

UHH Mathematics Program: External Reviewer's Report

Introduction

The faculty of the UHH Mathematics Department have done remarkable work to build and run an impressive mathematics Program. Their dedication, talent, and enthusiasm have drawn diverse students to the discipline, and the department has distinguished itself by undertaking an unusual effective program of value to the mathematics community over the last 10 years.

The delivery of the mathematics program is outstanding. Mathematics majors are being well served, and graduates are leaving with preparation that enables them to enter productive employment in quantitative fields or to continue study in a quantitative discipline.

The major has great potential to continue to grow and to thereby address the critical need in Hawaii for highly qualified math teachers as well as graduates for various technical fields. In my view, there is no question that this exemplary program will continue contributions significantly to the University and the mathematics community.

Given the nature of the UHH, a relatively small liberal arts (and science) institution, and the rate of growth of the mathematics program, I have suggestions on curriculum, faculty, and community outreach that I believe will help guiding the department to greater success in the future. My most immediate suggestions are to revamp the Developmental Mathematics Program and the Mathematics Center, institute an applied statistics program, and establish a plan of faculty development for both instructors and tenure track faculty in the department.

Many other suggestions are also detailed.

I begin with the current state of the program and then suggest directions for future growth.

The Current State of the Program

The mathematics major is thriving. The remarkable record of professional accomplishments shows the department's excellence in all three areas: teaching, research and service to the academic community. Further, the students I interviewed are extremely happy with the program and appear to be both prepared and motivated to be successful after graduation.

Students The UHH Mathematics Department produces outstanding math majors who receive prestigious fellowships to attend graduate school in top universities around the nation. The student population in the major is quite diverse. About 1/3 of the students I met were minority students and about 1/2 of the students were female. This last statistic is particularly high for mathematics programs, which historically have been male dominated. It is clear that these high percentages of minority and female students are due to several success programs, such as the UHH Math Club, STEM Research Honors Certificate Program, NSF funded the HiNTS Program and the summer Research Experience for Undergraduates (REU).

In two meetings with current students, I repeatedly heard that the strength of the department was its faculty. Students reported that faculty gave individual attention, were sensitive to student needs, volunteered to lead course/seminar offerings to facilitate timely graduation, and provided support for the transition to graduate studies, high school teaching, or industrial career pathways. The faculty attracted students to the study of mathematics, created a sense of community between students and faculty, and encouraged a sense of community between the students. Math majors seemed to fully understand the benefit of the problem solving skills and productive habits of mind that they gained in the department. The loyalty of students for the department is remarkable.

Major curriculum The department has established an excellent foundation for the curriculum of the major. Within the constraints imposed by a university just over 4000 students, the department has made very logical choices of offering rigorous courses to facilitate students timely graduation. The curriculum is efficient and effective. In particular, the department has very cleverly employed its research seminars and the UHH Mathematics Day to tailor projects to student interests and to thus address curricular deficiencies for students with particular learning goals. For example, to prepare for graduate school in pure mathematics, students often do a math project which the department isn't able to run a class in this standard subject. Similarly, there are many applied math projects being performed by students interested in industry or in graduate school, and also projects related to mathematics teaching and learning for those interested in the teaching profession.

Service Curriculum The department courses that serve other students and majors on campus are very good in terms of their current level of effectiveness. For example, the math course for computer science majors, the Pre-Calculus course and the calculus sequence, have been thoughtfully developed and/or updated. Other courses, for example, the developmental mathematics course, are in need of faculty attention. Suggestions for areas of emphasis will be given below.

Faculty The department has members who are outstanding educators and well recognized researchers with an impressive record of service to the academic and university community. Because of the department maintaining a noncompetitive, supportive environment, faculty are generally very enthusiastic about their program. They seem to be thoughtful and excited about creating and developing both the degree and the service courses in the program. The teaching I observed showed great talent and promise. The faculty are very open to new ideas for improving and revising their teaching and their courses. The significant redesign of Math 310 and the newly developed Math 314 for the math majors provide the strong foundation for understanding logic and proof-techniques. Further, when one instructor had issues with some parts of the transition, it was a good sign that a senior faculty worked together with the instructor to work toward a course where both were happy. The department appears to be developing a culture of respect for each other.

Community outreach The department has also reached out to the larger community, primarily through recently revitalized Math Club helping Big Island Math league and its very active work with local mathematics teachers, such as the project on transitioning Hawaii DOE High School

Mathematics to the new Common Core Standards . This level of involvement for a department of mathematics in K-12 outreach projects is unparalleled in the UH system. I believe that these local connections will raise the profile of UHH and lead more students to enroll. In particular, high school students with a potential interest in K-12 mathematics teaching will be much more likely to be sent to the UHH since their teachers will have experienced the UHH programs first-hand. On the other hand, the outstanding achievements of some math majors in nation-wide summer REU's and their acceptance in leading graduate programs attracts more talented high schools students, who would otherwise go to undergraduate programs elsewhere, to now enroll in the UHH Math program.

