

## Department of Mathematics and Statistics

### *Bachelor of Arts/Bachelor of Sciences in Mathematics (60/61)*

**Contact Person:**

Dr. Alan Johnson  
Mathematics and Statistics Department  
(501) 569-8102  
[amjohnson@ualr.edu](mailto:amjohnson@ualr.edu)

UNIVERSITY OF ARKANSAS AT LITTLE ROCK

Plan No. 60, 61

Assessment Progress Report Form - Calendar Year 2005

### **Introduction:**

The Department of Mathematics and Statistics revised its assessment plan during the 2002-2003 academic year. This occurred as a result of the participation by two faculty members, Jim Fulmer and Tom McMillan, in a 15-month workshop, *Supporting Assessment of Undergraduate Mathematics (SAUM)*. The team attended a series of three workshop meetings, which were sponsored by the Mathematical Association of America with funding from the National Science Foundation. This revised plan has been approved by the Department Gold Committee, consisting of the tenured and tenure-track faculty members. It was implemented effective with the 2002 calendar year and this is the fourth year for the new plan. In revising its plan, the department faculty kept as an overarching principle, "To make it work, keep it simple." This revised assessment plan consists of the following model: *Mission Statement, Program Goals, Student Learning Objectives, Assessment Criterion, Assessment Method, and Assessment Instruments*

In this model, for each student learning objective, there is at least one assessment criterion and an assessment method for measuring that assessment criterion. Currently, our assessment plan consists of six student learning objectives, which are stated in the *Approach* section of this report. Our plan had been to assess two of the student learning objectives each year, so that over a three-year cycle all student learning objectives will have been assessed. However, since we administer the ETS-MFT test each year and we consider the comparison with a national standard to be a strength of our assessment plan, we have decided to measure Objective B each year. Since we are in the process of revising our portfolio assessment, we are not using that assessment instrument this year. For the assessment year 2005, we are assessing student learning objectives B, D, and E. The assessment model that we are using, consisting of a student learning objective, assessment criterion, and assessment method, is illustrated in the *Approach* section of this report.

We feel that a primary strength of our assessment plan is that we are assessing our students relative to a national benchmark. All students enrolled in our Senior Seminar/Capstone course are required to take the Educational Testing Service – Major Field Test in Mathematics, a nationally recognized examination. We are strongly encouraging our mathematics majors to take the MFT test during their junior year. In this way, we are obtaining two scores on each student which can be used for assessment purposes. In these ways, we are using student performance and input as a part of the feedback mechanism in program assessment to improve our program.

As a result of recommendations of two recent assessment consultants which visited our campus, Dr. Trudy Banta of IUPUI and Dr. Ed White of the University of Arizona, we have decided to simplify and shorten our Assessment Progress Report and make it more concise.

### **Use of Assessment for Program Building and Improvement:**

For the second time, we are using the *Planning for Learning and Assessment* format, which was recommended by Dr. Trudy Banta of IUPUI in her visit last year to our campus as an assessment consultant. It consists of the six questions listed below.

1) *What general outcome are you seeking?*

- Objective B: Mathematics majors acquire the mathematical knowledge and skills necessary for success in their program or career.
- Objective D: Mathematics majors develop the ability to work both independently and collaboratively on mathematical problems.
- Objective E: Mathematics majors develop an appreciation for the roles of intuition, formalization, and proof in mathematics.

2) *How would you know it (the outcome) if you saw it? (What will the student know or be able to do?)*

- Objective B: In senior seminar, students are required to take the ETS Major Field Test. Score reports show their national percentile rank and five assessment indicators: calculus, algebra, applied, routine, and non-routine.
- Objective D: Students should demonstrate the ability to solve a variety of mathematics problems working collaboratively in a team setting. In senior seminar, assign problems to be solved in a small group setting.
- Objective E: In senior seminar, ask students to demonstrate both kinds of reasoning.

3) *How will you help students learn it?*

- Students will acquire this knowledge through their mathematics courses, including the Senior Seminar/Capstone course.

