Mathematics Undergraduate Student Outcomes Assessment

[Assessment Philosophy and Program Goals]

A meaningful assessment of the undergraduate degree program in mathematics must focus on what students are learning and how well they can use the knowledge gained. Assessment is the process of gathering and interpreting information about student learning in ways that inform faculty and students of the extent to which student achievement is meeting expectations for learning. The learning goals describe the intended learning in the major consistent with the missions of the College and University. The assessment process is designed to provide information for improvement of the undergraduate curriculum, not the assessment of individual students.

A student assessment serves no purpose unless it is communicated to faculty and they act on it as appropriate. Therefore the assessment process must be designed to have both involvement by and respect of the faculty.

[Outcomes and Competencies]

There is no accrediting body for mathematics, but the Mathematical Association of America provides guidelines (CUPM) for undergraduate programs. Furthermore, the Iowa Department of Education has strict requirements which must be met before our graduates are approved to teach. The Department of Education assures the quality of our teaching majors. Performance on the Actuarial exams provides a measure of the quality of our actuarial majors. Our SOA procedures will be presented in the context of the MAA (CUPM) guidelines. The guidelines are currently being revised (and probably always will be). They are designed as guidelines, not a mandate. In brief, they identify seven components of a Mathematics major:

A. Calculus (with differential equations) B. Linear algebra C. Probability and statistics D. Proof-based courses E. An in-depth experience in mathematics F. Applications and connections G. Track courses, departmental requirements and electives

We have four undergraduate math majors; Mathematics, Mathematics (Teaching), Statistics/Actuarial Science, and Applied. All of them begin with the core of three semesters of calculus and one semester of linear algebra. There is no assessment of the skills which entering students have. This is not necessary because of the significant prerequisite structure of mathematics, and our continual monitoring of the high school curriculum to know what skills our entering students will have. Many entering students take AP or CLEP tests to avoid repeating any advanced material they may have had in high school. Our curriculum does not force students to repeat what they already know.

Our Mathematics major is designed to allow students maximum freedom within the areas of mathematics and does not require probability or statistics. Modern Algebra I is a proof based course which Mathematics majors are required to take. An in-depth experience is provided by sequential upper level

courses and also by senior seminar. Applications and connections are not a focus of any course, but will naturally appear in courses.

Our Mathematics (Teaching) major requires a course in probability and statistics, has two proof based courses (geometry and modern algebra), sequential upper level courses to assure an in-depth experience, and a course in connections.

Our Statistics/Actuarial major is essentially a professional major preparing students to work as actuaries, and is continually modified to provide preparation for the actuarial exams as they change. It has significant coursework in probability and statistics, no proof based courses (but proofs are included in several courses), sequential upper level courses and senior seminar for an in-depth experience, and most students take a summer internship which provides experience with applications.

Our applied major is under revision, but will contain probability and statistics, perhaps no proof based courses (but some courses will contain proofs), an in-depth experience, and of course applications.

The primary outcome which we expect from our students is the mastery of the content of the courses. That is generally assessed by tests, quizzes, and homework. The outcomes exam will partially confirm mastery of content.

There are other qualities which we want our students to have which are not a focus of any course. These include:

1) Understanding mathematics in historical and contemporary contexts. (Teaching majors take a history of mathematics course.) 2) Understanding the interrelationships within mathematics (Teaching majors take a connections course.) 3) understanding the relationships to other disciplines 4) Understand the dichotomy/complementarity of mathematics as an abstract area of study versus an applied discipline. 5) Be aware of the role of technology and be able to appropriately use technology for mathematical problems 6) Be able to work independently including both formulating problems into mathematics and solving the mathematics (This may be covered in senior seminar.) 7) Be able to comprehend and communicate mathematics including making both oral and written presentations. (Communication is covered for teaching majors in methods courses, and may be covered in senior seminar.)

These objectives will be the primary concern of our assessment of graduating seniors; although the course content is our primary objective, these qualities are also necessary for our graduates. We shall also assess the degree to which Statistics/Actuarial and Applied majors are competent with proofs. We will monitor the percentage of math majors who elect to take probability and statistics.

[**Assessment Methods**]

The outcomes assessment will contain four pieces.

1) An outcome content test which will indicate what students have retained. At present, this test is envisioned as: 5 questions in each of the following area: calculus, probability/statistics, linear algebra, modern algebra, intermediate analysis (25 problems total)

The number of Actuarial exams passed by actuarial majors will be recorded.

Any concrete tests given to teaching majors will be recorded.

2) Interviews/surveys with students: This should ask the usual questions of what part of the curriculum they feel was the most/least useful, and in what areas they feel most/least prepared. In particular, pure math majors will be asked about their background in probability/statistics (we may look at their transcripts to see what they took) and their facility with technology (calculator guru?, Mathematica/Maple?, which computer languages they know, ...). Actuarial/Statistics majors will be asked their perception of their understanding of proof. All graduates will be asked how they feel about their ability to communicate mathematics.

These interviews have been done every Spring. In the case of teaching majors, this has been done with a group interview of students in the secondary teaching course (800 190); although they are not graduating, they are generally student teaching the next semester, and have completed most of their coursework at UNI. Non-teaching majors have been interviewed individually, but group interviews, perhaps in a course such as senior seminar, may be employed. Surveys may be administered instead of interviews if it seems appropriate.

3) Faculty will be interviewed/surveyed about their perception of the abilities of our graduates, with the purpose of identifying strengths and weaknesses of our students. In particular they will be asked to address mastery of content, understanding of proof, and ability to communicate mathematics.

4) All graduates will be surveyed between 3 and 6 years after graduation. This will allow them to give a more reflective opinion on the weaknesses/strengths of our curriculum and their preparation. We will also ask them for their employment history up to that time.

5) We shall continue to seek input from actuarial science recruiters, many of whom are our graduates, about what they want from our graduates and how well our graduates are prepared. (This provides a perspective several years after graduation from some of our graduates.) We regularly talk with cooperating teachers, supervising teachers, and student teaching coordinators about the quality of our students. Furthermore, information about teaching majors after graduations, both from the alumni and from school principals, is sometimes collected by the College of Education (Barry Wilson). When available, we shall use this to assess how well we have attained our goals at a time after graduation. We shall use whatever information we can get from the College of Education and their monitoring of our teaching majors.

[Methods of Evaluating and Interpreting Results]

The SOA commitee will prepare a summary of the results of the assessments and present it to the faculty each year.

[Procedures for Implementing Program/Curricular Change]

In order to assure that faculty are involved with and respect student assessmet, the following will be done:

1) Faculty shall serve on the SOA committee for three year terms, and be off

the committee for at least three years before serving again. This is important to make more faculty familiar with the assessment process and its purpose. This should facilitate the assessment process impacting the curriculum.

2) Each fall the faculty will be reminded of the outcomes/assessment goals, and which courses have been identified as helping students achieve particular goals.

3) The annual report of the SOA committee will be provided to faculty. In conjunction with 2) above (reminding faculty of outcome goals), this may enable faculty to improve their courses. Major curriculum revisions will of course consider the SOA reports.

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