

Education 543
Fall Semester, 2007

**Integrated Methods III:
Teaching Mathematics, Science and Health
in Early Childhood/Elementary/
Middle School Education
Pacific University College of Education (4 credit hours)**



Instructors:

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Course website: <http://fg.ed.pacificu.edu/charlesm/courses/mathsci/index.html>

Course Prerequisites: Admission to MAT 5th year program or instructors' consent.

Conceptual Framework: This course works to establish a risk-free community of learners around the often anxiety producing topics of mathematics, science, and health. It introduces aspiring early childhood, elementary, and middle school educators to the theories, strategies, resources, and technology applications appropriate to mathematics, science, and health methodology. It emphasizes the linkage to state and national standards, integrated curriculum design, and developmentally appropriate pedagogy with an emphasis on inquiry-based student centered learning. The course includes the contribution of underrepresented groups and multiple cultures to these fields.

Course Goals: To provide preservice early childhood, elementary, and middle school teachers with:

- an investigation of various methods and models for teaching science, mathematics and health to children;
- a study and review of selected mathematics, science, and health content;
- a study of materials, equipment, manipulatives, software and other resources for appropriate instructional applications for teaching mathematics, science, and health;
- an opportunity to plan and deliver lessons to peers in order to gain confidence and experience with teaching strategies;
- an awareness and understanding of recent curricular innovations and current instructional issues in science, mathematics and health education;
- an examination of the interaction between content areas with an emphasis on interdisciplinary teaching.

Course structure/approach:

This course is taught through a mixture of teacher presentation and hands on laboratory activities and explorations with an emphasis on inquiry-based approaches.

Requirements:

1. Attend all classes. Due to the highly interactive nature of this course and its comprehensive assessments, missing any class time is problematic. If you must miss class, talk with the instructor(s) in advance. Any class missed may require written make-up work. Missing class and/or tardies may result in a lower grade for the course.
2. Do all assigned readings so that you are prepared for class discussions with notes, comments and/or questions.
3. Complete all written assignments (typed) which must be maintained in a ring binder when returned to be able to draw from for portfolio development. Late assignments will receive a reduced grade.
4. There will be one mid-term exam. A mini-portfolio will be completed as a final assessment.
5. Attend one professional conference, and write a summary.

Textbooks:

1. Cathcart et al: Learning Mathematics in Elementary and Middle Schools, 4th ed., Pearson Merrill Prentice-Hall, Brooks/Cole, 2006. (3rd edition also works)
2. Friedl & Koontz: Teaching Science to Children -- An Inquiry Approach, 6th ed. McGraw-Hill, Inc., 2005. (5th edition also works)

Course website: <http://fg.ed.pacificu.edu/charlesm/courses/mathsci/index.html>

Special Needs:

It is our intent to fully include persons with special needs in this course. Please let us know if you need any special accommodations in the curriculum, instruction, or assessment to enable you to participate fully. We will make every effort to maintain the confidentiality of any information you share with us.

University and College of Education Policies

Be aware of the Pacific University Code of Academic Conduct and the College of Education policies for professional behavior and the competent and ethical performance of educators. In this course students are expected to demonstrate behavior consistent with the Professional and Academic Standards in the College of Education.

All University policies described in more detail at <http://www.pacificu.edu/catalog/index.php#policies> (Search page for key words such as "disabilities"). All College of Education policies described in more detail at <http://www.pacificu.edu/catalog/college.php?id=2> (Click on the link to "policies" at the top of the page).

Students With Disabilities

In general, the University will work with students to improve conditions that may hinder their learning. The university requires appropriate documentation of a disability in order to enable students to meet academic standards. It is the responsibility of each student to inform the Director of Learning Support Services of his or her disability. Students are encouraged to work with faculty proactively in developing strategies for accommodation.

Incompletes

Instructors may issue a grade of incomplete only when the major portion of a course has been completed satisfactorily, but health or other emergency reasons prevent the student from finishing all the requirements in the course. The instructor and the student should agree upon a deadline by which all work will be completed, with the following guidelines:

1. Incompletes given for Fall and or Winter III terms must be completed by the following April 15.
2. Incompletes given for Spring semester must be completed by the following November 15.

Instructors will issue the grade the student would have earned by not completing the course, preceded by an "I". This grade is determined by including a failing grade for the missing assignment(s) in the calculation of the final grade. If the agreed upon course work is not completed in the period allotted and an extension has not been granted, the grade issued will be permanent. The contingency grade will be used in the computation of the GPA until such time as a new grade is recorded.

