

EAST CAROLINA UNIVERSITY CERTIFICATE IN ELEMENTARY MATHEMATICS EDUCATION

The elementary mathematics education certificate provides interested elementary education licensed teachers the opportunity to fulfill requirements to apply for the add-on license in K-6 mathematics. Applicants to the certificate program must currently have a teaching license and meet graduate school standards for admission.

Applicants seeking admission must be graduate students or education professionals working in their respective fields. Professionals can enroll as nondegree seeking students. Admission is based on completion of the ECU certificate application and approval by the program coordinator.

The certificate program requires **18 s.h.** of graduate-level course work in a program of study designed by a consortium of UNC universities and approved by the NC State Board of Education. Required courses include MATE 6058, 6059, 6060, 6061, 6062, and 6063.

MATE: MATHEMATICS EDUCATION

MATE 6058. Number Systems and Operations: K-5 Mathematical Tasks (3) P: Teacher Licensure. Analysis and construction of effective mathematical tasks in teaching number systems and operations at the K-5 level; attention also given to the expansion of content knowledge.

MATE 6059. Rational Numbers and Operations: K-5 Learning Trajectories (3) P: MATE 6058. Focus on rational number concepts through learning trajectories at the K-5 level; attention also given to problem solving and content knowledge.

MATE 6060. Data Analysis and Measurement: K-5 Classroom Interactions (3) P: MATE 6058. Focus on statistical literacy of elementary teachers and the teaching of data analysis and measurement to K-5 students; attention also given to learning methods which facilitate appropriate classroom interactions.

MATE 6061. Algebraic Reasoning: K-5 Discourse and Questioning (3) P: MATE 6058. Focus on the early algebra concepts of functional thinking and generalized arithmetic in relationship to pedagogical practices centered on questioning in the mathematics classroom.

MATE 6062. Geometry and Spatial Visualization: K-5 Assessment (3) P: MATE 6058. Geometric concept development along with formative and summative assessment strategies of students' geometric thinking; attention also given to geometric content knowledge and diagnosis of student errors.

MATE 6063. Mathematical Modeling: K-5 Leadership (3) P: MATE 6058, 6059, 6060, 6061, 6062. Generating mathematical representations and making explicit connections between concepts. Pedagogy designed to equip elementary teachers to become mathematics teacher-leaders in school settings; attention also given to topics integrated within mathematical strands.

North Carolina Elementary Mathematics Add-on License

Unlike other licensing areas where individual universities establish a program of study to meet state licensing objectives, the NC State Board of Education charged the University of North Carolina System (UNCGA) with the establishment and maintenance of the program of study to support the Elementary Mathematics Add-on License. A consortium of seven UNC universities designed and piloted the program of study from 2009-2011. As much as possible, each university is using the same course syllabi and catalog descriptions. A common end-of-program assessment system is used as part of the NCDPI licensure requirements.

While the information cited here is from the East Carolina University Graduate Catalog, similar results have already been approved at the North Carolina State University, University of North Carolina – Chapel Hill, University of North Carolina – Charlotte, University of North Carolina – Greensboro and are anticipated at Appalachian State University and the University of North Carolina – Wilmington.

1. A statement of the educational objectives of the program.

The primary objective is to increase elementary school teachers' specialized mathematical content knowledge. The proposed certificate program consists of the six graduate courses required by the North Carolina Department of Public Instruction for licensed elementary school teachers to receive an elementary mathematics add-on license.

2. A statement of the admission standards for the certificate program and a statement of the academic retention standards for the successful completion of the program.

An individual may be admitted to the program if she or he: 1) holds at least a bachelor's degree from an accredited institution and 2) holds, or is eligible for, a NC Elementary Education Teaching License. Students must earn grades of B or better on all courses. Students have five years to complete the program.

3. A statement of the proposed course sequence associated with the certificate.

MATE 6058 is designed to be the first course in the sequence. It sets the foundation for the program expectations. MATE 6063 is designed to serve as the capstone course for the program of study. It provides a comprehensive assessment of the student's knowledge of elementary school mathematics necessary to be a successful teacher of mathematics. It also supports the teacher's transition to a role as school leader in elementary school mathematics.

The six courses were developed and piloted with two cohorts of 44 teachers by twelve graduate mathematics and mathematics education faculty from seven UNC universities. The same six courses (with identical catalog descriptions and where possible syllabi) are being proposed for delivery at each of the universities in the consortium. An evaluation team consisting of math specialist from four LEAs and the NC DPI completed the six pilot courses and assisted in the development of the syllabi.

Students will participate in the certificate program in 20-25 member cohorts at each partner university. The first ECU cohort will begin Fall 2011 and end their program of study in Fall 2012. The courses will be offered in the following sequence:

Fall 2011—MATE 6058	Spring 2012—MATE 6060	Fall 2012—MATE 6062
Fall 2011—MATE 6059	Spring 2012—MATE 6061	Fall 2012—MATE 6063

4. A statement of how the proposed course sequences associated with the certificate will meet the stated educational objectives.

The proposed program of study has been developed by the UNCGA through a carefully crafted curriculum research and development process. In January 2009, the UNCGA established a statewide Advisory Board, charged to support the design and implementation of a graduate program of study (four to six courses) leading to an elementary mathematics license focused on the mathematical knowledge needed for successfully teaching mathematics at the elementary level. This included facilitating the design of a program-of-study, advising the UNCGA on its curricular content and communicating with mathematics and mathematics education faculty regarding the implementation of the program-of-study to meet the requirements for a NC State Board of Education elementary mathematics add-on license. The Advisory Board included Alan Mabe & Alisa Chapman (UNCGA), Sid Rachlin (ECU), Sarah Berenson (UNCG), Tyrette Carter (NC A&T), Jere Confrey (NCSU), Susan Friel (UNCCCH), Katie Mawhinney (ASU), Kitty Rutherford (NCDPI), and Wendy Rich (Asheboro City Public Schools).

After a series of weekly meetings, the Advisory Board agreed that all courses in the proposed program of study would:

- Include graduate level expectations & accountability that balance direct instruction with project-oriented teaching methods
- Stress mathematical content needed to support the teaching of elementary mathematics, illustrating how a deeper understanding of subject matter can actually enhance problem solving, critical thinking, and other 21st century skills. Mathematical content strands include: number systems and

operations; rational numbers and operations; spatial orientation and visualization; measurement and data analysis; fostering the development of algebraic reasoning including patterns structure, conjecture, generalizations and proof; and algebraic operations as generalized arithmetic. Courses will stress the mathematical connections and representations across content strands.

- Provide connections to practice and the NC Standard Course of Study (currently this is the Common Core State Standards) with a focus on a thorough development of basic mathematical ideas and skills, with an emphasis on understanding the sequential nature of mathematics and the mathematical structures inherent in the content strands.
- Balance the needs of K-2 and 3-5 teachers with links to the mathematics content and skills students need to successfully learn middle grades mathematics.
- Enable 21st century professional learning communities for teachers that models the kinds of classroom learning that best promotes 21st century skills for students
- Cultivate teachers' ability to identify students' particular learning styles, intelligences, strengths and weaknesses
- Help teachers develop their abilities to use various strategies (such as formative assessments) to reach diverse students and to create environments that support differentiated teaching and learning
- Encourage knowledge sharing among communities of practitioners, using face-to-face, virtual and blended communications
- Support the use of technology to improve teaching and learning mathematics.

A statewide focus meeting was held in mid-February to review and revision the program of study and to have the proposed program-of-study finalized in the spring of 2009. The Focus Group totaled over fifty individuals and represented university mathematicians and mathematics educators from 12 UNC institutions, mathematics specialists from NCDPI and from school districts across the state. Participants at the meeting provided input on the design of the program of study, recommended curriculum writers and reviewers and advised the UNCGA on its implementation.

The proposed program of study recommended by the Focus Group includes six courses. Each course is distinguished by a focus on a high-leverage teaching practice, a primary area of mathematics necessary for successfully teaching elementary school mathematics and a secondary area of mathematical content. The primary content area provides the context for exemplifying the high-leverage teaching practice. The secondary content area provides the context for demonstrating the transfer of the high-leverage teaching practice to other content strands. For example, the understanding and applying knowledge of learning trajectories is initially developed for rational numbers and their operations. The generalization of the role and application of learning trajectories is modeled using measurement as the secondary curriculum area. Each course also identifies the profound understanding of fundamental mathematics teachers will develop and demonstrate through the program of study. The following chart provides an overview of the six courses.

HIGH-LEVERAGE MATHEMATICS TEACHING PRACTICES	MATHEMATICAL CONTENT
Selecting, Designing, and Using Mathematical Tasks	Primary (80%): Number Systems & Operations (Place Value) Secondary (20%): Number Theory and Rational Numbers
Understanding and Applying Knowledge of Learning Trajectories	Primary (80%): Rational Numbers and Operations Secondary (20%): Measurement
Orchestrating Classroom Interactions	Primary (80%): Measurement Secondary (20%): Data Analysis
Fostering Reasoning through Discourse and Questioning	Primary (80%): Algebraic Reasoning; Including Patterns Structure, Conjecture, Generalizations and Proof Secondary (20%): Number Systems & Operations
Assessing Student Knowledge (Diagnosis and Intervention)	Primary (80%): Spatial Orientation And Visualization Secondary (20%): Early Number Concepts
Helping Teachers Develop as School-based Leaders	Primary (80%): Connecting, Relearning, and Integrating Content Areas—Mathematical Modeling Secondary (20%): From Number to Algebra

Number Systems and Operations: Selecting, Designing, and Using Mathematical Tasks in the K-5 Classroom. Teachers will build on their content knowledge of elementary school mathematics while exploring mathematical tasks through the lens of a practitioner. Teachers will explore the role of effective mathematical tasks in teaching number systems and operations, emphasizing place value topics, and in teaching basic number theory and introductory rational number topics. As the first course in the program, the course will focus on the instructional role of constructing, analyzing, and/or selecting appropriate mathematical tasks to support student learning of mathematical concepts. The instructional activities – tasks, problems, and materials – with which students and teachers engage are a central component of mathematics instruction. How instructional activities are designed, with what mathematics potential, scope, and adaptability, matters for the work students do and their opportunities to learn. Teachers will explore and implement specific research-based mathematical tasks with their students. This will allow them to see how different types of mathematical tasks elicit different types of mathematical thinking in their students. These activities will also provide the teachers with opportunities to examine the depth of their own understanding of mathematical ideas and to build on that content knowledge. Teachers will learn how to construct effective mathematical tasks and how to analyze the nature and quality of instructional activities found in mathematics curriculum and resource materials. They will also learn how to select and construct mathematical tasks for assessment purposes.

