

The University of North Carolina at Charlotte
The College of Education

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Education 390

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Office hours: M, W 9:00 – 12:00 August 22-Sept 23. Germany (Sept. 26 – Nov. 19) by Appointment.

COURSE NUMBER: ELED 4255

Introduction to Teaching Mathematics (3G) - Basic Methodology in teaching mathematics from a constructivist perspective, with examination of other perspectives related to major models of teaching introduced in ELED 5100. Examination of the K-6 mathematics curriculum and instructional materials, with reference to curriculum integration and to developmental stages of learning, and the impact of diversity in mathematics instruction are major themes. Emphasis on basic, effective teaching strategies and organizational patterns expected to be used in schools, as framed by models of teaching. Includes attention to prospective teachers' mathematical knowledge as well as teaching competencies in all aspects of the K-6 NC mathematics curriculum.

COURSE PREREQUISITES: Admission to Teacher Education, Part of the Germany Cohort

COURSE RATIONALE AND RELATIONSHIP TO CURRENT PROGRAMS AND PROFESSIONAL STANDARDS:

Teachers in today's schools must be well prepared to help students develop numeracy. No longer is it enough to simply teach computational skills. Teachers must prepare their students to be problem solvers. Students must be able to identify a problem, plan appropriately, and carry out the plan to find a solution. These skills require a variety of instructional procedures developed to align with a student's level of cognitive development.

ELED 4255 is aligned with the six strands of the Conceptual Framework of the College of Education with emphasis placed on helping these beginning teachers to become knowledgeable as well as effective practitioners as they complete their on-site training. Candidates will become more knowledgeable about constructivist mathematics through their learning of concrete, representational, transitional, and symbolic instructional tactics. They will become effective practitioners with this instructional model as they employ each tactic with students of differing cognitive developmental levels. Candidates will become reflective practitioners as they develop an effective repertoire of instructional behaviors whereby analyzing and reflecting on their own instructional practices. As these individuals develop the ability to use each instructional tactic appropriately, they will become leaders in the field as they use state of the art procedures to help their students become effective problem solvers who are capable of using a myriad of approaches to solve problems. Computation accuracy, an emphasis of this program, will become a by-product of effective problem solving.

COLLEGE OF EDUCATION CONCEPTUAL FRAMEWORK

The Elementary Education program is built on a conceptual framework of principles and characteristics identified with effective teachers. In this course, a number of activities directly reflect elements of the conceptual framework and will be formally evaluated. These elements and their evaluation are identified below. The characteristics of excellent professionals who graduate from UNC Charlotte are:

1. Knowledgeable
2. Effective
3. Reflective
4. Responsive to Equity/Diversity
5. Collaborative
6. Leaders

These characteristics are measured by the following links to course content:

- Demonstrate highly advanced knowledge of human development and of student needs (exams, DMI clinical report)
- Make links among theory, research and practice as well as between content and pedagogy (exams, DMI clinical report)
- Demonstrate knowledge, high regard and adherence to the ethical standards of the field (DMI clinical report)
- Use data to make professional decisions (DMI clinical report)
- Demonstrate positive impact on student learning (course content DMI clinical report)
- Demonstrate flexibility and adaptability (clinical report)
- Apply knowledge and skills to foster educational environments that are respectful of diverse backgrounds and cultures (course content 9 Step Process for differentiated instruction)
- Provide developmentally appropriate, age appropriate, individually appropriate, and culturally responsive instruction (course content 9 Step Process for differentiated instruction)

This course builds upon knowledge developed in ELED 2100 and 3120 relating to child development and diversity, models of planning and teaching, issues in schools today, the use of the NCSCOS, expectations for student achievement and teacher accountability, classroom organization and management, and use of technology. It is designed to develop teachers who can foster effective problem solving whereby teacher competencies required for licensure by NCDPI can be mastered. Course objectives for this course are directly related to NCDPI competencies, NCATE Guidelines, INTASC Standards, and the Conceptual Framework for the College of Education at The University of North Carolina - Charlotte.

The INTASC Standards

An integral component of the new performance-based process is the use of the Interstate New Teacher Assessment and Support Consortium (INTASC) standards. These standards reflect the requisite knowledge, skills, and attitudes necessary for teachers starting their career.

1. Content Pedagogy

The teacher understands the central concepts, tools of inquiry, and structures of the discipline he or she teaches and can create learning experiences that make these aspects of subject matter meaningful for students.