Grade Changes

Once a grade is submitted to the Registrar it shall not be changed except in the case of recording errors. The appropriate Dean or Director will approve grade changes.

Safe Environment Policy

Pacific University's Rights and Responsibilities policy seeks to maintain conditions favorable to learning. Students have the right to pursue an education free from discrimination based on gender, religion, marital status, age, sexual orientation or handicap. Students have the responsibility to conduct themselves, both individually and in groups, in a manner which promotes an atmosphere conducive to teaching, studying and learning.

Academic Integrity

Honesty and integrity are expected of all students in class preparation, examinations, assignments, practicums and other academic work. Misconduct includes, but is not limited to cheating; plagiarism; forgery; fabrication; theft of instructional materials or tests; unauthorized access or manipulation of laboratory or clinic equipment or computer programs; alteration of grade books, clinical records, files or computer grades; misuse of research data in reporting results; use of personal relationships to gain grades or favors or other attempts to obtain grades or credit through fraudulent means; unprofessional conduct related to student care; threats to University personnel and conduct inconsistent with academic integrity.

The complete policy, definitions and appeal procedures are described in the *Pacific University online catalog* (see links above).

Assessment:

Incorporates multiple means of assessment including reflective papers, microteaching, midterm exams, and student portfolios. Scores on assignments will be based on the scoring guide below.

Integrated Methods III Scoring Guide	
5	a) Work is both thoughtful and insightful b) Distinctive and sophisticated application of knowledge and skills is demonstrated c) Work consists of professional quality writing (punctuation, grammar, spelling, word usage)
4	d) Work is clear and well-organized e) Application of essential knowledge and skills is present f) Minor composition errors are present (punctuation, grammar, spelling, word usage)
3	g) Errors or omissions detract from the overall quality h) Partial application of knowledge and skills is demonstrated. i) Frequent composition errors are present (punctuation, grammar, spelling, word usage)
2	j) Assignment is not complete k) Work is superficial, fragmented, or incomplete and needs significant development l) Errors or omissions are significant
1	m) Little or no application of knowledge and skills is demonstrated n) Major errors or omissions are present
NE	o) No evidence is provided

Many assignments use this same scale in multiples. For example, an assignment with 20 points possible that scores at the "4" level on this rubric earns 16 points.

We expect all assignments to be completed on time; work turned in late is subject to a reduction of at least one point on the scoring rubric above.

The total points scored will be used to determine semester grades according to the following table:

<u>Grade</u>	<u>Minimum Percentage</u>	<u>Grade</u>	<u>Minimum Percentage</u>
A	90%	B-	77%
A-	87%	C+	73%
B+	83%	C	70%
B	80%		

Assignment Schedule

Week	Date	Class Topics	Assignments (due the <i>following</i> week)
1	Wed. Sept 5	Discrepant Events Syllabus distributed	Write Math/Science Autobiography (C) Review Syllabus; bring questions Read "Revolution..." handout Read Ch. 1 & 2 (Friedl)
2	Sept 12	Discrepant Events cont. Turtle Geometry Syllabus discussion Curriculum Analysis—Intro.	Read Ch. 1 & 2 (Cathcart) Start School Survey (E) due Oct. 18 Read designated chapters in SFAA
3	Sept 19	Problem-Solving & the NCTM Standards Curriculum Analysis	Read Ch. 3 (Cathcart) Do Math Reflection #1 (A) Read Ch. 3, 4, & 5 (Friedl)
4	Sept 26	Number Sense Teaching About Astronomy	Read Ch. 12, 13, & 14 (Friedl) Do Science Text Report #1 (B) Read Ch. 5 (Cathcart)
5	Oct 3	Teaching About Electricity	Read Ch. 6, 7 and 8 (Friedl) Start Library Report (G) due Oct. 24
6	Oct 10	Number Systems	Read Ch. 6 (Cathcart) Do Science Text Report #2 (B) Finish School Survey (E) due Oct. 17
7	Oct 17	Whole Number operations	Read Ch. 7 & 8 (Cathcart) Do Math Reflection #2 (A) Finish Library Report (G) due Oct. 24
8	Oct 24	Measurement and Metrics Fractions	Read Ch. 9 & 15 (Cathcart) View Video "Choose a Method" Do Video Reflection #1 on Web CT (AV)
9	Oct 31	Fractions cont. Estimation Review	Prepare for Mid-Term Exam
10	Nov 7	Mid-Term Exam (L)	Prepare Lesson Samplers (D) for Nov. 15 Read Ch. 15 & 16 (Friedl) Read Ch. 10 & 11 (Cathcart) Do Science Text Report #3 (B)
11	Nov 14	Intro. to Geometry Sharing Lesson Samplers	Read Ch. 14 (Cathcart) View Video "Shapes from Squares" Do Video Reflection #2 on Web CT (AV) Read Ch. 17 (Friedl) Prepare MicroTeaching (F)
12	Nov. 28	MicroTeaching Health Issues in Oregon	Read Ch. 18 & 19 (Friedl) Begin Resource Purchase (I) due Dec. 12
13	Dec 5	MicroTeaching Assessing Scientific Inquiry	Read Ch. 20 & 21 (Friedl) Do Science Text Report #4 (B) Resource Purchase (I) due Dec. 12
14	Dec 12	Incredibly Average Images Teaching Scientific Inquiry	Read Ch. 12 & 13 (Cathcart) Conference Report (H)

