**CTEE 7430/7436: CURRICULUM & TEACHING IN NATURAL SCIENCE**

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| *Project Base Learning* | **Instructor:** Dr. L. Octavia Tripp  **Office:** Haley 5016  **Office Hours:** By appointment  **Phone:** 334-844-6799  **E-mail:** tripplo@auburn.edu  **Class Time:** By Appointment  **Location: SU16 - All Distance Delivery**  **Credit Hours**: 3 semester hours |  |

**Required Text:**

Krajcik, J. & Czerniak, C. (2007). *Teaching science in elementary and middle school: A project-*

*based approach*. New York: Routledge: Taylor and Frances Group, New York and London **4th edition,** ISBN: 978–0–415–53405–5 (pbk)

**Required Materials:**

Any materials that are required to will need to complete NASA Image Mars – Mars Survival Kit

**Required Equipment:**

Computer (updated software), high-speed Internet access, and **headset with microphone** (USB connection and noise cancelling) ($25-35) for access to Canvas Conferencing

Access to a digital video-camera (also in LRC for check-out) for taping an inquiry demonstration

**Electronic References:**

NASA’s Journey to Mars: http://mars.nasa.gov/participate/marsforeducators/soi/

Annenberg Learner: [www.learner.org](http://www.learner.org) (select <<Science-ALL>>)

National Research Council (2005). *How students learn: Science in the classroom*.

<http://www.nap.edu/catalog.php?record_id=11102>

National Research Council (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas.* <http://www.nap.edu/catalog.php?record_id=13165>

Next Generation Science Standards: <http://www.nextgenscience.org/>

**Course Description:**

This course will apply current research and Next Generation Science Standards (NGSS) on ‘best practices’ in science education to project-based design of science curriculum. Course experiences will build students’ understanding and ability to do Project Based Science (PBS) through lessons that support construction of the final project-based unit plan. Students will experience components of a model project-based science unit – *NASA’S Journey To Mars* – and how it ties to science literacy as it pertains to survival on another planet. Students design a sustainable community, considering criteria and constraints in an engineering and design process, learning Earth science concepts along the way. Human discovery and innovation often depends on our curiosity about science, technology, and society and ways to improve our lives and on our interactions with the natural world. Students build on their prior knowledge of communities on Earth and design their model for a community on Mars.

**Course Objectives:**

Upon completion of this course, students will be able to:

1. Identify and embrace important national goals of science education and science literacy in the K-6 classroom, including applications of science and technology to societal issues and problems.
2. Articulate a rationale for teaching science through social constructivism and brain-based research on how students learn.
3. Describe and define a project-based approach (PBA) to teaching science, including key components, and how it is different from other integrated and thematic approaches.
4. Meaningfully demonstrate the inquiry process including planning scientific investigations, interpreting data, and supporting student collaboration in PBS units.
5. Apply best practices that support project-based approaches in delivery strategies, management, and assessment of students in PBS units.
6. Create a project-based science unit plan for use in the classroom that incorporates PBA tenets.
7. A side from studying the PBL model, you will be reading what teachers and faculty have written to enhance your science knowledge

**Course Assignments and Evaluation:**

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| Required Assignments (420 POINTS):  Chapter Exercises – 80 points (8 @ 10 points each)  Science Reading Critiques – 60 points (6 @ 10 points each)  Rationale for Science Teaching Paper – 20 points  NASA’s Journey to Mars activities - 20 points  \*Article Manuscript – 70 points  \*Project-Based Science Unit Plan – 100 points  \*NOTE: PBS and Article Manuscript will serve as your final for the class. | Grading Scale:  378-420 points = A  336-377 points = B  294-335 points = C  252-293 points = D  251-0 points = F |

**Weekly Assignments and Deadlines**

**Chapter Exercises:** The chapter assignment is an individual completed assignment. You must use your text to complete the assigned exercises. You write (or draw) your responses in the word document given. Scanning of work into pdf format may be needed. Points per response are designated. These exercises prepare you to create your Project-Based Science Units.

Word or pdf documents must be uploaded under the Assignments tab of Canvas and under the appropriate chapter exercise. These assignments must be completed and uploaded by Thursday before Midnight CST the week AFTER the scheduled topic/date in the syllabus.

**Class Discussion Questions:** You will questions from your readings and or issues centered around Project Based Learning. You should follow the 2+2 format in responding the questions.

2+2 is feedback includes two compliments and two suggestions, questions, or requests for

elaboration that lead to further thought and discussion. This model was originally conceived as a

classroom observation feedback tool, but the principles can be applied to discussion as well.

