EAST CENTRAL UNIVERSITY

ASSESSMENT OF ACADEMIC ACHIEVEMENT

ASSESSMENT OF THE MAJOR

MATHEMATICS

Bachelor of Science

For the year 2008
17 students assessed

Program: Mathematics

Program Description:

The Mathematics Program supports the broader mission of the University by offering a Bachelor of Science degree in Mathematics with concentrations in applied mathematics, general mathematics, and teacher certification. The Program prepares students for entry into professions such as secondary school teaching, actuarial science, finance, and management science, as well as entry into graduate programs which lead to careers such as engineering, college-level teaching, and research. The Program also provides vital support courses for other programs such as Computer Science, Chemistry, Physics, Cartography, Environmental Health Science, Accounting, Business, Education, and pre-professional areas. In addition, the Program provides a required general education component (MATH 1413 Survey of Mathematics, MATH 1513 College Algebra, MATH 2213 Introduction to Probability and Statistics) for all ECU students. These activities directly support the mission of the College of Health and Sciences "to foster a learning environment in which students, faculty, staff, and community interact to educate students in the study of the natural sciences, technology, human-environment interaction, and health care through excellence in teaching, research, creative activities, and service" as well as the mission of the University "to foster a learning environment in which students, faculty, staff, and community interact to educate students for life in a rapidly changing and culturally diverse society. Within its service area, East Central University provides leadership for economic development and cultural enhancement".

The Mathematics Program strives to develop in students the skills needed for the effective use of and understanding of mathematics. Students gain the ability to think symbolically and logically by employing a variety of reasoning skills including induction, deduction, inference, generalization, comparison, evaluation, and synthesis. To this end, instruction is offered in a variety of formats including lecture, online, and computer-assisted. Technology in the form of programmable graphing calculators and various computer software packages is integrated into the curriculum. Instructors who teach courses using primarily a lecture format often also incorporate the use of in-class question-and-answer activities, organized small-group activities, student presentations, and hands-on manipulatives. In all courses, regular input is solicited from each student in the form of written assignments that require analyses of problem structures and solutions. All Program courses provide students with the opportunity to develop computational skills and theoretical reasoning, both of which are becoming more essential to problem solving in a modern technological society.

Analytical thinking is encouraged throughout the curriculum, and the student is expected to retain previously learned material in order to synthesize it with new topics of study. The pre-calculus and calculus components of the curriculum concentrate largely on techniques of problem solving, while the upper-level component provides a transitional stage from computational to theoretical mathematics. A fundamental part of the upper-level component is the regular use of rigorous mathematical arguments in the form of written proofs which allow the student to explore the theory behind routine calculations.

The primary goal of the Program is to prepare students for entry into professions requiring an undergraduate education in mathematics. The intent of the Program is to produce graduates who:

1. possess a working knowledge of fundamental mathematical concepts, methods of problem analyses, and techniques of problem solving,
2. possess technical writing skills appropriate to upper-level mathematics majors, and
3. possess a working knowledge of sound and current pedagogical techniques for the teaching of mathematics at the secondary level (teacher certification option only).

Assessment instruments used to evaluate the Program's effectiveness include the Educational Testing Service Major Field Test (MFT) in Mathematics, the Oklahoma Subject Area Test Field 11: Advanced Mathematics, and a folio of written assignments collected in MATH 3715 Linear Algebra or MATH 3813 Modern Algebra. This folio is evaluated by at least two faculty members not currently teaching the course in order to determine the level of both communication and proof writing skills that all Program majors should possess. A folio of written assignments is collected in MATH 4913 Methods of Teaching Secondary Mathematics. It is evaluated by two faculty members in order to determine the competency level of Program majors in the teacher certification option in preparing lesson plans. The performance of teacher certification majors is also evaluated during their student teaching experience by the cooperating teacher using the ECU Department of Mathematics' Student Teaching Final Evaluation by the Cooperating Teacher Form and by the University supervisor using the ECU Department of Mathematics' Student Teaching Final Evaluation by the University Supervisor Form. An Impact on Learning portfolio is created by each student participating in student teaching. This portfolio is evaluated by two faculty members in order to determine the impact teacher certification majors have on student learning in their own classrooms. With every instrument, an adequate number of students were assessed.

This report is available online at http://www.ecok.edu/math/docs/AssessmentReport2007.pdf and the link to the report will be disseminated annually via the Department of Mathematics' alumni newsletter and Facebook page.

MAJOR PROGRAM GOAL:
To prepare students for entry into professions requiring an undergraduate education in mathematics.

STUDENT OUTCOME 1:
Possess a working knowledge of fundamental mathematical concepts, methods of problem analysis, and techniques of problem solving.

CRITERION 1:
Performance of students on the Educational Testing Service (ETS) Major Field Test (MFT) in Mathematics.

INSTRUMENT:
The Educational Testing Service (ETS) Major Field Test (MFT) in Mathematics.

