Curriculum Syllabus MAE 4394
Perspectives on Mathematics and Science Education

Florida International University

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Text: T.S. Kuhn, *Structure of Scientific Revolutions*,
J**.** Dewey, *Experience and Education*
NCTM, *Changing Faces of Mathematics* (Selected readings)
Other selected readings and resources
Samples:
USDOE, Status and Trends in the Education of Racial and Ethnic Groups
IEA, Trends in International Mathematics and Science Study (TIMSS)
IEA, TIMSS Video Study of Eighth-Grade Mathematics Teaching
IEA, TIMSS Video Study of Eighth-Grade Science Teaching
G. Knijnik, An Ethnomathematical Approach in Mathematical Education: A Matter of Political Power
Calabrese-Barton, Teaching Science for Social Justice

Sunshine State Standards for Florida's Teachers
http://www.fldoe.org/bii/curriculum/sss/

Co-Requisite: You will need to have a TaskStream account from https://www.taskstream.com/pub/ .

Course Content and Structure:
Research into expertise indicates that effective teaching incorporates both deep understanding of content, pedagogy, and students as learners of mathematics and science. This course will help students to develop an understanding of the theoretical frameworks and familiarity with literature on the multiple perspectives underpinning mathematics and science education. It will provide opportunities for students to explore the teaching and learning of mathematics and science in countries around the world. Students will engage with literature and other resources as they become aware of and develop their understanding of multiple perspectives in mathematics and science education and develop knowledge of practices for teaching mathematics and science to diverse learners in multicultural and multiethnic environments. The course assignments will help support students' critical reflection on their emerging knowledge about mathematics or science teaching and learning.

Course Structure
This course employs a variety of approaches for student learning: small group work, whole group work, individual work and reading, as well as small group and individual presentations.

College-level Competency: Critical Thinking; Content/Discipline Knowledge and Skills; and/or Oral and Written Communication

Student Learning Outcomes

Students will:

(1) be able to demonstrate knowledge of the interrelatedness of issues of multicultural mathematics and/or science education at the local, global and international levels. (Global Learning(GL)-Global Awareness)
(2) be able to develop a global multiple-perspective analysis of an issue that impacts mathematics and/or science education. (GL-Global Perspective)
(3) be able to demonstrate willingness to develop multicultural mathematics or science education lesson plans that address the needs of diverse learners. (GL-Global Engagement)
(4) read about, discuss, and research issues of importance to teaching and learning mathematics or science from multiple perspectives developing knowledge of strategies for continuous improvement.
(5) learn to use data from classroom environments for exploring and reflecting on the teaching and learning in mathematics and science classes from multiple perspectives.
(6) discuss and examine the teaching and learning of mathematics or science among diverse populations and identify ways that educational research informs expert teaching practice.
(7) learn about various assessment strategies that can be used to determine student levels and needs.
(8) develop a mathematics or science lesson from a multicultural/social justice perspective.
(9) read and analyze research pertinent to issues of teaching and learning of mathematics or science among diverse populations.
(10) be able to describe appropriate mathematics or science instruction and curricula to reach a diverse student population.
(11) compare and contrast different approaches to teaching and learning mathematics or science and describe impacts of instruction on students with social, cultural, ethnic, cognitive, gender, and physical differences.
(12) reflect on and discuss their own perspectives on mathematics or science education with respect to the issues discussed in the literature and in class.

Florida Educator Accomplished Practices: The Florida Educator Accomplished Practices (FEAPs) formally assessed in this course include:

FEAP 5. Diversity. Preservice teachers develop knowledge of different ways diverse (e.g., cultural, linguistic, special needs, gender) students acquire knowledge and instructional materials and strategies that support and accommodate diverse student learning and encourage learning about diverse cultural groups. This is addressed in weeks 1, 3, 4, 7, 10-15.

FEAP 7. Human Development and Learning. Preservice teachers develop knowledge of learning theories and related strategies and rationale for accommodating students with different learning needs, developmental levels, experiential backgrounds, linguistic development and cultural heritage and apply knowledge of learning theories in planning lessons. This is addressed in weeks 4-15.

