George Mason University
College of Education and Human Development
UTEEM Program

EDUT 615: Developing Concepts in Early Childhood Mathematics and Science for Diverse Learners, K-3

Fall 2005

Fridays
Robinson A412

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Prerequisite

Admission to the UTEEM program or permission of the instructor.
This course is offered as one of the strands in the UTEEM program that prepares teachers to work with culturally, linguistically, and ability diverse young children and their families.

Course Purpose

Examines pre-operational and concrete operational thought processes of conservation, seriation, observation, comparison, classification, and early number concepts. Uses concrete science/math materials and experiences to foster development of quantitative thinking in geometry, measurement, graphing, and whole number arithmetic. Covers the construction of math and science lessons and hands-on experiences that address the needs of a variety of student populations, such as children with disabilities, gifted and talented children, and minority and culturally diverse groups

Course Objectives:

This course is designed to enable students to:

1. Develop an understanding of the changing focus in both curricula and pedagogy at the early childhood level and implications for math and science instruction.

2. Develop strategies to help young children become mathematically and scientifically literate, think critically and creatively, and to see the relationships between mathematics, science, social studies, and language/literacy.

3. Develop the skills necessary to utilize a variety of methods in teaching mathematics and science to young children.

4. Develop insight in selecting, modifying, and presenting instructional activities in mathematics and science.

5. Develop science activities for young children using the scientific process with an emphasis on describing, analyzing, and quantitatively presenting findings.

6. Construct math and science experiences in an environment which promotes equity and responds to cultural, linguistic, and ability diversity.

7. Become familiar with local curriculum standards for mathematics and science, with the Virginia Standards of Learning for science and mathematics, with the standards identified by the National Council of Teachers of Mathematics, and with the National Science Education Standards.

8. Consider the role of family and community knowledge, experience, and resources in planning and implementing mathematics and science content in the K-3 curriculum.

9. Become familiar with a variety of sources for ideas and materials useful in teaching mathematics and science.

10. Demonstrate the ability to integrate mathematics and science objectives into planning and implementing an integrated project.

11. Use authentic assessment strategies to describe young children's understanding of mathematics and science concepts.

12. Reflect on one's own use of inquiry strategies in facilitating children's learning of mathematics and science concepts.

Relationship of Course to Program Goals and Student Outcomes

This course is designed to enable preservice early childhood students to teach mathematics and science concepts in an integrated fashion to young children. It was developed with reference to the "Guidelines for Teacher Education in Four- and Five-Year Programs," prepared by the National Association for the Education of Young Children (NAEYC), with the standards identified by the Council for Exceptional Children for teachers of children with special needs, as well as with reference to the standards for Virginia teacher licensure in early childhood special education, early childhood education (PK-3), and English as a second language education. This serves as the foundational course for teaching mathematics and science and will enable students to develop and implement integrated mathematics and science experiences for diverse learners into the K-3 curriculum. Continuous opportunities for application of content knowledge to the K-3 classroom is ensured by students' concurrent participation in an internship placement in a K-3 class.

Required Texts

*Berk, L. & Winsler, A. (1995). Scaffolding Children's Learnng: Vygotsky and Early Childhood Education. Washington, DC: National Association for the Education of Young Children.

Chaille, C. & Britain, L. (1997). The young child as scientist. New York: Longman.

Charlesworth, R. & Lind, K. (1999). Math and science for young children. Albany, NY: Delmar.

Smith, S.S. (2001). Early childhood mathematics. Boston, MA: Allyn and Bacon.

*Vygotsky, L. (1986). Thought and Language. Cambridge, MA: The Massachussetts Institute of Technology.

**Certain chapters of these books will be on e-reserve or on Blackboard.*

Additional Resources

Baratta-Lorton. (1995). Mathematics their way. Menlo Park, CA: Addison Wesley.

Barba, R. (1998, 2nd ed.). Science in the multicultural classroom: A guide to teaching and learning. Boston, MA: Allyn and Bacon.