Rational Numbers and Operations: Understanding and Applying Knowledge of Learning Trajectories in the K-5 Mathematics Classroom. This Elementary Mathematics Add-on License Course is distinguished by its focus on understanding and applying knowledge of learning trajectories. Working with learning trajectories develops an awareness of how to think of the complex interaction of mathematical concepts and how they deepen across grade levels. Rational number and measurement are the primary and secondary content topics addressed with an emphasis on how related concepts build across the elementary grades. Participants will learn about the concepts of equipartitioning, fractions, ratio and rate, decimals and percents, proportional reasoning, and measurement through the lens of learning trajectories. They will participate in problem solving situations and explore basic principles related to how their students might approach such problems. Teachers will learn to identify the prior knowledge necessary to support students' problem solving and how to push the students toward new levels of understanding. The teachers' profound mathematical understanding will allow them to make connections among concepts and procedures that their students are learning, accept and encourage multiple solution strategies, stress basic ideas and dispositions in mathematics, and identify the coherence of their subject area within the elementary curriculum.

Data Analysis and Measurement: Orchestrating K-5 Mathematics Classroom Interactions. The course is designed to increase the statistical literacy of elementary teachers and to enable them to promote statistical literacy in the classroom. Statistical literacy is the ability to read and interpret data, the ability to think critically about statistics, and to use statistics as evidence in arguments. Utilizing the recommendations of the NCTM's Data Analysis and Probability Standard, elementary teachers will learn to work with students to collect data, organize their own or others' data, and display the data in graphs and charts that will be useful in answering questions. The course will also include learning methods for analyzing data and ways of making inferences and drawing conclusions from data. The basic concepts and applications of probability are also addressed, with an emphasis on the way that probability and statistics are related. Because measurement is a tool for data analysis, it will be a secondary focus in the course. Numerical measurements are collected as data for many of the questions that need to be answered. Consideration of the important concepts related to measurement within the applied context of data analysis provides opportunities for developing understandings in both content areas. The course is conducted in a problem-based setting that emphasizes multiple methods of orchestrating classroom interactions.

Algebraic Reasoning: Fostering the Development of Algebraic Habits of Mind through Discourse and Questioning in the K-5 Mathematics Classroom. Algebra in the elementary grades or early algebra lays a foundation for all learners of mathematics. This course will focus on early algebra as generalized arithmetic and functions along with pedagogical practices centered on the importance of questioning in the mathematics classroom. Close attention will be given to content knowledge in early algebra, how this knowledge relates to teaching, and the importance of early algebra in connection with both the National Council of Teachers of Mathematics Principles and Standards for School Mathematics and the North Carolina Standard Course of Study. The course is conducted in a problem-solving manner that emphasizes multiple representations of algebra, analysis of student thinking in algebra, and the processes of reversibility, flexibility, and the ability to generalize.

Geometry and Spatial Visualization: Assessing Student Knowledge (Diagnosis and Intervention) in the K-5 Mathematics Classroom. In this course teachers will deepen their knowledge of geometry while exploring the high leverage teaching practice of assessment. Geometry topics will include: properties of two and three-dimensional shapes, congruence, similarity, geometric transformations, spatial relationships, and visualization. A focus will be placed on analyzing students' thinking using the van Hiele Levels of Geometric Thinking and SOLO taxonomy. The use of clinical interviews to gather in-depth information about students' geometric thinking will be introduced to teachers and will be a key feature of one of the major projects for the course. Teachers will also learn how to diagnose and correct common student errors by analyzing student work samples and video clips of students solving geometric tasks. Formative assessment strategies that include designing and modifying tasks that build on and respond to student thinking as well as traditional and non-traditional summative assessment techniques will be applied in context of the learning and teaching of geometry and number concepts in K-5 classrooms.

Mathematical Modeling: Helping Teachers Develop as Elementary School-based Leaders in Mathematics. Capstone course in the Elementary Mathematics Add-on License (EMAoL). Mathematical content and pedagogy designed to equip elementary teachers to become mathematics teacher-leaders in school settings. Pedagogical emphases include study of national, and state standards for mathematics teaching and learning; use of both large-scale and formative assessments to make instructional and curricular decisions; exploration of models for working with teachers as individuals or in groups; examination of curriculum and ways to modify to meet state standards; examining teacher learning in mathematics education, including facilitating workshops, coaching and working with adult learners; critical issues such as mathematics reform, parent education and grant writing. In the course, the mathematics content will cover integration of mathematical concepts and the integration of mathematics teaching throughout the elementary curriculum. Mathematical emphases include topics that are integrated within mathematical strands and with other curricula and the real world; a mathematical modeling approach to mathematics; curriculum that is modified to become more cognitively demanding; and tasks at the elementary level and beyond the elementary level.

The EMaOL Curriculum Research and Development Team was established in the summer of 2009. Each course was developed by two faculty members. Each faculty member piloted his/her course with one of the cohorts. When possible the pilots for a course occurred during different semesters to enable the developers to revise and test two versions of their curriculum. One pilot was offered in the Guilford County Schools by graduate faculty from UNCG, UNCC, and ASU. The other was offered in the Cumberland County Schools by graduate faculty from UNCH, NCSU, ECU and UNCW.

A team of three evaluators (including math specialists from Asheboro City Schools, Randolph County Schools and NC PDI) participated as students in all six courses offered to the Guilford County teachers. After each class session they submitted a written evaluation including their sense of how well the lesson was meeting both course and program objectives. They also suggested ways that the material might be revised to make it provide a better fit with the NC Standard Course of Study. The Cumberland County Schools K-5 Math Specialist also served as an evaluator. She reviewed the session evaluations prepared by the others and discussed similarities and differences in the implementation in her cohort. Each of the four evaluators holds a masters degree.

Three times a year, the EMaOL Curriculum Research and Development Team met for one or two days to coordinate efforts, consider revisions to their courses and to work on the design of the end of program assessments. The evaluation team participated in these discussions and added the perspective of someone who has completed all six courses in the program of study.

5. A statement of the need for the proposed program and the basis for such a need supported by either externally or internally derived data.

A growing number of national reports call for the placement of mathematics specialists in elementary schools. These reports (The Mathematical Education of Teachers, 2001; Adding It Up: Helping Children Learn Mathematics, 2001; National Council of Teachers of Mathematics Principles and Standards of School Mathematics, 2000; No Common Denominator, 2008; and Foundations for Success: The Final Report of the

National Mathematics Advisory Panel, 2008) have converged around this common idea. Each report calls for qualified Elementary Mathematics Specialists to be placed in schools as a resource for improving instruction. States such as Virginia, Georgia, and Ohio have already established statewide licensure programs for elementary mathematics specialists. Projects such as the North Carolina Partnership for Improving Mathematics and Science (NCPIMS) have demonstrated that school-based Elementary Mathematics Specialists can serve as a resource in professional development, teaching, curriculum development and implementation, mentoring new teachers, and parent and community education. Some see this movement as paralleling the national Reading First Initiative with a mathematics initiative. But unlike reading, there is no infrastructure in place to support this effort in mathematics. Most elementary teachers are much less prepared to teach mathematics than they are to teach reading. Currently, elementary school teachers are considered generalists because they have only taken one or two mathematics courses in college and may need additional coursework to build the necessary understanding of mathematics, the process of learning mathematics and children's mathematical thinking in order to be strong mathematics teachers.

The Elementary Mathematics Add-On License is a coordinated effort between the North Carolina Department of Public Instruction (NCDPI), the University of North Carolina General Administration (UNCGA), statewide LEA representation at the school and district levels, and university faculty representation from colleges of education and arts and science. The collaborative statewide effort began spring 2008 when, through funding from the Burroughs Wellcome Fund and the Cisco Learning Institute, the NCDPI co-sponsored a weeklong retreat to design an Elementary Mathematics Specialist Program-of-Study for the North Carolina State Board of Education consideration. This initial effort gained focus and direction through the leadership of UNCGA. In response to questions and suggestions regarding the teaching of elementary school mathematics raised by Judge Howard Manning last summer, the UNCGA expanded their analysis of the preparation and development of middle grades mathematics teachers to focus on the preparation and development needs of teachers of elementary school mathematics. Based on the recommendation of the deans of the UNC colleges of education in August 2008 and a meeting with campus teams of faculty from UNC colleges of education and arts and science in Fall 2008, the UNCGA established an elementary mathematics advisory committee. The advisory committee (with representation from UNC faculty, NCDPI, the UNCGA and LEA mathematics specialists) met weekly to draft the design of a program of study that could potentially support an elementary mathematics add-on license. Feedback for this effort was provided at a focus meeting of fifty invited representatives including the UNCGA, the NCDPI, UNC mathematicians and mathematics educators, district-level mathematics specialists and elementary school mathematics teachers.

During the summer of 2009, the UNCGA commissioned twelve graduate faculty members from seven UNC universities to coordinate the design of the six courses. Course syllabi are in the process of being reviewed and finalized.

Funding to support the development and pilot of the program of study has been provided by the Cisco Learning Institute, the Burroughs Wellcome Fund, the UNC General Administration, the US Department of Education, and the North Carolina Model Teacher Education Consortium.

At the national level, this need has been recognized in a 2010 joint position of the Association of Mathematics Teacher Educators (AMTE), the Association of State Supervisors of Mathematics (ASSM), the National Council of Supervisors of Mathematics (NCSM), and the National Council of Teachers of Mathematics (NCTM).

The AMTE, ASSM, NCSM, and NCTM recommend the use of Elementary Mathematics Specialists (EMS) in PK–6 environments to enhance the teaching, learning, and assessing of mathematics in order to improve student achievement. We further advocate that every elementary school have access to an EMS. Districts, states/provinces, and higher education should work in collaboration to create: (1) advanced certification for EMS professionals and (2) rigorous programs to prepare EMS professionals. EMS professionals need a deep and broad knowledge of mathematics content, expertise in using and helping others use effective instructional practices, and the ability to support efforts that help all PK–6 students learn important mathematics.

Programs for EMS professionals should include foci on mathematics content knowledge, pedagogical knowledge, and leadership knowledge and skills.

The Association of Mathematics Teacher Educators went further and published a 2010 set of *Standards for*

Elementary Mathematics Specialists: A Reference for Teacher Credentialing and Degree Programs. The objectives provided in the MATE course proposals have been linked to these standards.

6. A statement of how the effectiveness of the certificate program will be evaluated.

The consortium will promote opportunities for professional development of participating faculty to strengthen and enhance the program and its course offerings. Every sixth year, the consortium will conduct a self-study and review its operating procedures by surveying participating departments, faculty, students, and program administrators. This review will be reported to the University of North Carolina-Office of the President.

