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PROPOSAL for COURSE CHANGE

To: Curriculum Committee

From: Department of Physical Science

Date Submitted: September 28, 2007

Request for: Course Addition

Submitted by: Dr. Linda C. Kondrick, Assistant Professor of Physical Science

Approved by:

Department Head:

(Dr. Jeff Robertson)

Dean of School of Physical and Life Science:

10/17/07

(Dr. Richard Cohoon)

Reviewed by:

Registrar:

(Ms. Tammy Rhodes)

Vice President of Academic Affairs:

(Dr. Jack Hamm)

I. New Course Description

Number: PHSC 1074

Title: for Catalog: Physical Science Inquiry

Title for Course Inventory: Physical Science Inquiry

app TEC 11/12/07
app CC 11/19/07
app FS 12/3/07

Description: Each Semester. Prerequisite: A score of 19 or above on the mathematics section of the ACTE exam or the completion of Math 0903, Intermediate Algebra, with a grade of "C" or better. This course is designed to model physical science teaching and learning through the process of inquiry. Topics explored are Interactions and Energy, Forces, Systems, Behavior of Gases, Physical Changes, and Chemical Changes. The focus is upon the construction of knowledge regarding 00science content and process skills essential to the preparation of teachers of physical science in early childhood education. It is recommended for early childhood education majors seeking to fulfill undergraduate requirements in preparation for upper level science methods courses and is equivalent to 3 hours of lecture and 3 hours of laboratory experience in physical science. However, the course requires that students participate as active learners in an activity-based, cooperative- learning-style curriculum.

Effective term: Fall 2008

Course fees: $10 laboratory fee

II. Justification and feasibility of course:

A. *What is the need for this course? Who will take it?*

Over the past three years it has become apparent to the author of this course-addition proposal that the majority of Early Childhood Education majors enrolled in the science methods course, PHSC 3213 Science in the Elementary School are inadequately prepared for that class. They lack the specific science content knowledge and science process skills in physics and chemistry pre-requisite for that course. However, the majority of them have completed their physical science requirement, usually by taking PHSC 1013, Introduction to Physical Science. The students themselves have discussed their frustration with the mismatch between the science preparation in that course (regardless of which instructor they had) and the expectations of the science methods course. PHSC 1013 is designed as a broad-survey of physical science intended to meet the goals of a liberal arts curriculum for non-majors.

Furthermore, their experiences in science classes typically model only expository methods of lecture and direct instruction. Neither PHSC 1013 nor

the companion lab, PHSC 1021, model for them the Guided Inquiry Method of learning. Yet, according to the National Science Resources Center (2000), this is the preferred method for science instruction at all levels of the science curriculum. Research on student learning consistently points to the need for: a) an exploratory class structure (National Science Resources Center, 1997; Cobb,1966); b) social interactions in learning (McDermott, Shaffer, & Constantinou, 2000;Vygotsky, 1986); and c) explicit attention to the nature of science issues (Hammer & Van Zee, 2006; Ackerson, Abd-El-Khalick, & Lederman , 2000).

The proposed course, PHSC 1074, Physical Science Inquiry is intended for undergraduates who are early childhood education majors ~~or non-science majors who need a physical science course for graduation requirements~~. It is ~~also~~ appropriate for early childhood or middle school teachers who need to enhance their content knowledge and inquiry skills in physical science.

It is specifically designed to prepare pre-service early childhood majors to teach physical science in the elementary school. The primary goal of this course is to develop the knowledge of science content and processes skills essential to prepare early childhood teachers skilled in to the guided inquiry method of learning. This is not a science methods course, but a science content, process, and skills course.

B. *How does it relate to other work being offered by your department? Is there an overlap with other courses in the department?* There is no other course being offered in physics or chemistry content that is designed specifically to meet the needs of Early Childhood Education Majors. The course which these majors are now taking in order to fulfill their physical science requirement is PHSC 1013, Introduction to Physical Science. However, that course is designed as a broad survey of issues in Physical science for non-science majors. It is not intended to prepare students to teach science content. The proposed course, PHSC 1074 is designed specifically for the purpose of preparing early childhood teachers to teach physics and

chemistry in the elementary school. It is not a methods course, but a science content and process course.

