Studies Program, providing interdisciplinary First Year Seminars, and offering MATH 301 History of the Scientific Revolution as an upper level Liberal Studies Perspectives course.

The Mathematical Association of America's (MAA) Committee on Undergraduate Program in Mathematics (CUPM) created the Curriculum Guide 2004 (<http://www.maa.org/CUPM>) which provides recommendations for undergraduate mathematics programs and courses. For undergraduate mathematics majors, the CUPM curriculum guide has six recommendations.

- 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 undergraduate program requirements are aligned with these recommendations. For recommendation C1, all of our courses are designed to help students develop mathematical thinking, progressing in difficulty from freshman level up to senior level courses (see course syllabi in Appendix 3.3). Our students are encouraged to collaborate with each other and participate in classroom discussions to improve their mathematical communication skills. Recommendation C2 is addressed by the core course MATH 340 Introduction to Scientific Computing, which introduces students to high-level mathematical languages like Mathematica and MATLAB in the context of mathematical problem solving and

simulation, as well as to the markup language LaTeX. In addition, many of our courses incorporate technological tools, such as hand-held graphing calculators, homework delivery systems, and learning management systems. The structure of the mathematics major itself addresses C3. Between the core courses and the electives chosen from the required categories, students work in a variety of mathematical areas. MATH 479 satisfies recommendation C4, and we meet C5 in the options available within the major. Many students choose to major in the Applied Mathematics Option, which requires a double major or a minor in a field of study in which mathematics is used. Students in the Traditional Mathematics Option are required to obtain a minor in another field, and students in the Mathematics Education Option earn a B.S.Ed. through the College of Education and Allied Professions (CEAP). Finally, with a strong record of student participation in conferences, national and international mathematics contests, and problem solving sessions, we excel in guideline C6. We have a very strong advising program and provide numerous opportunities for student engagement. Thus, we believe that our students, upon completion of our programs, will be competitive in the workforce and in post baccalaureate education.

Most freshmen that enroll at WCU as mathematics majors complete the degree in four years. However, as the data indicates, some students finish in five or six years. In most cases, these students have declared mathematics as a major late, and only then begin the calculus sequence. This creates a bottleneck because almost all of the mathematics courses in the major require Calculus I as a prerequisite. Those students are advised about the situation as soon as they meet with their advisors, and they know that their graduation may be delayed. In response to the university's new Finish in Four policy, we are studying the effectiveness of current placement criteria for early mathematics classes (see Standard 5).

To help develop the courses in the three options within the major, the mathematics faculty sought advice from graduate schools regarding the criteria they look for in accepting students, as well as from companies who hire our students, to assure we produce individuals who will be competitive with peers in the workplace. 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 program's efforts to meet the needs of the university and the region. We have introduced WeBWorK, an open-source online homework system supported by the MAA and the National Science Foundation, in a variety of mathematics courses to provide students with more immediate feedback on their work. Several instructors are presently incorporating WeBWorK into their course design. We have overhauled MATH 479 to include two early projects leading them up to the final main project. In addition, some instructors have recently incorporated a service-learning component to the capstone course. We have begun to offer MATH 361 Abstract Algebra I every semester and MATH 400 History of Mathematics every year to better accommodate Mathematics Education majors who are doing full-year internships as seniors. We designed MATH 200 Introduction to Mathematical Problem Solving to introduce Mathematics Education

students to program-specific curriculum earlier in their college career. This course also accommodates Middle Grades Education majors with mathematics concentrations who need one extra hour. As part of revamping the Professional Sequence by the CEAP, we were able to introduce MATH 414 Introduction to Secondary Mathematics Teaching Methods to replace a general educational methods course for all majors. We also were able to replace a general course on using computers in education with MATH 340.

Two committees, the Mathematics Curriculum Committee and the Mathematics Education Committee, handle all curriculum changes. 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 as a whole for a vote. 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>) using a new curriculum management system, Curriculog.

Mathematics Program assessment procedures (Appendix 3.7) ensure that content goals and skills are addressed across the mathematics curriculum and help the program to adjust course content and offerings. Mathematics Program Annual Assessment Reports (Appendix 3.8) are submitted to the University Office of Institutional Planning and Assessment (OIPE). In addition, we use group exit interviews (Appendix 5.9) for graduating students to capture those cohorts' experiences in the major.

