DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
Master of Arts in Mathematics Education
Master of Arts in Teaching in Mathematics Education

PROGRAM OVERVIEW

The graduate Mathematics Education program at UNC Pembroke consists of the Master of Arts (M.A.) in Mathematics Education and the Master of Arts in Teaching (M.A.T.) Program with Mathematics Specialization. The M.A. in Mathematics Education Program at UNC Pembroke has two concentrations: Licensure and Non-Licensure. The Licensure Concentration is designed to prepare currently licensed secondary school science teachers for the North Carolina Master's/Advanced Competencies License. The Non-Licensure Concentration is designed for applicants who meet all graduate school admission requirements with the exception of the teaching licensure requirement. Candidates completing the Non-Licensure Concentration are not eligible for North Carolina Standard Professional 1 or M level licensure and must sign a waiver to that effect upon admission. The Non-Licensure Concentration will not be discussed in this report. The M.A.T. Program with Mathematics Specialization is designed to prepare candidates to meet competencies of both Standard Professional 1 and M licenses. The Mathematics Education Graduate Program nurtures the development of mathematics teachers and further develops the instructional expertise and leadership qualities and skills of mathematics teachers. The graduate Mathematics Education program is accredited by the North Carolina Department of Public Instruction, the National Council for the Accreditation of Teacher Education (NCATE), and the Southern Association of Colleges and Schools (SACS). It is governed by the Teacher Education Committee and the Graduate Council and is guided by an advisory council comprised of representatives from the Department of Mathematics and Computer Science, public school teachers and administrators, graduates, and current candidates.

The Master of Arts in Mathematics Education Program seeks to build upon the undergraduate degree through the extension of the width and breadth of the mathematics background of the undergraduate student and through the enhancement of those skills and attributes, which assist in the improvement of learning and teaching. The program's conceptual framework is based upon the premise of extending the experienced teacher's instructional background in those subject areas that are pertinent to the secondary curriculum: function, algebra, and geometry. The extension of the instructional background is contained within the casing of problem solving and research. Problem solving and research should promote data collection, analysis, reflective thought, conjecture, and assessment which provide collaborative leadership to other experienced practitioners. The growth will be demonstrated through the capstone project of the Portfolio and the comprehensive exams.

Program of Study

Program Goals and Objectives: Program Goals

The educational objectives of the program are

1. To provide students with a solid foundation and understanding of mathematics
2. To enable students through study to appreciate both the aesthetic and practical aspects of mathematics
3. To provide experiences that will help students see that they will need to have a variety of teaching and learning strategies available at all times
4. To provide students with current theories regarding the psychological development of the learner and an understanding of human dynamics found in the home, the school, and the community
5. To demonstrate methods of evaluating student learning, textbooks, curriculum educational techniques, and the educational process as a whole
6. To prepare students to deal with a diverse population with a broad spectrum of needs, aspirations, and expectations for themselves and others
7. To provide a consideration of societal needs that are satisfied by applications of and careers based on mathematics and technology
8. To stress the importance to a teaching professional of keeping abreast of current trends in mathematics education through the reading of professional journals and participation in mathematics workshops, institutes, conferences, professional meetings, and in-service programs.

Standards for 9 - 12 Mathematics Teachers
Standards and Indicators

Standard 1: Number sense, numeration, and numerical operation.

Mathematics teachers have an in depth understanding of concrete algebraic systems and applications.

Mathematics Teachers:
   Indicator 1: demonstrate an understanding of the properties of, and operations on real and complex numbers, polynomials, vectors, matrices, and other concrete algebraic systems;
   Indicator 2: demonstrate an understanding of algebra and algebraic systems, including linear and abstract algebra;
   Indicator 3: demonstrate an understanding of elementary number theory;
   Indicator 4: demonstrate an understanding of set theory;
   Indicator 5: use computational tools and strategies and estimate appropriately.

Standard 2: Spatial sense, measurement, and geometry.

Mathematics teachers understand measurement, spatial sense, and the properties of relationships of two- and three-dimensional space.

Mathematics Teachers:

- Indicator 1:demonstrate an understanding of Euclidean and non-Euclidean geometry;
- Indicator 2:recognize geometry as an example of a deductive system, built from undefined terms, axioms, definitions, and theorems;
- Indicator 3:use deduction to establish the validity of geometric conjectures and to prove theorems;
- Indicator 4:demonstrate an ability to connect geometry to other strands of mathematics and use it to solve problems;
- Indicator 5:demonstrate an understanding of the properties of two- and three-dimensional geometric objects;
- Indicator 6:demonstrate an ability to solve geometric problems using vectors in two- and three-dimensions;
- Indicator 7:demonstrate an understanding of other coordinate systems and representational models and their uses;
- Indicator 8:demonstrate an ability to use trigonometric relationships to solve problems;
- Indicator 9:use appropriate technology to explore geometric concepts.

Standard 3: Patterns, relationships, and functions

Mathematics teachers understand patterns, relationships, functions, symbols and models.