The 2+2 discussion model is based on the premise that balanced, specific, thought**-**provoking feedback will stimulate and foster a rich discussion. 2+2 does not equal two positives and two negatives. See the Tips: Giving Compliments and format under files on canvas.

**Reading Packet Critiques:**

A **critique** is a paper that gives a critical assessment of a book or article.  It is a systematic, yet personal response and evaluation of what you read. The guidelines can be found within the reading packet on canvas for this course.

**NASA’s Journey to Mars activities**:

You will complete 3 STEP under the NASA’s Journey website. More information will be given.

**Video Conferencing:**

Video conferencing will take place on certain dates at specific time. Scopia will be used as the conferencing platform and will be explained under files on canvas. See your canvas syllabus for dates and times. Discussion posts are due by the Thursday of the following week by 11:59 CDT.

**Major Assignments and Deadlines**

The **Rationale for Science Teaching Paper** (SEE ATTACHED) will incorporate newly learned information about how students learn science best, what you consider is most important in this process, and how you do/will enact this best practice in your classroom. Submission of this paper will be under the ASSIGNMENTS menu on Canvas.

The **PBS Unit** (SEE ATTACHED) will be graded in three parts at three different times in the term. Comments and notes made on the first parts should be used to make changes to the final project due at end-term. Sample completed projects will be placed on Canvas. Submission of the PBS assignment will be under the ASSIGNMENTS menu on Canvas.

Major assignments are due by Thursday before Midnight CST of the week that they are due – See syllabus schedule.

**Course Content and Schedule:**

**Frequently check the Canvas Announcements for course news, assignment information, and**

**updates, including changes to this schedule.**

Week 1 Teaching Science to Children – Chapter 1

* **Chapter 1 exercises**

How Students Construct Understanding of Science – Chapter 2

* **Chapter 2 exercises**

Week 2 Establishing Relevance to Students’ Lives – Chapter 3

* **Chapter 3 exercises**
* **Rationale for Science Teaching Paper due next week**

Week 3 Establishing Relevance to Students’ Lives – Chapter 3

* **Reading critique I**
* **Discussion I**

Week 4 Developing Scientific Investigations – Chapter 4

*NASA’S Journey to Mars – Read over and review to become familiar with the Mars Survival Kit*

* **Chapter 4 exercises**
* **Reading Critique II**

Week 5 Developing Scientific Investigations – Chapter 4

* **Discussion #2**
* *NASA’s Journey – Complete Step 1 -1*

Week 6 Making Sense of Data and Sharing Findings – Chapter 5

{Using Learning Technologies to Support Students in Inquiry – Chapter 6}

* **Chapter 5 exercises**
* **Reading Critique III**

Making Sense of Data and Sharing Findings – Chapter 5

* *NASA’s Journey – Complete Step 2-4*
* **Discussion #3**

Week 7 Collaboration in the Science Classroom – Chapter 6

**Chapter 6 exercises**

*NASA’s Journey – Complete Step 3-12 & 4-13*

**Reading Critique IV**

Week 8 Instructional Strategies that Support Inquiry – Chapter 7

* **Chapter 7 exercises**
* **Discussion # 4 –** *NASA’s Journey – Complete Step 5 – You will present your*  designs on the discussion board and classmates will respond to your designs. You should have a small description explaining what you did.

Week 9 Assessing Students and Understanding in Science – Chapters 8

* **Chapter 8 exercises**
* **Reading Critique V**

Week 10 **Managing the Science Classroom – Chapter 9**

**Planning a Project-Based Curriculum - Chapter 10**

**Discussion #5/Reading Critique 6 will be included in discussion # 5**

**Week 11 Using Trade Books to Teach Science**

**Week 12 From STEM - Steam**

**Week 13 Zoom Conference and Discussion**

Week 14 **PBS Unit due on 7/29**

**Article Manuscript 7/29**

**Class Policy Statements**:

Standard English: All written assignments must be typed and should adhere to Standard English usage and conventions or be subject to point loss. Assignments with excessive grammatical errors or typos must be redone. Writing should follow APA Sixth Edition conventions.

Late Work Submissions: Weekly assignments (chapter exercises and blogs) must be presented or posted on time for credit. Other major assignments if submitted late without excuse will lose a letter grade for each day late up to three days. Points earned for each assignment will be posted under the Grades menu on Canvas.