DATA COLLECTED: Spring 2004 – Fall 2008

Scores of ECU Mathematics Majors on the Educational Testing Service Major Field Test (MFT) in Mathematics					
Year	**Number of students tested**	**Percent of institutions at or below ECU Math Department mean (nationally)**	**Percent of institution examinees at or below ECU Math Department mean (nationally)**	**Percent of institutions at or below ECU Math Department mean (peer only)**	**Percent of institution examinees at or below ECU Math Department mean**
2004	6	30			
2005	12	10			
2006	4	1			
2007	11	10	25	25	45
2008	10	1	15	5	20

PERFORMANCE GOAL:
The department mean score should be greater than or equal to the 50th percentile of peer institutions.

JUDGMENT:
The goal was not met.

In 2007, data became available for a group of "peer institutions" (17 institutions across the nation most similar to ECU based on Carnegie Classification, geographic location, or RUSO affiliation) to which ECU can now be compared. Prior to 2007, only aggregate data was available which included all institutions in the nation who use the MFT for assessment.

In the table above, columns 3 and 5 show ECU's rank when institutional averages (the average of test scores of students from the institution) are compared. Columns 4 and 6 show ECU's rank when examinees' scores institutions are considered individually, rather than aggregately by institution.

All students enrolled in Math 4923 Perspectives in Mathematics during the fall 2008 semester were required to take the Major Field Test in Mathematics. The test contains problems from a variety of traditional undergraduate mathematics courses, most of which are currently available in the mathematics curriculum at East Central University (some are requirements within the three degree options while others are simply electives).

Ten students took the test in November, 2008. Based on the individual total scores among the peer institutions group, three ECU students ranked in the 40^{th} percentile, one in the 30^{th} percentile, two in the 15^{th}, and 4 in the 5^{th} percentile. When considering the mean scores of all ECU students as a group in five different categories of problem type, the strongest performance is seen in Algebra (15^{th} percentile), with the weakest performance in "nonroutine" problems (1^{st} percentile). In each of the categories of Calculus, routine problems, and applied problems, the ECU group's mean scores fell into the 15^{th} percentile.

Student performance on this exam has declined from last year. Efforts should be made to ensure better performance on all five types of problems (applied, Calculus, algebra, routine, and nonroutine). Due to ongoing poor performance by ECU students on the MFT, the department instituted a number of changes in 2006, some of which did not take effect until the fall of 2008. The prerequisite structure for upper level courses was modified, MATH 3093 Introduction to Theorem Proving and Number Theory is no longer offered by independent study, and each student's MFT score is now incorporated into their course grade for MATH 4923 Perspectives in Mathematics, taught for the first time in Fall 2008, in an effort to improve MFT scores. The course format and content has been modified for the fall semester of 2009 based primarily upon the poor MFT scores in 2008. One of the course objectives for MATH 4923 is to synthesize the mathematical knowledge a student should have acquired in the course of completing the requirements for a mathematics degree. More time will be spent reviewing concepts covered in previous courses in an effort to solidify this synthesis of knowledge. It is hoped that these efforts will contribute to improved scores of ECU students on the MFT in the future.

CRITERION 2:
Performance of students on the Oklahoma certification exam for secondary teachers.

INSTRUMENT:
The Certification Examinations for Oklahoma Educators (CEOE) Oklahoma Subject Area Test (OSAT) Field 11: Advanced Mathematics.

DATA COLLECTED: Spring 2004 – Fall 2008

Scores of ECU Mathematics Majors on the Oklahoma Subject Area Test (OSAT) Field 11: Advanced Mathematics				
Year	**Number of exams taken**	**Exams passed**		**Oklahoma percentage passing**
		Number	**Percentage**	
2004	9	9	100%	80%
2005	4	3	75%	79%
2006	2	2	100%	73%
2007	8	6	75%	75%
2008	7	7	100%	76%

PERFORMANCE GOAL:
The percent of ECU Mathematics majors passing the test should be greater than or equal to the statewide percent passing.

JUDGMENT:
The performance goal was met.

In 2006, the department instituted a number of changes in the prerequisite structure for upper level courses and no longer offers MATH 3093 Introduction to Theorem Proving and Number Theory by independent study in an effort to improve OSAT scores.

In 2008, seven ECU students took the OSAT Field 11: Advanced Mathematics exam. It contains problems from areas of mathematics which the students will be expected to teach: problem solving, reasoning, mathematical systems, and number theory; algebra, functions, and analytic geometry; geometry and measurements; trigonometry and calculus; probability, statistics, and discrete mathematics. In addition, one constructed response item is included on the exam.

The OSAT is administered five times throughout the year (February, April, June, September, and November). At least one ECU student took the exam on each test date in 2007 with the exception of the September test date.

Of the seven students who took the Field 11 exam in 2008, all seven (100%) passed the exam. This pass rate exceeds the pass rate for all state examinees taking Field 11 tests on the same test dates. Mean scaled scores for ECU students were at or above the state mean scaled score on each test date with the exception of the February test date.