C. *Is this course part of any general plan of development within your department?* Yes. The Physical Science Department is currently reviewing the PHSC 1013: Introduction to Physical Science and the companion lab, PHSC 1021: Physical Science Laboratory. These are the physical science courses for non-science majors that many students take to fulfill their general education requirements. These courses are being transformed into an issues-based applied science format designed to develop science literacy among non-science majors. However, this change would make it even more unsuitable for Early Childhood Education majors who need a more rigorous approach to acquiring specific science content and process skills in order to teach early childhood level level science.

D. *How often will the course be offered?* The course will be offered in the Fall and Spring semesters and will be taught when ten or more students are enrolled.

E. *How will the course be staffed?* The course will be staffed with existing faculty in the Department of Physical Science. According to the demographics in Table 1 below, by dropping a section of PHSC 1013 and adding a section of PHSC 1074 one section of this course could be staffed each semester without adding additional faculty. Over the past three semesters, there has been an average of 36 students per semester who were identified as Early Childhood Education Majors. Due to the interactive nature of the proposed course, enrollment for PHSC 1074 would be limited to 36 students.
The number of students enrolled in PHSC 1013 over the past three semesters has averaged approximately 56 students per section. Enrollment ranges from 29 to 69 students per section. Six of the seventeen sections have not exceeded maximum enrollments over the past three semesters. The numbers in Table 1

below do not include students who withdrew from the course with a "W". Neither do they include Middle Level Education Majors enrolled in this course. Presumably some of them may also elect to take the new course as an alternative to PHSC 1013.

Table 1: Enrollment in PHSC 1013 Spring 2006 through Spring 2007					
PHSC 1013	**Enrollment: Lecture sections**	**Enrollment: Online sections**	**Number of Sections**	**Lecture Section Averages**	**ECED Majors Enrolled**
Spring 2007	304	40	5 lecture 1 on-line	61	40
Fall 2006	243	30	4 lecture 1 on-line	61	26
Spring 2006	313	29	5 lecture 1 on-line	57	41
Combined Semesters	860	99 (average 33)	14 lecture 3 online	61	36

F. *How will this course affect other departments' students and their offerings? When applicable, state with which departments you have specifically coordinated this change.* This proposal was discussed on August 21, 2007 in a joint Department Meeting attended by Dr. Jeff Robertson, Department Head of Physical Science; Dr. Jacqueline bowman, Science Education Co-ordinator and Associate Professor of Biology; and Dr. ~~Robert~~ David pec Bell, Department Head of Curriculum and Instruction. Also in attendance were: Dr. Cathy Baker, Associate Professor of Geology; Dr. Wilson Gonzalez-Espada, Associate Professor of Physical Science; and Dr. Linda Kondrick, Assistant Professor of Physical Science. No opposition to the proposal was offered.

1. Dr. Jeff Robertson, Head Department of Physical Science. YES. Dr. Robertson fully supports the proposed course addition. See signature on page one. David Pace

2. Dr. ~~Robert~~ Bell, Head Department of Curriculum and Instruction. YES. Dr. Bell asked that the course be offered as a recommended alternative to PHSC 1013, rather than a required course for Early Childhood Education majors. He was glad to have a larger selection of courses for these majors to fulfill their program and general education requirements. Date: August 21, 2007.

G. *How does the new course integrate with the assessment process of the department in which the course will be taught?* This course is offered primarily as a service to the Department of Curriculum and Instruction in the School of Education. It will expand the options for Early Childhood Education majors to fulfill their physical science general education requirements. This course is not a requirement for any of the programs offered in the Physical Science Department As such the addition of this course does not directly affect assessment process for programs offered through the School of Physical and Life Sciences.

Proposal Bibliography

Akerson, V., Abd-El-Khalick, F. & Lederman, N. (2000). The influence of a reflective activity-based approach to elementary teachers' conception of the nature of science. *Journal of Research in Science Teaching.* 37, pp 295-317.