At the time of each six-year review of the operating procedures, the program of study will be reviewed. Since the program-of-study was designed with the NC Department of Public Instruction and approved by the NC State Board of Education to meet a specific licensing need, the consortium will continue to work with NC DPI to review and when necessary update the approved program-of-study. This review will be reported to the NC State Board of Education.

In order to receive an Elementary Mathematics Add-On License, an applicant must:

- Have a minimum of three years teaching experience (i.e., hold a Standard Professional 2 NC Teaching License).
- Successfully complete an approved Elementary Mathematics Add-On License Program-of Study. The Program-of-Study will be developed and offered by the University of North Carolina System in collaboration with the NC Department of Public Instruction. To assure consistency of program, any university approved by the UNC System to offer the program-of-study will need to include all six courses. Credit for the six courses will be transferable among the participating UNC institutions. The successful completion of the program-of-study will require grades of B or better on all courses.
- Earn a passing grade on a comprehensive exam of their understanding of mathematics fundamental for the teaching of elementary mathematics, of the process of learning elementary mathematics, and of children's mathematical thinking. The exam will draw on national models and will be aligned with challenging state academic content standards and student achievement standards and developed in consultation with core content specialists, teachers, principals and school administrators.
- Complete a portfolio that gives an overview on what the candidate has learned and how it has affected his or her teaching.
- The Comprehensive Exam was developed by George Bright, working with the EMAoL Curriculum R&D Team, and piloted spring 2011 with the two pilot cohorts. The intent is for a common exam to be administered at each UNC consortium university. The portfolio assessment was also piloted in spring 2011. Representative from each partner university assisted in the portfolio reviews.

7. A quality enhancement plan addressing how deficiencies will be managed.

Unlike other programs where individual universities establish a program of study to meet state licensing objectives, the UNCGA has been charged with the establishment and maintenance of the program of study to support the K-6 Mathematics Add-on License. Therefore it is the charge of the UNC Consortium of Universities to monitor the program of study and assure that it continues to meet state needs. This will be accomplished at annual meetings of program coordinators from each participating institution and NCDPI. The common end of program assessments will also help with suggesting any needed revision.

8. The names of the faculty associated with or contributing to the certificate program, either by teaching one or more of the courses associated with the program or participating in the design of the course sequence.

Appalachian State University
Tracy Goodson-Espy
Kathleen Lynch-Davis

East Carolina University
Ron Preston
Katie Schwartz

North Carolina State University
Karen Hollebrands
Temple Walkowiak

UNC-Chapel Hill
Susan Friel

UNC-Charlotte
Drew Polly
David K. Pugalee

UNC-Greensboro
Kerri Richardson
Carol Seaman

UNC-Wilmington
Tracy Hargrove
Shelby Morge

9. The name of the faculty member who will be designated as the coordinator of the program for purposes of communication among the collaborating universities.

Sid Rachlin, East Carolina University

10. The professional license for which the certificate qualifies.

The Elementary Math Add-on License was approved by the North Carolina State Board of Education on November 4, 2009 (SBE Policy #TCP-A-001). The following is an excerpt from the Board's Executive Summary.

To improve instruction in the elementary school in the academic content areas of mathematics and science, a proposal to add content area concentrations (an add-on license) to the elementary license area is presented. Individuals with an elementary (K-6) license would be eligible to have the elementary concentration areas added to their license based on the completion of 18 hours (6 courses) of content-based graduate coursework designed for the elementary teacher in the core content areas of mathematics and/or science. The program of study for each content must be approved by the NC State Board of Education and offered by approved NC universities. Based on specific masters degree requirements at the universities, some or all of these courses may be applied towards existing degree programs.

11. The Classification of Instructional Program (CIP) title and six-digit code (descriptions available at: <http://www.ecu.edu/cs-acad/acadprograms/PoliciesForms.cfm>).

CIP: 13.1311 Mathematics Teacher Education

12. Course Syllabi

See attached.



Graduate Curriculum Committee Course Proposal Form For Courses Numbered 6000 and Higher

Note: Before completing this form, please carefully read the accompanying instructions.

1. Course prefix and number: MATE 6058 2. Date: 02/21/2011

3. Requested action:

X	New Course			
	Revision of Active Course			
	Revision & Unbanking of a Banked Course			
	Renumbering of an Existing Course from			
	from	#	to	#

4. Method(s) of delivery (check all boxes that apply for both current/proposed and expected future delivery methods within the next three years):

Current or Proposed Delivery Method(s):		Expected Future Delivery Method(s):
	On-campus (face to face)	
X	Distance Course (face to face off campus)	X
X	Online (delivery of 50% or more of the instruction is offered online)	X

5. Justification (must cite accreditation and/or assessment by the graduate faculty) for new course or course revision or course renumbering:

This is the first of six required courses for the 18-hour NC-DPI K-6 Mathematics Add-on License. The course is based on Standards from the North Carolina Board of Professional Teaching Advanced Standards (NCPTS) and the Mathematics Specialist Standards from the Association of Mathematics Teacher Education (AMTE). The Elementary Mathematics Add-on License is a coordinated effort between the North Carolina Department of Public Instruction (NCDPI), the University of North Carolina General Administration (UNCGA), statewide LEA representation at the school and district levels, and university faculty representation from colleges of education and arts and science. Elementary Mathematics Add-on Licensure students will be eligible to apply courses from the program of study to the MAEd in Mathematics Education. Assessment and verification of the need for the course was made by the graduate faculty in mathematics education (MATE).

6. Course description exactly as it should appear in the next catalog:

6058. Number Systems and Operations: K-5 Mathematical Tasks (3) P: Teacher Licensure. Analysis and construction of effective mathematical tasks in teaching number systems and operations at the K-5 level; attention also given to the expansion of content knowledge.

7. If this is a course revision, briefly describe the requested change:

8. Graduate catalog page number from current (.pdf) graduate catalog:

9. Course credit:

Lecture Hours	3	Weekly	<u>OR</u>		Per Term	Credit Hours	3	s.h.
Lab		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Studio		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Practicum		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Internship		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Other (e.g., independent study) Please explain.								
Total Credit Hours							3	s.h.

10. Anticipated annual student enrollment:

50

11. Affected degrees or academic programs:

Degree(s)/Program(s)	Current Catalog Page	Changes in Degree Hours
MAEd in Mathematics Education/Proposed Elementary Mathematics Education Certificate	186	None

12. Overlapping or duplication with affected units or programs:

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Notification & response from affected units is attached

13. Council for Teacher Education (CTE) approval (for courses affecting teacher education):

<input type="checkbox"/>	Not applicable
<input checked="" type="checkbox"/>	Applicable and CTE has given their approval.

14. Service-Learning Advisory Committee (SLAC) approval

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Applicable and SLAC has given their approval.

15. Statements of support:

a. Staff

<input checked="" type="checkbox"/>	Current staff is adequate
<input type="checkbox"/>	Additional staff is needed (describe needs in the box below):

b. Facilities

<input checked="" type="checkbox"/>	Current facilities are adequate
<input type="checkbox"/>	Additional facilities are needed (describe needs in the box below):

c. Library

X	Initial library resources are adequate
	Initial resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition of required initial resources):

d. Unit computer resources

X	Unit computer resources are adequate
	Additional unit computer resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition):

e. ITCS resources

X	ITCS resources are not needed
	The following ITCS resources are needed (put a check beside each need):
	<input type="checkbox"/> Mainframe computer system
	<input type="checkbox"/> Statistical services
	<input type="checkbox"/> Network connections
	<input type="checkbox"/> Computer lab for students
	<input type="checkbox"/> Software
	<i>Approval from the Director of ITCS attached</i>

16. Course information (see: *Graduate Curriculum and Program Development Manual for instructions*):

a. Textbook(s) and/or readings: author(s), name, publication date, publisher, and city/state/country

Chapin, S. H. & Johnson, A. (2006) *Math Matters: Understanding the math you teach, Grades K-8 (Second Edition)*. Sausalito, CA: Math Solutions. ISBN: 978-0-941355-71-1
 Membership NCTM – journal choice should be *Teaching Children Mathematics*
 See: <http://www.nctm.org/membership/>
 Additional required readings will be made available at the Blackboard class website

b. Course objectives for the course (student – centered, behavioral focus)

Student Learning Outcomes (SLO). Upon completion of this course the successful student will be able to:

1. Contrast models and interpretations of operations with whole numbers.
2. Compare place value in the base-ten number system and its relationship to place value in other number systems
3. Contrast and evaluate multi-digit calculations, including standard algorithms, “mental math,” and non-standard methods commonly created by students.
4. Explain the fundamental ideas of number theory as they apply to elementary grades mathematics.
5. Contrast models and interpretations fractions.
6. Explain the structure of the real number system.
7. Apply the *Mathematics Task Framework*, including
 - Distinguishing high cognitive and low cognitive demand tasks;
 - Using the framework to guide sorting and categorizing tasks
 - Connecting the use of tasks with the success of implementation (i.e., learning)

8. Select, modify and design mathematically rich tasks to meet the developmental needs of elementary school students.

c. Course topic outline

1. Introduction to Mathematical Tasks
2. Base 10 and Base 4: Place Value
3. Place Value in K-2 Grades
4. Analyzing Tasks, Creating a Lesson from Mathematically Rich Tasks
5. Place Value: How to use tasks to develop conceptual understanding
6. Cognitively Guided Instruction: Developmentally-Appropriate Tasks
7. Trajectory of place value, addition, and subtraction
8. Connecting multiplication and division strategies from place value
9. Designing tasks for the four operations
10. Modifying and selecting tasks for the four operations
11. Essential Understandings of Number Sense in the K-5 Standard Course of Study/Common Core
12. Developmentally-Appropriate Instruction for Fractions
13. Creating Tasks to Develop Fraction Understanding
14. Developing Tasks that Address Multiple Content Strands
15. Final Project

d. List of course assignments, weighting of each assignment, and grading/evaluation system for determining a grade

Written Assignments: The course assignments are intended to allow the student to apply course concepts as they design and implement mathematical tasks. Each assignment is described in detail below.

Task Analysis 1: Locate examples of each of the four kinds of tasks; explain the reasons for your choice. (SLO 7, 8)

Task Analysis 2: Share a case story about implementing a high cognitive demand task. (SLO 7, 8)

Task Analysis 3: Write a sequence of five or more story problems (Cognitive Guided Instruction). (SLO 1, 7)

Task Analysis 4: Unpacking Tasks Assignment

- i. Interview 2 students using a fraction interview; write up analysis of results. (SLO 5, 7, 8)
- ii. Design/use a set of Fosnot mini-lessons or "Wheatley" or "Wheatley-like" fluency tasks or version of Game of 24 with students. (SLO 7, 8)
- iii. Rewrite selected low cognitive demand tasks as high cognitive demand tasks using the principles of reversibility, flexibility, and generalizability. (SLO 7, 8)

Task Analysis 5: Final Course Assignment: Written: Select or create and implement a "connected" sequence of 2-3 high level tasks. Discussion: Share a Case Story. (SLO 7, 8)

Class Participation: This course is a seminar-style course, meaning your in-class and online contributions are a significant part of our class. The online writings activities serve as important springboards for class discussions and individual learning. You are expected to post your online postings within the specified deadlines. Responses to online prompts and your classmates' ideas should be thoughtful and detailed.