- demonstrates an understanding of the central concepts of his or her discipline.
- uses explanations and representations that link curriculum to prior learning.

- evaluates resources and curriculum materials for appropriateness to the curriculum and instructional delivery.
- engages students in interpreting ideas from a variety of perspectives.
- uses interdisciplinary approaches to teaching and learning.
- uses methods of inquiry that are central to the discipline.

2. Student Development

The teacher understands how children learn and develop, and can provide learning opportunities that support a child's intellectual, social, and personal development.

- evaluates student performance to design instruction appropriate for social, cognitive, and emotional development.
- creates relevance for students by linking with their prior experiences.
- provides opportunities for students to assume responsibility for and be actively engaged in their learning.
- encourages student reflection on prior knowledge and its connection to new information.
- accesses student thinking as a basis for instructional activities through group/individual interaction and written work (listening, encouraging discussion, eliciting samples of student thinking orally and in writing).

3. Diverse Learners

The teacher understands how students differ in their approaches to learning and creates instructional opportunities that are adapted to diverse learners.

- designs instruction appropriate to students' stages of development, learning styles, strengths and needs.
- selects approaches that provide opportunities for different performance modes.
- accesses appropriate services or resources to meet exceptional learning needs when needed.
- adjusts instruction to accommodate the learning differences or needs of students (time and circumstance of work, tasks assigned, communication and response modes).
- uses knowledge of different cultural contexts within the community (socio-economic, ethnic, cultural) and connects with the learner through types of interaction and assignments.
- creates a learning community that respects individual differences.

4. Multiple Instructional Strategies

The teacher understands and uses a variety of instructional strategies to encourage student development of critical thinking, problem solving, and performance skills.

- selects and uses multiple teaching and learning strategies (a variety of presentations/explanations) to encourage students in critical thinking and problem solving.
- encourages students to assume responsibility for identifying and using learning resources.
- assures different roles in the instructional process (instructor, facilitator, coach, audience) to accommodate content, purpose, and learner needs.

5. Motivation and Management

The teacher uses an understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement in learning, and self motivation.

- encourages clear procedures and expectations that ensure students assume responsibility

for themselves and others, work collaboratively and independently, and engages in purposeful learning activities.

- engages students by relating lessons to students' personal interests, allowing students to have choices in their learning, and leading students to ask questions and solve problems that are meaningful to them.
- organizes, allocates, and manages time, space and activities in a way that is conducive to learning.
- organizes, prepares students for, and monitors independent and group work that allows for full and varied participation of all individuals.
- analyzes classroom environment and interactions and makes adjustments to enhance social relationships, student motivation/engagement and productive work.

6. Communication and Technology

The teacher uses knowledge of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom.

- models effective communication strategies in conveying ideas and information and when asking questions (e.g., monitoring the effects of messages, restating ideas and drawing connection, using visual, aural, and kinesthetic cues, being sensitive to nonverbal cues both given and received).
- provides support for learner expression in speaking, writing, and other media.
- demonstrates that communication is sensitive to gender and cultural differences (e.g., appropriate use of eye contact, interpretation of body language and verbal statements, acknowledgment of and responsiveness to different modes of communication and participation.
- uses a variety of media communication tools to enrich learning opportunities.

7. Planning

The teacher plans instruction based upon knowledge of subject matter, students, the community, and curriculum goals.

- plans lessons and activities to address variation in learning styles and performance modes, multiple development levels of diverse learners, and problem solving and exploration.
- develops plans that are appropriate for curriculum goals and are based on effective instruction.
- adjusts plans to respond to unanticipated sources of input and/or student needs.
- develops short and long-range plans.

8. Assessment

The teacher understands and uses formal and informal assessment strategies to evaluate and ensure the continuous intellectual, social, and physical development of the learner.

- selects, constructs, and uses assessment strategies appropriate to the learning outcomes.
- uses a variety of informal and formal strategies to inform choices about student progress and to adjust instruction (e.g., standardized test data, peer and student self-assessment, informal assessments such as observation, surveys, interviews, student work, performance tasks, portfolio, and teacher made tests).
- uses assessment strategies to involve learners in self-assessment activities to help them become aware of their strengths and needs, and to encourage them to set personal goals for learning.
- evaluates the effects of class activities on individuals and on groups through observation of classroom interaction, questioning and analysis of student work.
- maintains useful records of student work and performance and can communicate student progress knowledgeably and responsibly.