4) *How could you measure each of the desired behaviors listed in Objective B, D, and E?*

- Objective B: Scores for each student on the ETS Major Field Test will be the assessment instrument, which measures five assessment indicator areas: calculus, algebra, applied, routine, and non-routine.
- Objective D: The Senior Seminar/Capstone course has a small enrollment and the instructor will include in the course a variety of mathematics problems assigned for students working collaboratively in a team setting.
- Objective E: The Senior Seminar/Capstone course has a small enrollment and the instructor will emphasize and ask students to respond that they can reason both intuitively and rigorously.

5) What are the assessment findings?

- Graph A represents the 2005 ETS Major Field Test (Percentiles) for the ten students taking the test.
- Two students made above the 50<sup>th</sup> percentile, three students were at the 50<sup>th</sup> percentile, and five students were below the 50<sup>th</sup> percentile, with one student at the 0<sup>th</sup> percentile. We are pleased that one of our students was at the 90<sup>th</sup> percentile and one student was at the 80<sup>th</sup> percentile.
- Graph B represents the ETS Major Field Test Percentile of Average Score (Seniors) and Number of Test Takers History over the years 1996 to 2005.
- Ten students took the Major Field Test in April 2005. This represented an increase of one from the nine students taking the test in 2004. According to Graph B, this number has varied from a low of two to a high of 16 over the past ten years.
- The average percentile score for 2005 is the 40<sup>th</sup> percentile. This represents a decrease over the previous year of about 13 percentile points.
- According to Graph B, the highest percentile was in the year 2000. We feel that this number is skewed as only two students took the test that year and one made an unusually high score.
- According to Graph B, the scores for 2000-2004 are somewhat better than the scores for 1996 to 1999; however, the score for 2005 represents a decrease to a score of 40<sup>th</sup> percentile.
- Graph C represents the ETS Major Field Test Assessment Indicators. The best mean percent correct(+/- standard error) for 2005 is in Algebra with a score of 40.0; the lowest mean percent correct is in Nonroutine (Problem Solving) area with a score of 25.8; others are Calculus at 34.6, Routine problems at 32.8, and Applied problems at 38.0.
- Scores for 2005 in all the assessment indicators were below the 50<sup>th</sup> percentile.
- Graph D represents the Assessment Indicator History in percent correct for the five years 2001 to 2005.
- According to Graph D, the percent correct for Calculus, Routine, and Nonroutine decreased from 2004.
- According to Graph D, the percent correct for Algebra and Applied increased from 2004.
- According to Graph D, there was an increase in two areas and a decrease in three areas.
- We are pleased that our scores in all assessment indicators for the year 2005 are above the lowest levels in four of the five areas as indicated by Graph D for the years 2001-2005.

- We are pleased that our score for 2005 for the assessment indicator Applied is at its highest level, 40.0, for the years 2000-2005.
- We are concerned that our score for 2005 for the assessment indicator Routine is at its lowest level, 32.8, for the years 2000-2005.
- In the Exit Interview from the Senior Seminar/Capstone course, Question #1 “Please give me your favorite mathematical insight or discovery. Have you discovered any connections between different areas of mathematics?”, the average rating was two, with zero = poor response and 2 = excellent response.
- In the Exit Interview from the Senior Seminar/Capstone course, Questions #2 “What are you going to be doing after graduation? Do you feel mathematically prepared?”, the average rating was two.
- In the Exit Interview from the Senior Seminar/Capstone course, Question #3, “Do you feel competent to read mathematical proofs that are technically involved?”, the average rating was one.
- In the Exit Interview from the Senior Seminar/Capstone course, Question #4, “What is problem solving? How do you approach problem solving?”, the average rating was two.
- In the Exit Interview from the Senior Seminar/Capstone course, Question #5, “How do you approach writing proofs?”, the average rating was 1.5.
- In the Exit Interview from the Senior Seminar/Capstone course, Question #6, “Have you developed the ability to work both independently (individually) and collaboratively (group work) on mathematical problems? State an example of each”, the average rating was two.
- The Senior Project is prepared by students in the Senior Seminar/Capstone course and presented to other students and department faculty members. A rubric for evaluating the project presentation is filled out by all department faculty attending the presentation. It is used by the instructor of the Senior Seminar/Capstone course and by the Department Assessment Committee in their evaluation of program assessment.
- Feedback from the Exit Survey, which is in narrative form, will be shared and discussed with the Department Assessment Committee and the Department Assessment Committee.

