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Rutgers, The State University of New Jersey
05:300:461:01 Science Pre-K and the Elementary School: Learning & Assessment
Spring 2021
Wednesdays 9:50-12:50 p.m.
Synchronous Meeting Dates: 1/20, 1/27, 2/10, 2/24, 3/10, 3/31, 4/14, /4/28
Location: https://zoom.us/j/99504588565

Instructor: Dr. Amy Lewis	amy.lewis@gse.rutgers.edu
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Office Hours: During asynchronous class meeting times & by appointment (schedule via email or Remind app)	
Mode of Instruction: ___ Lecture _X_ Seminar ___ Hybrid ___ Online ___ Other	Permission required: __ No _x_Yes Directions about where to get permission numbers: from the instructor

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Course Description

This course presents science as an integrated body of knowledge using investigative and inquiry techniques. Elementary and middle school methods, thematic or problem-based approach to science teaching, are utilized to engage students in conducting science and reflective discourse about their experiences. The science content is addressed using a three-dimensional approach in accordance with the *Next Generation Science Standards*. Through their class experiences and assignments students analyze and reflect on what they learn about the *Disciplinary Core Ideas, Science and Engineering Practices,* and *Cross Cutting Concepts* from the perspective of both students of science and future teachers of elementary or middle school science. Also highlighted are the impacts on the elementary school of new developments in science and new refinements in the teaching of science with an emphasis on content, methods, materials, and general curricular implications.

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PROFESSIONAL STANDARDS INFORMING THIS COURSE

New Jersey Professional Standards for Teachers 2014[1]

Standard Three: Learning Environments. The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self motivation.

ii. Essential Knowledge

1) The teacher understands the relationship between motivation and engagement and knows how to design learning experiences using strategies that build learner self-direction and ownership of learning;

iii. Critical Dispositions

2) The teacher values the role of learners in promoting each other's learning and recognizes the importance of peer relationships in establishing a climate of learning.

Standard Four: Content Knowledge The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches, particularly as they relate to the Common Core Standards and the New Jersey Core Curriculum Content Standards and creates learning experiences that make these aspects of the discipline accessible and meaningful for learners to assure mastery of the content.

ii. Essential Knowledge

1) The teacher understands major concepts, assumptions, debates, processes of inquiry, and ways of knowing that are central to the discipline(s) s/he teaches.
2) The teacher understands common misconceptions in learning the discipline and how to guide learners to accurate conceptual understanding.
3) The teacher knows and uses the academic language of the discipline and knows how to make it accessible to learners.
4) The teacher knows how to integrate culturally relevant content to build on learners' background knowledge.
5) The teacher has a deep knowledge of student content standards and learning progressions in the discipline(s) s/he teaches.

iii. Critical Dispositions

1) The teacher realizes that content knowledge is not a fixed body of facts but is complex, culturally situated, and ever evolving. S/he keeps abreast of new ideas and understandings in the field.

Standard Five: Application of Content. The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

ii. Essential Knowledge

6) The teacher understands communication modes and skills as vehicles for learning (for example, information gathering and processing) across disciplines as well as vehicles for expressing learning;

iii. Critical Dispositions

3) The teacher values flexible learning environments that encourage learner exploration, discovery, and expression across content areas.

Standard Seven: Planning for Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

ii. Essential Knowledge

2) The teacher understands how integrating cross-disciplinary skills in instruction engages learners purposefully in applying content knowledge.

3) The teacher understands learning theory, human development, cultural diversity, and individual differences and how theses impact ongoing planning

iii. Critical Dispositions

1) The teacher respects learners' diverse strengths and needs and is committed to using this information to plan effective instruction

4) The teacher believes that plans must always be open to adjustment and revision based on learner needs and changing circumstances.

Council for the Accreditation of Education Professionals 2018 K-6 Elementary Teacher Preparation Standards (2018)[2]

Standard 1: Understanding and Addressing Each Child's Developmental and Learning Needs

1.b **–** Candidates use their understanding of individual differences and diverse families, cultures, and communities to plan and implement inclusive learning experiences and environments that build on children's strengths and address their individual needs.

Standard 2: Understanding and Applying Content and Curricular Knowledge for Teaching

2.c – Candidates demonstrate and apply understandings and integration of the three dimensions of science and engineering practices, cross-cutting concepts, and major disciplinary core ideas, within the major content areas of science.

Standard 3: Assessing, Planning, and Designing Contexts for Learning

3.c – Candidates plan instruction including goals, materials, learning activities and assessments.