15	Jan 7	Math Assessment Math/sci integration project	Read Ch. 4 , 16 & 17 (Cathcart) Begin Integrated Math/Sci project due Jan 18
16	Jan 9	Mathematical Investigations Statistics and data analysis	View Video "The Missing Link" Do Video Reflection # 3 on WebCT (AV) OR Do Math Reflection # 3(A) on Chapters 4, 12, 13, 16 or 17.
17	Jan 11	Light, Color, Human Vision	Ch. 9, 10 & 11 (Friedl) Do Science Text Report # 5 (B)
18	Jan 14	Equity in Math & Science Sensitive Issues	
19	Jan 16	Probability Science issues/questions	Integrated Math/Sci project (K) due Jan. 18
20	Jan 18	Integrated Math/Science project Following children's ideas in mathematics Course evaluation	Portfolio (J) due Wednesday, Jan 22

Guidelines for Assignments

A. Math Problems and Reflections: (10 points) (Typed, 1 to 2 pages double spaced)

Purpose: To consider critical issues in mathematics education and to provide further practice in solving mathematics problems and in conducting effective mathematics lessons in your future classroom.

Read the assigned chapter(s) in Cathcart, skimming all activities and problems within the reading and at the end. Investigate the related websites (URLs in the text or you may access them at

<http://www.prenhall.com/cathcart>)

- 1) TRY some of the activities and problems described throughout the reading. Spend a minimum of one hour per week DOING the activities and problems you choose. Turn in your notes from these problems--don't feel you need to type up this work; hand-written is fine. (Note: exceptions: Chapters 1, 2, 4, & 7)
- 2) Write one learning objective associated with one activity or problem in the assigned chapter—e.g. Students will be able to demonstrate their understanding of _____ by _____. (Note: exceptions: Chapters 1, 2, 4, & 7). Identify the appropriate grade level when you write the objective.
- 3) Write a brief response to the reading—a personal reflection, summarizing what you learned (about mathematics concepts, about teaching math, or about your own math skills) from the reading assignment, the activities and problems, and the websites. This should be 1-2 page typed, double-spaced (with the work on problems and the learning objective stapled to it).

AV. Video Reflections: (10 points)

Purpose: To view and discuss with colleagues mathematics lessons conducted by practicing teachers that embody the NCTM Standards 2000.

View the assigned video online and answer the related questions posted on the course WebCT site.

- 1) Answer **one** of the questions that most interests you at the WebCT course discussions page in a paragraph or two. Then participate in the class discussion of the video by responding to others in the class as appropriate (at least two responses). (5 points)
- 2) Complete the "Try This!" Activity distributed in class (WITH the correct materials!) and include the written work that accompanies the activity with the assignment you turn in. Summarize in two or three sentences what you learned from the activity. (5 points)

B. Science Text Reports: (10 points) (Typed, 1 to 2 pages double-spaced)

Purpose: To develop skill in visualizing and planning science lessons.