6) What improvements might be based on assessment findings?

- We are concerned that the assessment indicator *nonroutine problems* continues to be our lowest score. This is an indicator that measures student problem-solving skills. We are not sure if this is an indication of actual student difficulties or an artifact of the relatively unfamiliar testing environment. Our plan is to use some time in the senior seminar to acquaint students with the MFT testing format and to increase the emphasis in the Senior Seminar and in all mathematics courses on solving problems that require knowledge from various mathematical disciplines.
- We are concerned that our students mean score continues to be below the 50<sup>th</sup> percentile in all five assessment indicator areas.
- We are pleased that the number of students taking the MFT in 2005 has increased to double digits, having been single digits the previous year. We plan an active recruitment effort to increase this number.
- A change for this year is the implementation of a written student Exit Survey and Exit Interview, which was given to students in the Senior Seminar course near the end of the course. This will enable us to use student responses near the end of their program as a part of the feedback loop in improving assessment.
- Another change is that the student score on the ETS-MFT is now a part of the course grade. It is felt that with this change, students will exhibit a more serious and conscientious attitude toward the test and will strive to give it their best effort. In the past, it was felt that students finished the test too quickly since their performance on the test was not a part of the grade for the course; thus their score did not represent their best effort.
- We continue to be concerned about problem solving skills, which on the MFT assessment indicators are referred to as nonroutine problems. We are concerned that this continues to be the assessment indicator for our students most in need of improvement.
- Although this is an expected difficult area, we are concerned that our students need more experience and exposure to reading, writing, and understanding mathematical proofs.
- We are concerned about the decrease of scores in 2005 for the assessment indicator Routine problems, now at 32.8 percentile.

## **Faculty and Stakeholder Involvement:**

- The Department Assessment Committee consists of five tenured/tenure-track faculty. Among the tasks accomplished by the committee are the development of a rubric for evaluating student portfolios, rubrics for the evaluation of student project presentations, how to assess the portfolio, ways to encourage students to take the Major Field Test during their junior year, developing a rubric for the exit survey, and decision to implement an exit interview. The assessment plan contains a schedule for all assessment activities.
- We are changing our method of assessing portfolios. We feel there is a better way than having faculty/professors responsible for collecting assignments to put in the portfolio. Two recent assessment consultants to the campus, Dr. Trudy Banta of IUPUI and Dr. Ed White of University of Arizona, both have recommended that the student should be responsible for creating and maintaining their own portfolio. The Department Assessment Committee has decided to make this a student responsibility and it will be a part of the Senior Seminar beginning in Spring 2006. Thus, portfolio assessment will be a part of the 2007 Assessment Progress Report.
- In the past, the department had two two-member teams of faculty attending a series of three workshops (Strengthening Assessment of Undergraduate Assessment – SAUM) sponsored by the Mathematical Association of America at the Joint Meetings of the Mathematical Association of America and the American Mathematical Society. One team (Jim Fulmer and Tom McMillan) concentrated on program assessment and the other team (Melissa Hardeman and Tracy Watson) concentrated on core assessment. This workshop series was funded by a National Science Foundation grant. The department teams participated in this assessment project for a period of fifteen months and the department has adapted its assessment plan to conform to standards for the assessment of undergraduate mathematics developed at these meetings.
- The CSAM Assessment Committee has decided to have a college-wide alumni and employer telephone assessment administered by Cindy Boland of the Institute of Government. This assessment survey of alumni and employers will be done during 2006; thus, there is no assessment data from alumni or employers for the 2005 assessment year, but there will be during the 2006 year.
- The department has implemented several changes in the Senior Seminar/Capstone course. This is due to assessment feedback and our revised assessment plan, which has indicated a need to have more activities in the course to provide additional data for measuring our student learning objectives. The changes are a) expand the course from one to three credit hours, b) move the course from the spring semester to the fall semester, and c) make the student score on the ETS-MFT a part of the course grade. It is felt that these changes will enable the course to expand the required student project in the course, cause students to make a better effort to score their best on the MFT, provide time for review and preparing students to take the ETS-MFT, and to help students prepare papers to be submitted for presentation at the student section of the annual Oklahoma-Arkansas Section of the Mathematical Association of America meeting, which occurs during the spring semester. By having UALR students presenting at this meeting would reflect favorably on our department.

