

MEMORANDUM

To: Scott Gordon
Chair, Educational Policies and Planning Committee

From: Sid Rachlin
Coordinator, MSITE Elementary Mathematics Add-on License Committee

Date: February 26, 2011

Subject: Educational Policies and Planning Committee Request

On behalf of the graduate faculty of the Mathematics Education Area of the Department of Mathematics, Science, and Instructional Technology Education, I request that the establishment of a new certificate program, Elementary Mathematics Education, be placed on the 4/8/2011 Educational Policies and Planning Committee agenda.

Unlike other programs where individual universities establish a program of study to meet state licensing objectives, the NC State Board of Education has charged the 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 has been working on the design and pilot of the program of study for the last two years. As much as possible, each university will be using the same course syllabi and catalog descriptions. A common end-of-program assessment system will be used by all universities as part of the NCDPI licensure requirements.

Proposed New Certificate Program in Elementary Mathematics Education

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, including titles and course descriptions both for existing courses and any new courses that may be developed.

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 is 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 is 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; Focus given to topics integrated within mathematical strands.

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.

These six courses are being 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 are completing all six pilot courses and assisted in the development of the syllabi.

If approved, students will participate in the certificate program in 25 member cohorts. The first cohort will begin Fall 2011 and end their program of study in Spring 2014. The courses will be offered in the following sequence:

Fall 2011—MATE 6058

Spring 2012—MATE 6059

Fall 2012—MATE 6060

Spring 2013—MATE 6061

Fall 2013—MATE 6062

Spring 2014—MATE 6063

4. The catalog copy for the certificate program.

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.

5. 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 Board included Alan Mabe & Alisa Chapman (UNCGA), Sid Rachlin (ECU), Sarah Berenson (UNCG), Tyrette Carter (NC A&T), Jere Confrey (NCSU), Susan Friel (UNCCH), Katie Mawhinney (ASU), Kitty Rutherford (NCDPI), and Wendy Rich, Asheboro 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 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%): Data Analysis Secondary (20%): Measurement
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
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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 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) participates as students in all six courses offered to the Guilford County teachers. After each class session they submit a written evaluation including their sense of how well the lesson was meeting both course and program objectives. They also suggest 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 is also serving as an evaluator. She reviews the session evaluations prepared by the others and discusses similarities and differences in the implementation in her cohort. Each of the four evaluators holds a masters degree.

Three times a year, the Curriculum Development Team meets 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 participates in these discussions and adds the perspective of someone who has completed all six courses in the program of study.

6. 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.

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

The consortium of UNC universities will develop a course evaluation and program assessment structure for use throughout the system. 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. Through reflection the candidate will answer the following questions: *Why you chose these artifacts? Taken together, why are these artifacts evidence of meeting this objective? How has what you've described had an impact on students' learning?* Specific objectives to be addressed by the portfolio include:

Objective I: Content and Pedagogical Knowledge –Demonstrate advanced knowledge of the mathematical pedagogy and content appropriate for the student in certification level by:

- a. Exhibiting knowledge of that level and a level beyond, and exhibiting knowledge of appropriate teaching methodologies for the mathematics and students of the certification level
- b. Using appropriate technology to support student learning
- c. Using different assessment strategies that will effectively measure student learning and understanding
- d. Helping students connect the content that they are studying to their existing mathematical knowledge, to other disciplines, and to the “real” world

Objective II: Issues of Diversity – Respond effectively to difference in how students learn by:

- a. Respecting differences among students due to exceptionalities, learning styles, cultural and socioeconomic backgrounds, and gender
- b. Using different instructional strategies that take into account the different learning styles of students
- c. Employing assessments that are equitable open coherent processes, that measure important mathematics and by which the teacher can make valid inferences of student learning

Objective III: The Teacher as a Learner – Improve capabilities and initiative to becoming more responsible for personal and professional growth by:

- a. Taking responsibility for their own learning
- b. Setting and maintaining high standards for their own learning
- c. Setting and maintaining high standards for own instructional performance
- d. “Critically reading” professional literature including current research in content, learning theories, pedagogy, and assessment

Objective IV: The Teacher as Leader – Serve as an educational leader by:

- a. Taking and active role in professional organizations

- b. Taking an active role on school advisory teams
- c. Serving as role models and mentors for less experienced teachers
- d. Working collaboratively with parents and the school community
- e. Taking advantage of community resources to enhance class instruction and student learning.

The Comprehensive Exam will be administered as part of MATE 6063, the capstone course. The exam will be piloted next spring with the two cohorts currently completing the pilot courses. A common exam will be administered at each UNC consortium university. The portfolio assessment will also be completed during the capstone course. Representative from partner universities will assist in the reviews of the portfolios submitted at ECU.

8. 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.

9. 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. Adjunct faculty associated with the program should also include up-to-date curriculum vitae.

