Mathematics Education Program
Southeastern Oklahoma State University

Assessment Report
2008-2009

Date Submitted: September 10, 2009

Prepared by Mathematics Education Program Faculty:

Charles Matthews, Chair of Mathematics
Brett Elliott
Karl Frinkle
Linda Kallam
Chris Moretti
Buddy Pierce
Patrick Reardon
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A. Departmental Mission Statement

The mission of the Mathematics Department at Southeastern Oklahoma State University is to prepare students to become teachers of mathematics, to enter graduate programs in the field of mathematics, to secure positions in business and government that require preparation in mathematics, and to satisfy the individual’s curiosity concerning the patterns of thought found within the body of mathematics. The programs in the Mathematics Department are based upon the philosophy that the study and application of mathematics requires the cultivating of thought processes and intellectual attitudes that are important and useful to all students in all academic disciplines. In keeping with this philosophy, the Mathematics Department provides courses for other academic programs and courses designed to fulfill general education requirements.

The mission of the Mathematics Education Program is embodied in the motto: “Teacher: Manager of Learning.” The intent is not only for Mathematics Education graduates to manage the learning of their students but to also manage their personal learning. The Mathematics Education Program will acquaint students with models for excellent teaching and provide a challenging academic program to help them develop the skills and habits that promote success as career educators.

B. Departmental Vision Statement

The Mathematics Department at Southeastern Oklahoma State University will be the leading mathematics department for quality mathematics education among regional universities in Oklahoma and northern Texas.

C. Statement for Assessment and Student Learning

The Mathematics Department at Southeastern Oklahoma State University believes that assessment fundamentally contributes to student learning and that it is useful in all academic disciplines and extracurricular activities. The Mathematics Department will make appropriate changes to the Mathematics Education program as needed to ensure optimal student learning based on assessment results. In addition to curricular matters, assessment will also be used for program review, budgeting and planning and it will provide useful information to guide continuous program improvement.
D. Program Goals

The goal of the Mathematics Education Program is to provide graduates with the knowledge, skills, dispositions, experiences, educational instruction, and assessment that will prepare them for success as teachers of mathematics, to prepare them for graduate study in Mathematics Education, and to satisfy their curiosity concerning the patterns of thought found within the body of mathematics.

E. Major Program Objectives and Outcomes

A student completing a B.S. degree in Mathematics Education shall:

1. Know, understand, and apply the process of mathematical problem solving.

2. Reason, construct, and evaluate mathematical arguments and develop an appreciation for mathematical rigor and inquiry.

3. Communicate their mathematical thinking orally and in writing to peers, faculty and others.

4. Recognize, use, and make connections between and among mathematical ideas and in contexts outside mathematics to build mathematical understanding.

5. Use varied representations of mathematical ideas to support and deepen students’ mathematical understanding.


7. Support a positive disposition toward mathematical processes and mathematical learning.

8. Possess a deep understanding of how students learn mathematics and of the pedagogical knowledge specific to mathematics teaching and learning.

9. Demonstrate computational proficiency, including a conceptual understanding of numbers, ways of representing numbers, relationships among numbers and number systems, and meanings of operations.

10. Emphasize relationships among quantities including functions, ways of representing mathematical relationships, and the analysis of change.

11. Use spatial visualization and geometric modeling to explore and analyze geometric shapes, structures, and their properties.
12. Demonstrate a conceptual understanding of limit, continuity, differentiation, and integration and a thorough background in the techniques and application of the calculus.

13. Apply the fundamental ideas of discrete mathematics in the formulation and solution of problems.

14. Demonstrate an understanding of concepts and practices related to data analysis, statistics, and probability.

15. Apply and use measurement concepts and tools.


17. Obtain a job utilizing their degree or be admitted to graduate school.

_F. New to this Year's Assessment Report_

The following changes have been made to this year’s report.

1. We began requiring all students to have an acceptable or target rating on a specific lesson plan in Math 4903 to use technology. See Section G.6b.

2. We began requiring all students to have an acceptable or target rating on lesson plans in Math 4903 in dispositions and pedagogy. See Sections G.7 and G.8.

_G. Assessment of Each Objective and Outcome_

1. Problem Solving

Objective #1 is *Know, understand, and apply the process of mathematical problem solving.* There are four indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

1.1 Apply and adapt a variety of appropriate strategies to solve problems.

1.2 Solve problems that arise in mathematics and those involving mathematics in other contexts.

1.3 Build new mathematical knowledge through problem solving.

1.4 Monitor and reflect on the process of mathematical problem solving.

This objective is assessed via the following instruments.
a) Oklahoma Subject Area Test

Mathematics Education majors are required to take the Oklahoma Subject Area Test (OSAT) before they do their student teaching. There are two certification exams: Advanced Mathematics and Intermediate Mathematics. The students currently all take the Advanced OSAT, so the department is using the results from that test only. Typically only three to six students take the test each year, so some variation from year to year is normal. In the 2008-09 academic year, 6 students took the OSAT exam.

The overall Advanced OSAT scores from 2004/05-2008/09 are given in the following table:

A passing score for the Advanced OSAT is 240. The mean scores overall show some variation due to raw student ability, but the means all surpass the 240 level, showing that our students are well prepared overall. In addition, in 2007/08 and 2008/09 all 10 students who took the exam scored 241 or higher, the first years since 2003 that all students passed the exam.

In addition to the overall advanced OSAT score, subscores are reported in 6 subareas – “Math Processes and Number Sense”, “Relations, Functions and Algebra”, “Measurement and Geometry”, “Trigonometry and Calculus”, “Probability and Statistics”, and “Constructed Response”. For each subarea 240 is also considered a passing score. The average subscore results for these areas are as follows:
The scores from 2004-2009 vary slightly from year to year, but consistently stay in the 240-270 range. In 2008/09, 5 of the 6 students scored over 240, with one student scoring a 212.

In 2008/09, all 6 students scored at least 254 on this subscore, way above the score required for passing.
In 2008/09, only 4 of 6 students passed the "Measurement and Geometry" portion of the test.

