**George Mason University**
**College of Education and Human Development, Graduate School of Education**
**FAST TRAIN Program**

# EDUC 513-601: TEACHING MATHEMATICS IN INTERNATIONAL SETTINGS

(3 credits) Spring 2011


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## I. Course Description

This semester-long course is an introduction to methods for teaching developmentally appropriate topics in arithmetic, algebra, geometry, measurement, and data analysis and probability to international students in international schools. Students focus on student mathematical thinking through field experiences, hands-on activities, and class discussions. Students learn to use their knowledge of student mathematical thinking as they engage in the cyclical process of planning, enacting, observing, and reflecting on instruction for diverse learners. Students work with manipulatives and technologies to explore mathematics, solve problems, and learn ways to teach mathematics content to elementary children. This course is approved for the sequence of courses in the George Mason University IB certificate program. Field experience is required.
Prerequisite: EDUC 511

## II. Student Outcomes

This course will enable students to:

A. Know what constitutes the essential topics in K-6 mathematics in international schools.
B. Identify and use selected manipulatives and technology such as Linking Cubes, Attribute Blocks, Geoboards, Base-10 Blocks, Fraction Circles, Tangrams, virtual manipulatives, calculators, and computers to teach appropriate mathematics content topics in K-6.
C. Know and explain what is a standards-based mathematics curriculum, what are the key elements of the National Council of Teachers of Mathematics Principles and Standards for School Mathematics, and what are the key elements of the International Baccalaureate Primary Years Programme.
D. Implement standards-based lessons using a variety of instructional resources, technology, and strategies (cooperative and peer group learning, activity centers, laboratories and workshops, teacher-directed presentations, etc.) to teach diverse learners.
E. Identify and use alternative methods for assessing student mathematical thinking and performance.
F. Reflect on practice to improve instruction.
G. Solve problems in the mathematical content areas of logic, number theory, geometry, algebra, probability, and statistics appropriate for adaptation to the early and intermediate grades.

## III. Relationship to Program Goals and Professional Organizations

**Student Outcomes Referenced to Selected National Standards**

| Course Student Outcomes (above) | NCTM Principles and Standards | ISTE NETS | INTASC |
|---|---|---|---|
| A | S1, S2, S3, S4, S5 | SI | P1, P7 |
| B | S10 | SII | P1, P2, P6 |
| C | S1-10, P1-6 | SI | P1, P7, P9 |
| D | P1, P2, P3, P4, P6 | SII | P1, P2, P3, P4 |
| E | P5 | SIV | P3, P8 |
| F | P3 | SII | P9 |
| G | S1, S2, S3, S5, S6 | SI | P4, P6 |

Key:
NCTM Principles and Standards = National Council of Teachers of Mathematics Principles and Standards for School Mathematics (2000), where P = principles and S = standards.
ISTE NETS = International Society for Technology in Education National Education Technology Standards 2000, where S = standard number
INTASC = Standards for Licensing Beginning Teachers, where P = principles

**Primary Years Programme Areas and Domains Relevant to Teaching K-6 Mathematics in International Schools**

| Course | Curriculum | Teach/Learn | Assessment | Professional |
|---|---|---|---|---|
| Teaching Elementary Mathematics in International Schools | A | E, F, G, H | I, J, M | N, O |

## Area of inquiry 1: Curriculum processes

A: International education and the role and philosophy of the IBO programmes

**What is international education and how does the IBO's mission and PYP philosophy promote it?**

A consideration of aims and development of international education, the values and mission of the IBO and the beliefs and values of the PYP programme including the:

- PYP perspective on internationalism
- the centrality of the learner profile
- criteria for assessing international mindedness in the school environment.

## Area of inquiry 2: Teaching and learning

E. Learning theories, strategies and styles

**What is constructivist learning and how is this exemplified in PYP practice?**

- the centrality of structured, purposeful inquiry and the engagement of students actively in their own learning.
- the role of the planner in supporting the planning and development of authentic PYP transdisciplinary learning.
- the value and role of collaboration and reflection in the development of authentic PYP transdisciplinary learning.
- criteria for the planning and evaluation of the effectiveness of authentic PYP transdisciplinary learning.

F. Teaching methodologies and the support of learning

**What learning activities and teaching strategies support PYP learning outcomes?**

- The centrality of using a range and balance of teaching strategies that incorporate student inquiry as an integral part of the learning process and demonstrate appropriate teaching strategies to develop meaningful and relevant inquiry.