Homework Problem Sets:

- Xmania (SLO 1, 2)

- Addition and Subtraction (SLO 1, 2, 3, 5)
- Multiplication and Division (SLO 1, 2, 3, 5, 6)
- Definitions (SLO 4, 5, 6)

Final Exam: The final exam provides an assessment of the depth understanding of the mathematical knowledge regarding place value, whole number operations, and the concept of rational numbers necessary to successfully teach elementary school mathematics. (SLO 1, 2, 3, 4, 5, 6)

Breakdown of the Final Grade:

Writing Assignments	55%
Task Analysis 1 (5%)	
Task Analysis 2 (10%)	
Task Analysis 3 (10%)	
Task Analysis 4 (10%)	
Task Analysis 5 (20%)	
Homework Problem Sets	20%
Xmania (5%)	
Addition and Subtraction (5%)	
Multiplication and Division (5%)	
Definitions (5%)	
Participation	10%
Final Exam	15%
TOTAL	100%

Grading Scale:

- A = 93–100%
- B = 83–92%
- C = 73–82%
- F = Below 73%



Graduate Curriculum Committee Course Proposal Form For Courses Numbered 6000 and Higher

Note: Before completing this form, please carefully read the accompanying instructions.

1. Course prefix and number: 2.

MATE 6059

02/21/2011

3. Requested action:

<input checked="" type="checkbox"/>	New Course			
<input type="checkbox"/>	Revision of Active Course			
<input type="checkbox"/>	Revision & Unbanking of a Banked Course			
<input type="checkbox"/>	Renumbering of an Existing Course from			
	from	#	to	#

4. Method(s) of delivery (check all boxes that apply for both current/proposed and expected future delivery methods within the next three years):

Current or
Proposed Delivery
Method(s):

Expected
Future Delivery
Method(s):

	On-campus (face to face)	
X	Distance Course (face to face off campus)	X
X	Online (delivery of 50% or more of the instruction is offered online)	X

5. Justification (must cite accreditation and/or assessment by the graduate faculty) for new course or course revision or course renumbering:

This is one of six required courses for the 18-hour NC-DPI K-6 Mathematics Add-on License. The course is based on Standards from the North Carolina Board of Professional Teaching Advanced Standards (NCPTS) and the Mathematics Specialist Standards from the Association of Mathematics Teacher Education (AMTE). The Elementary Mathematics Add-on License is a coordinated effort between the North Carolina Department of Public Instruction (NCDPI), the University of North Carolina General Administration (UNCGA), statewide LEA representation at the school and district levels, and university faculty representation from colleges of education and arts and science. Elementary Mathematics Add-on Licensure students will be eligible to apply courses from the program of study to the MAEd in Mathematics Education. Assessment and verification of the need for the course was made by the graduate faculty in mathematics education (MATE).

6. Course description exactly as it should appear in the next catalog:

6059. Rational Numbers and Operations: K-5 Learning Trajectories (3) P: MATE 6058. Focus on rational number concepts through learning trajectories at the K-5 level; attention also given to problem solving and content knowledge.

7. If this is a course revision, briefly describe the requested change:

190

8. Graduate catalog page number from current (.pdf) graduate catalog:

9. Course credit:

Lecture Hours	3	Weekly	<u>OR</u>		Per Term	Credit Hours	3	s.h.
Lab		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Studio		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Practicum		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Internship		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Other (e.g., independent study) Please explain.								
Total Credit Hours							3	s.h.

10. Anticipated annual student enrollment:

50

11. Affected degrees or academic programs:

Degree(s)/Program(s)	Current Catalog Page	Changes in Degree Hours
MAEd in Mathematics Education/Proposed Elementary Mathematics Education Certificate	186	None

12. Overlapping or duplication with affected units or programs:

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Notification & response from affected units is attached

13. Council for Teacher Education (CTE) approval (for courses affecting teacher education):

<input type="checkbox"/>	Not applicable
<input checked="" type="checkbox"/>	Applicable and CTE has given their approval.

14. Service-Learning Advisory Committee (SLAC) approval

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Applicable and SLAC has given their approval.

15. Statements of support:

a. Staff

<input checked="" type="checkbox"/>	Current staff is adequate
<input type="checkbox"/>	Additional staff is needed (describe needs in the box below):

b. Facilities

<input checked="" type="checkbox"/>	Current facilities are adequate
<input type="checkbox"/>	Additional facilities are needed (describe needs in the box below):

c. Library

X	Initial library resources are adequate
	Initial resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition of required initial resources):

d. Unit computer resources

X	Unit computer resources are adequate
	Additional unit computer resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition):

e. ITCS resources

X	ITCS resources are not needed
	The following ITCS resources are needed (put a check beside each need):
	<input type="checkbox"/> Mainframe computer system
	<input type="checkbox"/> Statistical services
	<input type="checkbox"/> Network connections
	<input type="checkbox"/> Computer lab for students
	<input type="checkbox"/> Software
	<i>Approval from the Director of ITCS attached</i>

16. Course information (see: *Graduate Curriculum and Program Development Manual for instructions*):

a. Textbook(s) and/or readings: author(s), name, publication date, publisher, and city/state/country

<p>Fosnot, K. T. & Dolk, M. (2002). <i>Young Mathematicians at Work: Constructing Fractions, Decimals, and Percents</i>. Boston: Heinemann.</p> <p>Chapin, S. H., & Johnson, A. (2006). <i>Math Matters</i> (2nd ed.). Sausalito, CA: Math Solutions Publications.</p> <p><u>Class Web Supplements:</u></p> <p>National Library of Virtual Manipulatives: http://nlvm.usu.edu/en/NAV/index.html</p> <p>Cramer, K., Wyberg, T., & Leavitt, S. (2009). <i>Rational Number Project: Fraction Operations and Initial Decimal Ideas</i>. [Available at http://www.cehd.umn.edu/rationalnumberproject/RNP2/RNP2.pdf.]</p>
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b. Course objectives for the course (student – centered, behavioral focus)

<p>Student Learning Outcomes (SLO). Upon completion of this course the successful student will be able to:</p> <ol style="list-style-type: none"> Describe and use learning trajectories to promote the teaching and learning of rational number concepts (AMTE 1, 2; NCPTS 2, 4). Identify how equi-partitioning, composing, and decomposing numbers facilitates students' understanding of rational number concepts (AMTE 1, 2; NCPTS 4). Order rational numbers and describe the process for making comparison decisions (AMTE 1a; NCPTS 3). Compare and contrast models and interpretations of fractions, including decimals and percents (AMTE 1a; NCPTS 3). Relate fractions, decimals, and percents and articulating the inter-relationship between multiple representations and uses of rational numbers (AMTE 1a; NCPTS 3).
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6. Describe conceptual models for algorithms for rational numbers including fractions, decimals, and percents (AMTE 1a; NCPTS 3).
7. Demonstrate the attributes and characteristics of ratios (AMTE 1a; NCPTS 3).
8. Compare and contrast additive versus multiplicative reasoning (within vs. between and integer vs. non-integer); Distinguish between additive & multiplicative thinking (AMTE 1a, 2; NCPTS 3, 4).
9. Use symbols and graphs to explore solutions to problems involving proportions (AMTE 1a; NCPTS 3).
10. Apply rational number concepts to tasks involving similarity and scaling (AMTE 1a; NCPTS 3).
11. Connect rational number concepts and operations to area and volume (AMTE 1a; NCPTS 3).
12. Develop rational number tasks and reviewing student work (AMTE 2; NCPTS 2, 4).

c. Course topic outline (1 module per topic)

	Topic	Materials	Objective
Module 1	Learning Trajectories for Rational Number	Confrey article; Simon article; NC Standard Course of Study/Essential Standards; Fosnot Chap 2	1, 2
Module 2	Equipartitioning	Math Matters, Chap 5 intro; Fosnot Chap 1; Steffe, part 1 – initial partitioning schemes	2
Module 3	Equipartitioning	Fosnot Chap 3; Math Matters: Activity 4, Fractions as Measures; Steffe, part 2 – emergence of a fractional multiplying scheme	2
Module 4	Fraction as a Number/ Decimals and Percents	Fosnot Chap 4; Math Matters: Understanding Positive and Negative Number Relationships; Math Matters: Activity 9, chapter 1 number line; Math Matters: Activity 2 Decimals between Decimals	3, 4, 5, 6
Module 5	Fraction as a Number/ Decimals and Percents	Math Matters: Activity 4 Linking Fractions, Decimals and Percents; Case of Randy Harris (Rational Numbers and Proportinality); Fosnot Chapter 5	3, 4, 5, 6
Module 6	Fraction as a Number/ Decimals and Percents	Math Matters, Activity 11 – Adding and subtracting with models; Rational Number Project Activities	3, 4, 5
Module 7	Fraction as a Number/ Decimals and Percents	Fosnot. Chap 6/7; Rational Number Project Activities	3, 4, 5
Module 8	Division and Multiplication	Math Matters: Activity 12 – Modeling Fraction Multiplication; Connected Mathematics: <i>Where does the decimal go?</i> ; Rational Number Project Activities	5, 6
Module 9	Division and Multiplication	Math Matters: Activity 13- Modeling Fraction Division; Math Matters: Activity 5: Decimal Products and Quotients	5, 6
Module 10	Ratio	Most Square Task and Math Matters Activity 1: More than 1 way to compare; Math Matters: Intro Chap. 8 on Ratios; Math Matters: Activity 5 – Percent as a Ratio	7, 8, 9

Module 11	Ratio	Case of Mary Hanson – Introducing Ratios and Proportions; Connected Math: Mixing Juice Problem; Annenberg video number 30: http://www.learner.org/resources/series32.html?pop=yes&pid=909#	7, 8, 9
Module 12	Similarity and Scaling/ Area and Volume	Math Matters (174-175); Square Puzzle; Math Matters: Exploring similar figures on a coordinate grid	9, 10, 11
Module 13	Similarity and Scaling/ Area and Volume	(Case of Marcia Green Comparing Similar Figures); Math Matters: Activity 5 Area of Similar Figures	9, 10, 11
Module 14	Similarity and Scaling/ Area and Volume	Math Matters: Activity 6 Doubling Dimensions of Solid; Math Matters: Activity 4 and 5 from the measurement chapter	9, 11, 12
Module 15	Rational Number Tasks	Fosnot Chapter 8/9; Assessment (Final)	12

d. List of course assignments, weighting of each assignment, and grading/evaluation system for determining a grade