In 2008/09, 5 of the 6 students passed the "Trigonometry and Calculus" portion of the test.
OSAT "Probability, Statistics, & Discrete Math" Means

The average subscore in probability, statistics and discrete math remains above the 240 level. In 2008/09, all 6 students passed with a score of 245 or higher.

OSAT "Constructed Response" Means

The Constructed Response has traditionally been the students’ weakest area of the Advanced OSAT, with the departmental average falling below the passing score of 240 from 2004-2006/07. In 2007/08 the students’ scores increased dramatically, with 3 of 4 students passing, and 2 of those being perfect scores. In 2008/09, 5 of 6 students received perfect scores and the sixth student scored a 226. Although more data is needed, it is reasonable to conclude that if these scores remain high it will be a consequence of the shift in focus resulting from the PMET grant the department received in 2004.
Based on responses from students and recommendations from national mathematics and mathematics education organizations, modifications are underway in the secondary mathematics education program at SOSU. The Department of Mathematics at SOSU was awarded a PMET (Preparing Mathematicians to Educate Teachers) grant from the MAA (Mathematical Association of America) in late fall, 2004. The purpose of the grant was to address the mathematical content and pedagogical needs of preservice secondary mathematics teachers at Southeastern Oklahoma State University.

The objectives of the PMET grant, Improving the Preparation of Preservice Secondary Mathematics Teachers, are: 1) Create a new course required of all mathematics education majors to connect the content knowledge from college mathematics courses to the content knowledge taught at the secondary level; 2) Revise other mathematics courses required for mathematics education students to more closely align the pedagogical format with reform methods. These objectives have been met, with the exception that the new course is not yet a degree requirement for mathematics education majors.

As the courses developed and modified by the PMET grant have only been taught for 2 years, it is still too early to draw meaningful conclusions about the success of the PMET grant. Hopefully the modifications from the PMET grant will continue to give positive results to report in the next year.

Below is an index which correlates each of the OSAT subareas with the specific outcomes from the NCTM:

<table>
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<td>Constructed Response</td>
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b) ETS Major Field Test

The Educational Testing Service (ETS) Major Field Exam in Mathematics was first used as an assessment tool in the Mathematics Department at Southeastern Oklahoma State University in the Spring of 1991. Nationwide the Major Field Exam in Mathematics is given to universities such as Ball State, Gonzaga, Kent State, the University of Colorado, and the University of Missouri as well as many smaller institutions. At Southeastern, the exam is given to all Mathematics Education majors who are enrolled in Senior Seminar. Senior Seminar is a capstone course and is required of all Mathematics Education majors. The ETS Major Field Exam in Mathematics counts as part of the grade in this course. This motivates the students to do well on the exam even though a certain score is not required in order for them to graduate.

This year a total of six (n =6) Mathematics Education majors took the ETS. The average overall scores on the ETS for the last seven years are represented in the chart below.

![Average Overall Scores on the ETS](chart.png)

The Mathematics Department has set the 40th percentile as a goal for Mathematics Education majors (because they are compared to mostly Mathematics majors across the country). Three out of six students scored at the 40th percentile or higher, and the average was right at the 40th percentile.

**Modifications:** No program modifications are indicated by the data from the ETS exam.
2. Proofs

Objective #2 is *Reason, construct, and evaluate mathematical arguments and develop an appreciation for mathematical rigor and inquiry.* There are four indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

2.1 Recognize reasoning and proof as fundamental aspects of mathematics.
2.2 Make and investigate mathematical conjectures.
2.3 Develop and evaluate mathematical arguments and proofs.
2.4 Select and use various types of reasoning and methods of proof.

This objective is assessed via the following instruments.

a) **Oklahoma Subject Area Test**

For a description of this test, see Section G.1a. The subareas relating to this objective are Mathematical Processes & Number Sense and Measurement and Geometry. In 2008/09 the mean scores for both subareas were above the passing level of 240 (266 and 246 respectively).

**Modifications:** None indicated by the data from the OSAT exam.

b) **Proof Analyses**

Students who take and pass Math 3283 – Foundations of Mathematics are expected to be able to construct and express mathematical proofs. The three fundamental areas of focus for proofs are logical correctness, mathematical completeness and verbal expression.

Proofs are evaluated and graded on a 5 point scale for each of these three fundamental areas. Every student who has passed Foundations of Mathematics will have proofs analyzed from this course. A student will be determined to be competent in their ability to construct and express proofs if at least one of the randomly chosen proofs receives, at minimum, a score of 12 out of 15, with the requirement that no one area (logical correctness, mathematical completeness, and verbal expression) receive a score less than 3. Thus, there will be no averaging of results used in the assessment. If a particular student does not meet the criteria for competency in the Foundations Course, they will be evaluated in each course for which Foundations is a requirement until one of the following two outcomes has occurred: The first outcome is that the student meets the criteria for competency in the proof making process. In this case, the student will be classified as competent in the overall analysis. The second outcome is that the student graduates without receiving a passing evaluation on any of the proofs examined in the subsequent courses. In this case, the student will be classified as not competent in the overall analysis. This method of determination of competency, together with the choice of using all students who have passed Foundations, will give an accurate assessment of our ability as a department to teach students the concepts required for them to construct and express mathematical proofs.

For the 2008-2009 academic year, proofs from six students were analyzed, all of which satisfied the required criteria to be assessed as competent in proof writing skills. Furthermore, the student whose proofs did not meet the criteria from last year’s analysis is one of the six who
passed this year's assessment. It should be noted that the score from the student who did not pass last year's assessment has been added to last year's distribution, and thus the 2007-2008 proof distribution has been adjusted. As a result, only five out of the six scores are to be included in the 2008-2009 academic year assessment.