ECU students were consistently strong in all test subareas in 2008, scoring at or above the state mean in each subarea with only one or two exceptions on each test date. In no subareas were their scores lower than the state means on more than two of the five test dates, so it appears that there is no particular area on which they are particularly weak as a group.

STUDENT OUTCOME 2:
Possess the technical writing skills appropriate to upper level mathematics majors.

CRITERION 1:
Performance of students on writing rigorous, formal mathematical proofs in MATH 3715 Linear Algebra or MATH 3813 Modern Algebra.

INSTRUMENT:
A department portfolio containing written mathematical proofs from all students enrolled in MATH 3715 Linear Algebra or MATH 3813 Modern Algebra. These proofs are evaluated by a committee of up to three department faculty not currently teaching the course from which the portfolio is drawn.

DATA COLLECTED: Spring 2004 – Spring 2005

Student Performance on Writing Mathematical Proofs in MATH 3715 Linear Algebra			
Year	**Number of students assessed**	**Number of students scoring at least 70%**	**Percentage of students scoring at least 70%**
2004	9	9	100%
2005	12	4	33%

PERFORMANCE GOAL:
A minimum of 90% of students should score at least 70%.

DATA COLLECTED: Spring 2006

Student Performance on Writing Mathematical Proofs in MATH 3715 Linear Algebra								
Year	**Number of students assessed**	**Number of proofs assessed**	**Number of proofs with a score of at least 2***	**Percentage of proofs with a score of at least 2***	**Number of proofs with a score of at least 3***	**Percentage of proofs with a score of at least 3***	**Number of proofs with a score of 0 or 1***	**Overall class average***
2006	4	36	31	86%	24	67%	5	2.69

*The rating scale is a 0 to 4 scale with 4 representing the highest score possible

PERFORMANCE GOALS:
A minimum of 90% of the proofs should have a score of at least 2.
A minimum of 70% of the proofs should have a score of at least 3.
The overall average should be at least 2.75.

DATA COLLECTED: Spring 2007 – Fall 2007

Student Performance on Writing Mathematical Proofs
in MATH 3715 Linear Algebra (Spring 2007) and MATH 3813 Modern Algebra (Fall 2007)
COMMUNICATION SKILLS

Year	Number of students assessed	Number of proofs assessed	Number of proofs scoring at least 2*	Percentage of proofs scoring at least 2*	Number of proofs scoring at least 2.5*	Percentage of proofs scoring at least 2.5*	Number of proofs scoring at least 3*	Percentage of proofs scoring at least 3*	Overall average
2007	16	106	102	96%	101	95%	100	94%	3.27

*The rating scale is a 0 to 4 scale with 4 representing the highest score possible

Student Performance on Writing Mathematical Proofs
in MATH 3715 Linear Algebra (Spring 2007) and MATH 3813 Modern Algebra (Fall 2007)
PROOF SKILLS

Year	Number of students assessed	Number of proofs assessed	Number of proofs scoring at least 2*	Percentage of proofs scoring at least 2*	Number of proofs scoring at least 2.5*	Percentage of proofs scoring at least 2.5*	Number of proofs scoring at least 3*	Percentage of proofs scoring at least 3*	Overall average
2007	16	106	84	79%	73	69%	64	66%	2.83

*The rating scale is a 0 to 4 scale with 4 representing the highest score possible

PERFORMANCE GOALS for 2007:
For each of the 2 categories of skills (proof and communication) –
The overall average should be at least 2.5.
A minimum of 90% of the proofs should have a score of at least 2.
A minimum of 70% of the proofs should have a score of at least 2.5.
A minimum of 50% of the proofs should have a score of at least 3.

JUDGMENT:
The performance goals were met in 2004, but not in 2005 nor in 2006. Six of the eight goals for 2007 were met, but the other two were not.

Mathematics majors evaluated in 2005 were unable to produce rigorous and logically sound proofs of mathematical statements. This decline was due only in part to changes in the evaluation process. In 2006, the use of a scoring rubric was introduced in order to provide greater consistency in the evaluation process.

The performance goals were not met in 2006, although the overall average was only slightly below the goal (2.69 compared to the goal of 2.75); 67% of the proofs scored at least 3, slightly below the goal of 70%; and 86% of the proofs scored at least 2, slightly below the goal of 90%. These results indicate a dramatic improvement in the 2006 student performance over the poor performance of students in 2005.

More specifically, while the overall writing ability of the students was still weak in 2006, including errors in notation and mistakes in computation that rendered some proofs incorrect, the students did seem to have an adequate understanding of the mathematical content. Poor writing skills weakened what had the potential to be good written proofs. All proofs reviewed contained a mixture of grammatical, spelling, and notational errors.