## **Approach:**

- Goal : To prepare our students to enter graduate school, to teach at the secondary level, and to be employed and act in a consulting capacity on matters concerning mathematics.
- Objective A: That mathematics majors develop an appreciation of the variety of mathematical areas and their interrelation.

Assessment criteria A1: Students should be able to name several different fields of mathematics they have studied.

Assessment method A1: In senior seminar exit interview, ask students about the variety of fields they have studied.

Assessment criteria A2: Students should demonstrate at least one relationship between different mathematical fields.

Assessment method A2a: In portfolio, look for items which demonstrate such a relationship.

Assessment method A2b: In senior seminar exit interview, ask students to demonstrate such a relationship.

- Objective B: That mathematics majors acquire the mathematical knowledge and skills necessary for success in their program or career.

Assessment criteria B1: Students should achieve an acceptable score on a nationally recognized test with comparison to national percentiles.

Assessment method B1a: In senior seminar, students are required to take the ETS Major Field Test. Score reports show their national percentile rank and various assessment indicators.

Assessment method B1b: In alumni/student survey, ask for opinions and comments on this.

- Objective C: That mathematics majors develop the ability to read, discuss, write, and speak about mathematics.

Assessment criteria C1: Students should make a presentation to their peers, including department faculty.

Assessment method C1: In senior seminar, students are required to develop and prepare a mathematics project, prepare a written handout of the project including solution, and then make a presentation to other members of the seminar and the department faculty.

- Objective D: That mathematics majors develop the ability to work both independently and collaboratively on mathematical problems.

Assessment criteria D1: Students should demonstrate the ability to solve a variety of mathematics problems working on their own.

Assessment method D1a: In portfolio, review the individual assignments and examinations. Look for whether there have been improvements over the students careers at UALR.

Assessment method D1b: In employer survey, ask for opinions and comments.

Assessment criteria D2: Students should demonstrate the ability to solve a variety of mathematics problems working collaboratively in a team setting.

Assessment method D2a: In senior seminar, assign problems to be solved in a small group setting.

Assessment method D2b: In employer survey, ask for opinions and comments.

- Objective E: That mathematics majors develop an appreciation for the roles of intuition, formalization, and proof in mathematics.

Assessment criteria E1: Students will show that they can reason both intuitively and rigorously.

Assessment method E1a: In portfolio, look for examples of both kinds of reasoning.

Assessment method E1b: In senior seminar, ask students to demonstrate both kinds of reasoning.

Assessment criteria E2: Students will show that they can reason both inductively and deductively.

Assessment method E2: In portfolio, look for examples of both kinds of reasoning.

- Objective F: That mathematics majors develop problem-solving skills.

Assessment criteria F1: Students will show they have problem-solving skills.

Assessment method F1a: In portfolio, look for examples of problem-solving skills.

Assessment method F1b: In senior seminar, students are required to take the ETS Major Field Test. One of the assessment indicators on the score reports is nonroutine problems.

Assessment method F1c: In employer survey, ask for opinions and comments.

Assessment method F1d: In alumni/student survey, ask for opinions and comments on this.

- Assessment instruments: Seven assessment instruments are used in our assessment plan: student scores on the ETS Major Field Test, the student portfolio, the senior seminar presentation, the student exit survey, the alumni survey, the employer survey, and the student exit interview.

- Timeframe for future assessment activities: The following table gives the timeframe for future assessment activities. Because they involve relatively small population sizes, the alumni and employer surveys will be conducted every three years and will involve more than one graduating class. The current assessment round is labeled “2005.”