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

The mathematics faculty consists of thirteen tenure-line faculty (two professors, seven associate professors, three assistant professors and one tenure-track assistant professor to hire this year) and four renewable fixed-term faculty members. All tenure-line faculty members possess terminal degrees in their fields and all fixed term faculty possess masters' degrees in mathematics (Appendix 4.2). Of the mathematics faculty 56% are male and 44% are female, and the faculty represent a range of age and experience (Appendix 4.1). While there is a lack of ethnic diversity, this feature is consistent with the university and the region. Our faculty have experience in a broad range of mathematical specialties, including mathematics education, statistics, graph theory, number theory, group theory, complex analysis, functional analysis, dynamical systems, mathematical biology, mathematical physics, and the history of mathematics.

In the past five years, mathematics faculty have published over 50 refereed articles, monographs and book chapters, gave over 100 presentations at professional meetings, seminars, and colloquia, and led 14 workshops (see the curricula vitae of the faculty in Appendix 4.4). In the same five-year period, undergraduate and graduate students took part in research with members of the mathematics faculty and

presented their work at regional and national conferences. Four mathematics faculty directed student research that led to publications. In addition, several mathematics faculty are involved in interdisciplinary research with colleagues from other departments. For example, several faculty members are engaged in research with colleagues from the Departments of Biology, Chemistry and Physics, and Engineering and Technology, respectively. Members of the faculty have received both external funds and funds from various WCU sources to support scholarly activity (Appendix 4.3).

Our faculty members regularly attend regional, national, and international conferences to maintain currency in their field and to disseminate research results. To this end, the department has managed to accommodate faculty travel with limited resources. Through external grants, the Chancellor's Travel Fund, Coulter Faculty Center Professional Development Grants and modest departmental support, most tenure-line faculty receive full travel reimbursement for professional presentations and professional development opportunities.

Faculty members have an equitable distribution of teaching loads in terms of credit hours (Appendix 4.6). The average teaching load for tenure-line faculty is 18 credit hours per year (9 per semester), with an expectation of scholarly work. Each fixed-term lecturer or instructor teaches 24 credit hours per year (with the exception of Deborah Walters; her teaching load is 30 credit hours per year) with no scholarly expectations. As Department Head (DH), Jeff Lawson teaches 6 credit hours per year. Mark Budden teaches 12 credit hours per year as Associate Department Head, and Risto Atanasov teaches 15 credit hours per year as Program Director of the Master of Science in Applied Mathematics program. As an Associate Director of MAA Project NExT (New Experiences in Teaching), Julia Barnes has a 4-credit-hour per year release from the MAA. Many faculty members in the Mathematics Program are engaged in the supervision of undergraduate research projects, master's theses or projects, and independent studies. Because these activities are in addition to faculty members' regular teaching loads, we have implemented a policy for accruing such credits (Appendix 4.8). The mathematics education faculty supervises student interns regularly and those internships lead to course releases. For each student enrolled in Internship I the supervisor is awarded two points, and for each student enrolled in Internship II, three points; the accumulation of 18 points earns that faculty member a three credit hour course release.

The department is an excellent work environment, lending to faculty collaboration on teaching and scholarly issues. The department offers a collegial atmosphere for faculty at all ranks to contribute in decision-making processes. Performance standards for faculty are spelled out in the Department Collegial Review Document (DCRD) (Appendix 4.5). Included are the guidelines for departmental Tenure, Promotion, and Reappointment (TPR), Post Tenure Review (PTR), and Annual Faculty Evaluation (AFE), as well as the process for electing members of the department to evaluate faculty at each stage of the process.

Our graduate students that receive assistantships are actively involved in teaching for the Mathematics Program. During their first year in the program, Graduate Assistants (GAs) worked part-time in the Mathematics Tutoring Center. Also, each fall semester, GAs enroll in MATH 694 Topics in Mathematics Education, in which they discuss various teaching methods and teach sample lessons in preparation for teaching. Any graduate student who earns 18 graduate-level credits in mathematics may teach one class each semester as an instructor of record, after being certified by the graduate committee. Each graduate student instructor is assigned a faculty mentor to assist in structuring the syllabus, developing lessons, and assessing student learning. With the termination of graduate assistantships, we will be without GAs for the first time in 2015-2016.