Changes instituted by the department in 2006, implemented in 2007, included a number of changes in the prerequisite structure for upper level courses and a discontinuation of the practice of offering MATH 3093 Introduction to Theorem Proving and Number Theory by independent study in an effort to improve students' proficiency at writing mathematical proofs. The rating rubric used in 2006 was modified to include an assessment of students' general writing/communication skills separate from the assessment of their analytical reasoning/proof skills and mathematical content knowledge for use in 2007. English correctness (communication skills) was evaluated based on the use of grammar, spelling, and punctuation along with paragraph development and general flow of the mathematical argument. Mathematical correctness (proof skills) was evaluated on the basis of the use of terminology and symbols along with accuracy of the mathematical logic and content. This represents the first attempt at a more holistic approach to assessing mathematics majors in the realm of mathematical writing/communication.

Of the 16 students assessed in 2007, 11 were in MATH 3715 Linear Algebra in the spring and 10 were in MATH 3813 Modern Algebra in the fall (five students were in both classes). How well students could construct a mathematical proof was evaluated using the two separate aforementioned rubrics for the first time. Each course instructor compiled a portfolio of assessment items for each student. These portfolios were photocopied and distributed to two ECU faculty members for evaluation using the rubrics. Ratings of the two evaluators were averaged to determine each student's rating on each proof.

In 2007, all four performance goals for communication skills were met, but only two of the four performance goals for proof skills were met. The overall average was 2.83, compared with a goal of 2.75, and 66% of the proofs scored at least 3, compared with the goal of 50%. Sixty-nine percent of the proofs scored at least a 2.5, only 1% below the goal of 70%, but missing the mark nonetheless. Only 79% of the proofs scored at least 2, compared to the goal of 90%. In general,

this was a dramatic improvement in proof writing skills of Program majors since 2005, but there was still work to be done.

The spring semester was a time of transition due to changes made in program requirements and prerequisite structure. As a result, most of the students assessed were taking MATH 3093 Introduction to Theorem Proving and Number Theory concurrently with MATH 3715 Linear Algebra even though the first is a prerequisite for the second. The Linear Algebra instructor made the necessary adjustments to the syllabus but the lack of maturity in these students' proof writing skills was very evident in the resulting assessment data. As shown in the following table, the level of their communication skills exceeded the level of their proof writing skills by a significant amount in Spring 2007. However, the table also shows that in Fall 2007, the nine students assessed in MATH 3813 Modern Algebra proved to be more skilled in proof writing.

In Fall 2008, ten students enrolled in MATH 3813 Modern Algebra were assessed on their ability to reason, construct, and evaluate mathematical arguments using the model piloted in 2007, although the assessment instrument and rubrics were still in a period of transition and refinement which will continue into 2009. The assessment included a component designed to assess students' ability to provide counterexamples when appropriate to disprove a statement. Another component of the assessment examined students' ability to evaluate mathematical arguments and proofs. Students' ability to select an appropriate method of proof was also evaluated. How well students could construct a mathematical proof was evaluated using the two rubrics developed in 2007—one for their mathematical correctness and logic and one for their writing skills.

A portfolio of assessment items was compiled for each of the ten members of MATH 3813 Modern Algebra by the instructor of the course. These portfolios were photocopied and distributed to three ECU faculty members for evaluation. Rubrics were provided to the evaluators for each component of the assessment. Ratings of the evaluators were averaged to determine the student's rating in each category. Category ratings were summed to provide a composite score for each student. The following table shows a comparison of the data from 2007 and 2008.

Summary of Students' Individual Averages Over All Proofs					
Year	**Range**	**Proof Skills**		**Communication Skills**	
		# of students	**% of students**	**# of students**	**% of students**
Spring 2007	0.0 – 0.9	0	0%	0	0%
	1.0 – 1.9	3	28%	0	0%
	2.0 – 2.4	1	9%	0	0%
	2.5 – 2.9	3	27%	0	0%
	3.0 – 4.0	4	36%	11	100%
Fall 2007	0.0 – 0.9	1	10%	1	10%
	1.0 – 1.9	0	0%	0	0%
	2.0 – 2.4	0	0%	0	0%
	2.5 – 2.9	0	0%	0	0%
	3.0 – 4.0	9	90%	9	90%
Fall 2008	0.0 – 0.9	0	0%	0	0%
	1.0 – 1.9	2	20%	4	40%
	2.0 – 2.4	2	20%	3	30%
	2.5 – 2.9	4	40%	3	30%
	3.0 – 4.0	2	20%	0	0%

PERFORMANCE GOALS for 2008:
For each of the 2 categories of skills (proof and communication) –
A minimum of 90% of the students should have an overall average of at least 2.
A minimum of 70% of the students should have an overall average of at least 2.5.
A minimum of 50% of the students should have an overall average of at least 3.

JUDGEMENT:
The performance goals were not met.

None of the performance goals for communication skills were met: only 60% of the students had an average of at least 2; 30% had an average of at least 2.5; and none had an average of at least 3. In addition, none of the performance goals for proof writing skills were met: only 80% of the students had an average of at least 2; 60% had an average of at least 3.5; and 20% had an average of at least 3.