Comparing these results to the previous few years, we notice that the results from this year are above average, and are quite similar to those from the 2006-2007 academic year. Also, after changing the lowest score from last year to a passing value of 15 scores from last year also now appear more distributed towards the higher end of the spectrum, but still reflect what one may expect from this assessment tool: scores evenly distributed throughout the passing range. Besides all students have passing proofs, it should also be noted that the overall distribution of scores for both proofs from all students is markedly higher than the distribution of proof scores from last year, with all but one student having a lowest score of 14.

Since this method of proof assessment was put into place, a total of twenty-three students have had their proofs analyzed. The single student who did not have proofs which passed the criteria last year passed this year, and this leaves only one student who has not exhibited proofs with passing status and has since graduated. Furthermore, since eighteen out of twenty-three (approximately 78%) of proof scores had the high grade values of 14 and 15, we can conclude that not only can these students construct proofs which possess the bare minimum qualities required to achieve a score of passing, but the majority can construct proofs to a high degree of competency.
This assessment tool has now been in effect for five years, and it clearly shows that our department is adequately teaching students the concepts required to construct and express mathematical proofs.

**Modifications:** No program modifications are indicated by the data from the proof analyses.

### 3. Mathematical Communication

Objective #3 is *Communicate their mathematical thinking orally and in writing to peers, faculty and others*. There are four indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

- **3.1** Communicate their mathematical thinking coherently and clearly to peers, faculty, and others
- **3.2** Use the language of mathematics to express ideas precisely.
- **3.3** Organize mathematical thinking through communication.
- **3.4** Analyze and evaluate the mathematical thinking and strategies of others.

This objective is assessed via the following instruments.

**a) Oklahoma Subject Area Test**

For a description of this test, see Section G.1a. The subareas relating to this objective are Mathematical Processes & Number Sense and the Constructed Response. Not only was the mean score for both subareas above the passing level of 240 (266 and 288 respectively), but the Constructed Response score showed marked improvement over prior years. Although we believe the improvement to be a result changes resulting from the PMET grant, an additional year of data is needed before drawing meaningful conclusions.

**Modifications:** No program modifications are indicated by the data from the OSAT exam.

**b) Proof Analyses**

For a description of this analysis, see Section G.2b. The data there shows that our students have a high degree of competency in this area.

**Modifications:** No program modifications are indicated by the data from the proof analyses.

### 4. Connections

Objective #4 is *Recognize, use, and make connections between and among mathematical ideas and in contexts outside mathematics to build mathematical understanding*. There are three indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):
4.1 Recognize and use connections among mathematical ideas.
4.2 Recognize and apply mathematics in contexts outside mathematics.
4.3 Demonstrate how mathematical ideas interconnect and build on one another to produce a coherent whole.

This objective is assessed via the following instruments.

a) Oklahoma Subject Area Test

For a description of this test, see Section G.1a. The subareas relating to this objective are Mathematical Processes & Number Sense, Relations, Functions, & Algebra, Measurement and Geometry, Trigonometry and Calculus, and Probability, Statistics, & Discrete Mathematics. The 2008/09 mean scores in all five of these subareas were above the passing level of 240 (266, 275, 246, 259, and 261 respectively), showing the overall strength of the program.

Modifications: No program modifications are indicated by the data from the OSAT exam.

b) ETS Major Field Test

For a description of this test, see Section G.1b. That section contains an analysis of the overall ETS scores for math education majors. The ideas listed in this objective are covered on the ETS exam according to their description of the exam, available at www.ets.org.

In addition, the ETS reports scores on subareas in mathematics, including a nonroutine subarea which includes the ideas in this objective. Problems in this subarea include those considered insightful or whose solution requires several steps of reasoning. Subscore means are only reported for math and math education majors together. The bar chart below reflects how our math and math education students did on the Nonroutine Assessment Indicator portion of the 2009 exam, as well as a comparison of scores for the last six years. The test was changed in 2004 and thus subscores and assessment indicators have not been compared to testing years prior to that.

![Bar chart showing scores over years for ETS Major Field Test](chart.png)

Our students had a mean score of 30 in 2009 which is at the 65th percentile nationally.

Modifications: No program modifications are indicated by the data from the ETS exam.
c) Proof Analyses

For a description of this analysis, see Section G.2b. The data there suggests that our students have a high competency for this objective.

Modifications: No program modifications are indicated by the data from the proof analyses.

5. Mathematical Representations

Objective #5 is *Use varied representations of mathematical ideas to support and deepen students’ mathematical understanding*. There are three indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

5.1 Use representations to model and interpret physical, social, and mathematical phenomena.
5.2 Create and use representations to organize, record, and communicate mathematical ideas.
5.3 Select, apply, and translate among mathematical representations to solve problems.

This objective is assessed via the following instruments.

a) Oklahoma Subject Area Test

For a description of this test, see Section G.1a. The subareas relating to this objective are Mathematical Processes & Number Sense, Relations, Functions, & Algebra, Measurement and Geometry, Trigonometry and Calculus, and Probability, Statistics, & Discrete Mathematics. The 2008/09 mean scores in all five of these subareas were above the passing level of 240 (266, 275, 246, 259, and 261 respectively), showing the overall strength of the program.

Modifications: No program modifications are indicated by the data from the OSAT exam.

b) ETS Major Field Test

For a description of this test, see Section G.1b. That section contains an analysis of the overall ETS scores for math education majors. The ideas listed in this objective are covered on the ETS exam according to their description of the exam, available at www.ets.org.

Modifications: No program modifications are indicated by the data from the ETS exam.
c) Summative Evaluation by Mentor Teachers

The Summative evaluation is the last evaluation by the mentor teacher of our student teachers. This is the third year we have used the expanded evaluation to assess the three indicators given above. We as a department felt that they were better indicators of the preparation of our student teachers. The mentor teacher has been working with the student teacher and observing the student teacher for twelve weeks and is qualified to make the evaluations. The indicators for the standards are rated as unacceptable, acceptable, or target. This past school year 2008-2009 we had four (n=4) student teachers. All four student teachers received either an acceptable rating or a target rating on each of the three indicators. From these ratings we feel that our student teachers did indeed use varied representations of mathematical ideas to support and deepen students’ mathematical understanding.