3.d – Candidates differentiate instructional plans to meet the needs of diverse students in the classroom.

3.f – Candidates explicitly support motivation and engagement in learning through diverse evidence-based practices.

Next Generation Science Standards for Science (NGSS): https://www.nextgenscience.org/

Other description of course purposes, context, methods, etc.:

The goals of the course include the following:

- As future teachers, students will be introduced to hands-on experiences that encourage them to teach science topics that are appropriate for elementary level students, and can be modified for diverse learners.
- Together as a class, we will consider ways that selected topics in the physical, life, and earth systems sciences can be presented to students at the pre-school through elementary level. We will also consider how these topics influence everyday life.
- Students will be introduced to, and have the opportunity to use, pedagogical techniques that foster inquiry approaches to science teaching.
- Students will become familiar with the Next Generation Science Standards (NGSS) with emphasis on science practices and content, and consider how fields such as literacy, language arts and mathematics can be integrated into science lessons and/or units.
- Together as a class, we will consider ways to enhance elementary student learning outcomes using research based approaches.

Class materials each student needs to have/buy/bring to class:

- Additional readings (will be available on the course website, save a copy on your computer or print)
- Next Generation Science Standards (save a copy on your computer)
- New Jersey Core Science Standards (save a copy on your computer)

Grading and Activities

Your course grade will be based on several different items. This syllabus offers an outline of the items, however it is not set in stone and adjustments may be made throughout the semester in order to meet our needs. You will be informed of any changes either in class or by email. Hard work, attendance to all classes, completion of all the assignments, participation in class activities/discussions and resubmission of the assignments are all factors considered for the attribution of the final grade for this course. To earn full credit for any academic task, each student must show signs of dedication to extending his/her scientific knowledge as well as constant academic effort aimed toward improvement and individual scientific knowledge and skills development. The more work you dedicate to the course, the more you will get out of it. Below is an outline of class activities. The goals of this course are to learn and practice techniques for teaching and transition from student to teacher and each assignment is designed to help you meet these goals. **Therefore, each assignment can be improved by submitting the assignment again, and I encourage you to do so**. After you submit each assignment it will be scored and feedback may be provided (depending on assignment). Once the assignment is returned to you, you may then work to improve it. All resubmissions are due before the next class after the work is returned.

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Assignments/Activities points

Attendance, Preparation, & Participation	10%
Science Learning & Teaching Checkpoints (Asynchronous Assignments)	30%
Unit Plan	60%
Overview, Outline, & Assessments (w/ rubric or checklist)	(20%)
Co-Designed Lesson Plan	(10%)
Lesson Play w/ Scientific Model	(10%)
Individual Lesson Plan & Demo	(20%)

Total **100**

The grade breakdown is as follows:

A – 90 - 100
B+ - 85 - 90
B – 80 - 85
C+ - 75 - 80
C – 70 - 75
D – 65-60

Attendance
(This policy is separate from the participation grade.)
Try not to miss any class meetings because it will be difficult (almost impossible) to learn the material on your own as some of what is learned is done through social interactions with peers. You are allowed ONE absence, which I will assume is for a good reason. You must contact your instructor about your absence providing an explanation for your absence. Beyond that, your final grade will be reduced as indicated (unless, of course, you have a doctor's note or other documentation indicating a bona fide reason): 2 absences—reduction of a half grade; 3 absences—reduction of 1 full grade; 4 absences—failing grade in course. Again, if it is an excused absence, you are responsible for contacting me, getting the course materials, and making up for the class in order to receive the participation points. Unsatisfactory participation and **any** unexcused absences will negatively affect your course grade.

Description of Activities

Attendance, Participation, & Preparation
In class, you will work to explore and learn various components of science that is often taught at the elementary and middle school level. At the same time you will learn how students construct similar concepts. We will also discuss the readings that you will do at home. You are welcome to express opinions you have and ask questions regarding the materials but make sure this is done in a respectful and professional manner. You are expected to show up, contribute to discussions, use technology for classwork, and be present for classroom. If you need to miss class for any reason, please email your instructor as soon as possible.

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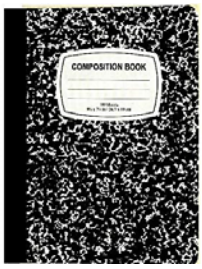
Science Teaching & Learning Checkpoints (Science Notebooks)
Through these asynchronous assignments, you will be prompted to explore science concepts in more depth as well. You will also be expected to explain what you learned from your experiences conducting science as a student and reflect on how and what you learned from your perspective as a future teacher. Lastly, you will leverage course resources to support your thinking and engage in discussion with peers.