Participation: Students are expected to participate in all class assignments and group discussions. It is the student’s responsibility to contact the instructor if assignment deadlines are not met or a group discussion is missed. Students are responsible for initiating arrangements for missed work. Late work will be accepted without penalty only for university-approved excuses as outlined in the *Student Policy eHandbook (*[*www.auburn.edu/studentpolicies*](http://www.auburn.edu/studentpolicies)*)*. Excused late work must be submitted directly to the instructor via email no later than 7 days after the original due date or it will not be accepted.

**Students must have the appropriate and working computer hardware, software, and Internet connection for this course. This is the student’s responsibility. Failure of students’ equipment (not University Canvas) is NOT an excuse for on-line absences and late assignments.**

Attendance/Absences: Attendance at scheduled instructor and group online synchronous meetings is required, as detailed already in the syllabus schedule. Excuse notes for absences (with proper letterhead and signature) must be scanned (pdf) and email attached to the instructor no more than seven days after the absence, or it is unexcused. **Three unexcused absences from scheduled online meetings will mean a failing course grade**.

Unannounced quizzes: There will be no unannounced quizzes.

Accommodations: "Students who need accommodations are asked to electronically submit their approved accommodations through AU Access and to arrange a meeting during office hours the first week of classes, or as soon as possible if accommodations are needed immediately. If you have a conflict with my office hours, an alternate time can be arranged. To set up this meeting, please contact me by e-mail. If you have not established accommodations through the Office of Accessibility, but need accommodations, make an appointment with the Office of Accessibility, 1228 Haley Center, 844-2096 (V/TT)."

Honesty Code: The University Academic Honesty Code and the *Student Policy eHandbook (*[*www.auburn.edu/studentpolicies*](http://www.auburn.edu/studentpolicies)*)* Rules and Regulations pertaining to Cheating will apply to this class.

Professionalism: As faculty, staff, and students interact in professional settings, they are expected to demonstrate professional behaviors as defined in the College’s conceptual framework. These professional commitments or dispositions are listed below:

* Engage in responsible and ethical professional practices
* Contribute to collaborative learning communities
* Demonstrate a commitment to diversity
* Model and nurture intellectual vitality

**Writing Center:** The Miller Writing Center provides free support on any writing you are doing while at Auburn, whether for a course or not. Trained consultants are available to work with you as you plan, draft, and revise your writing. For students in distance courses and students temporarily away from Auburn’s campus, the Miller Writing Center offers synchronous online consultations. Please check the Miller Writing Center website ([www.auburn.edu/writingcenter](http://www.auburn.edu/writingcenter)) for instructions and information about scheduling online appointments. If you have questions about the Miller Writing Center, please email [writctr@auburn.edu](mailto:writctr@auburn.edu) or call 334-844-7475 M-F  7:45am-4:45pm.

**RATIONAL FOR SCIENCE TEACHING PAPER – *40 points***

Why a rationale paper?

Writing a rationale paper for your chosen practice in the science classroom supports your development as a teacher because you have to ponder and articulate your current thoughts about teaching, learning, and goals in your practice. A “rationale” is different from a “philosophy” because it merges *who you are* (including personal experience, beliefs, and values) with *what you are learning* about effective science teaching (including National Standards, scientific literacy, inquiry, constructivism, learning cycle, brain-based research, reading-writing to learn, etc.). Thus, a rationale paper of “you” is supported by elements of effective teaching that you have learned and are learning in your program. It should cite specific readings or resources from this course, and related past ones, that most inform your practice. Being able to articulate your rationale for science teaching to other peers, teacher colleagues, and administrators shows that you know who you are as a teacher and have a definite plan for your future classroom and students. *Your final paper should be free of spelling and grammatical errors.* Your rationale should make sense with what you believe about science teaching linked to what we know about best practice and what you want to do in your science classroom with children.

NOTE: Job interviewers who care about the quality of teachers hired in their systems often ask candidates about their teaching approach, philosophy, typical week, or rationale for teaching.

What’s in a rationale paper?

A rationale for science teaching paper is made up of five (5) parts where you describe your thoughts on:

1. (10 points) How learning takes place, consistent with learning theory and research. Refer to specific information from the course text and NRC 2005 text (Krajcik & Czerniak, 2007; National Research Council (NRC), 2005).
2. (10 points) What science teaching is, consistent with how learning takes place – tied to methods, models of teaching, and National Standards (e.g., Krajcik & Czerniak, 2007; NRC, 2005, 2012).
3. (10 points) Goals for students. Why are you doing what you are doing? What will students learn from your efforts? What goals are most important to you? – tied to scientific literacy, National Standards, and equity and opportunity for all students (e.g., Krajcik & Czerniak, 2007; NRC, 2005, 2012).
4. (10 points) How you enact your rationale in practice, with descriptive examples of what you actually do (or plan to do) in your science classroom to demonstrate your rationale.
5. (Required) References (3 minimum) – a reference or bibliography section in APA format, must be connected to the citations in your paper (i.e., no stand-alone references). Three references should be used from the course texts listed above, with other readings adding to this list.