Modifications: No program modifications are indicated by the data from the summative evaluation.

6. Technology

Objective #6 is Embrace technology as an essential tool for teaching and learning mathematics. There is one indicator for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

6.1 Use knowledge of mathematics to select and use appropriate technological tools, such as but not limited to, spreadsheets, dynamic graphing tools, computer algebra systems, dynamic statistical packages, graphing calculators, data-collection devices, and presentation software.

This objective is assessed via the following instruments.

a) Oklahoma Subject Area Test

For a description of this test, see Section G.1a. The subareas relating to this objective are Mathematical Processes & Number Sense, Relations, Functions, & Algebra, and Probability, Statistics, & Discrete Mathematics. In all three subareas the students’ average score was above the passing score of 240 (266, 275, and 261 respectively), showing the overall strength of the program.

Modifications: No program modifications are indicated by the data from the OSAT exam.

b) Lesson Plans

Teacher candidates are expected to use their knowledge of mathematics to select and use appropriate technological tools, such as but not limited to, spreadsheets, dynamic graphing tools, computer algebra systems, dynamic statistical packages, graphing calculators, data-collection
devices, and presentation software. One of the requirements in MATH 4903, Methods and Media in Secondary Mathematics, is to create a specific lesson plan to teach mathematical concepts using technology.

Candidates enrolled in Spring 2009 were required to complete this assignment with a target or acceptable competency level in order to pass the class. In Spring 2009 three (n=3) students took and passed the class.

Modifications: No program modifications are indicated by the data from the lesson plan.

c) Summative Evaluation by Mentor Teachers

The summative evaluation is the last evaluation by the mentor teacher of our student teachers. This is the third year we have used the expanded evaluation to assess the given indicator. The mentor teacher has been working with the student teacher and observing the student teacher for twelve weeks and is qualified to make the evaluations. The indicators are rated as unacceptable, acceptable, or target. This past school year 2008-2009 we had four (n=4) student teachers. All four student teachers rated acceptable or target for this indicator. From these ratings we feel that our student teachers embrace technology as an essential tool for teaching and learning mathematics.

Modifications: No program modifications are indicated by the data from the summative evaluation.

7. Dispositions

Objective #7 is Support a positive disposition toward mathematical processes and mathematical learning. There are six indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

- 7.1 Attention to equity.
- 7.2 Use of stimulating curricula.
- 7.3 Effective teaching.
- 7.4 Commitment to learning with understanding.
- 7.5 Use of various assessments.
- 7.6 Use of various teaching tools including technology.

This objective is assessed via the following instruments.

a) Lesson Plans

Teacher candidates supporting a positive disposition toward mathematical processes and mathematical learning will exhibit the following indicators as they prepare lesson plans:

1. Incorporate stimulating curricula
2. Incorporate multiple forms of assessment
3. Incorporate various teaching tools including technology.

Lesson plans included in each candidates’ Unit Plan from MATH 4903, Methods and Media in Secondary Mathematics, were evaluated based on the quality of each of the three criteria.

Candidates enrolled in Spring 2009 were required to complete all assignments with a target or acceptable competency level in order to pass the class. In Spring 2009 three (n=3) students took and passed the class.

**Modifications:** No program modifications are indicated by the data from the lesson plans.

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**b) Summative Evaluation by Mentor Teachers**

The summative evaluation is the last evaluation by the mentor teacher for our student teachers. This is the third year we have used the expanded evaluation to assess four of the given indicators. The mentor teacher has been working with the student teacher and observing the student teacher for twelve weeks and is qualified to make the evaluations. The indicators are rated as unacceptable, acceptable, or target. This past school year 2008-2009 we had four (n=4) student teachers. The four student teachers received either a target rating or an acceptable rating on the four indicators. From these ratings we feel that our student teachers support a positive disposition toward mathematical processes and mathematical learning.

**Modifications:** No program modifications are indicated by the data from the summative evaluation.

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**8. Pedagogy**

Objective #8 is *Possess a deep understanding of how students learn mathematics and of the pedagogical knowledge specific to mathematics teaching and learning*. There are nine indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

8.1 Selects, uses, and determines suitability of the wide variety of available mathematics curricula and teaching materials for all students including those with special needs such as the gifted, challenged and speakers of other languages.

8.2 Selects and uses appropriate concrete materials for learning mathematics.

8.3 Uses multiple strategies, including listening to and understanding the ways students think about mathematics, to assess students’ mathematical knowledge.

8.4 Plans lessons, units and courses that address appropriate learning goals, including those that address local, state, and national mathematics standards and legislative mandates.

8.5 Participates in professional mathematics organizations and uses their print and
online resources.

8.6 Demonstrates knowledge of research results in the teaching and learning of mathematics.

8.7 Uses knowledge of different types of instructional strategies in planning mathematics lessons.

8.8 Demonstrates the ability to lead classes in mathematical problem solving and in developing in-depth conceptual understanding, and to help students develop and test generalizations.

8.9 Develop lessons that use technology's potential for building understanding of mathematical concepts and developing important mathematical ideas.

This objective is assessed via the following instruments.

a) Lesson Plans

Lesson plans included in the Unit Plan were evaluated for each of the three (n=3) teacher candidates enrolled in MATH 4903, Methods and Media in Secondary Mathematics for Spring 2009. Lesson plans were evaluated for all nine indicators except 8.3 and 8.8, which were assessed using a different instrument in Section G.8.b below.

Candidates enrolled in Spring 2008 were required to complete all assignments with a target or acceptable competency level in order to pass the class. In Spring 2009 three (n=3) students took and passed the class.