G. Differentiated teaching strategies

**How does the PYP enable the learning needs of all students to be supported?**

An appreciation of how differing teaching strategies impact and address the needs of students:

- with different levels of competency, types of ability, learning styles and learning difficulties
- for whom the language of instruction is not the mother tongue.

H. Selection and evaluation of teaching and learning materials

**What learning resources support PYP practice and how are they selected?**

Criteria for the selection and evaluation of appropriate teaching and learning resources to:

- support the achievement of PYP learning outcomes
- represent multiple perspectives and diverse cultures that exist in school and global communities
- meet the needs of students operating in languages other than their own
- meet the needs of students with special learning needs.

## Area of inquiry 3: Assessment and learning

I. The principles of assessment

**What is the role of assessment in PYP practice?**

J. Developing assessment strategies

**How are assessment strategies designed and implemented to support PYP practice?**

- strategies enable effective assessment of broad and specific PYP learning outcomes.
- strategies enable evidence from a variety of contexts to be gathered using a range of techniques according to the nature of what is being assessed.

M. Effective feedback

**How is student-learning progress effectively communicated to students and parents?**

The design and implementation of alternative procedures for:

- recording authentic student achievement
- providing feedback to students and parents about learning progress and outcomes.

**Area of Inquiry 4: Professional Learning**

N. The principles and processes of reflective practice

**What is reflective practice and how it supports programme implementation and enhance PYP practice?**

- the process of reflective practice and its role in improving teaching and learning in the PYP context.
- current standards and practices pertaining to the implementation of PYP programme.
- current innovations and ideas in the area of international education and other educational contexts and how these can apply to enhancing the implementation of the PYP.
- PYP authorization and evaluation processes.
- PYP curriculum review process.

O. Collaborative working: planning, implementation and evaluation

**What is the role of collaborative working practice in supporting the PYP learning outcomes?**

The PYP programme requirements regarding the desirability of effective collaborative planning, instructional design and evaluation in that they:

- address assessment issues throughout the planning process
- address all of the essential elements (concepts, skills, knowledge, attitudes and action)
- emphasize the connections between transdisciplinary and subject disciplinary teaching and learning
- recognize a variety of levels of language competency
- accommodate a range of individual learning needs and styles

## IV. Nature of Course Delivery

In this course we will begin an inquiry into mathematics teaching and learning that will guide you and give you the tools that will enable you to continue to inquire and learn as part of your work as a teacher. Class sessions will be interactive and will include a variety of hands-on experiences with concrete and virtual manipulatives appropriate for elementary school mathematics. We will explore the teaching of mathematics, investigating both *what* to teach and *how* to teach it. We will explore what it means to do mathematics and what it means to understand mathematics through individual, small group, and large group mathematical problem solving. We will investigate ways to represent understandings of mathematical concepts, communicate reasoning about mathematical ideas, and construct mathematical arguments. We will investigate and read about ways children might represent mathematical concepts, looking at ways to help children build connections and see relationships among mathematical ideas. We will explore characteristics of a classroom environment conducive to mathematical learning by reading and discussing the importance of mathematical tasks, mathematical tools, the roles of teachers and students, and the assessment of mathematical understanding.

## V. Texts & Readings

*Required:*

Reys, Lindquist, Lambdin, & Smith. (2007). *Helping Children Learn Mathematics*, 8th edition, New York: John Wiley & Sons, Inc.

Ashlock. (2006). *Error Patterns in Computation: Using Error Patterns to Improve Instruction*, 9th edition, Upper Saddle River, NJ: Pearson.

*Recommended Websites to Bookmark:*

National Council of Teachers of Mathematics: www.nctm.org
Virginia Department of Education: http://www.doe.virginia.gov/
Textbook Companion Site: http://www.wiley.com/college/

## VI. Course Requirements and Assignments

The assignments across the semester are intended to further your understandings of what it means to teach, learn, and assess mathematics in light of current reforms in mathematics education. Assignments are due at the beginning of class on the day which they are due. Electronic submissions must be made prior to the start of class that day. All assignments are to be turned in to your instructor on time. **LATE ASSIGNMENTS**: Late work will not be accepted for full credit. If the student makes prior arrangements with the instructor, assignments turned in late will receive a 10% deduction from the grade per late day or any fraction thereof (including weekends and holidays).