**See Purdue OWL for APA Formatting:** [**http://owl.english.purdue.edu/owl/resource/560/01/**](http://owl.english.purdue.edu/owl/resource/560/01/)

What format should I follow in presenting the five (5) parts in my paper?

* Write between 4 and 5 pages double-spaced, one-inch margins, NOT counting reference page.
* Write for a non-science education audience (e.g. principal) so avoid too technical a discussion, using technical terms sparingly and describing/defining them when used.
* Write in a narrative, first person form.
* Write reflectively and personally as you address each point, using specific examples from your readings (cite) and from the classroom (i.e., actual teaching and lessons).
* Write with no spelling or grammatical errors (Peer Check It: Does it read right and make sense?)

**Holistic Rubric:** 10 points = Excellent; 9-8 points = Good; 7-6 points = Fair; 5 points = Poor; 4-0 points = Incomplete

**NOTE:** Points will be deducted for incorrect citation and reference format. Papers with multiple spelling or grammatical errors can earn no more than a ‘C’ grade after rewrite.

Adapted from Tom Rocklin (2000) website: <http://www.uiowa.edu/~c07p385/philosophy.shtml>

**Article Manuscript (70 points)**

Directions: As a teacher scholar and a Master of Science Graduate Student you will have the opportunity for one of your science assignments to create a manuscript for Science and Children. Science and Children is an award-winning peer-reviewed practitioners’ journal National Science Teachers Association (NSTA) with audience of preK-5 science teachers and those who provide them support, as well as instructors of teachers and preservice elementary students. It is published nine times a year and is available in hard copy and as an e-journal. Your reading packet has several articles of which you will be reading for your critiques. The article you will write will be submitted to for the March 2017 and April/May 2017 journals.

March topic – Getting Students outdoors: Designing and Using Outdoor Spaces Deadline for submission is September 1, 2016

April/May – Matter and its Interactions – Deadline for submission is October 1, 2016

Summer 2017 – The Science and Math Connection – Deadline for submission is November 2, 2016

I will provide information about writing for Science and Children, since you may not be a member of National Science Teachers Association (NSTA).

**Project-Based Science Unit Requirements (100 points) – Follow chapter 12 of text**

Directions: Develop each given area below for your project-based science unit and grade. Submit your project online clearly delineating the seven sections ‘tabbed’. A project-based unit can be short or long, but for our course should be one to two weeks of 45-minute periods. Consider the topics for your manuscript or the use of *GEMS Guides* and other investigative curricula in your unit. You MUST use multiple sources for lessons or materials in your unit – to make it ‘your’ work. Use the national ***Frameworks*** (NRC, 2012) electronic resource for the **K-5 science and engineering practices, crosscutting concepts, and core ideas**.

1. Cover sheet (required) – Name, date, grade level, project driving question, duration of unit, related sketch/image
2. Student learning performances (objectives) **(24 points)**
   * Consult the ***Frameworks*** for the list of science and engineering practices, crosscutting concepts, and core and component ideas (physical science, life sciences, earth/space sciences) that apply to your chosen topic.
   * Develop learning performances or objectives in each of the four knowledge domains, considering higher levels of cognitive functioning, from your applicable frameworks.
   * Create a table similar to Table 12.1 on page 435 for your generated learning performances and place your chosen national frameworks before it.
3. Driving question **(16 points)**
   * Suggestion: See Learning Activity 12.2 on page 452.
   * Write out your driving question and your rationale for selecting it.
4. Lesson plans including[[1]](#footnote-1): **(48 points)**
   * student learning performances (or learning objectives) – applicable ones from #2 table above.
   * **relationship of lesson to the driving question** (How does its sub-question help answer it?)
   * materials (and any special needed print material for lesson parts or assignments)
   * instructional strategies[[2]](#footnote-2)
   * time required
   * cautions
   * instructional sequence – introduction, representing the content, establishing links to the driving question
   * assessment – description of the assessment embedded in the lesson for evaluating student learning
   * lesson source – specific URL, text, guide, etc.
5. Assessments **(32 points)**

* Create varied and embedded assessments that are appropriate for measuring student learning performances (objectives); Assessments in a separate section must be complete and with scoring rubrics, check-lists, etc.
* Revisit your learning performance table and add the assessment performance that matches it (See Table 9.1)

1. Calendar of activities **(16 points)** – {Place after section #3 in final order of PBS Unit}

* See Table 12.5 example on page 458 before creating your own calendar of activities. Entitle each day with your **sub-question** (or inquiry question) that the lesson addresses. Also, list your **embedded assessment**.