Bredekamp, S. & Rosegrant, T. (1995). Reaching potentials: Transforming early childhood curriculum and assessment (vol. 2). Washington, DC: National Association for the Education of Young Children.

Katz, L. & Chard, S. *The Project Approach.* (handout from Roopnarine)

Mode or Nature of Course Delivery

Course delivery will be through mini-lectures, cooperative learning groups based on learning theorists, and case study groups linking student learning to national standards and program/student outcomes. To meet course objectives, the delivery of EDUC 613 is accomplished through a combination of experiential learning activities, in-class collaborative work groups, and mini-lectures designed to help meet the needs of all learners and learning styles. These include:

- *Presentations* (i.e., mini-lectures, often assisted by Power Point and other visuals);
- *Discussions* (i.e., active involvement of students in learning by asking questions that provoke critical thinking and verbal interaction);
- *Cooperative learning* (i.e., small group structure emphasizing learning from and with others);
- *Collaborative learning* (i.e., heterogeneous groups in an interdisciplinary context);
- *Guest lectures;*
- *Student sharing and mini-presentations;*

Students with Special Needs

Students who require any special accommodations or those with disabilities that may affect their ability to participate fully in the course are encouraged to work with the instructor to ensure their successful participation.

This syllabus is subject to change based on the needs of the class. The Americans with Disabilities Act (ADA) prohibits discrimination against individuals with disabilities in the series, programs, or activities of all state and local governments. Under ADA a disability is defined as a physical or mental impairment that substantially limits a major life activity such as: learning, working, walking, speaking, hearing, breathing, and/or taking care of oneself. If a student has disability and needs course adaptations or accommodations because of that disability, it must be established with the faculty, in writing, at the beginning of the semester so arrangements can be made. Please call the Disability Resource Center for required documentation (703-993-2474).

Course Requirements and Explanation of Assignments

1. **Class participation:** regular and on-time attendance for morning and afternoon sessions. (If you are unable to attend a particular session, please leave a message on my answering machine); completion of assignments on-time (use APA format); and active participation in large and small group discussions.

2. **Constructivist Observation:** Read the article given in class, 9/3. Observe your cooperating professional and physical classroom environment. Write a 2-3 page observation regarding the following: *What is the teacher's role in the classroom? What is the student's role in the classroom? Is the environment a "hands on" environment or are all activities teacher driven? What informal assessment methods are used? What language opportunities are given to the children (across the curriculum)?* Address other points of interest to you that are brought up in the article. This activity is given during the first week of school so all concepts may not be addressed within your classroom but observe your entire environment for constructivist techniques and theories. This assignment will also be my assessment of your writing and observation skills.

3. **Teaching/Learning observation**:
    a. During your first weeks on site, observe at least one math lesson or science lesson. Consider what concepts were being addressed. What were the instructional objectives? Were there any individual objectives? How did you know? What would a child need already to understand in order to be successful in this activity? How did you determine if the objective was mastered? If the objective was not mastered, how did you know? What would be your next step? Your focus is on what is being taught, what is being learned, and what is not being learned.
    b. Prepare a brief paper (using the attached guidelines - **attachment 1**) which describes your understanding of what was being taught and on how well it was learned by at least two children. Provide specific linkages to the readings. **(Due September 30)**

4. **Lesson Plan**:
    a. Within your student teaching experience, you must select one (math or science) lesson to write as an in depth lesson plan. Based on the UTEEM planning format (attachment 2), you are provide me with a step by step accounting of what you did with your students. This in-depth plan should enable me to visualize exactly what you expected to happen.

    b. As a part of this assignment, you will interview your CP and post what you learned from that interview on blackboard. This will allow the entire class to read different approaches and methods of planning. Please include a copy of your Blackboard posting in your final submission of your lesson plan.

