Bachelor's Degree in Mathematics
***DRAFT* Assessment of Student Learning Program**
Kansas State University

A. College, Department, and Date of This Submission

College: Arts and Sciences
Department: Mathematics
Date of Submission: May 3, 2010

B. Contact Person(s) for the Assessment Plans

Louis Pigno, Department Head
Thomas Muenzenberger, Director of Undergraduate Instruction
Andrew Bennett, Director, Center for Quantitative Education

C. Program – degree, minor, or certification

B.S./B.A. in Mathematics

D. Annual Progress Reports on Assessment of Student Learning

1. **List the Student Learning Outcomes that were assessed during the year, including those for which data were gathered as well as those for which developmental work was done, such as the creation or piloting of assessment measures.**

   R-2: Students will be able to compose and explain mathematical proofs and counterexamples; make logical inferences.

   K-1: Students will know the standard facts and algorithms of calculus and differential equations.

   K-4 Students will know the standard facts and algorithms of a specialized area of mathematics at a basic level (as defined by the student's advisor).

   Relationship to K-State SLO

Program SLOs	Knowledge	Critical Thinking	Comm.	Diversity	Integrity	Program SLO is conceptually different from K-State SLOs
R-2	X	X	X			
K-1	X					
K-4	X	X	X			

2. **For each learning outcome, describe the measures used, the sample of students from whom data were collected, the timetable for the collection, and the forum in which the measures were administered. Remember that over a three-year period at least one-half of the measures used must be direct measures.**

R-2

- The assessment for this learning outcome is under development. Our plan (which we are following) calls for the outcome to be assessed in upper division mathematics courses. Majors take a minimum of six such classes. Our plan is that eventually all students enrolled in these courses will be assessed. Two proof problems on assignments/exams will be designated for evaluation for program assessment. In order to provide consistent scoring, the curriculum committee has developed a rubric for grading proofs. This rubric was used to evaluate work submitted during the past year in Math 512, Math 560, Math 572, and Math 633, which are recommended proof courses for math majors planning on attending graduate school, and in Math 511 and Math 572, which are recommended proof courses for math majors planning on working in education.
- Majors are asked during their exit interviews whether they believe they understand how to compose and explain proofs and what examples or reasons they have to support their belief. All graduating seniors are invited for such interviews and over 90% participate.

K-1

- Math 240, Elementary Differential Equations, serves as the capstone course for the calculus sequence. Students taking this course are assigned to complete 18-21 computerized assignments demonstrating their skill in calculus and differential equations (most differential equations are solved by reducing them to calculus problems) during the semester. Success of math majors on these problems will be recorded. Math 240 is a required course and over 90**%** of majors take the course on campus and so will complete the computerized assessments.
- Majors are asked during exit interviews whether they believe they have knowledge of basic calculus and differential equations and what examples or reasons they have to support their belief. All graduating seniors are invited for such interviews and over 90% participate.

K-4

- Advisors will be responsible for selecting a performance assessment (if available) for whether students have met this student learning outcome. Because students take a mathematics degree as preparation for a wide range of careers, many different measures will be appropriate in different circumstances. A list of nine different possible assessments that have been used in the past has been developed, but other measures may be suitable in the future. Since this is a new outcome for our program, current graduates may not have completed any such assessment. Majors were asked during exit interviews about whether they had completed any such performance measures.

- Placement data and alumni surveys will follow up on performance in selected area after graduation.

3. **Describe the results of the assessment. (What did you learn? What is working well? Where are improvements needed?) If specific results are not available, describe the progress that has been made on the initiatives included in the approved assessment plan.**

   For each student learning outcome, we have defined "exemplary," "proficient," "acceptable," and "developing" levels of performance. For our program as a whole, we have the following standards.

   The *program* will be *exemplary* in a particular outcome if at least 90% of students are proficient or better in that outcome and at least 50% are exemplary.

   The *program* will be *proficient* in a particular outcome if at least 80% of students are proficient or better in that outcome and at least 30% are exemplary.

   The *program* will be *acceptable* in a particular outcome if at least 70% of students are proficient or better in that outcome and at least 10% are exemplary.

   Otherwise, the *program* will be *developing* in that outcome.

   R-2

   - Rubric-based evaluations of proofs were collected from 40 students in upper-division courses during spring 2007. Note that this double counts some students who took more than one course where evaluations were performed. In each course, two representative problems were evaluated on a 6-point rubric. The standards of performance for the sum of the scores on the two problems was

Rating	*Score*
Exemplary	11-12
Proficient	9-10
Acceptable	7-8
Developing	0-6

   With these standards, student performance was rated as follows

Rating	*Number*	*Percent*
Exemplary	23	57.5%
Proficient	6	15%
Acceptable	2	5%
Developing	9	22.5%

   These numbers are *acceptable*. We note that the results would be *exemplary* were it not for issues in a single class. We hope to avoid these issues in the future.

K-1

- Twenty undergraduate majors passed Math 240 in 2009. Their average scores on the online assignments were computed. The following standards of performance were specified last year based on an analysis of student performance among both majors and non-majors.

Rating	*Score*
Exemplary	90 – 100%
Proficient	80 – 90%
Acceptable	70 – 80%
Developing	0 – 60%

Based on these standards, undergraduate majors' performances were rated as follows:

Rating	*Number*	*Percent*
Exemplary	12	60.0%
Proficient	6	30.0%
Acceptable	2	10.0%
Developing	0	0.0%

These values are *exemplary*. Note that this assessment measures students at the midway point in their work, rather than at exit, so we get feedback on how students are doing in a more timely fashion.

K-4

- Eighteen of the twenty-one students who went through exit interviews during 2009 had completed performance assessments tied to their knowledge of a specialized area of mathematics. As this is not a graduation requirement and suitable assessments are not always available depending on the interests of the student, we are happy that we have 80% of our graduates voluntarily and successfully completing this requirement.

- Placements for the 21 students who graduated during 2009 were

Placement	*Number*	*Percent*
Grad School	11	52.4%
High Tech Job	5	23.8%
Teaching	2	9.5%
Low Tech Job	2	9.5%
Unknown	1	4.8%

We are pleased that 80% of our graduates found situations using their skills in a very difficult job market.

4. Describe the process by which faculty reviewed the results and decided on the actions and/or revisions that were indicated by them.

This annual assessment report is brought to the attention of the faculty each spring and is available for them to read in the department office. We have not yet received any comments that actions or revisions are appropriate.

5. **Describe the actions and/or revisions that were (or will be) implemented in response to the assessment results.**

   This data is better in some areas and worse in others, but within reasonable fluctuations of previous results. The issues with the class that led to only acceptable results on R-2 will be dealt with through faculty assignments.

6. **In second and subsequent years, describe the efforts on student learning of the previous year's actions.**

   The Center for the Integration of Undergraduate and Graduate Research has been active in developing opportunities for students to pursue undergraduate research and to provide help for students preparing for graduate school. We feel the success in outcome K-4 has been helped by these actions.