<p>The course assignments are intended to allow you to apply course concepts as students design and implement learning trajectories.</p> <p>Assignment 1: Initial Thinking about Learning Trajectories using “Teaching Math in the Primary Grades the Learning Trajectories Approach” article and your current classroom curriculum as a guide. (SLO 1)</p> <p>Assignment 2: Write short stories about understanding of fraction operations. (SLO 1, 2, 3)</p> <p>Assignment 3: Abbreviated lesson study using Fosnot mini-lessons. (SLO 1, 2, 3, 4, 5)</p> <p>Assignment 4: Analyzing student thinking (algorithms) using NCTM Navigations and/or NAEP student work. (SLO 1, 6-12)</p> <p>Assignment 5: Final Course Assignment: Written: Select or create and implement a hypothetical learning trajectory including: learning goals, a plan for instructional activities, hypotheses of the learning process, and assessment of students’ knowledge. Discussion: Reflection on implementation of hypothetical learning trajectory (SLO 1-12)</p> <p>EVALUATION</p> <p>Online Discussions (15%): This course is a seminar-style course, meaning your online contributions are a significant part of our class. The online writings activities serve as important springboards for class discussions and individual learning. You are expected to post your online postings within the specified deadlines. Responses to online prompts and your classmates’ ideas should be thoughtful and detailed and will be evaluated with a rubric.</p> <p>In-class Activities (15%): Since this course seminar-style course, in-class contributions are a significant part of our class. These activities will focus on problem solving and reflection and will be collected periodically throughout the semester.</p> <p>Written Assignments (55%): These assignments are described above and weights are assigned in the list below.</p> <p>Final Exam (15%)</p>
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Breakdown of the Final Grade:		Grading Scale:
Written Assignments	55%	A = 93-100%
Assignment 1 (10%)		B = 83-92%
Assignment 2 (10%)		

Assignment 3 (10%)		C = 73-82%
Assignment 4 (10%)		F = Below 73%
Assignment 5 (15%)		
In-class Discussions and Activities	15%	
Online Discussions and Activities	15%	
Final Exam	15%	
TOTAL	100%	



Graduate Curriculum Committee Course Proposal Form For Courses Numbered 6000 and Higher

Note: Before completing this form, please carefully read the accompanying instructions.

1. Course prefix and number: MATE 6060 2. Date: 02/21/2011

3. Requested action:

X	New Course			
	Revision of Active Course			
	Revision & Unbanking of a Banked Course			
	Renumbering of an Existing Course from			
	from	#	to	#

4. Method(s) of delivery (check all boxes that apply for both current/proposed and expected future delivery methods within the next three years):

Current or Proposed Delivery Method(s):		Expected Future Delivery Method(s):
	On-campus (face to face)	
X	Distance Course (face to face off campus)	X
X	Online (delivery of 50% or more of the instruction is offered online)	X

5. Justification (must cite accreditation and/or assessment by the graduate faculty) for new course or course revision or course renumbering:

This is one of six required courses for the 18-hour NC-DPI K-6 Mathematics Add-on License. The course is based on Standards from the North Carolina Board of Professional Teaching Advanced Standards (NCPTS) and the Mathematics Specialist Standards from the Association of Mathematics Teacher Education (AMTE). The Elementary Mathematics Add-on License is a coordinated effort between the North Carolina Department of Public Instruction (NCDPI), the University of North Carolina General Administration (UNCGA), statewide LEA representation at the school and district levels, and university faculty representation from colleges of education and arts and science. Elementary Mathematics Add-on Licensure students will be eligible to apply courses from the program of study to the MAEd in Mathematics Education. Assessment and verification of the need for the course was made by the graduate faculty in mathematics education (MATE).

6. Course description exactly as it should appear in the next catalog:

6060. Data Analysis and Measurement: K-5 Classroom Interactions (3) P: MATE 6058. Focus on statistical literacy of elementary teachers and the teaching of data analysis and measurement to K-5 students; attention also given to learning methods which facilitate appropriate classroom interactions.

7. If this is a course revision, briefly describe the requested change:

8. Graduate catalog page number from current (.pdf) graduate catalog:

9. Course credit:

Lecture Hours	3	Weekly	<u>OR</u>		Per Term	Credit Hours	3	s.h.
Lab		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Studio		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Practicum		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Internship		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Other (e.g., independent study) Please explain.								
Total Credit Hours							3	s.h.

10. Anticipated annual student enrollment:

11. Affected degrees or academic programs:

Degree(s)/Program(s)	Current Catalog Page	Changes in Degree Hours
MAEd in Mathematics Education/Proposed Elementary Mathematics Education Certificate	186	None

12. Overlapping or duplication with affected units or programs:

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Notification & response from affected units is attached

13. Council for Teacher Education (CTE) approval (for courses affecting teacher education):

<input type="checkbox"/>	Not applicable
<input checked="" type="checkbox"/>	Applicable and CTE has given their approval.

14. Service-Learning Advisory Committee (SLAC) approval

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Applicable and SLAC has given their approval.

15. Statements of support:

a. Staff

<input checked="" type="checkbox"/>	Current staff is adequate
<input type="checkbox"/>	Additional staff is needed (describe needs in the box below):

b. Facilities

<input checked="" type="checkbox"/>	Current facilities are adequate
<input type="checkbox"/>	Additional facilities are needed (describe needs in the box below):

c. Library

X	Initial library resources are adequate
	Initial resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition of required initial resources):

d. Unit computer resources

X	Unit computer resources are adequate
	Additional unit computer resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition):

e. ITCS resources

X	ITCS resources are not needed
	The following ITCS resources are needed (put a check beside each need):
	<input type="checkbox"/> Mainframe computer system
	<input type="checkbox"/> Statistical services
	<input type="checkbox"/> Network connections
	<input type="checkbox"/> Computer lab for students
	<input type="checkbox"/> Software
	<i>Approval from the Director of ITCS attached</i>

16. Course information (see: *Graduate Curriculum and Program Development Manual for instructions*):

a. Textbook(s) and/or readings: author(s), name, publication date, publisher, and city/state/country

<p>Membership NCTM – journal choice should be <i>Teaching Children Mathematics</i>. See: http://www.nctm.org/membership/</p> <p>Additional required readings will be made available at the Blackboard class website</p> <p>Chapin, S. H. & Johnson, A. (2006) <i>Math Matters: Understanding the math you teach</i>, Grades K-8 (Second Edition). Sausalito, CA: Math Solutions. ISBN: 978-0-941355-71-1</p> <p>Chapin, S., O'Connor, C., & Anderson, N. (2009). <i>Classroom Discussions: Using Math Talk to Help Students Learn</i>, Grades, K-6 (Second Edition). Sausalito, CA: Math Solutions. ISBN: 978-1-935099-01-7.</p> <p>Students choose ONE of these two books based on the grade level they teach:</p> <p>FOR K-2: Sheffield, L. J., Cavanagh, M., Dacey, L., Findell, C. R., Greenes, C. E., & Small, M. (2002). <i>Navigating through Data Analysis and Probability in Prekindergarten – Grade 2</i>. Reston, VA: National Council of Teachers of Mathematics. ISBN: 0-87535-520-0</p> <p>FOR 3-5: Chapin, S., Koziol, A., MacPherson, & Rezba, C. (2002). <i>Navigating through Data Analysis and Probability in Grades 3 – 5</i>. Reston, VA: National Council of Teachers of Mathematics. ISBN: 0-87535-521-9</p>

b. Course objectives for the course (student – centered, behavioral focus)

<p>Student Learning Outcomes (SLO). <i>Upon completion of the course students will be able to:</i></p> <p>13. Demonstrate the process of statistical investigation by using the PCAI Method: Posing a question, collecting the data, analyzing the data, and interpreting the results. (AMTE 1a, 2; NCPTS 2,3).</p> <p>14. Describe how the PCAI Model can be applied across K-6 in developmentally appropriate ways (AMTE 2; NCPTS 4).</p> <p>15. Analyze how classroom environments can be set up to support discussion and interactions about statistical investigations (AMTE 2; NCPTS 4).</p>

16. Distinguish different types of data, including categorical and numerical and how each should be appropriately represented (AMTE 1a; NCPTS 3).
17. Demonstrate knowledge of key statistical concepts needed to analyze each type of data, including representations, measures of center, and measures of variability (AMTE 1a; NCPTS 3).
18. Recognize the shape and important features of various distributions of data, including the normal distribution (AMTE 1a; NCPTS 3).
19. Analyze simple probability experiments by representing the possible outcomes (sample space), predicting the probability of these outcomes, and testing predictions (AMTE 1a; NCPTS 3).
20. Make explicit connections between probability concepts and state standards; while creating developmentally appropriate activities for various grade levels (AMTE 2; NCPTS 4).
21. Investigate the common misconceptions held by students (and adults) about probability and data analysis (AMTE 2; NCPTS 4).
22. Use the process of measurement as applied to the collection of data (AMTE 1a; NCPTS 3).
23. Demonstrate key concepts related to units of measure, precision of measurements, and relationships between various units of measure (AMTE 1a; NCPTS 3).
24. Apply systems of measurement using standard and metric systems, including converting between systems using benchmarks (AMTE 1a; NCPTS 3).
25. Apply appropriate techniques, tools, and formulas to determine measurements explaining why these techniques, tools, and formulas determine the measurements desired (AMTE 1a; NCPTS 3).
26. Analyze classroom environments in terms of classroom interactions (language, doing mathematics, classroom culture) (AMTE 2; NCPTS 2,4).
27. Create a plan to support their and others' establishment of a mathematically rich classroom (AMTE 2; NCPTS 1, 2, 4).

c. Course topic outline (1 module per topic)

1. PCAI Model
2. Types of Data, Collecting Data
3. Analyzing Data
4. Interpreting Data
5. Probability
6. Misconceptions about Data, Statistical Literacy
7. Measurement Processes
8. Measurements and Data Collection
9. Systems of Measurement
10. Analyzing Measurement Data
11. Distributions and Inference
12. Setting Up a Mathematically Rich Classroom
13. Language and Vocabulary in Mathematics
14. Integrating Literature into Mathematics
15. Designing Developmentally-Appropriate Instruction

d. List of course assignments, weighting of each assignment, and grading/evaluation system for determining a grade

Course Evaluation: The final grade will be based on a series of written assignments, measures of participation, and scores on a midterm and final exam.