Both the communication skills and proof skills component scores were also lower in this year's assessment. A follow-up investigation indicated the instructor of the course did not emphasize well-written English in the students' proofs. The Department has noted this and will make an effort in the future to ensure that proficient written communication is more strongly emphasized in this and other proof-based courses.

Composite for 2008 were markedly lower than for the 2007 assessment, as shown in the table below, reflecting the generally poorer performance on the proof skills and communication skills components mentioned above. In addition, this composite data reveals a decline in the Evaluates

Arguments component from 2007 to 2008. None of the ten students was rated higher than a 2 on the 5 point scale. The poor performance in this area continues to be a concern, in particular because six of these ten students are teacher candidates. This is a skill they must be able to draw upon in their future work as teachers. It requires a much different level of expertise than simply writing a proof. The performance level on this component suggests that more work with similar activities should be incorporated in other courses throughout the program curriculum. Courses with proof-writing emphasis can incorporate similar activities, but even in the more computational calculus courses, students can (and should) be challenged to find mistakes in mathematical reasoning.

Summary of Students' Ratings on Three Components of the Proof Writing Assessment

Year	Rating	Prove or Disprove (6 point scale)		Evaluates Arguments (5 point scale)		Selects Appropriate Method of Proof (4 point scale)	
		Number of students	Percent of students	Number of students	Percent of students	Number of students	Percent of students
2007	0	1	10%	2	20%	1	10%
	1	0	0%	0	0%	0	0%
	2	0	0%	2	20%	0	0%
	3	0	0%	1	10%	0	0%
	4	4	40%	2	20%	9	90%
	5	3	30%	3	30%	N/A	N/A
	6	2	20%	N/A	N/A	N/A	N/A
2008	0	0	0%	0	0%	0	0%
	1	0	0%	2	20%	0	0%
	2	0	0%	8	80%	2	20%
	3	6	60%	0	0%	3	30%
	4	2	20%	0	0%	5	50%
	5	1	10%	0	0%	N/A	N/A
	6	1	10%	N/A	N/A	N/A	N/A

Another weakness of the program seems to lie in preparing students to determine if a statement can be proved or disproved. Only two of the students were rated 5 or higher (maximum of 6 points) on the Prove or Disprove component.

Results of the assessment indicate the strength of the mathematics major program in preparing students to select an appropriate proof method. The work of eight of the ten students was rated 3.0 or higher (maximum of 4 points).

CRITERION 2:
Performance of students on an expository paper in MATH 3715 Linear Algebra. The topic must be pre-approved by the instructor. Topic may be selected from the history of mathematics or a contemporary issue.

INSTRUMENT:
A department portfolio containing expository papers from all students enrolled in MATH 3715 Linear Algebra. These proofs are evaluated by a committee of up to three department faculty not currently teaching the course from which the portfolio is drawn.

DATA COLLECTED: Spring 2001 – Spring 2005

Student Performance on Expository Paper in MATH 3715 Linear Algebra			
Year	**Number of students assessed**	**Number of students scoring at least 70%**	**Percentage of students scoring at least 70%**
2001	14	14	100%
2002	11	11	100%
2003	9	9	100%
2004	11	11	100%
2005	12	10	83%

PERFORMANCE GOAL:
A minimum of 90% of the students should score at least 70%.

JUDGMENT:
The performance goal was met in four of the last five years criterion was assessed. Most mathematics majors were able to write a coherent expository paper although grammar, punctuation, and clarity showed some weaknesses.

This criterion was eliminated in 2006. It will be replaced with an alternative criterion in 2009.

STUDENT OUTCOME 3:
Students in the teacher certification option (indicated for this student outcome as "teacher candidates") will possess a working knowledge of sound and current pedagogical techniques for the teaching of mathematics at the secondary level.

CRITERION 1:
Performance of teacher candidates on an Ability to Plan Instruction assessment in MATH 4913 Methods of Teaching Secondary Mathematics.

INSTRUMENT:
A department portfolio containing lesson plans from all teacher candidates enrolled in MATH 4913 Methods of Teaching Secondary Mathematics. These plans are evaluated by a committee of up to three department faculty.

DATA COLLECTED: Fall 2007 – Fall 2008

Teacher Candidates' Performance on Ability to Plan Instruction Assessment in MATH 4913 Methods of Teaching Secondary Mathematics

Summary

Year	Number of candidates assessed	Number of candidates scoring at least 4*	Percentage of candidates scoring at least 4*	Number of candidates scoring at least 6*	Percentage of candidates scoring at least 6*
2007	6	6	100%	4	67%
2008	13	10	76%	8	61%

*The rating scale is a 0 to 8 scale with 8 representing the highest score possible

PERFORMANCE GOALS:
100% of teacher candidates should score at least 4.
A minimum of 70% of teacher candidates should score at least 6.