Modifications: No program modifications are indicated by the data from the lesson plans.

b) Summative Evaluation by Mentor Teachers

The summative evaluation is the last evaluation by the mentor teacher for our student teachers. This is the third year we have used the expanded evaluation to assess six indicators of the given objective. The mentor teacher has been working with the student teacher and observing the student teacher for twelve weeks and is qualified to make the evaluations. The indicators are rated as unacceptable, acceptable, or target. This past school year 2008-2009 we had four (n=4) student teachers. Each of the four student teachers received either an acceptable rating or a target rating on each of the indicators. From these ratings we feel that our student teachers possess a deep understanding of how students learn mathematics and of the pedagogical knowledge specific to mathematics teaching and learning.

Modifications: No program modifications are indicated by the data from the summative evaluation.
9. Numbers and Operations

Objective #9 is *Demonstrate computational proficiency, including a conceptual understanding of numbers, ways of representing numbers, relationships among numbers and number systems, and meanings of operations.* There are ten indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

9.1 Analyze and explain the mathematics that underlies the procedures used for operations involving integers, rational, real, and complex numbers.
9.2 Use properties involving numbers and operations, mental computation, and computational estimation.
9.3 Provide equivalent representations of fractions, decimals, and percents.
9.4 Create, solve, and apply proportions.
9.5 Apply the fundamental ideas of number theory.
9.6 Make sense of large and small numbers and use scientific notation.
9.7 Compare and contrast properties of numbers and number systems.
9.8 Represent, use, and apply complex numbers.
9.9 Recognize matrices and vectors as systems that have some of the properties of the real number system.
9.10 Demonstrate knowledge of the historical development of numbers and number systems including contributions from diverse cultures.

This objective is assessed via the following instruments.

**a) Oklahoma Subject Area Test**

For a description of this test, see Section G.1a. The subareas relating to this objective are Mathematical Processes & Number Sense, Relations, Functions, & Algebra, and Measurement and Geometry. The 2008/09 mean scores in all three of these subareas were above the passing level of 240 (266, 275, and 246 respectively), showing the overall strength of the program.

**Modifications:** No program modifications are indicated by the data from the OSAT exam.

**b) ETS Major Field Test**

For a description of this test, see Section G.1b. That section contains an analysis of the overall ETS scores for math education majors. The ideas listed in this objective are covered on the ETS exam according to their description of the exam, available at [www.ets.org](http://www.ets.org).

**Modifications:** No program modifications are indicated by the data from the ETS exam.
10. Algebra

Objective #10 is **Emphasize relationships among quantities including functions, ways of representing mathematical relationships, and the analysis of change.** There are six indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

- 10.1 Analyze patterns, relations, and functions of one and two variables.
- 10.2 Apply fundamental ideas of linear algebra.
- 10.3 Apply the major concepts of abstract algebra to justify algebraic operations and formally analyze algebraic structures.
- 10.4 Use mathematical models to represent and understand quantitative relationships.
- 10.5 Use technological tools to explore algebraic ideas and representations of information and in solving problems.
- 10.6 Demonstrate knowledge of the historical development of algebra including contributions from diverse cultures.

This objective is assessed via the following instruments.

**a) Oklahoma Subject Area Test**

For a description of this test, see Section G.1a. The subareas relating to this objective are Mathematical Processes & Number Sense, Relations, Functions, & Algebra, Measurement and Geometry, and Trigonometry & Calculus. The 2008/09 mean scores in all four of these subareas were above the passing level of 240 (266, 275, 246, and 259 respectively), showing the overall strength of the program.

** Modifications:** No program modifications are indicated by the data from the OSAT exam.

**b) ETS Major Field Test**

For a description of this test, see Section G.1b. That section contains an analysis of the overall ETS scores for math education majors. The ideas listed in this objective are covered on the ETS exam according to their description of the exam, available at [www.ets.org](http://www.ets.org).

In addition, the ETS reports scores on subareas in mathematics, including the subarea of algebra which includes the ideas in this objective. Subscore means are only reported for math and math education majors together. This year six (n=6) mathematics education majors took the ETS exam. The bar chart below reflects how this group of students did on the Algebra Assessment Indicator portion of the 2009 exam, as well as a comparison of scores for the last six years.

This year's group of students had an average score on the Algebra indicator of 35 while the national mean was 38.6. In terms of percentiles, our students placed at the 25th percentile nationally as a group. At the present time it is hard to explain this drop in terms of program requirements and for the time being we consider it to be an anomaly. When the results of the
2010 ETS exam are available and we should be able to arrive at more meaningful conclusions.

**Modifications:** No program modifications are indicated by the data from the ETS exam.

11.**Geometry**

Objective #11 is *Use spatial visualization and geometric modeling to explore and analyze geometric shapes, structures, and their properties.* There are eight indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

11.1 Demonstrate knowledge of core concepts and principles of Euclidean and non-Euclidean geometries in two and three dimensions from both formal and informal perspectives.

11.2 Exhibit knowledge of the role of axiomatic systems and proofs in geometry.

11.3 Analyze characteristics and relationships of geometric shapes and structures.

11.4 Build and manipulate representations of two- and three-dimensional objects and visualize objects from different perspectives.

11.5 Specify locations and describe spatial relationships using coordinate geometry, vectors, and other representational systems.

11.6 Apply transformations and use symmetry, similarity, and congruence to analyze mathematical situations.

11.7 Use concrete models, drawings, and dynamic geometric software to explore geometric ideas and their applications in real-world contexts.

11.8 Demonstrate knowledge of the historical development of Euclidean and non-Euclidean geometries including contributions from diverse cultures.

This objective is assessed via the following instruments.
**a) Oklahoma Subject Area Test**

For a description of this test, see Section G.1a. The subareas relating to this objective are Mathematical Processes & Number Sense, Relations, Functions, & Algebra, Measurement and Geometry, and Trigonometry & Calculus. The 2008/09 mean scores in all four of these subareas were above the passing level of 240 (266, 275, 246, and 259 respectively), showing the overall strength of the program.

**Modifications:** No program modifications are indicated by the data from the OSAT exam.

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**b) ETS Major Field Test**

For a description of this test, see Section G.1b. That section contains an analysis of the overall ETS scores for math education majors. The ideas listed in this objective are covered on the ETS exam according to their description of the exam, available at www.ets.org.