FEAP 8. Knowledge of Subject Matter. Preservice teachers develop knowledge of materials and technologies of the subject field for developing learning activities and ways to communicate with students about subject matter in a manner that enables students to learn. This is addressed in weeks 2, 7, 8, 10, 12-15.

FEAP 10. Planning. Preservice teachers learn to plan lessons that lead to student outcomes consistent with state and district standards in mathematics and science. They develop knowledge of activities and materials that support knowledge, processes, skills, and attitudes to be learned in mathematics and science in ways that addresses varied student learning needs and performance levels. This is addressed in weeks 6-8, 11-13, 15.

Course Policies

Attendance – Learning is an inherently social endeavor, and while it is true you could read the articles at home and think deeply about them, this does not support the socio-cultural view of learning as you will miss out on the norms, practices and tools this class will hope to engender. It is the student's responsibility to attend all class sessions. You are held responsible for all information from each class session whether you are present or not. Each unexcused absence will reduce your final grade by 5%.

Assignment submission – All assignments are to be turned in on time by due date. For assignments (other than homework) turned in late, 10% will be lost per late day or any fraction thereof, including weekends and holidays. There are no extra credit assignments in this course.

University Policies

Academic Misconduct – Academic misconduct by students includes all acts of dishonesty in any academically related matter and any knowing or intentional help or attempt to help, or conspiracy to help, another student

commit an act of academic dishonesty. The Academic Misconduct Disciplinary Policy will be followed in the event of academic misconduct.

Accommodations – If you are registered with the Office of Disability Services, please make an appointment with the instructor as soon as possible to discuss any course accommodations that may be necessary. If you have a disability but have not contacted the Office of Disability Services, please call 348-3532 or go to GC190 to register for services.

Plagiarism - Plagiarism is the act of representing words, data, works, ideas, computer program or output, or anything not generated by the student as his or her own. Plagiarism may be inadvertent or purposeful; however, plagiarism is not a question of intent. Plagiarism is considered a serious act of academic misconduct and may result in a student receiving an "F" in the course and being suspended from the University. Please note that your paper may be examined by turnitin.com to detect possible cases of plagiarism. For more information, see http://coeweb.fiu.edu/plagiarism/

Course Evaluation (tentative):

Homework (weekly-selected randomly)	20%
Participation Reflection	20%
Issues Position Paper (Taskstream)	30%
Multicultural Lesson and Reflection	30%

Grades based on following:	A 100%-93%	A- 93%-90%
B+ 90%-88%	B 88%-83%	B- 83%-80%
C+ 80%-78%	C 78%-73%	C- 73%-70%
D+ 70%-68%	D 68%-63%	D- 63%-60%
F Below 60%		

Homework Reflections: This class is focused on research and theory involving global and multiple perspectives in mathematics and science education. Accordingly, your reading and completion of weekly assignments is imperative. Students will complete all weekly homework assignments including readings and written work/responses to questions requested by due date. Work will be assessed using the Homework Responses Rubric.

Participation Reflections: You are responsible for reading and coming to class prepared to discuss and synthesize readings into a coherent global framework. Students will participate in weekly class activities and discussions. Students will reflect on the discussion and their participation in the discussion at the end of class. Students not in attendance can not submit a Participation Reflection for that class.

Issues Position Paper: Students will research an important issue in mathematics or

science education of diverse learners. Based on this research, participants will write a position paper on the issue that reports on global multiple perspectives of the issue and thoughtfully builds and defends a position on the issue. Students will share asks of their written position paper with the class.

Multicultural Mathematics or Science Lesson (Taskstream Assignment)
Develop a multicultural mathematics or science lesson that brings together the teaching of mathematics or science through a cultural context. The lesson will be aligned with recent theories of learning and will demonstrate ways of addressing diverse student needs for learning the intended mathematics and/or science content and processes.

Assignment Details and/or Rubrics

Issues Paper and Presentation
Students will research an important issue in mathematics or science education of diverse learners. Based on this research, participants will write a global multiple-perspective analysis of the issue and develop a position on the issue that is aligned with recent learning theories and ways of meeting diverse student needs. Students will make an oral presentation on their issue that informs the class and engages us in thinking critically about the issue.