- 1) Read the entire assigned chapters in Friedl; choose **one** lesson from the assigned text (or previous chapters) that particularly interests you. Write a brief description of the lesson and identify the target student group (the age/grade level you would teach).
- 2) TRY the activity; make it clear in your description that you have done the experiment/constructed the model/ tried the equipment. Indicate the manipulatives or equipment or devices which would be necessary.
- 3) List the objectives of the lesson. (Students will be able to demonstrate their understanding of _____ by _____)
- 4) Write a short paragraph for a substitute teacher briefly explaining the science concepts in the lesson (not the procedures or the logistics—but the *science* behind the lesson).
- 5) Indicate any difficulties you anticipate encountering in teaching this lesson to students, how you might overcome them, how you think this lesson could be modified/improved.

C. Mathematics and Science Autobiography (10 points)

Purpose: To reflect on the experiences you had in mathematics and science as an elementary student and to help us get to know you better.

We are all products of our experiences. As teachers, this is particularly true. How we operate in the classroom – our interactions with children, the activities we facilitate, the methodologies we implement, etc. – are often connected to the ways in which we experienced school and learning as children ourselves. As a prospective teacher, it is important that you carefully examine your own experiences as a learner even as you prepare to teach others.

There is no particular format for this writing exercise. Rather, you are to free-write about anything that comes to mind. You might want to recall your impressions of mathematics or science as a young child. You might want to describe activities or classroom events that caused you to think about mathematics and science in a particular way. Perhaps you have a "horror story" about math that you have never been able to shake. Or, perhaps you engaged in a hands-on science experiment that really stimulated your

thinking and creativity. Whatever the case, you are to write from one to three pages (double spaced) on your early experiences, and how those experiences have contributed to your present understanding of both mathematics and science.

D. Lesson Sampler: (10 points)

Purpose: To gather a collection of thoughtfully selected lesson plans to consider for use in their future classroom.

Write a very brief summary of **three** lessons from the readings, from your observations in your school placement, or from resources you borrow from Strain 323/322 Science/Mathematics/Health Resource Cabinets. Choose lessons that make effective use of manipulatives, equipment or other concrete materials. Write 1 or 2 instructional objectives for each. What works well in each lesson? For what grade level will it be effective? Choose one of these lessons to share in a round-table discussion (approximately 5 minutes). Bring the concrete materials and be prepared to describe the lesson but not actually teach it. Bring six copies of this lesson to class. This provides an opportunity to observe applications of a large variety of lessons and materials from colleagues in your group, and will assist you in observing and identifying specific characteristics of lessons. Note: if any specialized equipment or materials are required which you do not have access to at home or school, contact the instructor(s) to borrow them from the Math/Science Resource Center.

E. School Survey: (20 points)

Purpose: To provide you with the opportunity to learn about the types and quantity of materials, equipment, manipulatives, software, and other resources typically available to teachers in an elementary or middle school building.

Talk to your mentor teacher, the principal, and other teachers in your school to gather the following information. Summarize your findings and type to hand in.

1. What are the textbooks used in a) mathematics and b) science throughout the school? (Publisher, author, title) Are there individual math and science textbooks in each classroom for each student? Is there a district health education curriculum? What health topics does your mentor teacher teach?
2. What manipulatives, equipment, and/or supplies are available for teaching 'hands-on' lessons in math and science? (Describe or list)
3. Give an overview of the availability of films, filmstrips, videotapes and videodiscs available for use in math and science. To what extent are these used in the school?
4. Give an overview of the computer software available in the school. What computers and how many are available for teachers? for students? List specific examples of some of the software available.
5. What other resources are used for teaching science/mathematics/health, other than those previously described?
6. How dependent are teachers upon the textbook for the design of the curriculum and lessons? Comment.

F. MicroTeaching Presentations (20 points)

Purpose: To practice teaching a small group of peers.

Planning: (Scored-10 points)

Your lesson plan should describe objectives, activities, instructions to students, questions you will ask, manipulatives/equipment you will use, and a timeline. Attach student hand-outs if you use any. You may choose to prepare a detailed script, or your plans may be in a concise outline form. You may choose to use the standard MAT Lesson Plan form, or some other format.

Be certain that your plans are clear, neat and easy to follow. **Include at least 6 probing questions which you will ask during the lesson.** (Note: Cite any references that you used as sources for your plan.)

Teaching: (NOT Scored)

You will be allotted 30 minutes for your presentation. Of that, plan on 5 minutes for set-up and preparing your group as the target student audience. Inform them of their age, grade and ability level, what teaching/learning may have preceded your lesson, what their skill levels are, etc. The peer group should attempt to role play the student audience and ask appropriate questions, as much as possible.