Mathematics Teachers:
- Indicator 1:demonstrate an ability to model and analyze situations and number patterns with numerical, graphical, and symbolic representations; and explore their connections;
- Indicator 2:demonstrate an ability to use methods of proof to prove theorms and verify conjectures;
- Indicator 3:demonstrate an ability to analyze tables and graphs to identify properties and relationships;
- Indicator 4:demonstrate an understanding of differential and integral calculus;
- Indicator 5:demonstrate the ability to use mathematics and technological tools to solve "real world" problems that arise in social sciences, biological sciences, physical sciences, and other mathematical sciences;
- Indicator 6:demonstrate an understanding of different classes of functions and relations and the use of technology to investigate their properties.

Standard 4: Data, probability, and statistics

Mathematics teachers understand the major concepts of probability and statistics including collecting, displaying, analyzing, and drawing conclusions from data.

Mathematics Teachers:
- Indicator 1:demonstrate the ability to use a variety of standard techniques for organizing and displaying data in order to detect patterns and departures from patterns;

- Indicator 2:demonstrate the ability to use surveys to estimate population characteristics and experiments to test conjectured cause-and-effect relationships;
- Indicator 3:demonstrate the ability to use theory and simulations to produce, analyze, and apply probability distribution models;
- Indicator 4:demonstrate the ability to use probability models to draw conclusions from data and measure the uncertainty of those conclusions;
- Indicator 5:demonstrate an understanding of topics in discrete mathematics such as finite difference equations, graph and network theory, combinatorics, and models for social decision-making;
- Indicator 6:use appropriate technology to collect, display, organize, and interpret data;
- Indicator 7:develop computer programs in a structured language.

Standard 5: Process Skills

Teachers understand and use the processes of problem solving, reasoning and proof, communication, connection, and representation as the foundation for the teaching and learning of mathematics.

Mathematics Teachers develop instructional programs that
enable all students to:

Problem Solving
- Indicator 1:build new mathematical knowledge through problem solving;
- Indicator 2:solve problems that arise in mathematics and in other contexts;
- Indicator 3:apply and adapt a variety of appropriate strategies to solve problems;
- Indicator 4:monitor and reflect on the process of mathematical problem solving.

Reasoning and Proof
- Indicator 5:recognize reasoning and proof as fundamental aspects of mathematics;
- Indicator 6:make and investigate mathematical conjectures;
- Indicator 7:develop and evaluate mathematical arguments and proofs;
- Indicator 8:select and use various types of reasoning and methods of proof.

Communication
- Indicator 9:organize and consolidate their mathematical thinking through communication;
- Indicator 10: communicate their mathematical thinking coherently and clearly to peers, teachers, and others; Indicator 11: analyze and evaluate the mathematical thinking and strategies of others;
- Indicator 12: use the language of mathematics to express mathematical ideas precisely.

Connections
- Indicator 13: recognize and use connections among mathematical ideas;
- Indicator 14: understand how mathematical ideas interconnect and build on one another to produce a coherent whole; Indicator 15: recognize and apply mathematics in contexts outside of mathematics.

Representation

- Indicator 16: create and use representations to organize, record, and communicate mathematical ideas;
- Indicator 17: select, apply, and translate among mathematical representations to solve problems;
- Indicator 18: use representations to model and interpret physical, social, and mathematical phenomena.

Standard 6: Curriculum pacing and alignment

Mathematics teachers are aware of the importance of and implement effective instructional pacing and alignment.

Mathematics Teachers are:
- Indicator 1:knowledgeable of the NC Standard Course of Study, LEA (district) standards and pacing guides, and the NCTM standards;
- Indicator 2:able to locate and use various resources that support daily classroom practices (e.g. NCDPI, LEARN-NC,NCTM Publications, etc.).

Standard 7: Instructional strategies

Mathematics teachers use a variety of instructional strategies to promote student understanding of mathematics. They recognize students' level of mathematical understanding in order to implement the appropriate instructional practice.

Mathematics Teachers:
- Indicator 1:use varied strategies, including problem-based learning, inquiry, investigations, direct instruction, exposition;
- Indicator 2:are knowledgeable of current research on best practices;
- Indicator 3:match the appropriate strategy with the appropriate tools;
- Indicator 4:are knowledgeable about and sensitive toward various teaching/learning styles;
- Indicator 5:are aware that it will take a variety of teaching methods to lead all students to excel in mathematics.

Standard 8: Instructional tools

K-12 mathematics teachers understand and use effectively the hierarchy of the use of instructional tools.

Mathematics Teachers are able to identify, prescribe, and use appropriate:
- Indicator 1:hands-on tools (e.g. cubes, counters, rods, etc.);
- Indicator 2:representational tools (e.g. base-ten blocks, calculators, computer applications, algebra tiles/blocks, fraction bars, decimal squares, geometric blocks, etc.);
- Indicator 3:transitional tools (e.g. expanded notation, paper and pencil, calculator and computer methods, metaphors, analogies, etc.) that enable students to make connections between representational and symbolic levels of understanding;

- Indicator 4:symbolic tools (e.g. standard and alternative algorithms, calculator and computer applications, etc.).

Standard 9. Assessment practices

Teachers of mathematics understand a variety of formative and summative assessment tools, strategies, and practices and their appropriate use.