- solicits information about students' experiences, learning behavior, needs, and progress from parents, other colleagues, and students.

9. Reflective Practice: Professional Growth

The teacher is a reflective practitioner who continually evaluates the effects of his or her choices and actions on others (students, parents, and other professionals in the learning community) and who actively seeks out opportunities to grow professionally.

- uses classroom observation, information about students and research as sources for evaluating the outcomes of teaching and learning and as a basis for experimenting with, reflecting on and revising practice.
- uses professional literature, colleagues and other resources to support self-development as a learner and as a teacher.
- consults with professional colleagues within the school and other professional arenas as support for reflection, problem-solving and new ideas, actively sharing experiences and seeking and giving feedback.

10. School and Community Involvement

The teacher fosters relationships with school colleagues, parents, and agencies in the larger community to support students' learning and well-being.

- participates in collegial activities designed to make the entire school a productive learning environment.
- links with counselors, teachers of other classes and activities within the school, professionals in community agencies, and others in the community to support students' learning and well-being.
- seeks to establish cooperative partnerships with parents/guardians to support student learning.
- advocates for students

NCDPI Standards

Core Standards

Standard 1: Teachers know the content they teach – course content, field activities

Standard 2: Teachers know how to teach students – course content, DMI, field activities

Standard 3: Teachers are successful in teaching a diverse population – course content, field activities

Standard 4: Teachers are leaders

Standard 5: Teachers are reflective about their practice – course content, field activities

Standard 6: Teachers respect and care about students – course content, DMI, field activities

Diversity Standards

Standard 1: Accessible, Meaningful, and Culturally Relevant Subject Matter -- course content, field activities, DMI

Standard 2: Developmental Influences -- course content, field activities, DMI

Standard 3: Collaborative Linkages -- course content, field activities

Standard 4: Understanding of Diversity -- course content, field activities, DMI

Standard 5: Leadership in Meeting the Needs of Diverse Learners -- course content, field activities, DMI

Standard 6: Reflective Practice -- course content, field activities

Technology Standards

Standard 1: Sound Understanding of Technology Operations and Concepts – Software evaluation and assessment

Standard 2: Learning Environments – Software assessment, course content

Standard 3: Curriculum Plans – course content

Standard 4: Assessment and Evaluation – Software assessment, field activities

Standard 5: Productivity and Professional Practice – Software assessment

Standard 6: Social, Legal, Ethical, and Human Issues – Software assessment, DMI, course activities

NCATE STANDARDS FOR MATHEMATICS

Candidates know, understand, and use the major concepts, procedures, and reasoning processes of mathematics that define number systems and number sense, geometry, measurement, statistics and probability, and algebra in order to foster student understanding and use of patterns, quantities, and spatial relationships that can represent phenomena, solve problems, and manage data. – Course content (9 Steps to Differentiated Instruction,) DMI, software evaluation and assessment, field activities.

COURSE OBJECTIVES:

The Elementary Teacher Education Program should develop knowledge and understanding of the basic structure of mathematics, the mathematical processes and the understanding of mathematical concepts and their implications for developing learning environments appropriate to the needs of elementary school children. Study under this guideline should focus on the importance of learning through concrete, representational, and symbolic manipulative experiences as well as foster the development of positive attitudes toward mathematics.

To achieve this purpose, students completing the Program will be able to:

- Discuss current curriculum issues in mathematics education and develop an understanding of elementary school mathematics in light of the present national and state education reform issues (No Child Left Behind, State Standard Course of Study). (INTASC Standard 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; NCATE Standard 2, 2.3; NCPTS 1).
- Develop and apply a personal mathematics teaching philosophy that addresses the Principles and Standards for School Mathematics as identified by the National Council of Teachers of Mathematics (NCTM). (INTASC Standard 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; NCATE Standard 1, 2, 2.3; NCPTS 1, 2, 3, 4, 5, 6).
- Explore the role of constructivist thinking in creating a student centered environment. (INTASC Standard 1, 4, 5, 7, 8; NCATE Standard 1, 2, 2.3; NCPTS 1, 2, 3).
- Design instruction that applies the “concrete-to-abstract” approach to learning mathematics. (INTASC Standard 1, 7; NCATE Standard 1, 2, 2.3; NCPTS 1, 2, 3, 5).