Your lesson should be between 15 - 20 minutes of teaching. Ask a peer to time you; less than 15 minutes indicates inadequate preparation. If your lesson runs longer than 20 minutes, you will need to stop.

You will have 5 - 10 minutes for follow-up discussion of the lesson with your peers; their input will be valuable. Members of the group should provide constructive criticism, in a positive tactful manner. However, do not hesitate to identify areas of needed improvement; this is a necessary and valuable component of MicroTeaching.

Evaluation: (Scored-10 points)

Write a 1- to 2-page analysis of your lesson planning and classroom instruction. Identify strengths of the lesson, areas for improvement, changes you might/will make when you teach it again, feedback from the group, etc. Most important, provide personal reflection: what did you learn while teaching/planning this lesson? What did you learn about teaching, about science or math, about students, about yourself?

The Lesson Plans and Evaluation (stapled together) should be handed in during class the week following your presentation.

G. Library Report: (20 points)

Purpose: To investigate resources for supplying materials, equipment, manipulatives, software and teaching strategies.

For elementary (preschool/primary/intermediate):

Teaching Children Mathematics
(formerly **The Arithmetic Teacher**)

Science and Children

For middle school/junior high school:

Mathematics Teaching in the Middle School

Science Scope

For high school:

The Mathematics Teacher

The Science Teacher

Choose one mathematics and one science periodical from above; study the entire issue. Then answer the following questions for **each** of the two periodicals.

1. Name and date of the issue you have studied.
2. Who publishes this periodical?
3. What is the annual cost of a subscription? (Careful—note membership requirement and note the *student* price.)
4. Who is the target audience?
5. List any five advertisers, and the type of product they market.
6. List any six Departments or regular sections which are included in essentially every issue; describe the type of material to be found in this category or Department.
7. Summarize the most interesting feature article.
8. After skimming the entire periodical, what are your impressions?

H. Conference Report: (10 points)

Purpose: To share in focused discussions with practicing professionals.

Attend a professional conference; while you are encouraged to attend one sponsored by a professional organization focused on mathematics, science or health education, any professional conference is satisfactory. See the course website for specific links.

Write a brief report (1 – 2 pages) which includes the following:

- 1) A summary of the conference, including a sample of the workshops or presentations in which you participated;
- 2) A reflection on what you learned as a result of your participation. (What was valuable or surprising or disappointing?)

I. Resource Purchase (10 points)

Purpose: To become familiar with classroom resources, sources, and costs of support materials.

You have a (fictional) budget of \$500 to spend in your classroom. You will be provided with a variety of catalogs from educational suppliers. Skim through them to become familiar with the materials available to educators.

- 1) Make a list of what assumptions you are making. (For example: grade level, whether your room is currently well- or poorly-equipped, student special needs, if any.)
- 2) Indicate how you will spend the \$500. (Itemize equipment, supplier and \$ amounts)
- 3) Explain your rationale. Why did you make the selections you did? In the process, provide evidence that you have studied and reviewed a number of resource suppliers.

You can also review online catalogs at:
National Science Teachers Association" <http://store.nsta.org>
National Council of Teachers of Mathematics Buyer's Guide Online:
<http://www.nctm.org/buyersguide/>
Nasco: <http://www.enasco.com>
Delta Education:<http://www.delta-education.com/>
Science Kit and Boreal Labs: <http://www.sciencekit.com>
Cuisenaire: <http://www.etacuisenaire.com/>

J. Portfolio (30 points)

Purpose: A culminating project that provides evidence of progress on course goals.

A purposeful collection of student work that will demonstrate your progress toward achieving the goals of the course. This assignment will be explained further in a handout distributed near the end of the course.

Make certain you keep all your work from the course in a 3 ring binder to facilitate the portfolio preparation process.

K. Math/Science/Health Integration Group Project (25 points)

Purpose: A culminating project that uses a multimedia tool to demonstrate understanding of important science and math concepts in the course.

As part of a group, create an iMovie that illustrates an important concept that you learned in science or mathematics in this course. Present it to us at the final session. See the course webpage at

<http://fg.ed.pacificu.edu/charlesm/mathsci/> for more details.

L. Midterm examination (approximately 90 points)

Purpose: An opportunity to demonstrate understanding of important math emetics and science concepts from the first part of the course.

Near the middle of the course, there will be a written assessment of both content and pedagogical knowledge addressed thus far. There will be a review session prior to the exam. Students are encouraged to review in groups. Question formats include completion, short answer, and essay.

MTC/CLW/07