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|---|---|---|
| Mathematics Content Exam #1 (20%)<br>Error Patterns in Computation Exam #2 (10%)<br>Mathematics Content Exam #3 (20%) | > | **50% Mathematics Content** |
| Lesson Plans (20%)<br>Student Assessment Interview (20%)<br>Classroom Experience/Presentations/Participation (10%) | > | **50% Mathematics Pedagogy** |

### A. Exams (50%)

The two mathematics Content Exams **(Feb 2nd & April 20th)** in this course will consist primarily of multiple choice and problem solving questions that focus on mathematics content in the elementary grades, with some questions focusing on methodological content. Throughout the semester, brief content-specific homework assignments will assist you in reviewing important mathematics appropriate for the elementary grades. The Error Patterns Exam **(March 9th)** will focus on your ability to identify children's errors in computation for the purpose of improving mathematics instruction. If you must be absent from a scheduled exam (with instructor approval), you must contact the instructor personally, prior to the exam, to make alternative arrangements to take the exam.

B**. Three Lesson Plans (20%)**

You are required to plan, teach, and reflect on three mathematics lesson plans. One lesson will be planned collaboratively by grade level teams. The format for designing your mathematics lessons will be provided in class. Try to avoid the *overuse* of worksheets. Plan lessons with a problem solving approach. Focus on the integration of mathematical tools (manipulatives, calculators, computers) and representations (concrete, visual, symbolic) to provide children with an interactive, conceptually based mathematics experience.
The lesson plan summaries are a three-phase process: (1) Design the lesson plan, (2) Teach the lesson in your classroom, and (3) Collect and report evidence of student learning from the lesson.

**C. Student Assessment Interview (20%)**

Teacher Anthology and PBA's:

The Teacher Candidate Anthology (TCA) is designed to be a collection of performance-based tasks that are valid samples of candidate work throughout the program. It documents the individual's knowledge, skills, dispositions and ability to teach. Further it documents the candidate's ability to positively influence PK-6 student learning. Its purpose is to assess the attainment of the Interstate New Teacher Assessment and Support Consortium (INTASC) standards and to provide an avenue for growth and reflection. Please see the FAST TRAIN website: http://gse.gmu.edu/fasttrain/programs_of_study/elementary/ for more guidelines about the anthology requirement.

All FAST TRAIN licensure courses have a required Performance Based Assessment (PBA) which must be included in the students' TCA. The required PBA for this course is a student assessment interview. In order to plan effective instruction, you will need to know how to assess children's knowledge of mathematical concepts. One way to assess children's thinking is a diagnostic interview. This assignment has two parts: (1) Design a plan for the interview, assessing a specific mathematics topic using concrete, pictorial and abstract representations, (2) Conduct the interview with a child and write a report describing the outcome of the interview. Your PBA must be submitted to TASK STREAM, where it will be reviewed and graded, in order to receive credit. You will present a synopsis of your interview in class. **(PLAN due – Feb 16th: REPORT due – March 30th)**

**D. Classroom Experience/Presentation/Participation (10%)**

A variety of field experience, presentation, and participation activities will be integrated into our class sessions this semester. You will share ideas on student error patterns, required course readings, and technology during class sessions. You will participate in class activities such as problem solving and concept mapping during class time. These assignments require your active engagement in class sessions; therefore, there is no opportunity to "make-up" these assignments.

Field experience documents (signed logs of hours and signed teacher recommendation) will be part of your final grade. Grades are held until all documents are sent to your instructor; failure to complete your field work will make you ineligible to register for your next class. See field experience information sheets for more information

Attendance. It is your responsibility to attend all class sessions. You are held accountable for all information from each class session whether you are present or not. Please report your reasons for any absences to the instructor in writing. Tardiness. It is your responsibility to be on time for each class session. Please report your reasons for any tardiness to the instructor in writing.

**VII. Evaluation Schema**
Determination of the Final Grade:

Graduate Grading Scale

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|---|---|---|---|---|---|
| A | 93%-100% | B+ | 87%-89% | C | 70%-79% |
| A- | 90%-92% | B | 80%-86% | F | Below 70% |

The mathematics education courses in GSE's FAST TRAIN Elementary Education Program integrate pedagogy and mathematics content appropriate for the elementary school grades. For students to earn a grade of A in the course, they must demonstrate excellence in *both* the pedagogical knowledge and the content knowledge of the mathematics appropriate at their level of teaching. Thus, the grading in the course is structured to help evaluate