Cobb (1966). *Where is the mind? A coordination of sociocultural and constructionist perspectives.* In C.T. Fostnot (Ed.) *Constructivism: Theory, perspectives, and practice.* pp 34-52 New York, NY: Teachers College Press.

Hammer, D. & Van Zee, E. (2006). *Seeing the Science in Children's Thinking: Case Studies of Student Inquiry in Physical Science--A Staff Developer's Guide.* Portsmouth, NH: Heinemann. ISBN: 9780325009483

McDermott, L, Shaffer, P, & Constantinou, C (2000). Preparing teachers to teach physics and physical science by inquiry. *Physics Education. 35.No.6*, 411-416.

National Science Resources Center, (1997). *Science for All Children: A Guide to Improving Elementary Science Education.* Washington, DC: The National Academies Press. ISBN: 0-309-05297-1

National Science Resources Center (2000). *Inquiry and the National Science Education Standards.* Washington, DC: The National Academies Press. ISBN: 9780309064767

Vygotsky, L. (1986). Thought and language. Cambridge, MA: MIT Press.

ARKANSAS TECH UNIVERSITY

School of Physical and Life Sciences

Course Syllabus
Physical Science Inquiry
PHSC 1074
Fall 2008

Instructor:

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Office Hours:

Please feel comfortable about contacting me outside of class. My schedule, including lab times, is posted on my office door. I will make a special effort to be near my desk on MWF 11:00 a.m. to noon; TR 10:00 a.m. to noon; and W 2:00 to 5:00 p.m. Other hours are available by appointment. Please e-mail your request.

Course Description:

This course is designed to model physical science teaching and learning through the process of inquiry. Topics explored are Interactions and Energy, Forces, Systems, Behavior of Gases, Physical Changes, and Chemical Changes. The focus is upon the construction of knowledge regarding science content and process skills essential to the preparation of teachers of physical science in early childhood education. It is recommended for early childhood education majors seeking to fulfill undergraduate requirements in preparation for upper level science methods courses and is equivalent to 3 hours of lecture and 3 hours of laboratory experience in physical science. However, the course requires that students participate as active learners in an activity-based, cooperative- learning-style curriculum.

Course Rationale and Objectives (Correlated Assessment):

This general education course is designed to meet the goals of a Liberal Arts University as described in the 2007-2008 ATU Undergraduate Catalogue. In part that goal is to ". . . provide a foundation for knowledge common to educated people and to develop the capacity for an individual to expand that knowledge over his or her lifetime (page 79)." Upon successful completion of Physical Science Inquiry, students will be able to:

- Demonstrate knowledge and comprehension of certain basic laws, principals, and methods used in the physical sciences with a minimum of 60% freedom from errors.
- Demonstrate the ability to formulate models and explanations of everyday phenomena based upon analysis of observations and empirical evidence.
- Analyze basic problems in physical science with a minimum of 60% accuracy.
- Discuss naïve science ideas held by children and analyze methods to guide their development of concepts in physical science.
- Evaluate the implications of recent developments in physical science and technology affecting our quality of life.

Textbook:

The PSET materials required for this course serve as both the textbook and laboratory manual: Fred Goldberg, Rebecca Kruse, Steve Robinson, Valerie Otero, and Nephi Thompson, principal developers (2007). *Physical Science and Everyday Thinking (PSET) SE.* The PSET project was supported in part by Grant #0096856 from the National Science Foundation. ISBN 978-1-58591-668-9. Armonk, NY: It's About Time, Herff Jones Education Division.

Ancillary course materials are available on the ATU tdata drive: linda.kondrick>PHSC 1001. (The t-data drive can be accessed from My Computer when on campus. When off campus it can be accessed via the web at: **ftp://tdata.atu.edu.)**

Assignments:

Daily Participation: Student participation in group laboratory activities is required and will be assessed on a behavioral rubric.