1. Resources **(16 points)**

* Select and evaluate (See Table 12.6 and 12.7) major resources not readily available to all teachers
* Create a resource list with contact-purchase information (e.g., community contacts, GEMS guide, FOSS kit)

1. Integration of curriculum **(8 points)** [NOTE: This is NOT a separate section of your unit plan]

* Review your unit for other national inter-disciplinary standards that you meet (e.g., math, social studies, language arts, etc.): See other national standards for your grade level or grade band.
* Add these standards under their appropriate discipline heading (math, etc.) to #2 above.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Project-Based Learning Unit Scoring ‘Analytical’ Rubric (160 points)**

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| RUBRIC  8.0 points = completely meets requirement  6.0 points = mostly meets requirement  4.0 point = sometimes meets requirement  2.0 point = rarely meets requirement  0.0 point = does not meet requirement | NOTE KEY LESSON REQUIREMENTS  +Multiple sources (more than one) for lesson plans are required.  +At least one detailed Scientific Investigation as defined in this  course is required.  +At least one community resource is required.  +Children’s literature is required.  +Use of technology across lessons is required. |

1. Cover sheet complete: \_\_\_\_\_\_\_ **(required check)**
2. Student learning performances **(24/\*8 points)**
3. All new national science Frameworks (from three areas) that apply are listed: \_\_\_\_\_
4. \*All non-science national standards (e.g., math, language arts, etc.) that apply are listed: \_\_\_\_\_
5. Learning performances in a table in all knowledge *domains* and *dimensions*: \_\_\_\_\_
6. Learning performances are congruent with listed Frameworks and standards: \_\_\_\_\_
7. Driving question **(16 points)**
   1. The driving question meets the 6 criteria for a good question: \_\_\_\_\_
   2. Learning performances directly address the Driving Question: \_\_\_\_\_
8. Lesson plans section **(48 points)**
   1. Opening and closing activities address the Driving Question: \_\_\_\_\_ **(required check)**
   2. Lesson-to-lesson sequence (multiple sources) is coherent & conceptually strong: \_\_\_\_
   3. Lesson content and process matches student learning performances: \_\_\_\_\_
   4. Lesson sub-questions or outcomes help answer the driving question: \_\_\_\_\_
   5. Scientific Investigation *(clearly identified)* includes all appropriate sections: \_\_\_\_\_
   6. *Instructional sequence* of lessons are ‘teacher-ready’ to follow and use: \_\_\_\_\_
   7. Each lesson includes all completed 9 sections outlined in the assignment: \_\_\_\_\_
9. Assessments section **(32 points)**
   1. Assessments are *authentic*, meaningful, multiple, and varied: \_\_\_\_\_
   2. Assessments are *embedded* in instruction: \_\_\_\_\_
   3. Assessments are congruent with learning performances (and listed in Table): \_\_\_\_\_
   4. Assessments have rubrics/checklists for scoring, where appropriate: \_\_\_\_\_
10. Calendar of Activities **(16 points)** – {Place after section #3 in your final PBS Unit}
    1. Calendar lists each day of unit instruction & activity description in table format: \_\_\_\_\_
    2. Calendar days list sub-question as header and embedded assessment piece: \_\_\_\_\_
11. Resources **(16 points)**
    1. All major resources and materials that are not readily available to the teacher are listed: \_\_\_\_\_
    2. Resources include contact, location, source/costs, and purchasing information: \_\_\_\_\_
12. (Integrated into #2b above).

TOTAL SCORE: \_\_\_\_\_\_\_\_ (out of 160 points)

1. Most curricula will include activities written like lesson plans that address most of these bullets. Attach a copy of the activity itself and only add the missing bullets of information. Also, attach any needed print materials for lesson parts or assignments. **Note: You must have an opening and culminating activity that address your Driving Question.** [↑](#footnote-ref-1)
2. Consider varied instructional strategies from each category: Direct, indirect, experiential, independent – Also, collaborative learning instruction as need. You MUST include at least one scientific investigation (inquiry question, data gathering, data analysis, conclusion, and sharing), a community resource, children’s literature, and use of technology – ALL OF THESE ITEMS ARE REQUIRED. [↑](#footnote-ref-2)