

PART 2: NARRATIVES & MATRICES

MATHEMATICS CONTENT PREPARATION

Mathematics Content Preparation Narratives:

Mathematics Content Preparation Outcomes 1.1 through 1.4: Problem Solving, Reasoning, Communication, and Connections:

It is difficult to discuss each of the four content preparation outcomes separately because all four are so carefully woven into all of the nine mathematics content courses that our middle childhood mathematics teachers are required to take. The following information for this narrative is a quote from the Overview and Scope section of this document:

It is well documented that prospective teachers, even those with great success in mathematics at the secondary and/or college level, have a very shallow understanding of mathematics – one which does not prepare them to teach in the ways recommended in multiple reform documents. Students who choose to seek licensure in mathematics at the middle childhood level complete a sequence of nine mathematics content courses during the undergraduate phase and one mathematics methods course during the graduate phase. The emphasis in the mathematics content courses is on the development of deep and connected knowledge of the mathematics they will be expected to teach. The emphasis in the mathematics methods course (predicated on the assumption that the students arrive with the content knowledge developed in the first nine courses) is on the development of pedagogical content knowledge in mathematics.

The nine content courses taken during the undergraduate phase of the program are dedicated courses designed specifically for, and taken only by, preservice teachers. These courses carefully develop the types of deep understanding and mathematical content knowledge that is not typically learned in traditional K through 12 or college level mathematics courses. In addition, these nine courses are taught within a carefully developed learning environment which models the spirit and recommendations set forth in the Principles and Standards for School Mathematics (NCTM, 2000). The students' mathematical process skills (problem solving, reasoning and proof, communication, connections, and representations) are carefully developed during the early courses and an integral part of the later courses. The process skills are not developed as a separate segment of content knowledge but instead are woven into all of the learning activities so that they become a natural part of the students' mathematical repertoire. Manipulatives and technology are regular elements of these content courses, however it must be emphasized that the focus is on the use of these tools for development of the prospective teachers' own knowledge. While it is inevitable that some casual discussion about how these tools might be used with children naturally arises, the primary goal is to provide the prospective teachers with opportunities to experience using these tools as learners. Focused discussion on how to use tools like manipulatives and technology, as well as discussion on how to design lessons for children, is saved until the methods course.

PART 2: NARRATIVES & MATRICES

Mathematics Content Preparation Matrix:

4-8 Outcomes	Course #'s which address this outcome. Be sure the syllabus for each listed course reflects that this outcome is addressed.
1.5 Programs prepare prospective teachers who can --	
1.5.1 apply concepts of number, number theory, and number systems;	Mathematics 143 (Syllabus begins on page 43) Mathematics 243 (Syllabus begins on page 45) Mathematics 244 (Syllabus begins on page 48)
1.5.2 apply numerical computation and estimation techniques and extend them to algebraic expressions;	Mathematics 143 (Syllabus begins on page 43) Mathematics 243 (Syllabus begins on page 45) Mathematics 244 (Syllabus begins on page 48) Mathematics 343 (Syllabus begins on page 51) Mathematics 446 (Syllabus begins on page 65) Statistics 342 (Syllabus begins on page 66)
1.5.3 apply the process of measurement to two- and three-dimensional objects using customary and metric units;	Mathematics 243 (Syllabus begins on page 45) Mathematics 244 (Syllabus begins on page 48) Mathematics 345 (Syllabus begins on page 60)
1.5.4 use geometric concepts and relationships to describe and model mathematical ideas and real-world constructs;	Mathematics 243 (Syllabus begins on page 45) Mathematics 244 (Syllabus begins on page 48) Mathematics 345 (Syllabus begins on page 60)
1.5.5 use both descriptive and inferential statistics to analyze data, make predications, and make decisions;	Mathematics 143 (Syllabus begins on page 43) Statistics 342 (Syllabus begins on page 66)
1.5.6 interpret probability in real-world situations, construct sample spaces, model and compare experimental probabilities with mathematical expectations, use probability to make predications;	Mathematics 143 (Syllabus begins on page 43) Statistics 342 (Syllabus begins on page 66)
1.5.7 use algebra to describe patterns, relations, and functions, and to model and solve problems;	Mathematics 143 (Syllabus begins on page 43) Mathematics 243 (Syllabus begins on page 45) Mathematics 244 (Syllabus begins on page 48) Statistics 342 (Syllabus begins on page 66)