Science Investigations & Notebooks: During synchronous class meetings, you will work with an Investigation Team to conduct investigations related to the content addressed each week. You will be asked to bring the materials needed to conduct this work for one week of class. You will also be expected to purchase a composition notebook for this course and to "bring" to class with you each week. You will often use this notebook to record class notes when you conduct science in class and when you reflect on the work you through the lens of a future teacher. Occasionally, you will be asked to conduct "Do Nows," homework assignments, and to draw scientific models in your science notebook. At certain points throughout the semester you will be required to use the work you have conducted in your science notebook to reflect on your experiences as both a student and future teacher of science. Notes taken in your science notebook will be used as evidence/student work samples. You will be expected to use evidence from these notebooks as student work samples to analyze and reflect upon your experiences. Specific questions may be assigned in conjunction with these assignments.

Unit Plan:
Throughout the entire course you will work on developing a comprehensive science unit plan including a final, summative assessment (performance task) and corresponding rubric. You will include as many lessons as are necessary to comprehensively teach the concepts within the unit (including the three detailed lessons, one composed together and one composed by each unit planning member individually). You will also collaboratively develop a scientific model that depicts a concept central to your unit (as part of the Lesson Play assignment). Select your unit topic from curriculum of a local school district and use the Next Generation Science Standards (http://www.nextgenscience.org/next-generation-science-standards). More information will be provided in class.

Lesson Plans and Demo-teaching:
You will fully compose two lesson plans of elementary school length (approximately 30 minutes) for this course. One will be created and delivered in class. These lessons will be composed in the GSE format. Both will be present in the Unit Plan. First, collaborate with your unit partner to begin thinking about and planning the overall unit overarching concepts/understandings, essential questions, and objectives. Then decide which plan you will compose together (Co-Designed Lesson Plan) and which you will compose individually (Individual Lesson Plan & Demo Reflection).

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Co-Designed Lesson Plan: For this lesson, you and your unit planning partner will work together to develop a full lesson from within your unit.

Individual Lesson Plan & Demo Reflection: For this lesson, you and your unit planning partner will work individually to each develop a full lesson from within your unit. You will then choose a part of the lesson you've designed to demonstrate to your peers. Following this demonstration of your teaching, you will use feedback from your peers to compose an analysis and reflection of your planning and teaching.

Lesson Play w/ Scientific Model
This assignment is designed to get you to consider the dialogue through which you will engage students in thinking about and practicing science and to consider how your students' thinking will be expressed and guided through interactions with peers and with the teacher. You will compose a play of a scene that takes place in the science learning environment and incudes dialogue between the teacher and students. The scientific model from your unit plan is the mediation through which they focus their attention to develop understanding or explanations of scientific phenomenon.

Check your e-mail and Canvas announcements regularly. I will use these tools to make class announcements and contact you individually. You will need to pay attention to these announcements/emails in a timely fashion.

Week	**Teaching Science Pedagogy Topic/Guiding Question**	**Science Content Topic/Guiding Question**	**Readings** (Readings are aligned with the week's content and should be read prior to class.)	**Assignments**
1 1/20	Course Introduction **The Nature of Science & The Goals of Science Education:** How can teaching practices facilitate opportunities for students to think like scientists?	***Doing* Science:** How can teachers facilitate experiences that get students to think like scientists?	Syllabus	• Complete your Concept Map, screenshot it and submit to Canvas • Research your assigned scientist
2 1/27			Duncan & Cavera, *DCIs, SEPs, and CCs, Oh My!*	**CHOOSE UNIT TOPIC**

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	Shifts in Science Education & Learning Progression: How teachers help students reason through scientific problems? How do students deepen their understanding of science concepts over time?	**Matter & Its Interactions** How can evidence be used to develop scientific explanations?	Using Phenomena in NGSS-Designed Lessons and Units Review: NGSS Learning Progressions	
3 2/3 ASYNC			Varelas & Pappas, *Children's Ways with Science and Literacy Integration*, Chapter 1 Phenomenon, Not Just for the Classroom Resource: Phenomenon for NGSS	Asynchronous Assignments
4 2/10	**Engaging in Discipline-Specific Discourse:** How can social interaction, science-focused discussions facilitate learning and the assessment of student understanding before, during, and after instruction?	**Sinking/Floating:** In what ways do variables in scientific investigations affect the results? How can/why should variables in scientific investigations be controlled?	Brown, *Science in the City*, Chapter 4 Wiggins & McTighe, *Understanding by Design Framework*	
5 2/17 ASYNC			Beyond General-Purpose Talk Moves: Using discipline-specific probes with English learners in the science classroom 5E's Lesson Planning http://nextgenerationscience.weebly.com/5-es-of-science-instruction.html	**Unit Outline (NGSS Identified) & Unit Resources (minimum of 6 sources, Essential Questions, and Disciplinary Core/ Overarching Concepts, Summative Assessment summarized)** Asynchronous Assignments

