

DEPARTMENT OF MATHEMATICS ANDE COMPUTER SCIENCE
Bachelor of Science in Mathematics Education

PROGRAM OVERVIEW

The undergraduate Secondary Mathematics Education program at The University of North Carolina at Pembroke is designed to prepare candidates for professional careers in public school teaching. The Secondary Mathematics Education program nurtures the development of teachers who help others develop mathematical understanding, reasoning by critical thinking, and problem solving skills.

The program of study in Mathematics Education consists of four curricular components: freshman seminar and general education, the specialty area, professional studies, and content pedagogy (methods and internship). Upon successful completion of the program and related requirements, graduates are eligible for a Standard Professional License to teach in the State of North Carolina. The NC Department of Public Instruction issues the teaching license based on University recommendation.

The Mathematics Education program is accredited by the National Association for the Accreditation of Teacher Education (NCATE) and the NC State Board of Education. Administratively, the program is housed in the Department of Mathematics and Computer Science in the Oxendine Science Building. The Secondary Mathematics Education program is guided by an advisory committee comprised of representatives from the Department of Mathematics and Computer Science faculty, the School of Education, public school teachers and administrators, program completers, and current candidates. Mary Klinikowski coordinates the undergraduate program.

Program of Study

Program Goals and Objectives

The Mathematics Education program recognizes that teaching mathematics is a complex endeavor. Pre-service teachers of mathematics need to be involved in developing their knowledge, skills, understandings, and dispositions to teach mathematics to diverse learners. The goal of the Mathematics Education program is to prepare effective and professional mathematics teachers who are ready to make positive contributions to the mathematical development of middle and high school students in diverse settings. To accomplish this goal, the Mathematics Education program will

1. Provide students with a solid foundation and understanding of mathematics.
2. Enable students to appreciate both the aesthetic and practical aspects of mathematics.
3. 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. 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. Demonstrate methods of evaluating student learning, textbooks, the curriculum, educational techniques, and the educational process as a whole.
6. Prepare students to deal with a diverse population that has a broad spectrum of needs, aspirations, and expectations for themselves and others.
7. Provide a consideration of societal needs that are satisfied by applications of and careers based on mathematics and technology.
8. 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 meeting and in-service programs.

Standards for 9 - 12 Mathematics Teachers

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 theorems 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.

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.