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

The number of undergraduate mathematics majors was 96 in the 2009-2010 academic year and rose to a five-year high of 122 in the 2011-2012 academic year before decreasing to 84 in the 2013-2014 academic year (Appendix 5.2). The relative gains and losses of undergraduate mathematics majors were inversely related to overall university enrollment (Appendix 5.3). Some of the recent decline in the number of majors is due to the elimination of the Teaching Fellows program in 2011-2012 and the 4+1 BS/MS program in 2012-2013, two valuable recruiting tools. As the program continues to struggle with recruiting and retaining high quality students, we must redouble our recruiting efforts. In addition to recruiting prospective students through the WCU open houses, we are employing other strategies. For example, the annual WCU High School Mathematics Contest exposes around 500 middle/high school students to the campus and to our program, and we have successfully recruited new majors from our calculus classes. These students usually major in computer science, chemistry, or engineering, and add mathematics as their second major.

Our mathematics majors are majority female, a profile not significantly different from the undergraduate population at WCU. The lack of racial diversity in Mathematics Programs echoes the ethnic homogeneity of WCU's campus (Appendix 5.1). Most of the students in the program are white United States citizens, and are overwhelmingly North Carolina residents. (Note that WCU lacks the resources to offer financial incentives to recruit top out-of-state prospects from neighboring Southeastern states.)

The program had its two smallest classes of full-time first-year (FTFY) mathematics majors in the five-year review period during the 2009-2010 and 2010-2011 academic years (13 and 11, respectively), followed by its largest incoming FTFY class in 2011-2012 (25 students). The final two years of review included FTFY classes of 15 and 16 students in the academic years 2012-2013 and 2013-

2014, respectively (Appendix 5.3). The academic qualifications of FTFY mathematics majors are notably stronger than those of FTFY students at WCU overall. Note that the average GPA of math majors is greater than that of the general FTFY undergraduate population with the exception of the 2009-2010 academic year. As expected, the mean SAT Math score is greater for math majors for all five years, while the average SAT, average SAT Verbal and average ACT are greater for math majors in every academic year with the exception of the 2010-2011 academic year. If FTFY data is any guide, the outlook for future viability of the program is brighter than five years ago.

The Mathematics Program has established and maintained a reputation for high quality advising founded on a commitment to advising as a partnership between student and advisor. Students meet with their academic advisors formally at least once a semester (the University has a dedicated advising day to assist with this), and informally more often. Eight-semester plans and course forecasts are kept current, and each student/advisor pair uses departmental check-sheets and the degree evaluation function in MyCat, the institutional registration and records portal, to plan and track progress toward graduation (Appendices 3.2 and 3.6). Paper records are kept in the department office so that faculty can access planning for any major. We are able to evenly divide advisees among the faculty, ensuring that advising responsibilities overwhelms nobody. Colloquia, seminars, and yearly panel discussions with practicing mathematicians and computer scientists set up by the department ensure that our students have the most up-to-date information on mathematics, career options, and alumni contacts. The Mathematics Program has also worked closely with WCU Career Services, inviting the Associate Director to classes annually to speak to students about résumé development, interviewing, and career placement.

Mathematics majors have several opportunities to engage in enrichment activities outside of the classroom, such as professional conferences (Appendix 5.6). Our students regularly present their research at the MAA Southeastern Section meeting, and often they receive awards for their presentations. Each year there are 12-16 undergraduate students who attend the North Carolina Council of Teachers of Mathematics (NCCTM) Annual meeting in Greensboro. Our undergraduate students also participate in the bi-annual Smoky Mountain Undergraduate Research Conference on the History of Mathematics hosted at WCU.

In addition the Mathematics Program has grown in the number and types of engagement opportunities offered to the students during the review period. We have created MATH 394 Contest Preparation Seminar for students seeking extracurricular challenges; students enrolled in this course usually participate in the Virginia Tech Regional Mathematics Contest and the William Lowell Putnam Competition. We have had multiple teams competing in the Mathematical Contest in Modeling and Interdisciplinary Contest in Modeling, both hosted by the Consortium for Mathematics and Its Applications. The department as a whole uses social activities such as a game night, the Halloween

progressive dinner, the departmental Christmas party, and biannual departmental picnics to create an environment that promotes student engagement, connection and retention.