Written Assignments: Task Analysis, Development, Implementation, and Reflection (TADIR) Projects. Students will be introduced to three different mathematical tasks/problems which will

require them to a) explore mathematical content in depth and engage in mathematical reasoning and problem solving, b) modify the task for use in their grade level and c) teach the mathematical content of the task and implement various pedagogical strategies designed to enhance interaction in the classroom, and d) reflect on students' mathematical learning and the effectiveness of the strategies used. Each of the tasks will be introduced at an advanced level. Students will be responsible for revising the task for their grade level and implementing the task in the classroom. Student samples will be used to reflect on student learning and the role that new pedagogical strategies and content depth played in mathematical understanding. Students will be graded on their participation in the problem solving process, their modification of the task/lesson planning, and their reflections.

- a. TADIR Project #1 – Data Analysis (SLO 1, 2, 3, 4, 5, 6, 9)
- b. TADIR Project #2 – Probability (SLO 7, 8, 9)
- c. TADIR Project #3 – Measurement (SLO 10, 11, 12, 13)

Class Participation: Students are expected to be on time for each class session and to be prepared by completing and reflecting upon each reading – i.e., marking points that they would like to discuss and noting questions they would like to ask – as well as completing any assignments. During class, they should offer thought-provoking comments/questions and participate in all in-class projects and activities. Please monitor their participation, adding to the conversation but not dominating entirely. This course is seminar-style, meaning that in-class and online contributions are a significant part of the class. The online writings activities serve as important springboards for class discussions and individual learning. Students are expected to post their online postings within the specified deadlines. Responses to online prompts and their classmates' ideas should be thoughtful and detailed.

Exams: A midterm and final exam will be administered to assess the extent to which the students have mastered the course objectives. Both exams will be a blend of multiple choice and open response and will be administered online through Blackboard; dates for the exams will be announced at the first class meeting.

Breakdown of the Final Grade:

Written Assignments	210 points
Task Analysis and Development #1 (70 points)	
Task Analysis and Development #2 (70 points)	
Task Analysis and Development #3 (70 points)	
Midterm Exam	100 points
Final Exam	100 points
Class Discussion	100 points

TOTAL: 510 points

Grading Scale:

- A = 474–510 points
- B = 423–473 points
- C = 372–422 points
- F = Below 372 points



Graduate Curriculum Committee Course Proposal Form For Courses Numbered 6000 and Higher

Note: Before completing this form, please carefully read the accompanying instructions.

1. Course prefix and number: MATE 6061 2. Date: 02/21/2011

3. Requested action:

X	New Course			
	Revision of Active Course			
	Revision & Unbanking of a Banked Course			
	Renumbering of an Existing Course from			
	from	#	to	#

4. Method(s) of delivery (check all boxes that apply for both current/proposed and expected future delivery methods within the next three years):

Current or Proposed Delivery Method(s):		Expected Future Delivery Method(s):
	On-campus (face to face)	
X	Distance Course (face to face off campus)	X
X	Online (delivery of 50% or more of the instruction is offered online)	X

5. Justification (must cite accreditation and/or assessment by the graduate faculty) for new course or course revision or course renumbering:

This is one of six required courses for the 18-hour NC-DPI K-6 Mathematics Add-on License. The course is based on Standards from the North Carolina Board of Professional Teaching Advanced Standards (NCPTS) and the Mathematics Specialist Standards from the Association of Mathematics Teacher Education (AMTE). The Elementary Mathematics Add-on License is a coordinated effort between the North Carolina Department of Public Instruction (NCDPI), the University of North Carolina General Administration (UNCGA), statewide LEA representation at the school and district levels, and university faculty representation from colleges of education and arts and science. Elementary Mathematics Add-on Licensure students will be eligible to apply courses from the program of study to the MAEd in Mathematics Education. Assessment and verification of the need for the course was made by the graduate faculty in mathematics education (MATE).

6. Course description exactly as it should appear in the next catalog:

6061. Algebraic Reasoning: K-5 Discourse and Questioning (3) P: MATE 6058. Focus on the early algebra concepts of functional thinking and generalized arithmetic in relationship to pedagogical practices centered on questioning in the mathematics classroom.

7. If this is a course revision, briefly describe the requested change:

8. Graduate catalog page number from current (.pdf) graduate catalog:

9. Course credit:

Lecture Hours	3	Weekly	<u>OR</u>		Per Term	Credit Hours	3	s.h.
Lab		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Studio		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Practicum		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Internship		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Other (e.g., independent study) Please explain.								
Total Credit Hours							3	s.h.

10. Anticipated annual student enrollment:

50

11. Affected degrees or academic programs:

Degree(s)/Program(s)	Current Catalog Page	Changes in Degree Hours
MAEd in Mathematics Education/Proposed Elementary Mathematics Education Certificate	186	None

12. Overlapping or duplication with affected units or programs:

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Notification & response from affected units is attached

13. Council for Teacher Education (CTE) approval (for courses affecting teacher education):

<input type="checkbox"/>	Not applicable
<input checked="" type="checkbox"/>	Applicable and CTE has given their approval.

14. Service-Learning Advisory Committee (SLAC) approval

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Applicable and SLAC has given their approval.

15. Statements of support:

a. Staff

<input checked="" type="checkbox"/>	Current staff is adequate
<input type="checkbox"/>	Additional staff is needed (describe needs in the box below):

b. Facilities

<input checked="" type="checkbox"/>	Current facilities are adequate
<input type="checkbox"/>	Additional facilities are needed (describe needs in the box below):

c. Library

X	Initial library resources are adequate
	Initial resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition of required initial resources):

d. Unit computer resources

X	Unit computer resources are adequate
	Additional unit computer resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition):

e. ITCS resources

X	ITCS resources are not needed
	The following ITCS resources are needed (put a check beside each need):
	<input type="checkbox"/> Mainframe computer system
	<input type="checkbox"/> Statistical services
	<input type="checkbox"/> Network connections
	<input type="checkbox"/> Computer lab for students
	<input type="checkbox"/> Software
	<i>Approval from the Director of ITCS attached</i>

16. Course information (see: *Graduate Curriculum and Program Development Manual for instructions*):

a. Textbook(s) and/or readings: author(s), name, publication date, publisher, and city/state/country

<p>Blanton, M. L. (2008). <i>Algebra and the elementary classroom</i>. Heinemann: Portsmouth, NH.</p> <p>Carpenter T. P., Franke, M. L., & Levi, L. (2003). <i>Thinking mathematically: Integrating arithmetic & algebra in the elementary school</i>. Heinemann: Portsmouth, NH.</p> <p>Students choose ONE of these two books based on the grade level you teach:</p> <p>FOR K-2: Sheffield, L. J., Cavanagh, M., Dacey, L., Findell, C. R., Greenes, C. E., & Small, M. (2002). <i>Navigating through Algebra in Prekindergarten – Grade 2</i>. Reston, VA: National Council of Teachers of Mathematics. ISBN: 0-87535-520-0</p> <p>FOR 3-5: Chapin, S., Koziol, A., MacPherson, & Rezba, C. (2002). <i>Navigating through Algebra in Grades 3 – 5</i>. Reston, VA: National Council of Teachers of Mathematics. ISBN: 0-87535-521-9</p>

b. Course objectives for the course (student – centered, behavioral focus)

<p>This course aims to develop the content and pedagogical content knowledge of in-service elementary teachers in the areas of Algebra and Algebraic Reasoning. Algebra is a content standard listed by the National Council of Teachers of Mathematics beginning at the Pre-K level and extending through grade 12. <i>Early Algebra</i> is of particular importance to children and is foundational in helping them to reason and problem-solve – especially in the areas of arithmetic and functions. This course is also designed to help teachers make the decision-making processes required for providing appropriate mathematical experiences for children. By engaging in and analyzing activities which emphasize algebraic reasoning, students of this course will develop an understanding of the essential approaches vital in teaching algebra effectively.</p> <p>Student Learning Outcomes (SLO). Upon completion of this course the successful student will be able to:</p>

28. Design a variety of appropriate instructional strategies to assist elementary children in constructing algebraic ideas (AMTE 2; NCPTS 4).
29. Compare and Contrast content knowledge in K-8 algebraic thinking based upon national standards (i.e. NCSCS – North Carolina Standard Course of Study, NCTM – National Council of Teachers of Mathematics) (AMTE 1a; NCPTS 3).
30. Distinguish patterns, relations, and functions from a variety of perspectives. (AMTE 1a; NCPTS 3).
31. Represent mathematical situations and structures using algebraic symbols (AMTE 1a; NCPTS 3).
32. Prove mathematical conjectures (AMTE 1a; NCPTS 3).
33. Create mathematical models to represent and understand quantitative relationships (AMTE 1a; NCPTS 3).
34. Illustrate how to facilitate discourse to elicit algebraic reasoning in elementary classrooms (AMTE 1b; NCPTS 2).
35. Demonstrate the assessment of algebraic reasoning in elementary classrooms through questioning and listening to students, analyzing students' written work, documenting patterns of students' thinking and planning appropriate student/teacher interactions (AMTE 1b; NCPTS 2).
36. Develop a plan to support teachers' use of higher-order questions (AMTE 3; NCPTS 1)

c. Course topic outline (1 module per topic)

- Module 1 – Getting to know you/Building a discussion based mathematics community
- Module 2 – Algebra as generalized arithmetic/encouraging students to make and test mathematical conjectures
- Module 3 – Generalizations and arithmetic properties including number systems & operations
- Module 4 – Making a known quantity unknown/varying a known quantity
- Module 5 – The equal sign/finding missing numbers
- Module 6 – Thinking algebraically with the hundred chart
- Module 7 – Exam 1
- Module 8 – Algebra as functional thinking through discourse and questioning
- Module 9 – Developing representational tools
- Module 10 – Keeping the independent variable explicit
- Module 11 – Transitioning from recursive patterns to functional relationships
- Module 12 – Moving from words to symbols/ Transforming arithmetic tasks into opportunities for algebraic thinking/Exam 2
- Module 13 – Review for portfolio guidelines/final exam
- Module 14 – Portfolio/Final Exam

d. List of course assignments, weighting of each assignment, and grading/evaluation system for determining a grade

Weekly Homework Assignments (SLO 1, 2 etc)

Each week you are expected to post comments on **Blackboard** about a reading or problems I have assigned. These comments are graded on a 3-point rubric as follows:

- 3 – Response addresses the prompt with references to the readings for the week, and when appropriate, earlier readings. Opinions, observations, and/or past experiences are thoughtfully related to the readings throughout the response.
- 2 – Response addresses the prompt with references to the readings for the week. Connections between the readings and opinions, observations, and/or past experiences are present.