    c. Once you have implemented the lesson/activity, write a **reflection** to attach to the lesson. What worked? What did you change on the spot? What would you change if you did it again? What did you notice about children's learning? What further extensions/adaptations would reinforce that learning? What would be good follow up? Were your objectives appropriate? Too difficult? Too easy? What inquiry strategies did you use? How well did they work? **This assignment is due to me as soon as possible after the day on which you implemented the lesson/activity. All assignments must be turned in to me no later than the final session on December 2. In your reflection, please include connections to the readings.**

5. **Informal Assessment:** In order to understand how children think about various science concepts, choose one child from your internship classroom to interview **(ideally, this is the child for whom you will be developing a portfolio in the assessment class)**.

    a. In this interview, you want to find out what this child knows about a selected science concept (selected from the text and/or from POS/SOL's). Use an open ended interview; ask the child to demonstrate his/her knowledge with manipulative or with a drawing. **NOTE: This should feel like a conversation not a test for the child.**
    b. Based on your conversation with this child, as well as the child's drawing or demonstration, develop a brief paper which includes: 1) The child's age/grade/brief description of your prior understanding of the child; 2) the concept investigated and why; 3) a description of interview and what the child showed you in demonstration or picture; 4) an analysis of what you have learned about the child's understanding; 4) a brief description of the types of experiences you would plan to enrich the child's understanding of the concept investigated. Include any adaptive strategies that would promote gender, ethnic, and ability equity in addressing this concept with this child; and 5) your own reflection about what you learned about children and science teaching/learning. Provide support and documentation from the interview and from your readings. Use the readings to support your approach to the

interview. Please attach a transcript of the conversation and any artifacts which document the child's understanding. **You should plan to do this during October, as it will contribute to your full time teaching and also contribute to your individual child portfolio. The paper is due no later than 10/28.**

7. **Teaching Analysis:** During the weeks of November 1-23, maintain a reflective log about yourself as a math/science teacher.

   a. On a **daily basis**, describe and reflect (briefly - jottings are fine) on each math or science lesson you teach or observe, or any math or science learning that occurs incidentally.

   b. Prepare a paper which discusses what you have learned about yourself, what was easy or hard, what you enjoyed , what you were afraid to try, what you are still wondering. Based on your experiences, what were your strengths related to teaching math/science? What goals do you have for yourself? **Provide your jottings as an attachment to the paper**. In the reflection, use your readings, as well as issues discussed in class to support your analysis. It is expected that you will specifically demonstrate that you have made adaptations for children with special needs and efforts to establish a community, culturally, and linguistically relevant environment. **Due anytime between November 23 and December 9. I will not accept papers given to me after December 9, unless for some reason you did not complete your internship.**

8. Final Project: Group Materials/Resources.

   a. As teams, you will be developing materials/resources for teaching mathematics/science concepts to share with your classmates. Select from the list of attached mathematics/science categories **(attachment 3)** and develop resource packets which includes:

   - an explanation of why this concept is important.
   - a description of strategies that could be used to help children learn about the concept. (Include issues of equity and access)
   - references to children's literature that could be used to support instruction around this concept. (Include at least five references and an independent annotation for each book)
   - references for technology resources (for use by children) appropriate for this concept. (Include at least five, with at least one, not more than two, web sites)
   - teacher references and resources (minimum of five, including one, and not more than two web sites).
   - list of hands-on manipulative and other materials to support this concept.

   b. Come to class **December 9**, with enough copies of your resource guide for the instructor and your classmates. Prepare a resource display. Prepare a presentation which: models an appropriate instructional activity; demonstrates

one technology resource; and briefly highlights the concept area.