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6 2/24	**Science & Engineering Practices:** How can teachers merge the teaching of science content with the development of science practices?	**Forces & Motion:** What can be learned from the development and testing of different investigation designs?	Bybee, *Science & Engineering Practices in K-12 Classrooms* Mistrell & van Zee, *Using Questioning to Assess and Foster Student Thinking*, (Chapter 5) Everyday Assessment in the Science Classroom	
7 3/3 ASYNC			NGSS: Science and Engineering Practices	**Unit Plan Lessons 1-5 Objectives/Assessments Outlined** Asynchronous Assignments
8 3/10	**Scientific Modeling:** How does creating and analyzing scientific models influence students' thinking? How can using scientific models in science education create more equitable learning spaces and opportunities for students to explain their thinking?	**Light & Moon Phases:** How can teachers use relevant, authentic phenomena to motivate students to engage in science?	Passmore, Schwarz, & Mankowski, *Developing and Using Models* (Chapter 6) *Helping Students Make Sense of the World using the Next Generation* *SEP*	
		SPRING RECESS		
9 3/24 ASYNC		**Seasons** Content-related: How can the examination of evidence (i.e. multiple data sources) help students to understand science?	Developing and Using Scientific Models	**Lesson Plan #1 Due (Co-Designed)** Asynchronous Assignments
10 3/31	**Engaging in Argument from**	**Unity & Diversity:** How	Davies, *Learning through Assessment: Assessment for Learning in the Science Classroom*, (Chapter 2) Everyday	

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	Evidence: What should teachers consider when identifying which resources, tools, and materials to use and how to use them? How can the analysis of evidence help scientists to engage in argumentation?	can the development of multiple scientific explanations be used to develop deeper understandings of scientific concepts?	Assessment in the Science Classroom Developing an Argument based on Evidence: http://www.argumentationtoolkit.org/evidence.html	
11 4/7 ASYNC			Mason & Bohl, *More than Data* Engaging in Argument from Evidence	**Lesson Play w/ Scientific Model Due** Asynchronous Assignments
12 4/14	**Authentic Instruction and Assessment:** How can students practice authentic application of science content, practices, and engineering skills? What "counts" as evidence of learning?	**Energy & Engineering:** What kinds of resources/evidence should scientists use to examine scientific phenomena? How can knowledge and understanding of scientific phenomena be used to solve authentic science- and engineering-based problems?	Review: NGSS: Cross Cutting Concepts Review: Engineering Design	**Unit Plan Check-in**
13 4/21 ASYNC			Lottero-Perdue, Lovelidge, & Bowling, *Engineering for All*	**Individual Lesson Plan #2 Due** • Asynchronous Assignments • Complete your Concept Map, screenshot it and submit to Canvas
14 4/28	**Microteaching:** What can be learned about teaching and learning by participating in demonstration lessons and engaging in reflective	**Demonstration Lessons** **Unit Plan Share**		**(Demo Reflection due 4/30)** **Unit Plan Due**

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	discourse about practice?		

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Academic Integrity

Academic integrity is essential to the success of the educational enterprise and breaches of academic integrity constitute serious offenses against the academic community. Every member of that community bears a responsibility for ensuring that the highest standards of academic integrity are upheld. Only through a genuine partnership among students, faculty, staff, and administrators will the University be able to maintain the necessary commitment to academic integrity.

The University administration is responsible for making academic integrity an institutional priority and for providing students and faculty with effective educational programs and support services to help them fully understand and address issues of academic integrity. The administration is also responsible for working with other members of the academic community to establish equitable and effective procedures to deal with violations of academic integrity.

For further information, visit http://academicintegrity.rutgers.edu/.

Violations of Academic Integrity

Any involvement with cheating, the fabrication or invention of information used in academic exercise, plagiarism, facilitating academic dishonesty, or denying others access to information or material may result in disciplinary action being taken at either the college or university level. Breaches of academic integrity can result in serious consequences ranging from reprimand to expulsion.

http://senate.rutgers.edu/FinalInterimAcademicIntegrityPolicy.pdf

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