PART 2: NARRATIVES & MATRICES

Mathematics Content Preparation Matrix (continued):

4-8 Outcomes	Course #'s which address this outcome. Be sure the syllabus for each listed course reflects that this outcome is addressed.
1.5.8 understand the role of axiomatic systems and proofs in different branches of mathematics, such as algebra and geometry;	Mathematics 243 (Syllabus begins on page 45) Mathematics 244 (Syllabus begins on page 48) Mathematics 345 (Syllabus begins on page 60)
1.5.9 understand calculus as modeling dynamic change, including an intuitive understanding of differentiation and integration and apply calculus concepts to real-world settings;	Mathematics 348 (Syllabus begins on page 64)
1.5.10 understand the major concepts of Euclidean geometry from a variety of perspectives including coordinate and transformational;	Mathematics 345 (Syllabus begins on page 60)
1.5.11 use mathematical modeling to solve real-world problems;	Mathematics 446 (Syllabus begins on page 65)
1.5.12 use counting to enumerate and order; use matrices, finite graphs, and trees to model problem situations; describe basic algorithms for accomplishing tasks;	Mathematics 344 (Syllabus begins on page 55)
1.5.13 understand and apply the concepts of proportional reasoning.	Mathematics 143 (Syllabus begins on page 43) Mathematics 243 (Syllabus begins on page 45) Mathematics 244 (Syllabus begins on page 48)
1.6 Programs prepare prospective teachers who have a knowledge of historical development in mathematics that includes the contributions of underrepresented groups and diverse cultures.	Mathematics 348 (Syllabus begins on page 64)

PART 2: NARRATIVES & MATRICES

TEACHING PREPARATION

Teaching Preparation Narratives:

The first part of our program, the nine mathematics content courses, prepare teachers who can meet these outcomes in two ways: 1) by developing a depth of understanding of the mathematical content they will be expected to teach which will give them greater insight into their own students' understanding; and 2) by providing them with multiple opportunities to experience learning in environments which model the spirit and recommendations set forth in the reform documents. These experiences will make the non-traditional instructional strategies recommended familiar and comfortable and thus will facilitate the prospective teachers' implementation of these strategies in their own classrooms.

Only after the nine mathematics content courses have been completed do the prospective teachers begin to devote focused attention to children as learners of mathematics.

2.1 Diverse Learners:

Our program focuses on diverse learners from three perspectives: learning style, learning exceptionalities (from students who struggle with learning mathematics to those who are gifted) and cultural differences.

- A. Diversity in Learning Style: Our prospective teachers experience, as learners, a wide variety of instructional strategies in their nine required mathematics content courses. The general methods courses the students take incorporate a wide variety of experiences which focus on diversity in learning styles not necessarily connected directly with mathematics. The mathematics methods course requires students to consider what they have learned about diversity in learning styles and incorporate activities that will allow students to capitalize on their strengths when they develop lesson plans for mathematics.
- B. Diversity in Learning Exceptionalities: The general methods courses our prospective teachers take incorporate a wide variety of experiences which focus on the causes and manifestations of learning exceptionalities. The mathematics methods course dedicates one class period to a focused discussion on learning exceptionalities and invites an intervention specialist to come to the class to talk to the prospective teachers about this topic. The prospective teachers are required to develop modifications for lesson plans they design which will accommodate exceptional learners on both ends of the spectrum – from those who may be struggling with a concept to those who grasp a concept quickly and need additional challenge and extensions.
- C. Cultural Diversity: The general methods courses our prospective teachers take incorporate a wide variety of experiences which focus on cultural diversity. The mathematics methods course addresses two elements of cultural diversity: 1) how the culture of learning environments, both at home and at school, influence motivation and the development of effective learning strategies; and 2) how to evaluate instructional materials for gender and/or cultural bias or imbalance. The field experiences guarantee that all prospective teachers experience teaching in both urban and suburban settings.

PART 2: NARRATIVES & MATRICES

2.2 Technology:

The prospective teachers in our program take two general methods courses which focus on technology in education: EDT 280, Classroom Applications of Computer-Based Technology; and ED 622, Technological Instruction & Integrated Methods for the Middle Level.

The nine mathematics content courses incorporate technology whenever it is possible and appropriate. Students use scientific calculators, graphing calculators, and computer programs like Sketchpad and Fathom on a regular basis.