Written paper will be approximately 12 pages. The topic for the paper may be drawn from the following list of topics or a topic of interest to the student that is approved by the instructors.

- evolution,
- problem solving,
- role of computers (e.g. simulations, virtual labs/tools)
- role/use of calculators
- cooperative learning
- problem based learning
- discourse based teaching methods
- breadth vs. depth of curriculum

Oral presentation should be approximately 15 minutes and should use a technological presentation tool such as Powerpoint. Presentation should engage class members in thinking critically about your issue and why the issue is important in mathematics and science education. (Spend some time presenting the issue, but also provide an experience/activity to help class engage in critical thinking about your issue.)

Criteria to consider in development of paper
Writing (is it grammatically correct?)
Do you pose an issue that impacts mathematics or science education?
Do you consider multiple perspectives in your analysis of the issue and the development of a position on the issue?
Do your references support the position developed?
Do you provide supporting examples?

Issues Paper and Presentation Rubric

Category	Target (3 pts)	Acceptable (2 pts)	Unacceptable (1 pt)
Posing of Issue	Written paper demonstrates a clearly posed issue that impacts mathematics and/or science education.	Written paper demonstrates a somewhat clearly posed issue that somewhat impacts mathematics and/or science education.	Written paper demonstrates a lack of clarity in the posed issue.
Global Multiple Perspectives and Position developed	Content of paper was valuable and raised important considerations related to issue researched. It was thought provoking and informative. It provided global multiple perspectives on the issue and led to the development of a position demonstrating consistency with research and literature on the issue.	Content was valuable to some extent and raised some considerations of importance related to the issue. It was somewhat informative. It provided some multiple perspectives on the issue and led to the development of a position somewhat consistent with research and literature on the issue.	Content was of limited value and provided limited information on the issue. It lacked multiple perspectives on the issue and led to the development of a position lacking consistency with the research and literature on the issue.
Use of existing literature	All aspects of written paper are clearly supported by appropriate use of and reflection on existing literature that is appropriately referenced. Articles and references drawn on to support analysis and provide examples are used effectively and	Some aspects of written paper are supported by appropriate use of and reflection on the existing literature that is appropriately referenced. Articles and references drawn on to support analysis and provide examples are used to some extent.	The written paper has very limited use of and reflection on the existing literature and references. Articles and references drawn on are used to a limited extent.

	consistently.		
Communication and coherence among written paper and presentation demonstrate abilities for continuous improvement (Communication Competency, i.e., written and oral)	Written materials and oral presentation are well-organized, grammatically accurate, and professionally presented. Written materials and presentation demonstrate important abilities for continuous improvement including clear coherence in research, depth analysis of existing literature, and reflection, as well as strong ability to present to and share learning with colleagues/peers.	Written materials and oral presentation are somewhat appropriately organized, grammatically accurate with few errors, and professionally presented. Written materials and presentation demonstrate some abilities for continuous improvement including some appropriate coherence in research, some depth in analysis and reflection on issue in relation to existing literature, as well as ability to present to and share learning with colleagues/peers.	Written materials or oral presentation lack appropriate organization, lack grammatical accuracy, and are limited with respect to professional presentation. Written materials and presentation demonstrate limited abilities for continuous improvement including lack of appropriate coherence in research, lack of depth in analysis and reflection on issue in relation to existing literature, or lacking ability to professionally present to and share learning with colleagues/peers.

Multicultural Mathematics or Science Lesson (Taskstream Assignment)
The completed assignment will include the following:
I. A description of the mathematics students with whom this lesson might be used (can be hypothetical).

