

## EDUCATION/MATH 104 – MATHEMATICS EDUCATION

### PURPOSE:

This course is an introduction to the study of curriculum theory and instructional processes as they relate to the mathematics classroom. The major emphasis is on the relationship between subject matter knowledge and the instructional processes used to teach the subject matter knowledge (subject Matter knowledge focused on the fundamental and integrated ideas inherent in quantitative literacy, algebra, geometry and analysis). The mission is to assist teachers/future teachers with developing and realizing a new vision of school mathematics teaching pertinent to our contemporary and technologically complex society. This will require the presentation of a realistic philosophy of mathematics that is research based and that reflects mathematical knowledge and pedagogical experiences. The three fundamental questions which will form the thrust of this course are:

What is mathematics?

What does it mean to know mathematics?

What techniques are appropriate for maximizing of student learning?

### LEARNING OUTCOMES:

Teachers/future teachers of mathematics at any level should know and understand mathematics substantially beyond and below that which they are expected to teach. They should be able to relate mathematics to the world of their students, and to the natural sciences/social sciences. Teachers/future teachers should be able to provide illustrations of the role of mathematics in our culture and should have sufficient understanding of its nature and philosophy to interpret the various strands of the curriculum beyond a superficial level. They should have a knowledge of the historical development of mathematics in the different cultures of the world so they can illustrate its cross cultural nature using examples that will appeal to students from the diverse cultures represented in society.

Teachers/future teachers of mathematics need to develop a knowledge of mathematics so that they:

- Understand and interpret mathematical concepts, structures, procedures and the connections among them.
- Reason mathematically and solve problems using a variety of problem solving strategies and applications of mathematics.
- Understand and appreciate the nature of mathematics and the role of mathematics in the diverse cultures that make up the school student population.
- Represent mathematical structures, concepts and procedures through the use of a variety of tools including calculators, computers and physical materials.

Teachers/future teachers of mathematics need to develop a knowledge of how students learn mathematics so that they:

- Understand and evaluate theories of learning and incorporate various aspects of the

theories in their instructional processes.

- Design developmentally appropriate instructional plans that take into account students' age, knowledge, abilities, linguistic and cultural background and world experiences.
- Engage students in an active process of learning in which students create, discover, and make sense of mathematics.
- Affirm and encourage full participation and continued study of mathematics by all students.
- Use a variety of formal and informal assessment techniques that are aligned with instructional goals and are appropriate for students based on their developmental level, mathematical maturity, cultural, and linguistic backgrounds.

#### COURSE TOPICS:

##### Mathematical Knowledge

1. Mathematics as a Language (Symbolism, Abstraction, Generalization, Proof, Formalization) and as a Science (Inductive and Deductive Reasoning, Inquiry, Critical Thinking, Evaluation of Ideas, Analysis).
2. Understanding the Misunderstandings: Integrating the language of the student and the language of mathematics (Word problems, variables, proof, directed numbers and operations, irrational numbers, kinds of infinity, algebraic algorithms).
3. Mathematical Connections with other Content Areas and within the various branches.
4. Selected Topics in Mathematics (Algebra, Geometry, Statistics/Probability, Patterns/Functions/Relationships).

##### Mathematical Environment

1. Instructional Representations (discovery, guided discovery, cooperative learning, direct teaching, technology awareness as appropriate).
2. Evaluation of Student Understanding (language assessment, performance assessment, standardized tests, teacher constructed tests, portfolios).
3. Factors Influencing Student Learning (language Acquisition and development, sexism, equal access, motivation, relevance, cultural background).
4. Dominate Issues in Mathematics including National and State Curriculum Content Standards and Frameworks

#### INSTRUCTIONAL PROCESSES:

A variety of instructional processes will be used to present the content topics. The goal is to provide student teachers/future teachers with proven teaching methods and instructional theory appropriate for the mathematics classroom. Experiencing learning via a particular instructional process provides teachers/future teachers with a technique that they can refine to suit their individual personalities and their particular classroom situation. Since "teachers/future teachers will usually teach the way they were taught, " it becomes a necessity to teach teachers/future teachers by example. Teachers/future teachers own experiences will provide an impact on how they view teaching and learning mathematics. Discovery learning, guided inductive inquiry, simulation, and small group learning are examples of several instructional processes which will be used to teach this

course.

#### ASSESSMENT:

Teaching Mathematics is a considerably more complex undertaking than using mathematics in daily practice. It entails the study of several domains of knowledge - mathematics, foundations of education, and pedagogy. It requires that teachers/future teachers develop an understanding of the impact of socioeconomic background, culture heritage, attitudes and beliefs, and political climate on what happens in the learning environment. It serves as a catalyst for developing personal knowledge of oneself as a teacher of mathematics that combines sensitivity and responsiveness to learners, with knowledge, skills, understanding and disposition to teach mathematics.

Teaching mathematics is a function of what a teacher knows and does. This course provides an avenue for teachers/future teachers to learn contemporary mathematics ideas and way to teach mathematics to a diverse student population. The evaluation and assessment of teachers/future teachers performance in the course should be based on multiple sources of information. Teachers/future teachers in this course should be assessed on their knowledge of mathematical concepts and procedures. Methods of assessment and/or tools may include:

- Paper and pencil tests
- Open ended questions
- Oral presentations of mathematics ideas
- Portfolios
- Geometric constructions and/or physical representations of mathematics concepts
- Review of research centered around a mathematics education question
- Formulation of potential research questions in the area of mathematics education

Teachers/future teachers must have an understanding of the teaching of mathematics. They must demonstrate an awareness of instruction alternatives to enhance the delivery of mathematical concepts. Processes which engage students by connecting strategies with concepts and with students abilities must be utilized and part of the teaching knowledge obtained in this course. Methods of assessment and/or tools may include:

- Self analysis of student teacher strengths and weaknesses
- Video tape analysis
- Journals
- Case Studies
- Evaluation of teaching by other student teachers/future teachers
- Portfolios
- Classroom Projects.