Homework: Weekly assignments are included in subsequent sections of this syllabus. *Mastery of the concepts and skills in these homework assignments will be essential to your success in this course.*

Connection Project: One Connection Project is required. The student will complete a research project that includes a graphic organizer and an essay discussion.
The goal of this project is to increase your awareness of the connections between physical science and other disciplines, your lifestyle, and your career. A rubric will be provided for evaluation of the Connection Project.

Tests: There are six unit exam as and a comprehensive final exam. The format is multiple choice and essay.

Assessment:

Evaluation of a student's achievement of the course objectives will be based upon the following assessment criteria:

- Daily Participation is worth approximately 10 points per class for a total of approximately 300 points.
- Homework assignments are worth approximately 10 points each for a total of approximately 350 points.
- Connection Project is worth 100 points.
- Six unit exams, are worth 100 points each. The worst test scc : will be dropped leaving a total of 500 test points.
- Comprehensive Final Exam is worth 150 points.

Grading:

The arithmetic mean is calculated by dividing the total points earned by the number possible (approximately 1400). The resulting percentage score is converted to a letter grade according to the following scale:

A > 90%
B = 80% to 90%
C = 70% to 79%

D = 60% to 69%
F < 60%

Class Policies:

All behavior is subject to ATU academic policies as covered in the Undergraduate Catalogue and Student Handbook. Below are my specific requirements to insure success:

- Be present. Students with five absences may be dropped from the course with an F grade.
- Be on time and stay until dismissed. Daily quizzes cannot be made-up.
- Be prepared. Class notes are available on the course website: http://pls.atu.edu/physci/physics/people/kondrick/index.htm
- Be diligent. Assignment due dates are not flexible.
- Be honest. Plagiarism and all forms of cheating are absolutely unacceptable. Detection of such behavior will result in a failing grade for the course. All essays are required to be submitted to an electronic monitoring program called *turnitin.com.*
- Be respectful of fellow students, instructors, and ATU property. Rude, destructive, or disruptive behavior will not be tolerated.

Access and Accommodation:

- If you need a specific accommodation due to temporary or long-term injury, handicap, or disability, please contact me as soon as possible.
- Remember that this is a Liberal Arts teaching institution that focuses on its teaching mission. If you need clarification, or other individual help with course material or objectives, please contact me as soon as possible. Do not fail to take advantage of all the resources available to you. I chose teaching as a career because I like interacting with students.

Course Bibliography:

National Science Resources Center, (1997). *Science for All Children: A Guide to Improving Elementary Science Education.* Washington, DC: The National Academies Press. ISBN: 0-309-05297-1

(2000). *Inquiry and the National Science Education Standards*. Washington, DC: The National Academies Press. ISBN: 9780309064767

David Hammer & Emily Van Zee, (2006). *Seeing the Science in Children's Thinking: Case Studies of Student Inquiry in Physical Science--A Staff Developer's Guide.* Portsmouth, NH: Heinemann. ISBN: 9780325009483

McDermott, L, Shaffer, P, & Constantinou, C (2000). Preparing teachers to teach physics and physical science by inquiry. *Physics Education. 35.No.6*, 411-416.

(2007). Concept to Classroom. Retrieved October 10, 2007, from Thirteen Ed Online Web site: http://www.thirteen.org/edonline/concept2class/inquiry/index.html

(2007). Inquiry Learning Forum. Retrieved October 10, 2007, from Center for Research on Learning and Technology Web site: http://www.thirteen.org/edonline/concept2class/inquiry/index.html