We have had excellent success with mathematics majors pursuing the Secondary Teaching obtaining their licensure from the State of North Carolina. During the review period, 100% of our graduates who applied received their licensure. In the past, our students have not been required to pass professional certification exams, but due to recent changes by the NC Department of Public Instruction, all students in the program will now be expected to successfully pass the Praxis II Test. We have also seen graduates of the program in the other two options go on to a variety of careers as well as pursue additional education (Appendix 5.7).

The program maintains some financial support to recruit and retain high quality students. Our undergraduate students benefit from the Crum and Milton Scholarships, endowed by former faculty members and awarded to outstanding Mathematics and Mathematics Education students on a yearly basis. On a regular basis, the WCU Mathematics Tutoring Center (MTC) employs undergraduate students with experiences to develop teaching skills while at the same time providing some compensation. The discontinuation of our graduate program will require an increase in the number of undergraduate tutors that will be necessary to adequately staff the MTC. We can hire a limited number of either work-study or non-work-study students for the front office or as assistants for specific courses.

A key to student retention is reliable placement into the proper mathematics course. To finish on time mathematics majors must begin the calculus sequence promptly, but some incoming students arrive at WCU underprepared. On a larger scale, many of our partner disciplines require coursework in precalculus or calculus, and an improperly placed student is a clear retention risk. To this end, we have criteria for placement into MATH 146 Precalculus and MATH 153 Calculus based upon SAT or ACT mathematics scores or attempts of AP Calculus AB (see Appendix 5.8). Students falling below these thresholds must start in MATH 130 College Algebra. The placement is imperfect; for example, a student who took a calculus course in high school may not qualify to start MATH 153. However, our experience shows that the extreme variability in high school calculus makes this an unreliable indicator. We have investigated several options for a mathematics placement exam, but logistical impediments have been overwhelming. Along another path, John Wagaman has worked with OIPE to develop a multilinear regression placement model incorporating additional indicators such as unweighted high school GPA. Preliminary results yielded a low coefficient of determination, and we will gather another year of data before refining this model. Extending the drop-add period from one week to two may also be a strategy to improve placement.

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

The Department of Mathematics and Computer Science is committed to collective decision making through monthly department meetings. The DH and the Steering Committee provide leadership and work to maintain good practices in departmental governance (Appendix 6.1). Training and support for these leadership positions is provided through internal and external mentoring processes. For example, the DH has attended two American Mathematical Society Department Chairs Workshops and receives regular training through the WCU Department Heads Workshop, led by the Associate Provost. Program directors are mentored internally by former program directors and by other senior faculty. Additionally, our department has a strong committee structure that involves faculty in decision-making processes (Appendix 6.2). This administrative structure facilitates achievement of the strategic program directions as delineated below.

The Mathematics Curriculum Committee handles issues associated with the undergraduate mathematics curriculum, particularly the traditional and the applied option. The Mathematics Education Committee oversees the mathematics education option in our program together with the B.S.Ed. in Mathematics Education. They work closely with the Mathematics Curriculum Committee and the CEAP Professional Education Council. These two committees review proposed new curricula and changes in current curricula. After committee review, successful proposals are brought to the entire faculty for approval during regular department meetings. These procedures not only contribute to the governance of the department but also ensure high standards of quality in the curriculum.

Other standing committees (Appendix 6.2) advise disciplinary student organizations and manage various contests including undergraduate mathematics contests and the annual High School Mathematics Contest, which involves undergraduate majors as monitors and as graders. One committee is charged with scheduling and inviting colloquium speakers, while another organizes the annual departmental awards banquet where our outstanding students are recognized. Other departmental service includes coordinating our annual departmental commencement receptions to recognize graduating seniors and advising students to identify research opportunities, such as summer REUs, internships, and scholarships. Altogether, these team efforts contribute to student growth as professionals and as educated members of society, while encouraging strong connections to our department both academically and socially.