ECU Graduate Faculty who participated in the initial weeklong retreat that led to the initial planning of the program of study: Kwaku Adu Gyamfi, Sunday Ajose, Sid Rachlin, and Katie Schwartz

ECU Graduate Faculty who participated in the Curriculum Research & Development Pilot of the Six Graduate Courses: Katie Schwartz, Ron Preston, and Sid Rachlin

10. The name and curriculum vita of the faculty member who will be designated as the coordinator of the program for purposes of communication with the Graduate School.

Sid Rachlin, Professor of Mathematics Education (Curriculum Vita Attached)

11. If the proposed graduate certificate program contains no new courses, no new faculty, no additional costs, and maintains the admissions and academic standing requirements of a related degree program, the proposal will be given expedited review in the approval process.

NA

12. The unit offering the certificate program must specify what professional license, if any, 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.

13. 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

14. The minimum number of weeks required for a student to complete this certificate. Fall and spring semesters count as 15 weeks each and a regular summer term counts as 5 weeks. Prerequisites should be considered in determining this number.

The certificate is anticipated to take ninety weeks to complete. Programs will generally include three academic years.

SIDNEY L. RACHLIN
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EAST CAROLINA UNIVERSITY, GREENVILLE, NC 27858

PROFESSIONAL PREPARATION

Shippensburg State University, Secondary Education — Mathematics, BSc, 1969.
Lehigh University, Secondary Education — Mathematics, MA, 1971.
University of Georgia, EdD, 1981.

APPOINTMENTS

East Carolina University, Professor of Mathematics Education

Joint Appointment, Department of Mathematics, College of Arts & Sciences and Department of Mathematics, Science, & Instructional Technology Education, College of Education 2003– present

Department of Mathematics, College of Arts & Sciences 1993 – 2003

University of Hawaii, Mathematics Coordinator, Curriculum R. & D. Group, 1982 – 93

University of Calgary, Mathematics Education Area Coordinator, 1980 – 82

Reading Area Community College, Assistant Professor and Chair of Mathematics, 1970 – 73

Wilson School District, Pennsylvania, Mathematics Teacher 1969 – 72

PUBLICATIONS SINCE 2004

Books and Monographs

Kathy Harris, Alice Brown, and Wilma Godwin. Measuring in One and Two Dimensions, (Sid Rachlin, Ed.). Chapel Hill, NC: North Carolina Partnership for Improving Mathematics and Science, 2007.

Sid Rachlin, Kathleen Cramer, Connie Finseth, Linda Cooper Foreman, Dorothy Geary, Seth Leavitt, & Margaret Schwan Smith. Navigating through Number and Operations in Grades 6-8, Principles and Standards for School Mathematics Navigations Series. Reston, Va.: National Council of Teachers of Mathematics, 2006.

Mary B. Eron and Sidney L. Rachlin (Eds). MIDDLE MATH: Improving the Undergraduate Preparation of Teachers of Middle Grades Mathematics, AMTE Monograph Series (Volume 2). San Diego, Ca.: Association of Mathematics Teacher Educators, 2005.

Jo Ann Fitchett, Kathy Harris, Kacey Sensenich, and Lori Stancill. Developing Algebraic Thinking in the Elementary Grades, (Sid Rachlin and Carol Midgett, Eds.). Chapel Hill, NC: North Carolina Partnership for Improving Mathematics and Science, 2005.

Alice Brown, Karen Hill, Joyce Hodges, and Elfreda Robinson. Reading for Mathematical Proficiency In Geometry and Number & Operations. (Sid Rachlin and Carol Midgett, Eds.). Chapel Hill, NC: North Carolina Partnership for Improving Mathematics and Science, 2005.

Sid Rachlin, and Olof Steinthorsdottir Algebraic Reasoning for Grade K–5 Teachers. Chapel Hill, NC: North Carolina Partnership for Improving Mathematics and Science, 2004.

Kathy Harris, Joyce Hodges, and Lori Stancill. Navigating Geometry in Grades K-5. (Sid Rachlin, Ed.). Chapel Hill, NC: North Carolina Partnership for Improving Mathematics and Science, 2004.

Jo Ann Fitchett, Elfreda Robinson, and Marcie Wysocki. Exploring Number and Operations in Grades K-5. (Sid Rachlin, Ed.). Chapel Hill, NC: North Carolina Partnership for Improving Mathematics and Science, 2004.

Chapters in Books or Monographs

Sidney L. Rachlin, “Foreword.” In Kathleen Lynch-Davis and Robin L. Rider (Eds.). The Work of Mathematics Teacher Educators: Continuing the Conversation, AMTE Monograph Series (Volume 3). San Diego, Ca.: Association of Mathematics Teacher Educators, 2006.