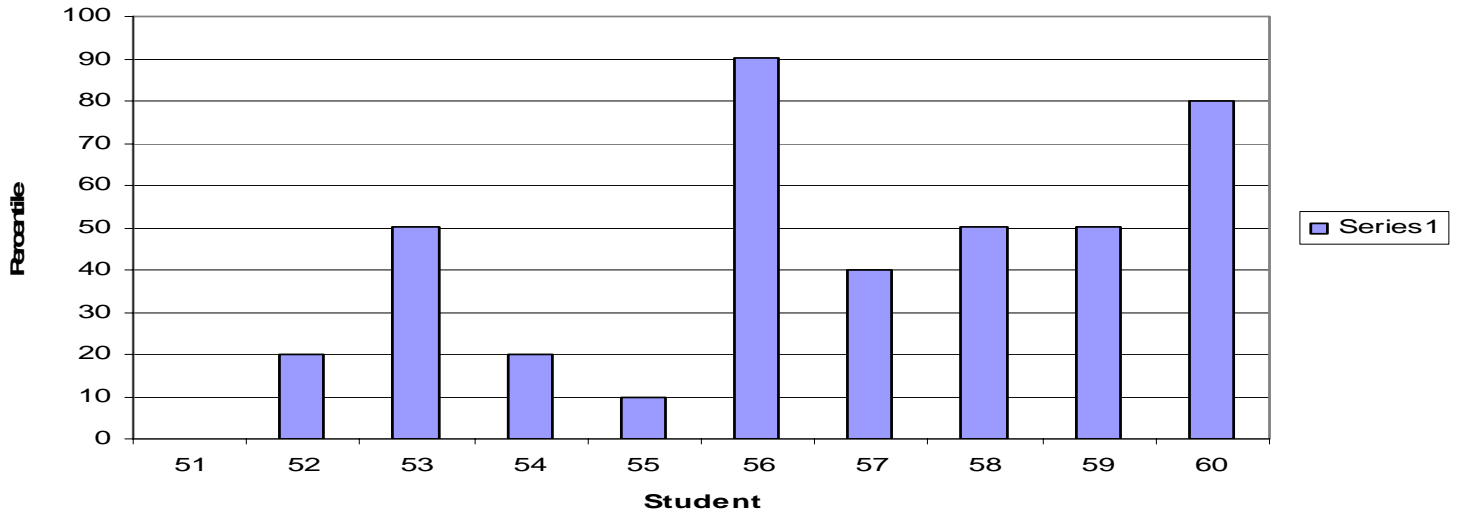
<b>Learning Objective</b>	2003	2004	2005	2006	2007	2008
B and F	MP			AEMPIU		
A, B, and C		M			EIPMSU	
B, D, and E			IMUS			AEIMPS
M=ETS-MFT, P=Portfolio, S=Senior Project, A=Alumni Survey, E=Employer Survey, I = Exit interview, U = Exit survey						

### **Addressing evaluator’s comments from last year:**

- Last year, evaluators noted that the department was making a number of revisions in our assessment plan, including expansion of the Senior Seminar/Capstone course from one to three hours, moving the course from spring to fall, and making the student score on the ETS-MFT a part of the course grade. This has been accomplished.
- Last year, evaluators suggested that plans for improving non-routine problem solving should include more than work in the senior seminar. We plan to address this with more non-routine problem solving in all mathematics courses and perhaps in activities of the Math Club.
- Last year, evaluators noted that the department plans to add student Exit Interviews from the Senior Seminar/Capstone course during the 2005 assessment year. This has been done and results are included in this report.
- Last year, evaluators noted that alumni and employer surveys had been delayed due to the upcoming college-wide telephone alumni/employer survey to be administered by Cindy Boland of the UALR Institute of Government. This survey has been delayed until the 2006 calendar year and will be included in the 2007 Assessment Progress Report.