- Understand the concept of “math anxiety,” and the role that teachers can play in alleviating feelings of frustration and failure in mathematics education. (INTASC Standard 1, 7; NCATE Standard 1, 2, 2.3; NCPTS 2).
- Examine the role that literature and technology can play in mathematics instruction. (INTASC Standard 6; NCATE Standard 2.8; NCPTS 1).
- Examine how to create a problem-based learning environment in the mathematics classroom. (INTASC Standard 1, 2, 3, 4, 5, 7; NCATE Standard 2.3, 2.8, 3.1, 3.3; NCPTS 1, 2, 3, 5).
- Identify and apply cultural responsive pedagogy and methodology for meeting the needs of all students, especially those in poverty. (INTASC Standard 1, 3, 7; NCATE Standard 2.3, 2.8, 3.1, 3.2; NCPTS 1, 2, 3, 5, 6).
- Apply skills in using a variety of instructional materials, strategies, and assessment techniques for teaching elementary school mathematics. (INTASC Standard 4, 7, 8; NCATE Standard 3.1, 3.2, 3.3, 3.4, 3.5; NCPTS 1, 2, 3, 5).
- Use manipulatives to develop a conceptual understanding of mathematics skills and processes within students. (INTASC Standard 1; NCATE Standard 2.3, 3.1, 3.2, 3.3, 3.4, 3.5; NCPTS 1, 2, 3).
- Use “action language” to describe mathematical processes and procedures. (INTASC Standard 1; NCATE Standard 2.3, 3.1, 3.2, 3.3, 3.4, 3.5; NCPTS 1, 2, 3).
- Use the developmental levels of students to create differentiated mathematics instruction. (INTASC Standard 2, 4; NCATE Standard 1, 2, 2.3, 3.1, 3.2, 3.3, 3.4, 3.5; NCPTS 1, 2).
- Integrate mathematics process standards to other content areas. (INTASC Standard 1, 7; NCATE Standard 2.3, 2.8; NCPTS 1, 2).
- Explore opportunities to create “mathematical partnerships” with family and community members. (INTASC Standard 10; NCATE Standard 2.3, 5.2, 5.3; NCPTS 6).
- Use diagnostic testing information to make instructional decisions. (INTASC Standard 7, 8; NCATE Standard 3.1, 3.2, 3.3, 3.4, 3.5; NCPTS 1, 2, 3).
- Network with other master elementary mathematics educators in the profession. (INTASC Standard 10; NCATE Standard 5.1, 5.2, 5.3; NCPTS 4).
- Develop the necessary skills and confidence to become an effective and dynamic teacher of elementary school mathematics. (INTASC Standard 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; NCATE Standard 5.1, 5.2, 5.3; NCPTS 4).

INTASC-Interstate New Teacher Assessment and Support Consortium

NCATE-National Council for Accreditation of Teacher Education

NCPTS-North Carolina Professional Teaching Standards

COURSE CONTENT:

1. Within models of teaching, relationship of numeracy research and theory to instructional practices in mathematics learning.
2. Developmental differences affecting choice of instructional tactic.
3. Impact of cultural diversity upon numeracy learning and instruction.
4. Impact of problem solving on all forms of instruction.

5. Concrete manipulatives and numeration, number sense, numeration, and numerical operations; spatial sense, measurement, and geometry; patterns, relationships, and functions; data, probability, and statistics.
6. Representational manipulatives and numeration, number sense, numeration, and numerical operations; spatial sense, measurement, and geometry; patterns, relationships, and functions; data, probability, and statistics.
7. Transition activities connecting manipulative procedures with paper and pencil activities and numeration, number sense, numeration, and numerical operations; spatial sense, measurement, and geometry; patterns, relationships, and functions; data, probability, and statistics.
8. Symbolic and alternative algorithms for numeration, number sense, numeration, and numerical operations; spatial sense, measurement, and geometry; patterns, relationships, and functions; data, probability, and statistics.
9. Quantitative and Referential meanings for problem solving
10. Checking for reasonableness and checking for accuracy when using strategies for problem solving
11. Using technology to enhance mathematics understanding
12. Avoiding the artificial pacing of students through pacing of instruction
13. Lessening the gap between performing and under-performing groups through a plan of varied instruction.
14. Evaluating student performance
15. Reporting results of student performance