**Modifications:** No program modifications are indicated by the data from the ETS exam.

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**12. Calculus**

Objective #12 is *Demonstrate a conceptual understanding of limit, continuity, differentiation, and integration and a thorough background in the techniques and application of the calculus.* There are five indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

12.1 Demonstrate a conceptual understanding of and procedural facility with basic calculus concepts.
12.2 Apply concepts of function, geometry, and trigonometry in solving problems involving calculus.
12.3 Use the concepts of calculus and mathematical modeling to represent and solve problems taken from real-world contexts.
12.4 Use technological tools to explore and represent fundamental concepts of calculus.
12.5 Demonstrate knowledge of the historical development of calculus including contributions from diverse cultures.

This objective is assessed via the following instruments.

---

**a) Oklahoma Subject Area Test**

For a description of this test, see Section G.1a. The only subarea relating to this objective is Trigonometry & Calculus. The 2008/09 mean score in this subarea was 259, well above the passing score of 240. Five of the six students passed this portion.
Modifications: No program modifications are indicated by the data from the OSAT exam.

b) ETS Major Field Test

For a description of this test, see Section G.1b. That section contains an analysis of the overall ETS scores for math education majors. The ideas listed in this objective are covered on the ETS exam according to their description of the exam, available at www.ets.org.

In addition, the ETS reports scores on subareas in mathematics, including a calculus subarea which includes the ideas in this objective. Subscore means are only reported for math and math education majors together. This year six (n=6) mathematics education majors took the ETS exam. The bar chart below reflects how this group of students did on the Calculus Assessment Indicator portion of the 2009 exam, as well as a comparison of scores for the last six years.

This year the calculus subscore for our group was 32. This corresponds to the 30th percentile nationally.

![Calculus Subscores Graph]

Modifications: No program modifications are indicated by the data from the ETS exam.

13. Discrete Mathematics

Objective #13 is *Apply the fundamental ideas of discrete mathematics in the formulation and solution of problems*. There are four indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

13.1 Demonstrate knowledge of basic elements of discrete mathematics such as graph theory, recurrence relations, finite difference approaches, linear programming, and combinatorics.
13.2 Apply the fundamental ideas of discrete mathematics in the formulation and solution of problems arising from real-world situations.
13.3 Use technological tools to solve problems involving the use of discrete structures and the application of algorithms.
13.4 Demonstrate knowledge of the historical development of discrete mathematics including contributions from diverse cultures.

This objective is assessed via the following instruments.

a) Oklahoma Subject Area Test

For a description of this test, see Section G.1a. The only subarea relating to this objective is Probability, Statistics, & Discrete Mathematics. In 2008/09 the mean subscore was 261, well above the passing score of 240. All six students passed this portion of the test.

Modifications: No program modifications are indicated by the data from the OSAT exam.

b) ETS Major Field Test

For a description of this test, see Section G.1b. That section contains an analysis of the overall ETS scores for math education majors. The ideas listed in this objective are covered on the ETS exam according to their description of the exam, available at www.ets.org.

Modifications: No program modifications are indicated by the data from the ETS exam.

14. Statistics and Probability

Objective #14 is Demonstrate an understanding of concepts and practices related to data analysis, statistics, and probability. There are eight indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

14.1 Design investigations, collect data, and use a variety of ways to display data and interpret data representations that may include bivariate data, conditional probability and geometric probability.

14.2 Use appropriate methods such as random sampling or random assignment of treatments to estimate population characteristics, test conjectured relationships among variables, and analyze data.

14.3 Use appropriate statistical methods and technological tools to describe shape and analyze spread and center.

14.4 Use statistical inference to draw conclusions from data.

14.5 Identify misuses of statistics and invalid conclusions from probability.

14.6 Draw conclusions involving uncertainty by using hands-on and computer-based simulation for estimating probabilities and gathering data to make inferences and conclusions.

14.7 Determine and interpret confidence intervals.

14.8 Demonstrate knowledge of the historical development of statistics and probability including contributions from diverse cultures.
This objective is assessed via the following instruments.

a) Oklahoma Subject Area Test

For a description of this test, see Section G.1a. The only subarea relating to this objective is Probability, Statistics, & Discrete Mathematics. In 2008/09 the average subscore was 261, well above the passing score of 240. All six students passed this portion of the test.

Modifications: No program modifications are indicated by the data from the OSAT exam.

b) ETS Major Field Test

For a description of this test, see Section G.1b. That section contains an analysis of the overall ETS scores for math education majors. The ideas listed in this objective are covered on the ETS exam according to their description of the exam, available at www.ets.org.

Modifications: No program modifications are indicated by the data from the ETS exam.

15. Measurement

Objective #15 is Apply and use measurement concepts and tools. There are four indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

15.1 Recognize the common representations and uses of measurement and choose tools and units for measuring.
15.2 Apply appropriate techniques, tools, and formulas to determine measurements and their application in a variety of contexts.
15.3 Complete error analysis through determining the reliability of the numbers obtained from measures.
15.4 Demonstrate knowledge of the historical development of measurement and measurement systems including contributions from diverse cultures.

This objective is assessed via the following instruments.

a) Oklahoma Subject Area Test

For a description of this test, see Section G.1a. The only subarea relating to this objective is Measurement & Geometry. In 2008/09 the average subscore was 246, above the passing score of 240.

Modifications: No program modifications are indicated by the data from the OSAT exam.
16. Field-Based Experiences

Objective #16 is *Complete field-based experiences in mathematics classrooms*. There are three indicators for this outcome as written by the National Council for Teachers of Mathematics (NCTM):

16.1 Engage in a sequence of planned opportunities prior to student teaching that includes observing and participating in both middle and secondary mathematics classrooms under the supervision of experienced and highly qualified teachers.

16.2 Experience full-time student teaching in secondary mathematics that is supervised by a highly qualified teacher and a university or college supervisor with secondary mathematics teaching experience.