II. Lesson plan clearly describing each of the following:
(1) **Overarching Affective, Cognitive or Process Learning Goal(s)**
(2) **Specific Next Generation Sunshine State Standards (NGSSS) and Lesson Objectives**: Sunshine State Standards and learning objectives for what the students will learn within the particular lesson;
(3) **Approx. time** (e.g., 50 min., or 2 class periods (45 min. each), etc.);

(4) **Materials:** Delineate materials and resources needed to effectively complete lesson;
(5) **Procedures**: Procedures for the lesson (including discussion of what the students will do and what the teacher will do or ask)—if you do not have your own format for this, numbering the procedures as steps in the lesson is one clear way to layout the procedures;
(6) **Assessment**: Discuss how to assess student learning in the particular lesson—can be informal or formal.
(7) **Accommodations:** Any special accommodations that may be made for students with learning disabilities, physical disabilities or limited English proficiency (as needed).
(8) **Handouts**: Any worksheets or copies of materials needed for the lesson;

III. **Bibliography** of actual or potential resources for the lesson.

IV. **Reflection** of how this lesson is aligned with recent theories of learning. how it is aligned with and incorporates a multicultural mathematics education perspective, and how it is related to Weist's or Bank's approaches for multicultural mathematics instruction.

V. Presentation of Lesson. Oral presentation of lesson (15 mins.), engaging class in exploring multicultural activities that are part of lesson.

Multicultural Mathematics Lesson Rubric

Category	Target (3 pts)	Acceptable (2 pts)	Unacceptable (1 pt)
Instruction Goals, NGSSS & Objectives for Lesson and Related Activities (FEAP 10 Planning)	Instructional goals, objectives, and NGSSS are specifically identified and clearly stated and directly represent the learning expected as a result of the lesson, including intended activities.	Instructional goals, objectives, and NGSSS are stated and somewhat represent the expected learning as a result of the lesson, including intended activities.	Instructional goals, objectives, and NGSSS are not appropriately stated or do not appropriately represent the expected learning as a result of the lesson, including intended activities.
Aligned with recent Learning Theories and Accommodation of Diverse Student Learning (FEAP 7 Human Development and Learning)	All instructional strategies and activities are well organized and clearly aligned with recent learning theories, research, and documented best practice. Lesson includes	Most instructional strategies and activities are somewhat organized and aligned with recent learning theories, research, and documented best practice. Lesson includes	Instructional strategies and activities are aligned in limited ways with recent learning theories, research, and documented best practice. Lesson lacks appropriate

	appropriate accommodations for diverse student learning.	somewhat appropriate accommodations for diverse student learning.	accommodations for diverse student learning.
Mathematics or Science Content in Lessons (FEAP 8 Knowledge of Subject Matter)	Mathematics or science content in lessons and related activities is accurate and promotes coherent understanding and learning of the content. All handouts are included and materials list is complete. No errors with respect to content in lesson and related materials.	Mathematics or science content in lessons and related activities is mostly accurate and promotes a somewhat coherent understanding and learning of the content. All handouts are included and materials list is somewhat complete. Made few, un-substantive errors with respect to content in lesson and related materials. .	Mathematics or science content in lessons and related activities is accurate with a few errors and lacks appropriate coherence for the development of understanding and learning of the content. Handouts are incomplete and materials list is lacking. Made some errors or a central substantive error with respect to content in lesson and related materials.
Multicultural Education Perspective in Lesson (FEAP 5 Diversity)	Instructional activities and related reflection on lesson plan are clearly aligned with a multicultural education perspective to learning mathematics or science and clearly addresses diverse student needs.	Instructional activities and related reflection on lesson plan are mostly aligned with a multicultural education perspective to learning mathematics or science and includes some ways to address diverse student needs.	Instructional activities and related reflection on lesson plan lack some alignment with a multicultural education perspective to learning mathematics or science and weakly addresses diverse student needs.
Communication and coherence among assignment, lesson	Written materials and oral presentation are	Written materials and oral presentation are	Written materials or oral presentation lack appropriate

plan, reflection and presentation (Communication Competency, i.e., written and oral)	well-organized, grammatically accurate, and professionally presented. Materials and presentation demonstrate important abilities for continuous improvement including clear coherence in research, planning and reflection, as well as strong ability to present to and share learning with colleagues/peers.	somewhat appropriately organized, grammatically accurate with few errors, and professionally presented. Materials and presentation demonstrate some abilities for continuous improvement including some appropriate coherence in research, planning and reflection, as well as ability to present to and share learning with colleagues/peers.	organization, lack grammatical accuracy, and are limited with respect to professional presentation. Materials and presentation demonstrate limited abilities for continuous improvement including lack of appropriate coherence in research, planning and reflection, or lacking ability to professionally present to and share learning with colleagues/peers.