ILLUSTRATIVE COURSE ACTIVITIES

- Presentation by course instructor as to the rational for constructivism: The case for developmental grouping as a method of preventing the artificial pacing of students.
- The rational for action language.
- Presentation and student follow-up for the effective use of concrete manipulatives with whole number operations (counters, unifix cubes, cuisenaire rods, etc.).
- Presentation and student follow-up for the effective use of representational manipulatives with whole number operations (base ten blocks, place value charts, software packages, calculators, etc.).
- Presentation and student follow-up for the effective use of transition activities connecting manipulative procedures with symbolic procedures with whole numbers (expanded notation, partial sums, differences, products and quotients, arrays, etc.).
- Presentation and student follow-up for the effective use of alternative algorithms and problem solving (low stress, equal addition subtraction, lattice multiplication, scaffolding division, etc.).
- Presentation and student follow-up for the effective use of concrete, representational and symbolic procedures when teaching geometric principles.
- Presentation and student follow-up for the effective use of concrete, representational, and symbolic procedures when teaching about data, statistics and representing results.
- Field based evaluation and fluid grouping procedures when planning and evaluating instruction.

ASSIGNMENTS AND GRADING

Developmental case study using the DMI **100 pts**

Exams and quizzes **300 pts**

Course Grading System

A = **372 - 400**

B = **344 - 371**

C = **316 - 343**

Attendance is required and will be taken each class period. Students who miss class will not pass the course. In keeping with a Constructivist Approach, Exam content is made up of 50 % written, 50 % performance based items.

ACADEMIC INTEGRITY

Students have the responsibility to know and observe the requirements of The UNCC Code of Student Academic Integrity. This code forbids both cheating and complicity in academic dishonesty. Academic evaluations in this course assume that student work is free from academic dishonesty of any type, and grades will therefore be adversely affected by academic dishonesty. In addition students who violate the Code can be expelled from UNCC.

COMMITMENT TO DIVERSITY

The College of Education Commitment to Diversity

The College of Education at UNC Charlotte is committed to social justice and respect for all individuals, and it seeks to create a culture of inclusion that actively supports all who live, work, and serve in a diverse nation and world. Attaining justice and respect involves all members of our community in recognizing that multi-dimensional diversity contributes to the College's learning environments, thereby enriching the community and improving opportunities for human understanding. While the term "diversity" is often used to refer to differences, the College's intention is for inclusiveness, an inclusiveness of individuals who are diverse in ability/disability, age, economic status, ethnicity, gender, language, national origin, race, religion, and sexual orientation. Therefore, the College aspires to become a more diverse community in order to extend its enriching benefits to all participants. An essential feature of our community is an environment that supports exploration, learning, and work free from bias and harassment, thereby improving the growth and development of each member of the community.

College of Education Technology Statement

Professional education programs at UNC Charlotte are committed to preparing candidates for success in the 21st century through an emphasis on knowledge, effectiveness and commitment to technology integration and application. Preparation in the integration and application of technology to enhance student learning is essential for all candidates. Programs across the professional education unit, including the College of Arts + Architecture, College of Education, and College of Liberal Arts and Sciences, reflect this commitment in coursework, early field experiences, and clinical practice which includes student teaching and/or the capstone/internship phase of the respective programs.

REQUIRED TEXTS

Piel, John. A., & Green, M. (2010). *Constructing Number Sense in the Elementary and Middle Grades Classroom*. Des Moines, Iowa. Kendall Hunt Publishing.

SELECTED REFERENCES:

Achieve. (1999). Preliminary results of the analysis of state standards and assessments. East Lansing, MI: TIMSS Center.

Black, A. (1989). Developmental teacher education. Preparing teachers to apply developmental principles across the curriculum. *The Genetic Epistemologist*. 17 (4), 5-14.

Committee on Mathematical Education of Teachers. (1991). *A call for change*.

Recommendations for the mathematical preparation of teachers of mathematics. Washington, DC. The Mathematical Association of America.

National Center for Educational Statistics. (1997). *The 1996 mathematics report card for the nation and the states*. Washington, DC: Author.

National Council of Teachers of Mathematics. (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics. (1991). *Professional standards for teaching mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics. (1995). *Assessment standards for school mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics. (2002). *Revised Principles and standards for school mathematics*. Reston, VA: Author.

National Research Council. (1989). *Everybody counts: A report to the nation on the future of mathematics education*. Washington, DC: National Academy Press.

Piaget, J. (1954). *The construction of reality in the child*. New York: Basic Books.

Vygotsky, L. S. (1962) *Thought and language*. Cambridge, MA: M.I.T. Press.