16.3 Demonstrate the ability to increase students’ knowledge of mathematics.

This objective is assessed via the following instruments.

a) **Teacher Work Sample**

As teacher candidates complete field-based experiences in mathematics classrooms, they must demonstrate the ability to increase their students’ knowledge of mathematics. The Teacher Work Sample (TWS) is completed during EDUC 4919, Student Teaching. Teacher candidates are required to teach a comprehensive unit on a concept, skills, or topic that is currently in their student teaching curriculum.

The TWS was developed by 11 universities over a period of years with adequate field testing and revisions, and is a nationally recognized project (Renaissance Project). The key concepts of the TWS are: planning; teaching; assessing; analyzing and reflecting. The components of the TWS document include: contextual factors; learning goals; assessment plan; design for instruction; instructional decision-making; analysis of student learning; reflection and self-evaluation.

Two teacher candidates enrolled in EDUC 4919, Student Teaching, completed the TWS in Spring 2009. Each of the TWS components has a set of indicators used to identify the competency level of each teacher candidate. The table below compares percentages for candidates in Fall 2006, Spring 2007, Spring 2008 and Spring 2009:

<table>
<thead>
<tr>
<th>Component and Competency Level</th>
<th>Fall 2006 (n=1)</th>
<th>Spring 2007 (n=3)</th>
<th>Spring 2008 (n=2)</th>
<th>Spring 2009 (n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contextual Factors (5 Indicators)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Target</strong></td>
<td>40.0%</td>
<td>33.3%</td>
<td>90.0%</td>
<td>33.3%</td>
</tr>
<tr>
<td><strong>Acceptable</strong></td>
<td>60.0%</td>
<td>33.3%</td>
<td>10.0%</td>
<td>66.7%</td>
</tr>
<tr>
<td><strong>Unacceptable</strong></td>
<td>0%</td>
<td>33.3%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

28
<table>
<thead>
<tr>
<th>Summary of Learning Goals</th>
<th>Target</th>
<th>Acceptable</th>
<th>Unacceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4 Indicators)</td>
<td>25.0%</td>
<td>92.0%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>75.0%</td>
<td>0%</td>
<td>0%</td>
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<tr>
<td></td>
<td>0%</td>
<td>8.0%</td>
<td>0%</td>
</tr>
<tr>
<td>Summary of Assessment Plan</td>
<td>Target</td>
<td>Acceptable</td>
<td>Unacceptable</td>
</tr>
<tr>
<td>(5 Indicators)</td>
<td>0%</td>
<td>60.0%</td>
<td>70.0%</td>
</tr>
<tr>
<td></td>
<td>20.0%</td>
<td>13.0%</td>
<td>20.0%</td>
</tr>
<tr>
<td></td>
<td>80.0%</td>
<td>27.0%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Summary of Design for Instruction</td>
<td>Target</td>
<td>Acceptable</td>
<td>Unacceptable</td>
</tr>
<tr>
<td>(5 Indicators)</td>
<td>20.0%</td>
<td>33.3%</td>
<td>70.0%</td>
</tr>
<tr>
<td></td>
<td>60.0%</td>
<td>46.7%</td>
<td>20.0%</td>
</tr>
<tr>
<td></td>
<td>20.0%</td>
<td>20.0%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Summary of Instructional Decision-Making</td>
<td>Target</td>
<td>Acceptable</td>
<td>Unacceptable</td>
</tr>
<tr>
<td>(3 Indicators)</td>
<td>0%</td>
<td>77.8%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>11.1%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>0%</td>
<td>11.1%</td>
<td>0%</td>
</tr>
<tr>
<td>Summary of Analysis of Student Learning</td>
<td>Target</td>
<td>Acceptable</td>
<td>Unacceptable</td>
</tr>
<tr>
<td>(4 Indicators)</td>
<td>0%</td>
<td>16.7%</td>
<td>62.5%</td>
</tr>
<tr>
<td></td>
<td>0%</td>
<td>83.3%</td>
<td>37.5%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Summary of Reflection and Self-Evaluation</td>
<td>Target</td>
<td>Acceptable</td>
<td>Unacceptable</td>
</tr>
<tr>
<td>(4 Indicators)</td>
<td>0%</td>
<td>41.7%</td>
<td>87.5%</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>58.3%</td>
<td>12.5%</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Candidates enrolled in MATH 4903, Methods and Media in Secondary Mathematics, during Spring 2009 spent a great deal of time working with most of the components included in the TWS. Candidates were also encouraged to work with the instructor of MATH 4903 until an acceptable document was completed. Scores on all components improved dramatically over those in previous semesters, but the assessment plan and analysis of student learning continue to be a problem for candidates. Additional work in these areas will be necessary to improve the scores. Candidates are also having difficulty designing instruction that utilizes reform methods and addresses the needs of all students. These issues will be addressed in more detail in MATH 4903. Exposing candidates to alternative forms of instruction in other mathematics classes may also help them prepare lessons that incorporate techniques to enhance student understanding.
17. Obtain a Job

Objective #18 is *obtain a job utilizing their degree or be admitted to graduate school*. This objective does not come from the National Council for Teachers of Mathematics (NCTM) but we believe it is important enough to include in addition to the ones suggested by the NCTM. The objective is assessed via the following instruments.

**a) Alumni Data**

Records are kept for graduates of the Mathematics Education program. These records are used to evaluate whether our graduates obtain a job utilizing their degree or are admitted to graduate school.

Since the Fall of 2004, we have had 16 Mathematics Education graduates. Of the 16, 13 are currently teaching mathematics, 1 is unemployed by choice and we have lost track of the other 2. Of those teaching, 8 are teaching at high schools in Texas, 4 are teaching at high schools in Oklahoma and 1 is teaching at a middle school in Texas. One indication that these schools are happy with our graduates is that in three cases (Broken Bow, Denison, and Collinsville High Schools) they have hired one of our graduates and then 1 to 3 years later hired another one of our graduates. Denison High School has hired as many as 7 of our graduates in the last several years and Broken Bow has hired 5.