Sid Rachlin, Ron Preston, and Hollylynne Lee. “The North Carolina Middle Mathematics Project (NCM2): Supporting Teacher Retention and Renewal,” The Proceedings of the Fourth Annual Hawaii International Conference on Education. Honolulu, 2006.

Rose Sinicrope, Mary Eron, Sid Rachlin, Ron Preston, Cheryl Johnson, Mike Hoekstra and Sunday Ajose. “East Carolina University”. In Mary B. Eron and Sidney L. Rachlin (Eds). MIDDLE MATH: Improving the Undergraduate Preparation of Teachers of Middle Grades Mathematics, AMTE Monograph Series (Volume 2). San Diego, Ca.: Association of Mathematics Teacher Educators, 2005, 59-77.

EXTERNAL FUNDING SINCE 2004

Co-Principal Investigator with Russell Rowlett, Henry Johnson and Gerry Madrazo, National Science Foundation (2001–06), *The North Carolina MIDDLE MATH Project: A Professional Development Project to Improve Grade 6–8 Mathematics Education*. A teacher retention and renewal grant leading 135 middle grades mathematics teachers across the state through the national boards process and encouraging their participation in graduate degree programs through the provision of 3-5 graduate courses (\$2.1 million).

Rachlin, S. L. *NC-Middle Math Tuition & Fees Award*. Funding was provided by ECU (2003-08) to support the tuition and fees for 26 of ECU's Middle Math Teachers to complete master's degree in mathematics education.

Co-Principal Investigator with Verna Holoman, David Haase, Jose D'Arruda, William Harrison, and William Tucci, National Science Foundation and the US Department of Education (2002–08), *The North Carolina Partnership for Improving Mathematics and Science*. A Comprehensive MSP providing professional development to over 6000 K-12 mathematics teachers in twelve counties in eastern North Carolina (\$16 Million).

Rachlin, S. L. *NC-PIMS Tuition & Fees Award*. Funding was provided by ECU (2004-09) to support the tuition and fees for fifty of ECU's NC-PIMS Lead Teachers to complete masters degree in mathematics education.

Rachlin, S. L. "Developing & Implementing a NC K-5 Mathematics Specialist Certificate." The award funded a partnership between ECU and the Cisco Learning Institute (2007-08) to design a state-level model for recognizing and certifying teachers as K-5 mathematics specialist (\$100K).

Rachlin, S. L. *NC-AMTE Spring Conference: Designing a K-5 Mathematics Specialist Certificate Program-of-Study*. Funding was provided by the Cisco Learning Institute (2008) to support the national participation in the weeklong retreat to support the design of a national K-5 mathematics specialist program of study (\$200K).

Rachlin, S. L. *NC-AMTE Spring Conference: Designing a K-5 Mathematics Specialist Certificate Program-of-Study*. Funding was provided by the Burroughs Wellcome Fund (2008) to support the North Carolina participation of mathematicians and mathematics educators in the weeklong retreat to support the design of a national K-5 mathematics specialist program of study (\$50K).

Rachlin, S. L. Funding was provided by the UNC General Administration (2008-11) to co-coordinate for UNCGA Academic Planning and University-School Programs the development of an online certificate program consisting of six graduate courses for elementary school teachers focused on mathematical knowledge for teaching at the elementary level. This includes facilitating the design of a program-of-study, curricular content development, coordination of planning for online module development, and communications with mathematics and mathematics education faculty, K-12 public school personnel, and system and state level leadership regarding implementation of the module to meet the requirements for a State Board of Education elementary mathematics add-on licensure endorsement (\$300K).

Rachlin, S. L. *Supplemental Attachment to Quest VII ECU Elementary Mathematics Award*. The USDOE funded project (\$100K) provides the tuition and fees for the initial pilot with 50 teachers of three graduate courses of the six included in the program of study for the new Elementary Mathematics Add-On License (2009-10).

Rachlin, S. L. *Supplemental Attachment to Quest VIII ECU Elementary Mathematics Award*. The USDOE funded project (\$106K) provides the tuition and fees for the final pilot courses with 44 teachers of two graduate courses of the six included in the program of study for the new Elementary Mathematics Add-On License and for the evaluation and revision of the six courses (2010-11).

RELATED ACTIVITIES AND HONORS

Coordinator, The East Carolina University—Middle Grades Mathematics Teacher Preparation Program, one of four recipients of the U.S. Department of Education's National Award for Effective Teacher Preparation. At the award ceremony in Washington, DC, Secretary Riley stated, "These cutting-edge programs will provide powerful examples for others seeking to ensure that their graduates make a measurable difference in the achievement of K-12 students, We looked for programs that could provide compelling evidence that their graduates were effective classroom teachers capable of advancing the learning of all students." December 2000.

President, President Elect and Immediate Past President of the Association of Mathematics Teacher Educators—AMTE (2004-2008).

Scholar-Teacher Award, East Carolina University, 2007-2008.