On campus the department considers the MTC to be a resource not only to support student learning in our courses but also to provide opportunities for our majors to serve as tutors for a wide range of mathematics classes. The Director of the MTC regularly attends department meetings and provides information and advice on activities to support student success. We work with the WCU Career Center, in which their expertise enhances students' skills in writing résumés, crafting personal statements on career

objectives, and using appropriate rhetoric for written materials. We also partner with the Career Center to arrange externships and internships in the profession. Alumni play a vital role in identifying such opportunities in industry. In cooperation with the CEAP, we place mathematics education students into school settings for internships (student teaching), where their lead high school teachers and their supervising mathematics education faculty mentor them. These efforts combine to help prepare our students for careers in industry, government, and education.

Each year individual faculty work is assessed as part of AFE and TPR using faculty-developed AFE guidelines and DCRD guidelines (Appendix 4.5). Membership on these two committees is determined by faculty vote. The AFE committee is elected each year. The TPR committee consists of four members elected for staggered two-year terms and two members elected annually. This ensures that each year's committee contains both new and returning members to provide continuity in this important process. Each committee provides written comments for every faculty member reviewed to supplement the DH's independent review. In this way, our faculty benefit from both DH and peer reviews on a continual basis. The departmental faculty also participates in annual reviews of the DH as part of the college-level review process conducted by the Dean of the College of Arts & Sciences. The TPR Committee evaluates Program Directors on an annual basis.

Students have a voice in program and faculty evaluation. They give feedback through the student evaluations included in the faculty evaluation process 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. Every year we conduct exit interviews with our graduating students in which we ask them various questions concerning the mathematics curriculum and advising of our majors (Appendix 5.9). As partial response to exit interviews from future mathematics educators, we are in the process of requiring Supervised Internship I (EDSE 484) for students enrolled in Mathematics Education option. Several student comments on the exit interviews communicated that they felt unprepared to deal with potential issues in the classroom.

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

The Mathematics Program shares a departmental operating budget with the Computer Science Program. The total budget has been relatively stable for the last three years but with fluctuations in categories of expenses (Appendix 7.1), mainly in faculty travel and faculty recruiting.

Department funds for faculty travel to conferences and professional meetings are limited. However, travel expenses can be augmented significantly by university funds, such as the Chancellor's Travel Fund, which will cover up to \$1200 when presenting research at professional venues, and by

Professional Development Grants offered through the Coulter Faculty Center for Excellence in Teaching and Learning (CFC), which can contribute up to \$1200 for professional development opportunities.

Through a revenue sharing model, summer revenues may be used to fund travel by faculty who have taught that summer, but these fluctuate from year to year. The DH prioritizes allocation of travel support by identifying need. Priority is placed on covering gaps between revenues from external sources and expenditures and supporting supervision of student interns. Activities not covered by extramural funds or by individual grants are also priorities for support; we especially value regional conferences that involve students. Students presenting at professional conferences have received additional travel support from the Honors College and other institutional sources. Two students have received a travel grant from the MAA.

Faculty recruiting costs have increased partly due to increased advertising expenses, as well as expenses to comply with the U.S. Department of Labor when considering foreign nationals for hire. However, the College of Arts and Sciences funds the site visits for job candidates, another mounting expense. Technology expenses include purchase of instructional technologies such as handheld devices and interactive whiteboards, as well as maintenance and repair of hardware. We have bought instructional technologies with one-time monies, and we must also pay for repairs on hardware and replacement of handheld devices and mathematics manipulatives. A recurring expense is the per-machine computer management fee charged by Information Technology. We are held harmless for printing through the networked PawPrint system. We are in trouble if they change this policy, as this third-party system is expensive. The department has a separate fund generated from the University Education and Technology fee. This may be used for educational supplies and instructional technology. In addition the Office of the Provost has paid for certain software service contracts just as it has paid for equipment service contracts in the past.

Starting in 2014-2015 we are implementing a budget request strategy in which individual staff may identify needs and send requests to the Administrative Support Associate (ASA). This includes travel. The DH prioritizes these into large, medium, and small cost. Small cost items are purchased by the month. For medium items the DH and the ASA look at quarterly spending against the main department fund and whether we could use other funds. If the spending is at pace or behind pace, we will acquire the highest priority medium cost items. Large expenses are submitted to the college for College Budget Request Hearings and are also vetted for possible external funds. Rollups and uncertainty with summer revenues have been a problem in the past – pacing spending and quarterly forecasting may relieve that.