The mathematics methods course addresses technology in three ways. First, there is focused discussion on the use of technology in the mathematics classroom, including discussion about how technology can be used well or used poorly as well as discussion about the public controversy and misconception surrounding use of technology (most specifically calculators) in classrooms.

In addition, the mathematics methods course emphasizes the technological resources available to teachers. Prospective teachers are introduced to, and required to use, discussion lists, the internet, OhioLink, and ERIC as resources for student activities and professional development.

Finally, the College of Education and Human Services has a commitment to building a library of software resources that will be housed in our Educational Resource Center. As our holdings of educational software increase we are committed to making use of that software an important element of the mathematics methods coursework. The prospective teachers will be required to explore and evaluate software that may be used in the middle childhood mathematics classroom and develop lesson plans which incorporate instructional software in effective and meaningful ways.

2.3 Assessment:

Our students will experience, as learners, a wide variety of non-traditional assessment strategies in their nine mathematics content courses. These experiences will make non-traditional assessment strategies familiar and comfortable and thus will facilitate the prospective teachers' implementation of these strategies in their own classrooms.

Within the mathematics methods course, prospective teachers will be required to think about and articulate the "prior knowledge" or "scaffolding" required for a child to be ready to learn a given concept and to identify strategies to determine whether or not a child is ready to begin learning a new concept. Students will also be required to articulate objectives for student learning which will have embedded in them strategies for assessing whether or not the student has mastered the material desired. Finally, students will be required to incorporate into those objectives, and into their lesson plans, a wide variety of assessment strategies which are sensitive to the learning styles and exceptionalities of their students. A major focus of discussion related to assessment will be alignment with objectives and learning experiences.

Our prospective teachers will be required to implement and reflect upon a variety of assessment strategies during their field experiences.

PART 2: NARRATIVES & MATRICES

Teaching Preparation Matrix:

Although the mathematics content courses contribute in a significant way to the outcomes below (see the narratives above), they do not focus specifically on the concepts described in outcomes 2.4 through 2.10 below. To avoid an overly complicated matrix, only the methods class – in which the prospective teachers think about children as learners -- has been listed in the matrix below.

4-8 Outcomes	Course #'s which address this outcome. Be sure the syllabus for each listed course reflects that this outcome is addressed.
2.4 Programs prepare prospective teachers who can identify, teach, and model problem solving in grades 5-8.	Education 610 (Syllabus begins on page 37)
2.5 Programs prepare prospective teachers who use a variety of physical and visual materials for exploration and development of mathematical concepts in grades 5-8.	Education 610 (Syllabus begins on page 37)
2.6 Programs prepare prospective teachers who use a variety of print and electronic resources.	Education 610 (Syllabus begins on page 37)
2.7 Programs prepare prospective 5-8 teachers who know when and how to use student groupings such as collaborative groups, cooperative learning, and peer teaching.	Education 610 (Syllabus begins on page 37)
2.8 Programs prepare prospective teachers who use instructional strategies based on current research as well as national, state, and local standards relating to mathematics instruction.	Education 610 (Syllabus begins on page 37)
2.9 Programs prepare prospective teachers who can work on an interdisciplinary team and in an interdisciplinary environment.	Education 610 (Syllabus begins on page 37)
2.10 Programs introduce and involve prospective teachers in the professional community of mathematics educators.	Education 610 (Syllabus begins on page 37)

PART 2: NARRATIVES & MATRICES

Field Experience Matrix:

4-8 Outcomes	Course #'s which address this outcome. Be sure the syllabus for each listed course reflects that this outcome is addressed.
3.0 FIELD-BASED EXPERIENCES	
3.1 Programs provide prospective teachers with a sequence of planned opportunities prior to student teaching to observe and participate in 5-8 mathematics classrooms with qualified teachers. Experiences include observing, tutoring, mini-teaching, and planning mathematics activities and lessons for different mathematics courses.	Education 610 (Syllabus begins on page 37) Education 614 (Syllabus begins on page 70) Education 616 (Syllabus begins on page 72) Education 641 (Syllabus begins on page 75)
3.2 Programs provide prospective teachers with a full-time student teaching experience in 5-8 mathematics that is supervised by a qualified teacher and a university or college supervisor with a 5-8 mathematics teaching experience.	Education 616 (Syllabus begins on page 72) Education 641 (Syllabus begins on page 75)
3.3 Programs provide prospective teachers with time to confer with the supervising teacher and to do instructional planning.	Education 641 (Syllabus begins on page 75)

PART 2: NARRATIVES & MATRICES