Outcomes Assessment of the Mathematics Undergraduate Programs

The Mathematics Department has had an assessment effort in place since 2006. Assessment reports and other information (e.g. SLOAA recommendations) are available on the website: http://www.math.uri.edu/Programs/undergraduate/assessment.html The last report available on the website was given in 2012. In 2015, Dr. Orlando Merino agreed to take on the position of undergraduate assessment committee director. Dr. Li Wu and Dr. Mark Comerford joined Dr. Merino to form the Undergraduate Assessment Committee.

The structure of the previous assessment reports was judged to be inadequate and not aligned with the current graduate program assessment structure. Therefore, in the Spring of 2016, Dr. Merino requested to change the structure, that is to re-start the assessment from scratch. Assistant Director Elaine Finan of the office of Student Learning, Outcomes Assessment, and Accreditation (SLOAA) approved this request.

The first action performed was a review of the previous assessment of undergraduate mathematics programs. This extensive reviewed showed that previous reports lacked valuable program information (e.g. a curriculum map) and continuity across the curriculum.

The new committee met several times during the Spring 2016 semester. The committee produced a set of learning outcomes and a curriculum map for the undergraduate programs of Mathematics (Bachelor of Arts and Bachelor of Science), see attachments.

In March of 2016 Dr. Laura Barnes joined the committee, and an application was submitted to participate in the “Collaborations in Assessment Program” of the Office for the Advancement of Teaching and Learning. Under this program, L. Barnes attended the Lily Conference on Evidence Based Teaching held on June 2-5 in Bethesda, MD. L. Barnes submitted a report (attached).

The plan going forward during the academic years 2016-17 and 2017-18 is to implement the following steps:

1. Get approval of work done so far from the office of SLOAA. Work with the undergraduate committee to finalize the documents and bring to the department faculty for discussion and final approval. The target date to have this completed is October 31st, 2016.
2. By November 30, 2016, establish a list of outcomes that will be evaluated and determine the methods/processes used to evaluate the work.
3. Data collection starts in December 2016 and will be done continuously thereafter.
5. Produce a set of recommendations by May 2018.

Orlando Merino, August 31st, 2016
UNDERGRADUATE PROGRAMS BA and BS (pure + applied)

GOALS and OUTCOMES

1. Graduates demonstrate a command of general mathematics.
   1.1 Graduates demonstrate a command of fundamental concepts of calculus and linear algebra.
   1.2 Graduates demonstrate a command of mathematics at the upper division level.

2. Graduates can apply mathematical constructions and techniques to perform computations and produce mathematical proofs.
   2.1 Graduates can read and understand rigorous mathematics.
   2.2 Graduates can construct a rigorous mathematical argument.
   2.3 Graduates can use technology to do calculations, visualizations, and test hypotheses.

3. Graduates can communicate mathematical ideas effectively.
   3.1 Graduates can communicate mathematical ideas in written form.
   3.2 Graduates can communicate mathematical ideas orally.

4. Graduates can apply mathematical methods to solve problems in other disciplines
Academic Program: BS, BA in Mathematics

Program Student Learning Outcomes: Explicit statements of observable, measurable results that specify what a student is expected to know or be able to do as a result of their participation in an academic program. Statements should be detailed and meaningful enough to guide decisions in program planning, improvement, pedagogy, and practice.

Map Key
I = Outcome Introduced
R = Outcome Reinforced
E = Outcome Emphasized for Mastery

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<th>Goal #</th>
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<td>Goal #1</td>
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<td>Graduates can construct a rigorous mathematical argument.</td>
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<td>Graduates can communicate mathematical ideas orally.</td>
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Overall:
This conference was very focused on moving from teacher centered approaches to student centered approaches. The conference director, Todd Zakrajsek, advised us not to think of our efforts as either teacher centered or student centered, rather Learning Centered.

Many of the sessions were workshops that were not necessarily relevant to the study of mathematics or to our departmental program assessment efforts. As I read through my notes, I almost always rote down the same question, how do I apply this to math? But I did pick up a few new thoughts. Not all sessions provided slides but here is what is available. Thank you for allowing me to attend. I am available to help with our department’s program assessment in any way.