Mathematics Teachers are able to:
Indicator 1:use assessment to inform instructional practice;
Indicator 2:recognize and use formative and summative assessment;
Indicator 3:match assessment strategies to instructional strategies;
Indicator 4:use assessment to enhance student learning.

Teachers believe that all students can learn mathematics. They exhibit an enthusiasm for teaching mathematics and view diversity as a strength in the classroom.

Standard 10: Ethnicity, gender, race, and socioeconomic status

Mathematics teachers recognize that all students, regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to study and learn mathematics.

Mathematics Teachers:

- Indicator 1:are sensitive to the needs and strengths of the mathematical backgrounds and abilities of individual students and have high expectations for all students;
- Indicator 2:   treat students equitably, not necessarily equally, by accommodating individual student needs;
- Indicator 3:understand the need to encourage parental involvement in all students' education and frequently communicate with parents or guardians of their students;
- Indicator 4:strive to dispel the myths regarding the learning of mathematics, challenging derogatory and/or stereotypical beliefs based on ethnicity, gender, race, or socioeconomic status;
- Indicator 5:understand and confront their own beliefs and biases to effectively and sensitively accommodate differences among students.

Standard 11: Accommodating individual needs

To promote diversity as a strength, teachers are knowledgeable about and sensitive toward various teaching/learning styles.

Mathematics Teachers:

- Indicator 1:stay abreast of current research which indicates the optimal teaching methods to address students' diverse learning styles, non-native speakers of English, students with disabilities, and gifted students.
- Indicator 2:are aware that it will take a variety of teaching methods to lead all students to excel in mathematics.

Standard 12: Historical perspective

Mathematics teachers understand that historically based pedagogy can give all students, regardless of their learning preferences, the opportunity to learn mathematics. It provides an opportunity to focus on special interests, and it provides the teacher with insights into the diversity in the development of mathematics.

Mathematics Teachers:

- Indicator 1:are able to plan instructional topics of particular interest through the use of the historical development of mathematics;
- Indicator 2:understand that the investigation of historical topics in mathematics requires the use of substantial mathematics;
- Indicator 3:understand and incorporate the mathematical contributions of all cultures into their lessons.

STANDARDS FOR THE MASTER'S DEGREE LICENSE

Standard 1: Instructional Expertise

The candidate demonstrates instructional expertise by applying the theoretical, philosophical, and research bases for educational practice in P-12 settings to improve student learning

Indicators:
1. The candidate plans, implements, and evaluates instruction that is rigorous, coherent, and consistent with a well-developed theoretical and philosophical base and best practices emerging from educational research.
2. The candidate designs and modifies instruction and learning environments based on assessment of student learning problems and successes.
3. The candidate monitors the effects of instructional actions, selection of materials, and other instructional decisions on students' learning and behavior.
4. The candidate incorporates findings from educational literature into school and classroom strategies to improve student learning.
5. The candidate understands and links subject matter and students' developmental and diverse needs in the context of school settings.
6. The candidate uses technology to create learning environments that support students' learning.

Standard 2: Knowledge of Learners

The candidate incorporates knowledge of the nature of the learner, learning processes, variations in learning abilities and learning styles, and strategies for evaluating learning into the planning, delivery, and evaluation of instruction.

Indicators:
1. The candidate seeks to increase understanding of and respect for differences in students, including exceptionalities.
2. The candidate designs and delivers instruction that is responsive to differences among all learners.
3. The candidate reflects on and modifies instruction that fosters student learning.
4. The candidate understands and respects differences between the learning behaviors and outcomes expected in diverse communities.
5. The candidate creates and maintains a classroom environment conducive to learning in which all learners feel welcome and can be successful.

Standard 3: Research

The candidate uses research to examine and improve instructional effectiveness and student achievement.

Indicators:
1. The candidate critically reads and applies historical and contemporary educational literature, including theoretical, philosophical, and research materials.
2. The candidate uses student and school performance data to improve student learning, classroom processes, and school practices.
3. The candidate investigates educational problems through action research.

Standard 4: Content Knowledge

The candidate demonstrates advanced depth and breadth of knowledge and skills in the academic discipline and in education.

Indicators:
1. The candidate analyzes and articulates relationships between and among theory, philosophy, research findings, and current practice as appropriate to the discipline.
2. The candidate analyzes and articulates relationships between and among theory, philosophy, research findings, and current practice across disciplines.
3. The candidate demonstrates theoretical and applied advanced content knowledge.
4. The candidate understands current knowledge and trends in education.

Standard 5: Professional Development and Leadership

The candidate engages in continued professional development and provides leadership at the classroom, school, and community levels, and within the profession.

Indicators:
1. The candidate initiates professional inquiry through reading, dialogue, reflection, professional development, and action research.
2. The candidate seeks, evaluates, and as appropriate, acts on input from educators, parents, students, and other members of the community for continuous improvement.
3. The candidate participates, formally and informally, in appropriate professional communities.
4. The candidate participates in collaborative leadership to address educational problems.
5. The candidate provides leadership in working with parents and strengthening the home-school partnership.