JUDGMENT:
The performance goals were not met.

Only 67% (compared to the goal of 100%) of the teacher candidates assessed scored at least 4, and only 61% (compared to the goal of 70%) scored at least 6. This represents a sharp decline in scores from 2007.

A departmental portfolio containing a set of three lesson plans from each student enrolled in MATH 4913 Methods of Teaching Secondary Mathematics is prepared. The plans are evaluated by a committee of at least two department faculty members. Evaluators indicate whether the standard for each of the four bulleted items has been met, partially met, or not met in each set of lesson plans. The evaluators' scores for a given student are averaged to obtain the student's overall score.

Results shown in the following table indicate the Program does not do an adequate job in preparing teacher candidates to use P.A.S.S. objectives (or NCTM standards) to drive their lesson plans, to make use of print and on-line teaching resources, to incorporate a variety of instructional strategies, nor to use technology appropriately.

Teacher Candidates' Performance on Ability to Plan Instruction Assessment in MATH 4913 Methods of Teaching Secondary Mathematics

Individual Criteria

Number and percentage of teacher candidates receiving EACH rating

		P.A.S.S. Objectives		Print and On-line Resources		Instructional Strategies		Technology	
Year	**Rating**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
2007	0	0	0%	1	17%	0	0%	1	17%
	1	3	50%	0	0%	2	33%	1	17%
	2	3	50%	5	83%	4	67%	4	67%
2008	0	3	23%	0	0%	1	8%	3	23%
	1	4	31%	3	23%	3	23%	8	62%
	2	6	46%	10	77%	9	69%	2	15%

Teacher candidates should possess a deep understanding of how students learn mathematics and of the pedagogical knowledge specific to mathematics teaching and learning. The Ability to Plan Instruction assessment is designed to address the following indicators specified by the National Council of Teachers of Mathematics.
The mathematics teacher candidate:

- Plans lessons, units and courses that address appropriate learning goals, including those that address local, state, and national mathematics standards and legislative mandates.
- Participates in professional mathematics organizations and uses their print and on-line resources.
- Uses knowledge of different types of instructional strategies in planning mathematics lessons.
- Develops lessons that use technology's potential for building understanding of mathematical concepts and developing important mathematical ideas.

The Mathematics Department should incorporate an additional methods course taught within the department to be taken by teacher certification majors during the sophomore year. Many students enrolled in the MATH 4913 Methods of Teaching Secondary Mathematics course taught in the fall semester of 2008 reported having had no prior experience developing lesson plans. This should not be the case. By the time students reach the senior-level methods course, they should be well-prepared for a summative evaluation of their ability to plan instruction. A senior-level course is not the appropriate place for a first introduction to planning instruction. A single 3-hour course does not allow adequate time to prepare students for the student teaching experience in addition to covering introductory topics such as lesson plan development.

CRITERION 2:
Performance of teacher candidates on development of an assessment plan and self-evaluation of student learning in their own classroom during the student teaching experience.

INSTRUMENT:
An Effect on Learning portfolio submitted each teacher candidate at the conclusion of the student teaching experience. These portfolios are evaluated by a committee of up to three department faculty.

DATA COLLECTED: Spring 2007 – Fall 2008

Teacher Candidates' Performance on Effect on Learning Portfolios

Summary

Year	Number of candidates assessed	Number of candidates scoring at least 4*	Percentage of candidates scoring at least 4*	Number of candidates scoring at least 6*	Percentage of candidates scoring at least 6*
2007	6	6	100%	4	67%
2008	5	4	80%	4	80%

*The rating scale is a 0 to 8 scale with 8 representing the highest score possible

PERFORMANCE GOALS:
100% of teacher candidates should score at least 4.
A minimum of 70% of teacher candidates should score at least 6.

JUDGMENT:
One of the performance goals was met and one was not.

Only 80% (compared to the goal of 100%) of the teacher candidates assessed scored at least 4, but 80% (compared to the goal of 70%) scored at least 6.

Mathematics teacher candidates should possess a deep understanding of how students learn mathematics and of the pedagogical knowledge specific to mathematics teaching and learning. The Effect on Learning assessment is designed to address the following indicators specified by the National Council of Teachers of Mathematics.
The mathematics teacher candidate:

- Uses multiple strategies, including listening to and understanding the ways students think about mathematics, to assess students' mathematical knowledge.
- Demonstrate the ability to increase students' knowledge of mathematics.

To evaluate the Program's ability to prepare its teacher candidates to achieve these indicators, teacher candidates prepare a portfolio during their student teaching semester. The portfolio includes a plan prepared by the teacher candidate to assess his or her student's knowledge of mathematics before, during, and after an instructional unit taught by the teacher candidate. The portfolios are evaluated by at least two department faculty members. Evaluators check for the

inclusion of multiple assessment formats within the portfolio as well as calculation and analysis of students' learning gains.