Homework and Participation Reflection Rubric

Reflections Response Grading Rubric

Score	Criteria for Written Reflections
3	Answers all reflection questions completely and thoughtfully. Responses to questions demonstrate awareness of global multiple perspectives and critical thinking including synthesis of ideas, evaluation from various perspectives, and connections to material from this course, own experiences, and/or other courses. Statements and observations made are supported and defended through connections, critical thinking and sufficient description. **Submitted on due date.**
2	(a) Answers most questions or parts of questions at level (3) criteria for reflection but missing responses to some key parts of questions (all questions not answered fully). **Submitted on due date.** Or (b) Answers all reflection questions demonstrating some thoughtful points that incorporate some analysis, synthesis or evaluation and some awareness of global multiple perspectives. Tends toward description rather than analysis or lacks some support and defense of statements and observations through connections, critical thinking and sufficient description. **Submitted on due**

	date.
1	(a) Answers a limited number of reflection questions or parts of questions at level 2(b) of criteria for reflection. **Submitted on due date.** Or (b) Answers all or most reflection questions at a descriptive level without much depth of thought and lacking some awareness of global multiple perspectives. **Submitted by due date.**
0	Lacks responses to all reflection questions because did not **submit on due date.** Or Submitted reflection questions by due date but does not respond to any of the questions posed.

Tentative Course Outline (this is a tentative reading list and is subject to change to meet the needs of the students and evolving instructional goals)

Week	Topic	FEAPS
Week 1	Expectations. International and national or regional assessments in mathematics and science (e.g., TIMSS, NAEP, FCAT)	Assessment, Diversity
Week 2	Paradigms in Math/Science, Nature of Math/Science as starting place	Continuous Improvement, Knowledge of Subject Matter
Week 3	Progressive Education from a global multicultural perspective	Diversity
Week 4	Sociocultural perspective in science/math education and related classroom discourse	Diversity, Human Development & Learning, Continuous Improvement, Communication, Critical Thinking
Week 5	Constructivism; Assign Issues Paper	Human Development & Learning
Week 6	Reflecting on and aligning teaching math/science with recent theories of learning for meeting the needs of diverse learners in global multicultural/multiethnic environments; RTOP analysis	Human Development & Learning, Continuous Improvement, Planning, Assessment, Communication, Critical Thinking
Week 7	Situated Cognition and Experiential education	Diversity, Human Development & Learning, Knowledge of Subject Matter, Planning
Week 8	Problem-based learning and related classroom teaching and	Knowledge of Subject Matter, Human Development & Learning, Continuous

	discourse	improvement, Planning, Assessment, Communication, Critical Thinking
Week 9	Students submit and present Issues Position Paper	Continuous Improvement,
Week 10	Culture, Ethnomathematics and Social Change	Diversity, Human Learning and Development, Subject Matter Knowledge, Continuous Improvement
Week 11	Global multicultural Education and math/science teaching and learning; Assign Multicultural Lesson	Diversity, Planning, Continuous Improvement, Human Development and Learning, Assessment, Critical Thinking
Week 12	Culturally Relevant Pedagogy	Diversity, Human Development and Learning, Planning, Knowledge of Subject Matter, Assessment
Week 13	Conceptual change; Preconceptions and Misconceptions	Diversity, Human Learning and Development, Continuous Improvement, Knowledge of Subject Matter, Planning
Week 14	Resource View of Learning	Diversity, Continuous Improvement, Knowledge of Subject Matter, Human Development and Learning
Week 15	Students submit and present Multicultural Lesson and Reflections assignment	Diversity, Continuous Improvement, Knowledge of Subject Matter, Planning, Human Development and Learning, Communication, Critical Thinking