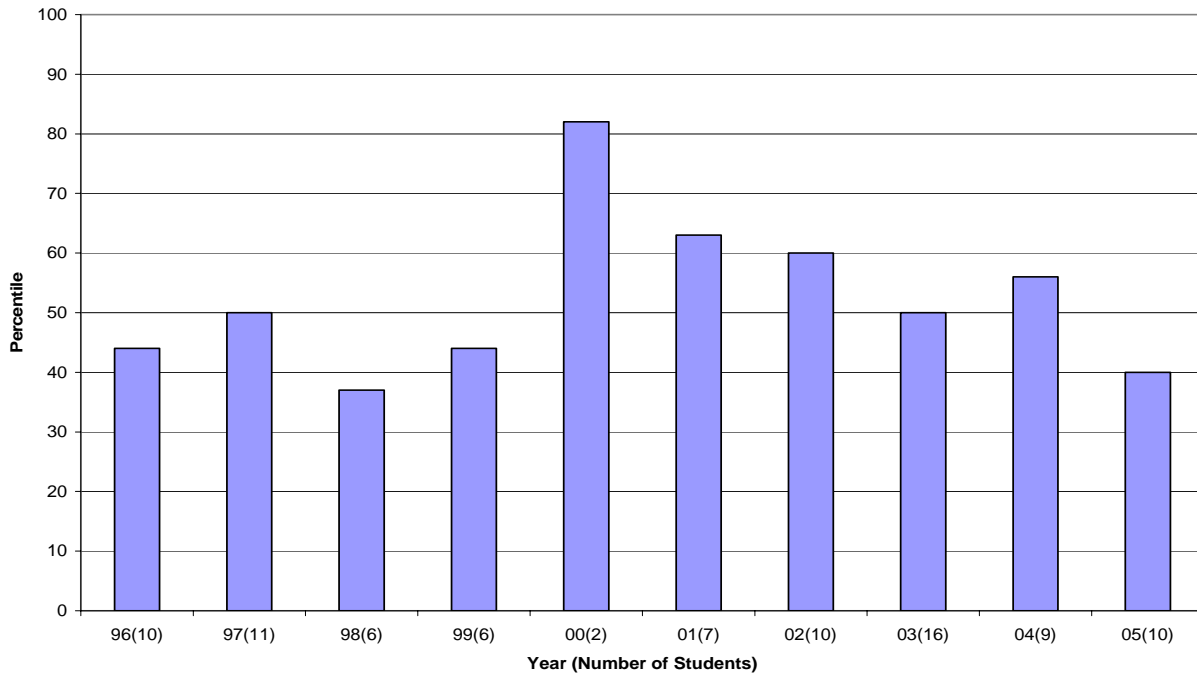
Graph A

2005 ETS Major Field Test (Percentiles)



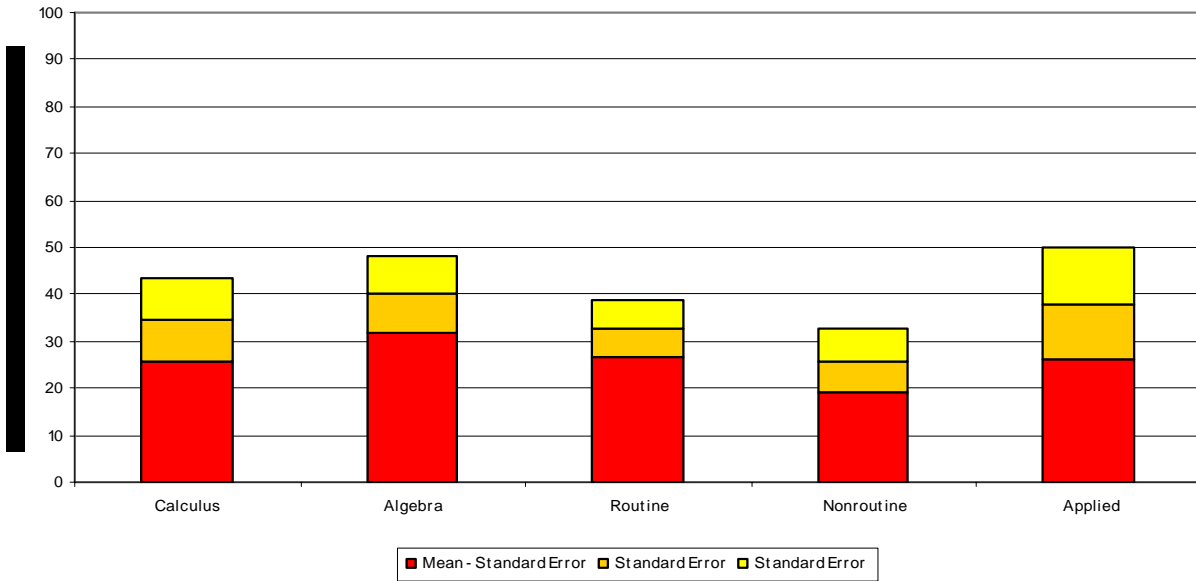
Graph B

ETS Major Field Test Percentile of Average Score (Seniors) History



Graph C

2005 ETS Major Field Test Assessment Indicators  
(Ten students)



Graph D

Assessment Indicator History