The department resides in a wing of the fourth floor of the Stillwell Building renovated in 2006. The wing includes classroom space well suited to program instruction, as well as space for the MTC and faculty and graduate student offices. Two of the classrooms on our floor are equipped with interactive

white boards, and they are located near a central storage area for mathematics manipulatives. Although we do not “own” these classrooms we can designate specific course sections as priorities for scheduling those rooms. Consequently our important courses for pre-service teachers as well as many of the courses for majors are taught on our floor. That proximity, coupled with open study workspaces and the presence of the MTC, contributes to the department atmosphere.

As the demand for graduate student space has decreased we are filling the offices with both fixed term and part time adjunct lecturers. We feel that it is important even for a faculty member who teaches one class to have an office to conduct business and maintain a presence. We have good common space with seating and whiteboards or blackboards but we need to think about how to optimize its use. We have no place for a lounge and students may gather in the “fishbowls” (study areas) but these are right outside classrooms and faculty offices, working to the detriment of faculty-student interactions.

The two departmental computer labs, containing both personal computers and servers, are open to students for homework and research. Computers in our departmental lab run a variety of operating systems: Linux, Windows, and Mac OS X. The departmental Linux servers have over twenty-four cores and several terabytes of storage (Appendix 7.3). Upgrades to faculty computers occur every third year on average (Appendix 7.2). We have excellent library resources for a small university (Appendix 7.4) with campus-wide online access to MathSciNet (Mathematical Reviews) and databases such as JSTOR, Elsevier Science Direct, and Springer Link. A small number of journals and magazines are also available in print. The ABC loan system (between WCU, Appalachian State University, and UNC-Asheville) and Loanshark (our ILL delivery system) expand our borrowing repertory significantly. The University Library also provides a department budget each year to be used to acquire mathematical sciences titles.

At our last program review, the external reviewers report identified the critical need for instructional staffing, particularly in the tenure lines. Unfortunately, that year coincided with a round of budget cuts, in which the program lost faculty lines, in spite of the growth in the major and growth in student credit hours. Over the last four years the student credit hours generated by mathematics courses have increased by 14.5%. However, the number faculty lines have remained flat. To compound the problem we will lose the GAs, who have provided three to six sections of instruction each semester. This leads to a seeming paradox in which the elimination of the graduate program has increased the need for faculty. Indeed, only one or two courses per term are dedicated graduate courses (not cross listed as 400/500) so we have a net loss of two to four sections. We have let many class sizes creep up to as many as 40 seats but this could compromise instructional quality, particularly in courses with students who are retention risks due to weak backgrounds in mathematics. Furthermore, several of our partner disciplines, particularly the Kimmel School of Construction Management and Technology and the College of Health and Human Services, have growth outpacing the already substantial overall enrollment growth. To meet

the needs in the short term we have made a budget request to move a one-off lecturer position to recurring funding. However, the growth in the STEM partner disciplines, particularly in the Kimmel School, has created demand for mathematics courses up to junior level and points to the need for a new tenure line. One other initiative we are pursuing is to raise the level of compensation for lecturers to university standards. As our pool of part-time adjuncts will suffer from the loss of the graduate programs, recruiting and retaining quality full-time faculty will be a high priority.

Our Administrative Support Associate (ASA) manages the department office, running a department of 17 tenure lines, 4 renewable fixed term lines and numerous one-year fixed terms and part time adjuncts. The ASA designs and maintains reports, records, and asset inventories, while managing budgets, travel reimbursements, purchase orders, and department communication using a full spectrum of media. She is supported by six hours of student workers per week, but even then this is inadequate for the needs of such a large and complex department, as we see more tasks from the Registrar's Office, Academic Affairs, and Advancement pushed down to the department level. The ASA's work for the department and the programs within is invaluable.

The management of the computer labs, system administration of the servers, and inventory control for handheld technologies falls to two computer science faculty members. The department also supports the MTC by providing GTAs and undergraduate tutors, and we hire a student assistant for MATH 340. No doubt, the MTC will lose a large source of its staffing pool when the last graduate students finish in May 2015. We hope to fill this void by helping the MTC to recruit some of our most capable majors as tutors.