Pacing Guide: *Dates are approximate and subject to change.*

Week	Month	Days	Topics	Assignment	*Assessment*
I	Aug	21	Introduction 1. Measuring Motion	**Chapter 1** *Activity 1*	*HW 1: Learning Science*
II	Aug	26,28	2. Motion and energy 3. Slowing and Stopping 4. Warming and Cooling	*Activity 2-4*	*HW 2: Scientific Explanations* *HW 3: Push Pull Interactions* *HW 4: Interactions with Surroundings*
III	Sept	2,4	5. Light and Seeing 6. Electric Circuits	*Activity 5-6*	*HW 5: Children's Ideas About Light* *HW 6 Energy Transfer*
IV	Sept	9,11	7.keeping Track of Energy 8. Using Energy Models to Explain Everyday Phenomena	*Activity 7-8*	*HW 7 Energy Conservation and Efficiency*
Tues	**Sept**	**16**	***Test Unit 1***		***Interactions and Energy***
V	Sept	16,18	1. Interactions and Forces 2. Pushes and Slowing Down 3.Friction and Slowing Down 4.Force-strength and Mass	**Chapter 2** Activity 1-5	*HW1: Pushing a Skateboarder* *HW2: Combinations of Forces* *HW3: Children's Ideas About Forces* *HW4: Changing Direction*
VI	Sept	23,25	5. Motion with Balanced Forces 6. Using Force Models to Explain Everyday Phenomena	*Activity 5-6*	*HW5: Balanced Forces* *HW 6: Children's Ideas About Friction*
Tues	**Sept**	***30***	***Test Unit 2***		***Interactions and Forces***
VII	Sep/Oct	30, 2	1. Magnetic Interactions 2. Electric Charge Interactions 3. Gravitational Attractions	**Chapter 3** Activity 1-3	*HW1A: Model for Magnetism* *HW1B: Historical Development of Model of Magnetism* *HW2: Charged and Uncharged* *HW3:Gravitational Potential Energy*
VIII	Oct	7,9	4. Falling Objects 5. Using Electro-Magnetic Models to Explain Everyday Phenomena	Activity 4-5	*HW4: Using Energy and Force Ideas* *HW5: Observations, Inferences, and Models*
Tues	***Oct***	**14**	***Test Unit 3***		***Interactions and Systems***
IX	Oct	14,16	1. Small Particle Model Gases 2. SPM and Gas Pressure 3. Effects of Pressure Difference	**Chapter 4** Activity 1-3	*HW2: Explaining Phenomena Using Gas Pressure* *HW 3:Children's Ideas About Gases*
X	Oct	21,23	4. SPM and Temperature 5. Explanations Involving Gases	Activity 4-5	*HW4A: the Ideal Gas Law* *HW4B: Small Particle Simulator* *HW5: Nature of Science*
Tues	***Oct 28***		***Test Unit 4***		***Interactions and the Behavior of Gases***

Week	Month	Days	Topics	Assignment	*Assessment*
XI	Oct	28,30	1. Density 2. SPM and Density 3. Heating Liquids and Solids	**Chapter 5** Activity 1-3	*HW1: Sinking and Floating* *HW2: Density and SPM* *HW3: Children's Ideas About Density*
XII	Nov	4,6	4. Changes of State and SPM 5. Vapor Pressure and SPM	Activity 4-5	*HW 4: Melting and Boiling* *HW5. Vapor Pressure and Other Liquids*
XIII	Nov	11,13	6. Solubility and SPM 7.Explanations Involving Physical Changes	Activity 6-7	*HW6: Dissolving and Polarity* *HW7: Using Physical Properties and Changes*
Tues	***Nov 18***		***Test Unit 5***		***Interactions and Physical Changes***
XIV	Nov	18,20	1. Chemical Changes 2.Chemical Changes and SPM 3. Elements and Periodic Table	**Chapter 6** Activity 1-3	*HW1: Rate of Chemical Changes and Temperature* *HW2:Models of the Atom*
XV	Nov	25	4. Atoms and Periodic Table 5. Conservation of Mass and SPM	Activity 4-5	*HW4:Electrons, Chemical Bonds, and Chemical Formulas* *HW 5: Ideas About Learning Science*
XV	Nov	~~27~~	***Thanksgiving Holiday, No classes!***		
XVI	Dec	2,4	6. Social Scientist's Ideas 7. Chemical Changes and Energy 8. Explanations Involving Chemical Changes	Activity 6-8	*HW7: Solubility and Energy*
TBA	***Dec 9-14***		***Test Unit 6*** ***and*** ***Comprehensive Final Exam***		***Interactions and Chemical Changes; and Comprehensive Final Exam***