1 – Response submitted either does not address the prompt or does not refer to the readings.

0 – No response is submitted.

Class Participation/Attendance (SLO 1, 2 etc)

This course is an opportunity for you to become part of a community of learners who are committed to learning about teaching and learning through reading, writing, discussing, and collaborating. Your overall involvement in the course includes the following:

- **Intellectual risk taking:** demonstrated willingness to offer and pursue ideas and suggestions that go beyond the ordinary
- **Making connections:** demonstrated ability to connect the theoretical and the practical, to relate specific ideas to larger themes
- **Thinking clearly on paper:** demonstrated proficiency in expressing ideas, organizing information, and communicating in writing
- **Contributing to the community:** demonstrated willingness to share information and ideas with the group and to support others in their efforts to build understanding
- **Commitment to developing listening and speaking skills:** demonstrated effort to develop effective speaking skills and active listening and responding skills
- **Commitment to exploring new ways to think about teaching and learning mathematics:** demonstrated willingness to being open to trying out new ways of teaching mathematics and to allowing children opportunities to make sense of mathematics.

Midcourse Exams (SLO 1-8)

There will be 2 exams given that cover K-8 algebraic content, the first exam will cover algebra as generalized arithmetic and the second will cover algebra as functional thinking. Each exam will be a blend of multiple choice and open response. See **Blackboard** for dates.

Questioning & Discourse Assessment (SLO 1-8)

Students are to spend time interacting with a small group of children (Grades K-5). Complete five student activities from their textbooks. The assessment of the activity is to be focused on discourse and questioning in developing algebraic reasoning. Prior to each session you are to complete a planning grid. At the completion of each session, you are to record your experiences from the session. Examine each student's understanding by completing the chart, "Analyzing Students' Written Work". Write notes on the questions you asked, the discourse tools you used, and the impact they had on student understanding. Bring both the planning grids and notes to class in July so that you can share ideas with others and raise questions about what you noticed. You will submit a written reflection of the student assessments to be included in your final portfolio.

Grades will be determined in the following manner:

- | | |
|---|-----|
| 1. Weekly Homework Assignments | 15% |
| 2. Class Participation/Attendance | 10% |
| 3. Midcourse Exams (2) | 20% |
| 4. Questioning & Discourse Assessment | 25% |
| 5. Final Assessment (content exam/course portfolio) | 30% |

Grading Scale:

A = 93–100%

B = 83–92%

C = 73–82%

F = Below 73%



Graduate Curriculum Committee Course Proposal Form For Courses Numbered 6000 and Higher

Note: Before completing this form, please carefully read the accompanying instructions.

1. Course prefix and number: MATE 6062 2. Date: 02/21/2011

3. Requested action:

X	New Course			
	Revision of Active Course			
	Revision & Unbanking of a Banked Course			
	Renumbering of an Existing Course from			
	from	#	to	#

4. Method(s) of delivery (check all boxes that apply for both current/proposed and expected future delivery methods within the next three years):

Current or Proposed Delivery Method(s):		Expected Future Delivery Method(s):
	On-campus (face to face)	
X	Distance Course (face to face off campus)	X
X	Online (delivery of 50% or more of the instruction is offered online)	X

5. Justification (must cite accreditation and/or assessment by the graduate faculty) for new course or course revision or course renumbering:

This is one of six required courses for the 18-hour NC-DPI K-6 Mathematics Add-on License. In this course teachers will deepen their knowledge of geometry while exploring the high leverage teaching practice of assessment. The course is based on Standards from the North Carolina Board of Professional Teaching Advanced Standards (NCPTS) and the Mathematics Specialist Standards from the Association of Mathematics Teacher Education (AMTE). The Elementary Mathematics Add-on License is a coordinated effort between the North Carolina Department of Public Instruction (NCDPI), the University of North Carolina General Administration (UNCGA), statewide LEA representation at the school and district levels, and university faculty representation from colleges of education and arts and science. Elementary Mathematics Add-on Licensure students will be eligible to apply courses from the program of study to the MAEd in Mathematics Education. Assessment and verification of the need for the course was made by the graduate faculty in mathematics education (MATE).

6. Course description exactly as it should appear in the next catalog:

6062. Geometry and Spatial Visualization: K-5 Assessment (3) P: MATE 6058. Geometric concept development along with formative and summative assessment strategies of students' geometric thinking; attention also given to geometric content knowledge and diagnosis of student errors.

7. If this is a course revision, briefly describe the requested change:

8. Graduate catalog page number from current (.pdf) graduate catalog:

9. Course credit:

Lecture Hours	3	Weekly	<u>OR</u>		Per Term	Credit Hours	3	s.h.
Lab		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Studio		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Practicum		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Internship		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Other (e.g., independent study) Please explain.								
Total Credit Hours							3	s.h.

10. Anticipated annual student enrollment:

50

11. Affected degrees or academic programs:

Degree(s)/Program(s)	Current Catalog Page	Changes in Degree Hours
MAEd in Mathematics Education/Proposed Elementary Mathematics Education Certificate	186	None

12. Overlapping or duplication with affected units or programs:

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Notification & response from affected units is attached

13. Council for Teacher Education (CTE) approval (for courses affecting teacher education):

<input type="checkbox"/>	Not applicable
<input checked="" type="checkbox"/>	Applicable and CTE has given their approval.

14. Service-Learning Advisory Committee (SLAC) approval

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Applicable and SLAC has given their approval.

15. Statements of support:

a. Staff

<input checked="" type="checkbox"/>	Current staff is adequate
<input type="checkbox"/>	Additional staff is needed (describe needs in the box below):

b. Facilities

<input checked="" type="checkbox"/>	Current facilities are adequate
<input type="checkbox"/>	Additional facilities are needed (describe needs in the box below):

c. Library

X	Initial library resources are adequate
	Initial resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition of required initial resources):

d. Unit computer resources

X	Unit computer resources are adequate
	Additional unit computer resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition):

e. ITCS resources

X	ITCS resources are not needed
	The following ITCS resources are needed (put a check beside each need):
	<input type="checkbox"/> Mainframe computer system
	<input type="checkbox"/> Statistical services
	<input type="checkbox"/> Network connections
	<input type="checkbox"/> Computer lab for students
	<input type="checkbox"/> Software
	<i>Approval from the Director of ITCS attached</i>

16. Course information (see: *Graduate Curriculum and Program Development Manual for instructions*):

a. Textbook(s) and/or readings: author(s), name, publication date, publisher, and city/state/country

Clarke, D. (1997). *Constructive assessment in mathematics: Practical steps for classroom teachers*. Berkeley, CA: Key Curriculum Press.

Chapin, S. H., & Johnson, A. (2006). *Math Matters* (2nd ed.). Sausalito, CA: Math Solutions Publications.

Assessment Standards for School Mathematics
 <<http://standards.nctm.org/Previous/AssStds/index.htm>>
 North Carolina Standard Course of Study

b. Course objectives for the course (student – centered, behavioral focus)

Student Learning Outcomes (SLO). *Upon completion of the course, students will be able to:*

1. Demonstrate content knowledge of geometry, specifically shapes and properties, location, transformations and spatial relationships/visualization (AMTE 1a; NCPTS 1, 3)
2. Demonstrate advanced knowledge of mathematics pedagogy related to geometry in the elementary grades (AMTE 2b, NCPTS 3)
3. Demonstrate the use of appropriate technology to support student learning of geometry (AMTE 2b, NCPTS 3)
4. Determine and use different assessment strategies that will measure student learning and understanding (AMTE 2a, 2c, NCPTS 1, 3)
5. Demonstrate the ability to help students connect the content that they are studying to their existing mathematical knowledge, to other disciplines, and to the “real” world (AMTE 2b, NCPTS 3)

c. Course topic outline (1 module per topic)

37. Introduction to Geometry, VanHiele Levels of Development

38. Analyzing Students' Spatial Visualization
39. Triangles
40. Quadrilaterals/Circles
41. SOLO Taxonomy—Diagnosing Students' Computational Errors
42. Transformations
43. Tessellations, Patterns in Geometry
44. Symmetry
45. Nets of 3-Dimensional Shapes
46. Categorizing 3-Dimensional Shapes
47. Area and Perimeter
48. Volume of 3-Dimensional Shapes
49. Geometry/Algebra Connections
50. Analyzing and Creating Content-Based Tests
51. Formative Assessment—Using Data to Drive Instruction

d. List of course assignments, weighting of each assignment, and grading/evaluation system for determining a grade

Assignments

1. *IQs* (Included in participation grade). Each student is expected to read and respond to the assigned readings with at least two ideas (I) that you learned about teaching and learning mathematics and at least two questions (Q) that you will share with the class to help guide the class discussion of the reading. We will use the IQs as we discuss the assigned readings in class. For selected classes you may be asked to bring in a favorite math activity to share and to bring copies for the class. (SLO 1, 2, 3, 4)
2. *Test Analysis/Creation* (15%) You will translate North Carolina Standard Course of Study goals and objectives into appropriate assessment activities for evaluating student learning. (SLO 1, 2, 3, 4, 5)
3. *Diagnostic Interview* (15%) You will interview a student using geometry tasks and report that student's understanding, using research to support your judgments and statements. (SLO 1, 2, 4, 5)
4. *Content Analysis of Student Responses* (15%) You will use assessments to inform and improve student learning. (SLO 1, 2, 3, 4, 5)
5. *Developing Mathematical Understanding* (20%) You will complete problem sets that focus on geometry content knowledge. (SLO 1)
6. *Test/Quizzes* (25%) Formal assessments that will assess your content knowledge. (SLO 1)

Grades will be determined in the following manner:

- | | |
|--|-----|
| 6. Preparedness, Participation, & Attendance (Assignment #1 - IQs) | 10% |
| 7. Test Analysis/Creation | 15% |
| 8. Clinical Interview | 15% |
| 9. Content Analysis | 15% |
| 10. Developing Mathematical Understanding | 20% |
| 11. Quizzes/Tests | 25% |

Grading Scale:

- A = 93–100%
- B = 83–92%
- C = 73–82%
- F = Below 73%



Graduate Curriculum Committee Course Proposal Form For Courses Numbered 6000 and Higher

Note: Before completing this form, please carefully read the accompanying instructions.