Session: Promoting Student Competence, Stockton University, slides, handouts

Summary:
This workshop emphasized the integration and assessment of ‘The Essential Learning Outcomes’ (ELO) from the LEAP (Liberal Education & America’s Promise) program developed by The American Association of Colleges and Universities’ (aacu.org) public policy and campus action initiative. The Stockton team constructed a list of student abilities and faculty integration themes that supported the ELO’s.

The Stockton team then instituted this approach with a series of workshops for faculty where the facilitators helped faculty revise assignments to support and promote ELO competence. Included in those workshops was the 50 Classroom Assessment Techniques (CATS) by Angelo and Cross. Other techniques and approaches used by the Stockton team included:

- Fink’s model of significant learning experience
  https://www.deefinkandassociates.com/GuidetoCourseDesignAug05.pdf
- Syllabi evaluation using rubric adapted from Palmer, Bach & Sterifer, 2014
- Faculty interviews
- Brown Bag seminars for initiative education
- Faculty Fellows – change agents who used the ELOs creatively
- Student self-evaluation of ELO competence.

This workshop was the most practical of all I attended. However, once the University wide ELO’s were identified, the emphasis shifted to specific courses.

How might this session benefit the Math Department:
1) Elaine Finan and her team would be able to facilitate workshops where we develop a set of ELO’s for use across the department
2) We could have a small group of faculty review the 50 CATS to determine which techniques would be relevant to mathematics. We could then encourage faculty to adopt those practices and therefore have some set of assessment techniques that would be similar across the department.
Session: SLOw Learning, Stephen Carroll, Santa Clara University, slides

Summary:
This session emphasized that learning is affective, durable change. Professor Carroll’s main thesis is that how we define learning shapes how students learn, more than how we define teaching or our course goals because it defines how we assess learning. He suggests departments and instructors ask themselves:

- What do you want students to be able to do at the end of your course/curriculum?
- What do you still want them to be able to do 50 years later?

Professor Carroll spent most of the session describing how he writes learning objectives, incorporates them into his syllabus and reinforces those objectives on a daily basis. He constantly reminds his students what is being done in the class and why it’s being done.

He makes ample use of Bloom’s Taxonomy of Educational Objectives in his learning objectives. He directly ties assessments to these objectives but divides traditional measurements into two categories, Assess and Evaluate. Assess uses no or low stakes activities such as homework or in-class assignments to determine student learning. Evaluate uses activities such as traditional testing that yield points toward a final grade.

Professor Carroll also shared two sets of learning objectives, one for an Engineering course and one for an English course. He also provided a handout of verbs organized by Bloom’s taxonomy.

How might this session benefit the Math Department:
1) I think the two questions asked by Professor Carroll are very relevant to our program. The questions may need to be asked for two categories; those graduates staying in academia and those working in industry.
2) The department could adopt a policy that both the program and individual courses use Bloom’s Taxonomy of Educational Objectives. We could have a brown bag seminar for faculty to review the Taxonomy structure and verbs and then suggest that course syllabi be modified to use this approach.

Session: Elevate Student Learning, Course Redesign at the University of Maryland

Summary:
This session emphasized the University of Maryland’s approach to course redesign by describing their process, curriculum, and activities. Their efforts were based on Purdue’s Impact program, whose goal is ‘achieve a greater student-centered learning environment by incorporating active and collaborative learning as well as other student-centered teaching and learning practices and technologies into large enrollment foundational courses’.

Both Maryland and Purdue set up yearlong Faculty Learning Community Cohorts (competitive). At Maryland, faculty learn techniques and approaches in the spring, plan during the summer and pilot their course changes in the fall. The programs are funded through a teaching and learning office (similar to our ATL) and the individual departments. Student surveys administered during the pilot help assess the changes.

How might this session benefit the Math Department:
This approach is more university wide and better implemented by ATL. I don’t see a specific use in our department.