Suggested Directions for Future Growth

I divide this section into three parts: (1) Service courses, (2) Courses for majors and minors, and (3) Faculty:

(1) Service courses

Developmental Mathematics Program Math 103, a developmental course intended for students who need to enroll in the Calculus but are not yet prepared to enter Pre-Calculus. The course catalog describes the course as being “For students who need to improve algebraic skills prior to taking Pre-calculus or Applied Calculus, or for courses in Introductory Chemistry, Physics or Statistics” but concerns about this goal being reached seem to be unanimous, though sometimes for different reasons, by the faculty from mathematics and their client quantitative disciplines. The success rate for students in Math 103 is below what the department itself deems acceptable. I would strongly recommend redesigning Math 103. The goal of the redesign should be to better prepare students for college-level mathematics, particularly those who are headed to quantitative disciplines like computing science, business, and natural sciences. The following issues should be addressed in the redesign: rigor of the curriculum – students must have the opportunity to be well prepared for success in pre-calculus and beyond, preparation of faculty – instructors and teaching assistants must have sufficient expertise in both the content and pedagogy of the developmental program, and assessment of student achievement.

The Math Center No one in the department seems to be satisfied with the current state of the Math Center. I agree with the suggestion in the self-study that the Math Center Coordinator should have a dual appointment in the Math Center and the Mathematics Department in order to increase the communication and cooperation between the Mathematics Department and the Math Center. Under the general supervision of the Mathematics Department Chair, the Coordinator should act as the central resource where students, instructors, staff, and other interested parties may access information regarding the Developmental Mathematics Program at the UHH.

The Math Placement The UHH should require new students to be tested in mathematics as soon as possible after they are admitted and before enrolling at the UHH. One of very success math placement tests that has been using in the California State University System is the ENTRY

LEVEL MATHEMATICS (ELM) Examination. The ELM is designed to assess and measure the level of mathematics coursework (Algebra I and II, and Geometry) of students entering the California State University. The ELM must be completed by all non-exempt entering undergraduates prior to enrollment in any course, including remedial courses. Students may be exempt from this test if they have scored well on other specified tests or have completed appropriate courses, such as a score of 550 or above on the mathematics section of the College Board SAT Reasoning Test or a College Board SAT Subject Test in Mathematics (level 1 or level 2).

Statistics Education With the high need for statistics courses that serve other students and majors at the UHH I suggest that the department faculty engage in dialogue regarding the long-term plans for developing the statistical education and expertise needed to support these programs. On far too many universities, a lack of advanced planning for statistics education has led to a duplication of course content, and a dilution of the expertise needed to support student study and research. Perhaps the Mathematics Department can take the lead in ensuring the statistical needs of the UHH community are vibrant, relevant, and truly interdisciplinary.

(2) Program and courses for majors and minors

An Applied Math/Statistics Concentration The Mission statement for the degree includes “The major program is designed to prepare its students for successful careers in secondary education and other areas requiring a strong foundation in Mathematics, or for success at the graduate level, either in Mathematics or a related discipline”. The students seem to choose all three of these post-bachelor’s paths, but, at the moment, there are course concentrations only in “pure mathematics” and “education”, which primarily address only two of these three paths. To address the employment option better, I suggest a three course “Applied mathematics/Statistics” concentration.

(3) Faculty

Additional Faculty With a worldwide need for statistical analysis, it will need at some point to develop its statistics side at the UHH. In particular, I recommend that the department give serious consideration to hiring a Ph.D. statistician. With a statistician, the department can begin to form a statistics minor. If the department wants a major in statistics or actuary, there will need to be a number of statisticians hired for the programs to be credible.

Professional development The department currently works diligently and laudably to make sure that local K-12 teachers receive professional development. ***Similarly, the university and the department should encourage professional development for its faculty, specifically its instructors and junior faculty.*** From our individual conversations, it was clear that the

instructors and tenure-track members are very excited about research, teaching and eager to improve their methods. This is particularly good to do early in teaching careers as it is much more difficult to change a teaching style that is repeated over too many years. There are many cost-effective ways to do this. The easiest is to develop a culture where faculty at all levels attend each other's classes (perhaps one class visit per semester) and *informally* discuss the class afterwards. For these discussions to be useful and allow faculty to exchange ideas freely, it is important that such discussions not be part of formal evaluations. Further, to prevent insularity, it is also important to support occasional trips for faculty to other universities to observe mathematics classes or to go to AMS/MAA conferences or, if they recently received their Ph.D., to be a part of Project NExT. This support should also be available for instructors who usually have less experience and background than their tenure-track colleagues and therefore need enrichment even more. Activities like this will keep the faculty thinking about fresh ways they can improve their teaching/research throughout their careers and lead to productive discussions about teaching that can improve department cohesiveness. The investment for such activities is small; the long-run pay-off can be huge.

I hope these suggestions will help to improve what is already a thriving and successful department.