Results shown in the following table indicate the strength of the Program in preparing teacher certification students to make proper use of formative assessments and to provide instruction that results in a positive impact on their own students' learning. The weakness of the Program seems to lie in preparing students to make use of pre- and post-tests.

Teacher Candidates' Performance on Individual Criteria of Effect on Learning Portfolios

Individual Criteria

Number and percentage of teacher candidates receiving EACH rating

		Assessment plan table (1 point scale)		Pre- and post-tests (1 point scale)		Formative assessments (1 point scale)		Learning gain table (1 point scale)		Positive impact on student learning (1 point scale)		Reflection (1 point scale)		Multiple assessment formats (2 point scale)	
Year	**Rating**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
2007	0	0	0%	0	0%	3	50%	3	50%	0	0%	0	0%	2	33%
	1	6	100%	6	100%	3	50%	3	50%	6	100%	6	100%	0	0%
	2		N/A		N/A		N/A		N/A		N/A		N/A	4	67%
2008	0	1	20%	2	40%	1	20%	2	40%	0	0%	0	0%	1	20%
	1	4	80%	3	60%	4	80%	3	60%	5	100%	5	100%	0	0%
	2		N/A		N/A		N/A		N/A		N/A		N/A	4	80%

CRITERION 3:
Performance of teacher candidates in student teaching as evaluated by the cooperating teacher.

INSTRUMENT:
ECU School of Education and Psychology's Student Teacher Evaluation Form.

DATA COLLECTED: Spring 2004

Final Evaluation by the Cooperating Teacher						
Year	**Number of candidates**	**Low Potential (%)**	**Below Average (%)**	**Average (%)**	**Better Than Average (%)**	**Percentage of candidates Average or Better**
2004	3	0	0	33%	67%	100%

PERFORMANCE GOAL:
100% of teacher candidates participating in student teaching should receive a final evaluation of average or better from their respective cooperating teachers.

INSTRUMENT:
ECU Department of Mathematics' Student Teaching Final Evaluation by the Cooperating Teacher Form.

DATA COLLECTED: Fall 2006 – Fall 2008

Final Evaluation by the Cooperating Teacher					
Year	**Number of candidates participating in student teaching**	**Number of candidates scoring at least 2.5***	**Percentage of candidates scoring at least 2.5***	**Number of candidates scoring at least 3***	**Percentage of candidates scoring at least 3***
2006	1	1	100%	1	100%
2007	6	6	100%	5	83%
2008	5	5	100%	5	100%

*The rating scale is a 0 to 4 scale with 4 representing the highest score possible

PERFORMANCE GOALS:
100% of teacher candidates should receive a final evaluation score of at least 2.5 from their respective cooperating teachers.
A minimum of 70% of teacher candidates should receive a final evaluation score of at least 3 from their respective cooperating teachers.

JUDGMENT:
The performance goals were met.

All of the teacher candidates assessed scored at least 3.

CRITERION 4:
Performance of teacher candidates in student teaching as evaluated by the University supervisor.

INSTRUMENT:
The ECU School of Education and Psychology's Student Teacher Evaluation Form.

DATA COLLECTED: Spring 2004

Final Evaluation by the University Supervisor				
Year	**Number of Candidates**	**Average rating***	**Number meeting or exceeding standard**	**Percentage meeting or exceeding standard**
2004	3	4.6	3	100%

*The rating scale is a 1 to 5 scale with 5 representing the highest score possible and 3 representing the standard score set as a measure of teacher candidate achievement.

PERFORMANCE GOAL:
100% of teacher candidates participating in student teaching should receive a final average rating of average (3) or better from their respective university supervisor.

INSTRUMENT:
ECU Department of Mathematics' Student Teaching Final Evaluation by the University Supervisor Form.

DATA COLLECTED: Fall 2006 – Fall 2008

Final Evaluation by the University Supervisor					
Year	**Number of candidates participating in student teaching**	**Number of candidates scoring at least 2.5***	**Percentage of candidates scoring at least 2.5***	**Number of candidates scoring at least 3***	**Percentage of candidates scoring at least 3***
2006	1	1	100%	1	100%
2007	6	6	100%	6	100%
2008	5	5	100%	5	100%

*The rating scale is a 0 to 4 scale with 4 representing the highest score possible

PERFORMANCE GOALS:
100% of teacher candidates should receive a final evaluation score of at least 2.5 from their respective university supervisors.

A minimum of 70% of teacher candidates should receive a final evaluation score of at least 3 from their respective university supervisors.

JUDGMENT:
The performance goals were met.

All of the teacher candidates assessed scored at least 3.