1. Course prefix and number: MATE 6063 2. Date: 02/21/2011

3. Requested action:

X	New Course			
	Revision of Active Course			
	Revision & Unbanking of a Banked Course			
	Renumbering of an Existing Course from			
	from	#	to	#

4. Method(s) of delivery (check all boxes that apply for both current/proposed and expected future delivery methods within the next three years):

Current or Proposed Delivery Method(s):		Expected Future Delivery Method(s):
	On-campus (face to face)	
X	Distance Course (face to face off campus)	X
X	Online (delivery of 50% or more of the instruction is offered online)	X

5. Justification (must cite accreditation and/or assessment by the graduate faculty) for new course or course revision or course renumbering:

This course is the required capstone course for the 18-hour NC-DPI K-6 Mathematics Add-on License. Learners focus on generating mathematical representations and making explicit connections in the context of completing mathematical tasks. The course is based on Standards from the North Carolina Board of Professional Teaching Advanced Standards (NCPTS) and the Mathematics Specialist Standards from the Association of Mathematics Teacher Education (AMTE). The Elementary Mathematics Add-on License is a coordinated effort between the North Carolina Department of Public Instruction (NCDPI), the University of North Carolina General Administration (UNCGA), statewide LEA representation at the school and district levels, and university faculty representation from colleges of education and arts and science. Elementary Mathematics Add-on Licensure students will be eligible to apply courses from the program of study to the MAEd in Mathematics Education. Assessment and verification of the need for the course was made by the graduate faculty in mathematics education (MATE).

6. Course description exactly as it should appear in the next catalog:

6063. Mathematical Modeling: K-5 Leadership (3) P: MATE 6058, 6059, 6060, 6061, 6062. Generating mathematical representations and making explicit connections between concepts. Pedagogy designed to equip elementary teachers to become mathematics teacher-leaders in school settings; attention also given to topics integrated within mathematical strands.

7. If this is a course revision, briefly describe the requested change:

8. Graduate catalog page number from current (.pdf) graduate catalog:

9. Course credit:

Lecture Hours	3	Weekly	<u>OR</u>		Per Term	Credit Hours	3	s.h.
Lab		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Studio		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Practicum		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Internship		Weekly	<u>OR</u>		Per Term	Credit Hours		s.h.
Other (e.g., independent study) Please explain.								
Total Credit Hours							3	s.h.

10. Anticipated annual student enrollment:

50

11. Affected degrees or academic programs:

Degree(s)/Program(s)	Current Catalog Page	Changes in Degree Hours
MAEd in Mathematics Education/Proposed Elementary Mathematics Education Certificate	186	None

12. Overlapping or duplication with affected units or programs:

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Notification & response from affected units is attached

13. Council for Teacher Education (CTE) approval (for courses affecting teacher education):

<input type="checkbox"/>	Not applicable
<input checked="" type="checkbox"/>	Applicable and CTE has given their approval.

14. Service-Learning Advisory Committee (SLAC) approval

<input checked="" type="checkbox"/>	Not applicable
<input type="checkbox"/>	Applicable and SLAC has given their approval.

15. Statements of support:

a. Staff

<input checked="" type="checkbox"/>	Current staff is adequate
<input type="checkbox"/>	Additional staff is needed (describe needs in the box below):

b. Facilities

<input checked="" type="checkbox"/>	Current facilities are adequate
<input type="checkbox"/>	Additional facilities are needed (describe needs in the box below):

c. Library

X	Initial library resources are adequate
	Initial resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition of required initial resources):

d. Unit computer resources

X	Unit computer resources are adequate
	Additional unit computer resources are needed (in the box below, give a brief explanation and an estimate for the cost of acquisition):

e. ITCS resources

X	ITCS resources are not needed
	The following ITCS resources are needed (put a check beside each need):
	Mainframe computer system
	Statistical services
	Network connections
	Computer lab for students
	Software
	<i>Approval from the Director of ITCS attached</i>

16. Course information (see: *Graduate Curriculum and Program Development Manual for instructions*):

a. Textbook(s) and/or readings: author(s), name, publication date, publisher, and city/state/country

Carpenter, T., Fennema, E., & Franke, M. L. (1996). Cognitively guided instruction: A knowledge base for reform in primary mathematics instruction. *The Elementary School Journal*, 97(1), 3-20.

Franke, M.L., Kazemi, E., & Battey, D. (2007). Understanding teaching and classroom practice in mathematics. In F. Lester (Ed.) *Second Handbook of Research on Mathematics Teaching and Learning*, (p. 225-256).

Heck, D.J., Banilower, E.R., Weiss, I.R., & Rosenberg, S.L. (2008). Studying the effects of professional development: The case of the NSF's local systemic change through teacher enhancement initiative. *Journal for Research in Mathematics Education*, 39(2), 113-152.

Loucks-Horsley, S., Love, N., Stiles, K. E., Mundry, S. & Hewson, P. W. (2003). *Designing professional development for teachers of science and mathematics (2nd ed.)*. Thousand Oaks, CA: Corwin Press. (selected chapters)

b. Course objectives for the course (student – centered, behavioral focus)

- Student Learning Outcomes (SLO).** Upon completion of the course students will be able to:
1. Generate multiple mathematical representations for a given task (AMTE 1a, 1b; NCPTS 3).
 2. Make explicit connections between mathematical concepts within the context of mathematical tasks (AMTE 1a, 1b; NCPTS 3).
 3. Solve mathematical tasks that integrate numerous mathematical concepts (AMTE 1a, 1b; NCPTS 3).
 4. Communicate research trends in mathematics teaching and learning (AMTE 2; NCPTS 3).

5. Synthesize knowledge from previous courses to complete mathematical tasks (AMTE 1a, 1b; NCPTS 3).
6. Synthesize national and state mathematics standards to identify commonalities and differences (AMTE 3; NCPTS 1, 3, 5).
7. Critically discuss mathematics curriculum related to the teaching of mathematical concepts (AMTE 1c; NCPTS 3).
8. Differentiate between types of assessment, citing issues, benefits and drawbacks of each (AMTE 1a, 2; NCPTS 3, 5).
9. Design professional development based on mathematical concepts and high-leverage pedagogies (AMTE 2; NCPTS 4).

c. Course topic outline (1 module per topic)

Unit I: Critical Issues in Mathematics

1. Foundations of Standards
2. Current Issues in Mathematics Teaching and Learning
3. State Issues in Mathematics Teaching and Learning
4. Leading Mathematics Teachers in an Era of High-Stakes Assessment

Unit II: Exploring the Role of Curriculum

5. Overview of Elementary Mathematics Curriculum
6. Mapping Mathematics Curriculum, Content, and Standards
7. Modifying Elementary Mathematics Curriculum
8. Alternative Assessments in Elementary Mathematics

Unit III: Effective Mathematics Teaching

9. Unpacking and Pacing the Instruction of Mathematics Content
10. Differentiating Mathematics Instruction
11. Teaching Mathematics to Diverse Learners

Unit IV: Supporting Teacher Change

12. Supporting Teacher Learning in Elementary Mathematics
13. Coaching and Mentoring Elementary Mathematics Teachers
14. Facilitating Mathematics Professional Development Workshops
15. Evaluating Teachers and Grant Writing

d. List of course assignments, weighting of each assignment, and grading/evaluation system for determining a grade

ASSIGNMENTS:

All written items should include a professional standard of spelling, grammar and punctuation. Cohesion of thought, clarity of expression, depth of reading, analysis of issues and relevance of discussion will need to be evident. Use of appropriate referencing style, use of headings and subtitles if necessary and reference list will be standard requirements for each assignment.

1. **Assignment #1 – Critical Issues Paper** (Unit 1). Given the foundation on critical issues provided in class, the student will choose an issue upon which to expand or choose a related issue upon which to investigate and report. Recommendations for the student’s educational context must be provided in the paper. (SLO: 4 and 6)
2. **Assignment #2 – Analysis of Mathematics Curriculum** (Unit 2). Using tasks frameworks introduced or reviewed in the course, the student will analyze a portion of a mathematics textbook for the cognitive demands of the tasks, how the text motivates and develops mathematics ideas,

and to what extent the treatment of the mathematics has the potential to encourage and foster the use of multiple representations. Explicit attention is to be given to curriculum-embedded assessments. (SLO: 1, 2, 4, 7, and 8).

3. **Assignment #3 – Pacing Guide** (Unit 3). Pacing guide is to be developed by teams of teachers and is to be based on state and national curriculum standards, a current textbook, and recommendations from research. (SLO: 4, 6, and 7)
4. **Assignment #4 – Mentoring Elementary Mathematics Teacher on Differentiation and Diversity** (Unit 3). Based on best practices for professional development, and particularly models for coaching, the student will mentor an elementary mathematics teacher in using assessment data (informal and formal) to enhance student learning. Product will be a synthesis of key ideas on assessment and coaching used for the mentorship, field notes on the mentoring episodes, and a conclusion/reflection on the process. (SLO: 4, 8, and 9)
5. **Assignment #5 – Proposal for a Grant to Support Mathematics Teaching** (Unit 4). Student will write and submit a grant proposal designed to fill a need within her/his educational setting. Grant proposal must address either mathematics standards for learning or provide a professional development opportunity for teachers. (SLO: 6 or 9)
6. **Assignment #6 – Professional Development Module** (Unit 4). This is the culminating leadership activity for the course. Student will select, design, modify, etc. a sustained professional development activity and deliver a portion of it. Professional development must involve teachers or administrators and is to be research based, standards based, and have a strong mathematics focus (SLO: 2, 4, 6, and 9)
7. **Assignment #7 – Portfolio of Mathematical Tasks Explored During the Semester.** Mathematical tasks will be assigned, collected, and provided with feedback throughout the semester. The student will collect these tasks, ensure they are correct, provide the appropriate numbers of solutions and representations, and reflect on a subset of the tasks. (SLO: 1, 2, 3, and 5)
8. **Assignment #8 – Mathematics Content Test.** Comprehensive mathematics test assesses mathematical capability from each of the certificate courses. Emphasis will be on ability to solve problems from all mathematical strands, using various problem-solving strategies, and multiple representations for modeling the mathematics. (SLO: 1, 2, 3, and 5)

Course Requirements and Evaluation:

Grading: Final grade for the semester will be based on a series of written assignments, projects, test, and portfolio as shown below. Specific guidelines and grading criteria will be given over the course of the semester for each assignment. Anticipate a grade reduction for late assignments. Your final grade will be determined as follows:

Assignment #1 – Critical Issues Paper (Unit 1)	10%
Assignment #2 – Analysis of Mathematics Curriculum (Unit 2)	10%
Assignment #3 – Pacing Guide (Unit 3)	5%
Assignment #4 – Mentoring Elementary Math Teacher on Differentiation and Diversity (Unit 3)	15%
Assignment #5 – Proposal for a Grant to Support Mathematics Teaching (Unit 4)	5%
Assignment #6 – Professional Development Module (Unit 4)	15%
Assignment #7 – Portfolio of Mathematical Tasks Explored During the Semester	20%
Assignment #8 – Mathematics Content Test	20%

Grading Scale:

A = 93–100%
B = 83–92%
C = 73–82%
F = Below 73%