It is a strength of our program that our Mathematics Education graduates do not seem to have any problem finding jobs utilizing their degrees.

**Modifications:** No program modifications are indicated by the alumni data.

**b) Alumni Surveys**

A survey will be administered to alumni every five years. Questions will be asked to evaluate how our graduates use their Mathematics Education degree in their current work. The next alumni survey is scheduled to be sent in the fall of 2009 and will be reported on in the 2009-2010 assessment report.

**H. Faculty Level of Involvement in Assessment Process**

All faculty members in the Mathematics Department will be involved in the collecting and analyzing of data and in the writing of the assessment report. In addition to the editing and proofreading of the entire document, the following is a list of responsibilities for academic year 2008-2009:

- Brett Elliott: write Section G.17 on alumni
- Karl Frinkle: write Section G.2b on proof analyses
- Linda Kallam: collect data for lesson plans
- Charles Matthews: compile report, organize faculty responsibilities
I. Constituents and Stakeholders

The constituents and stakeholders relevant to the Mathematics Education Program are our present and past students, our faculty, and the schools at which our graduates teach. All Mathematics Education faculty are heavily involved in writing the assessment report as the above section demonstrates. Summative evaluations by mentor teachers keep schools where our graduates teach involved in the assessment of our program. One indication that these high schools are happy with our graduates is that in three cases (Broken Bow, Denison, and Collinsville High Schools) they have hired one of our graduates and then 1 to 3 years later hired another one of our graduates. Denison High School has hired as many as 7 of our graduates in the last few years and Broken Bow has hired 5. These numbers are significant because we have only had an average of 3 graduates per year.

J. Assessing IETV and/or Web-Based Instruction

There are no IETV or web-based courses offered in the Mathematics Education Program. Some mathematics courses are offered online, but these are not in the Mathematics Education Program. Most of these courses are assessed in the Mathematics Department’s General Education Assessment Report.

K. Strengths and Weaknesses of the Program

There are several strengths in the mathematics education program at Southeastern. Teacher candidates tend to perform well in the areas of relations, functions, algebra, probability, and statistics. Mean scores on the OSAT exams were considerably higher than the state mean in these areas. Teacher candidates also tend to have a good understanding of how to construct proofs, as indicated by the high scores on proof evaluations from various courses in the program. Summative evaluations from mentor teachers indicate that our teacher candidates have an excellent understanding of how students learn mathematics and the pedagogical knowledge specific to the teaching and learning of mathematics.

OSAT scores in the area of constructed response are remarkably high (see Section G.1a). We hope that this is the beginning of a trend as a result of our emphasis on constructed response and math processes and not just an anomaly.
L. How Modifications are to be Made

When assessment results indicate a need for a change in the Mathematics Education Program, the Mathematics Department as a whole will meet and discuss what changes are needed. Appropriate changes will be made and forwarded to the necessary entities for final approval (e.g. the Curriculum Committee, Board of Regents, etc.). These changes will allow the department to improve the Mathematics Education Program, plan for the future, and request budget modifications as necessary based on assessment results. Additionally, assessment will sometimes occur in other ways. For example, an individual instructor may make changes in their course based on their own personal experience. Also, modifications in the assessment plan will occur annually, as assessment reports are reviewed by faculty and the Institutional Assessment Committee (IAC). Modifications in the assessment plan will be the direct result of assessment reports from the previous years or suggestions from the IAC or Director of Assessment.

M. Effectiveness of Previous Modifications

Based on recommendations from national mathematics and mathematics education organizations, modifications are underway in the Mathematics Education program at SOSU. Course revisions created as a result of the PMET (Preparing Mathematicians to Educate Teachers) grant awarded in 2004 continue, while a new course created as a result of the same grant has been discontinued. As a result of NCATE and NCTM requirements, the program has been revised to include MATH 4653, History of Mathematics, as a required course. A 3-semester rotation of MATH 2113, MATH 3323, and MATH 4653 has also been implemented to ensure candidates have an opportunity to take all required courses. These changes have been extremely effective in increasing our students’ constructive response scores on the OSAT exam.

Changes to MATH 4903, Methods and Media in Secondary Mathematics, are ongoing. Due to changes in the number of hours associated with student teaching, this course has returned to the 4-week block format and is offered in spring semesters only. The focus continues to be on inquiry-based instruction, and using technology and manipulatives to enhance student understanding of mathematical concepts. A performance-based method of assessment was utilized for this class during Spring 2008, resulting in higher scores on all assignments and a greatly improved level of commitment from candidates. Candidates were also required to complete several components of the Teacher Work Sample (TWS) during this class, resulting in higher scores when the actual document was submitted during the student teaching experience. The field component was removed from this class as most candidates would be student teaching at the end of the four weeks.

MATH 2113, Analytic Geometry, continues to be taught using a mix of lecture and guided discovery of concepts and relationships implemented through class discussions and group activities. Candidates were also required to present a research paper they had written and explain homework problems to the class to improve their communication skills. Constructed Response
scores on the OSAT in Advanced Mathematics, typically the lowest score for our candidates, will be closely followed to determine whether this type of activity has any impact. This year the Constructed Response scores were excellent.

**MATH 3323**, College Geometry was revised in Spring 2008 to include a substantial technology component and an investigative mode of introducing content. Candidates were also required to explain homework problems to the class to improve their communication skills. Constructed Response scores on the OSAT in Advanced Mathematics, typically the lowest score for our candidates, will be closely followed to determine whether this type of activity has any impact. As mentioned above, the scores were excellent this year.

**MATH 4973**, Mathematics for Secondary School Teachers, was removed from the program. Requirements from NCATE and NCTM indicated a greater need for MATH 4653, History of Mathematics, which was taught in Fall 2008.

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**N. Signatures**

Chair of Mathematics: Charles G. Mathews

Dean of Arts & Sciences: [Signature] 09/16/09

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SEP 10 2009

Dean's Office
School of Arts & Sciences