East Central University Mathematics Program (Calendar Year) 2008

Mission Statement	Student Outcomes	Criteria & Performance Goals	Assessment Results	Use of Results
The Mathematics Department strives to serve its three constituencies by engaging its students in a challenging and broad undergraduate mathematics curriculum, by providing its faculty a professionally stimulating academic environment, and by encouraging its alumni to remain aware of the needs and interests of the department. Goal Statement The primary goal of the Mathematics Department is to prepare students for entry into professions requiring an undergraduate education in mathematics.	1. Possess a working knowledge of fundamental mathematical concepts, methods of problem analysis, and techniques of problem solving.	1a. Performance of students on the Educational Testing Service (ETS) Major Field Test (MFT) in Mathematics. The department mean score should be $\geq$ the 50th percentile.	1a. The performance goal was not met. The department mean score is in the 5th percentile of peer institutions. (goal: 50th)	1a. The department instituted a number of changes in the prerequisite structure, will no longer offer MATH 3093 Introduction to Theorem Proving and Number Theory by independent study, and will incorporate a student's MFT score into course grade for MATH 3715 Linear Algebra in an effort to improve MFT scores. The MFT will be given in the capstone course beginning in 2008 – allows for more preparation time and synthesis of content.
		1b. Performance of students on the Oklahoma Subject Area Test (OSAT) Field 11: Advanced Mathematics. The percent of ECU majors passing the test should be greater than or equal to the statewide percent passing.	1b. The performance goal was met. 100% of ECU majors passed (goal: 76% state pass rate)	1b. The department instituted a number of changes in prerequisite structure and will no longer offer MATH 3093 Introduction to Theorem Proving and Number Theory by independent study in an effort to improve OSAT scores. No additional action is warranted.
	2. Possess the technical writing skills appropriate to upper level mathematics majors.	2a. Performance of students on writing rigorous, formal mathematical proofs in MATH 3715 Linear Algebra or MATH 3813 Modern Algebra. For each of the 2 categories of skills (communication and proof):	2a. The performance goals for communication skills and proof skills were not met. Communication skills: 60% had average $\geq$ 2 (goal: 90%) 30% had average $\geq$ 2.5	2a. The department instituted a number of changes in prerequisite structure and will no longer offer MATH 3093 Introduction to Theorem Proving and Number Theory by independent study in an effort to improve students' proficiency at writing

	A minimum of 90% of the students should have an overall average $\geq$ 2. A minimum of 70% of the students should have an overall average $\geq$ 2.5. A minimum of 50% of the students should have an overall average $\geq$ 3.	(goal: 70%) 0% had average $\geq$ 3 (goal: 50%) Proof skills: 80% had average $\geq$ 2 (goal: 90%) 60% had average $\geq$ 2.5 (goal: 70%) 20% had average $\geq$ 3 (goal: 50%)	mathematical proofs. The use of rubric began in 2006 – provides consistency in evaluation process. Modified rubrics used in 2007 and 2008.
	2b. Performance of students on an expository paper At least 90% of students should score at least 70%.	2b. This criterion was not assessed in 2008.	2b. The department eliminated this criterion in order to increase amount of time spent focused on the writing of mathematical proofs in an effort to increase student performance on the writing of mathematical proofs (criterion 2a). This criterion will be replaced in 2009.
3. Students in the teacher certification option (indicated for this student outcome as "teacher candidates") will possess a working knowledge of sound and current pedagogical techniques for the teaching of mathematics at the secondary level.	3a. Performance of teacher candidates on an Ability to Plan Instruction assessment in MATH 4913 Methods of Teaching Secondary Mathematics. 100% of teacher candidates should score $\geq$ 4 (on 8-point scale). A minimum of 70% of teacher candidates should score $\geq$ 6.	3a. The performance goals were not met. 76% scored $\geq$ 4 (goal: 100%) 61% scored $\geq$ 6 (goal: 70%)	3a. The department should incorporate an additional methods course during the sophomore year. One 3-hour senior-level course does not provide adequate preparation for teacher candidates.
	3b. Performance of teacher candidates on Effect on	3b. One performance goal	3b. No action is warranted at this time but performance

Learning portfolios submitted during their student teaching experience. 100% of teacher candidates should score ≥ 4 (on 8-point scale). A minimum of 70% of teacher candidates should score ≥ 6.	was met and one was not. 80% scored ≥ 4 (goal: 100%) 80% scored ≥ 6 (goal: 70%)	should be closely monitored.
3c. Performance of teacher candidates in student teaching as evaluated by the cooperating teacher. 100% of teacher candidates participating in student teaching should score ≥ 2.5. A minimum of 70% of teacher candidates participating in student teaching should score ≥ 3.	3c. The performance goals were met. 100% scored ≥ 2.5 (goal: 100%) 100% scored ≥ 3 (goal: 70%)	3c. No action is warranted.
3d. Performance of teacher candidates in student teaching as evaluated by the University supervisor. 100% of teacher candidates participating in student teaching should score ≥ 2.5. A minimum of 70% of teacher candidates participating in student teaching should score ≥ 3.	3d. The performance goals were met. 100% scored ≥ 2.5 (goal: 100%) 100% scored ≥ 3 (goal: 70%)	3d. No action is warranted.