Course evaluation

Constructivist Observation	5%
Teaching/Learning Observations	10%
Lesson Plan and Reflection	20%
Informal Interview Assessment	15%
Teaching Analysis	20%
Group Materials/Resources	20%
Participation	10%

Grading Criteria

93-100	A
89-93	A-
86-89	B+
83-86	B
79-83	B-
70-79	C
<70	F

Honor Code

To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of George Mason University and with the desire for greater academic and personal achievement, we, the members of George Mason University, have set forth the following code of honor: Any individual who is caught in the act of cheating, attempting to cheat, plagiarizing, or stealing will be brought forth before a council of their peers. In the event that the individual is found guilty, he or she will be punished accordingly. For further information, please refer to the University Catalog or Website at www.gmu.edu.

EDUT 615 Class dates and topics

Date	Topics addressed	Required Reading	Assignments Due
9/2	Introduction Syllabus Overview		
9/16	Constructivist Approach to Math; Lesson plan overview;	Charlesworth & Lind 3,22 Smith 1,13 Berk & Winsler 6	Constructivist Observation
9/30	Constructivist Approach to Science; Equity in math and science education	Charlesworth & Lind 7 Chaille & Britain 1-4 Vygotsky 6	Teaching/Learning Observation
10/14	Modifications for diverse learners; Assessment; Scope and sequence.	Charlesworth & Lind 4, 15 Appendix A Smith 12,14	
10/28	Inquiry Approach to Science; Technology	Charlesworth & Lind 5,6 Smith (technology referenced throughout book) Chaille & Britain 5,6,7	Informal Assessment
12/2	Debriefing; Unfinished business!	Charlesworth & Lind TBD Smith TBD Chaille & Britain TBD	Lesson Plan (on or before 12/2)
12/9	Presentations		Group Resource Project Teaching Analysis

Attachment 1
Teaching/Learning Observation (complete one for math and science)

Subject Area:

Description of Activity:

Concept/s Being Taught:

Objectives (Individual and/or group)

Describe one child who was successful. How did you know? What contributed to his success?

Describe one child who seemed to miss the concept or who was less successful. How did you know? What might have enhanced his success?

What else do you need to know to better understand this observation?

What teaching strategies seemed most effective?

Attach a page which provides an analysis linked to course discussion and readings.

Attachment 2
UTEEM Lesson Plan Format

Intern: **Grade Level:**

Lesson Topic/Subject:

Date/Time:

1. Lesson Overview

Concept:
Objectives, linked to school, county, state objectives:
Classroom context: (grouping, numbers of children, location, transition in/out, role of teacher, role of support staff)

2. Teaching/Learning Procedures

Objectives for each group
Individual objectives
Introductory activities (accessing prior knowledge and student interests)
Developmental activities (learning strategies, active learning opportunities, higher level thinking)
Summary activities (closure, transition, follow-up)

3. Materials

Students
Teacher

4. Links to Family/Community Knowledge and Experience

Preliminary information
Contribution
Follow-up
Link to family/community/knowledge and experience

5. Adaptations for Individual Learners and Developmental Needs

Gender, cultural, linguistic, and ability equity
Learning styles
Adaptive strategies

6. Orchestration and Monitoring

Ensuring active engagement

Introducing activities and experiences
Transitions
Forms of feedback
Management procedures

7. Assessment

Monitoring progress
Anecdotal records
Teacher observation
Work samples
Checklist
Student report
Student evaluation

8. Effectiveness of Lesson

Reflection on objectives, appropriateness, next steps.
Self reflection on teaching strategies.

Describe the children's responses to your lesson. Identify the aspects of your lesson that went well and why. Identify aspects that did not go well and why. Address changes you would make.

Attachment 3
Group Project Topics (from Virginia Standards of Learning)

Choose from one of the following groups:			
Number and Number Sense **Computation and Estimation** **Measurement**	**A**	**Scientific, Reasoning, & Logic** **Force, Motion, & Energy** **Matter**	**B**
Geometry **Probability and Statistics** **Patterns, functions, and algebra**	**C**	**Life Processes** **Interrelationships in Earth/Space Systems** **Earth Patterns, cycles, & Change** **Resources**	**D**

For each topic in the group, you will create a resource packet and give a presentation.