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Course Name: Science Instruction for Elementary Teachers	**Course Code:** SCI 5073	**Go Live Date:** 08/01/2030

Faculty Name: Bridgette L Davis, PhD

The Big Idea: *What's the most important concepts you want your students to walk away mastering? What do you hope they remember in five years from now?*

Students in this course will examine current standards in science and practice the process of aligning curriculum and lesson plans to these standards.

Relevance: *How can theory be applied in practice? Are there current events that can be discussed? What assignments can you use to mimic what they will be doing when they graduate?*

This course is meant to provide a foundation for teaching science. The course will use an integrated scientific inquiry approach in order to use critical thinking skills to explore social, cultural, and ethical aspects of science. Students will be required to create lesson plans and practice instructing students to mimic what they will do when they graduate.

Instructor Presence: *What strategies and scheduled communications can you use to help support students' learning?*

I will be recording engaging lecture content in order to illustrate important concepts to the students. I will also provide a review lecture at the end of each module to revisit important concepts. This will be paired with regular feedback on assignments and a regular cadence of announcements.

Course Learning Objectives:
From your syllabus, check that they are written using active verbs.

At the conclusion of the course, students will be able to…

CLO1. Describe components of scientific inquiry-based instructional best practices.
CLO2. Select literacy and assessment strategies that support the cultural/multicultural needs of students and deep understanding of science concepts.
CLO3. Develop content and inquiry-based instructional strategies which are aligned with science standards, integrated with technology, and engage students in the study of physical science, Earth and space science, life science, engineering, and technology.
CLO4. Describe the guidelines for establishing a safe science learning environment that provides opportunities for multisensory exploration and ensures the humane and ethical treatment of living organisms.
CLO5. Describe the unifying concepts of science, engineering, and technology and their social, cultural, and ethical aspects and interactions.
CLO6. Incorporate engineering principles to create inquiry-based science instruction which fosters the development of critical and creative thinking, reasoning, problem-solving, and performance skills.
CLO7. Evaluate current trends and standards in K-12 science education best practices, and how society benefits from elementary teachers delivering science instruction with an integrated scientific inquiry-based approach that includes appropriate literacy, technology, and engineering principles.

Topics and Learning Objectives		Outputs (What are students producing as evidence of mastery?)		Inputs (What is required for students to be able to create outputs?)	
Topics	**Module Learning Objectives**	**Individual/Collaborative Activities**	**Discussions**	**Readings**	**Videos, Micro-Lectures, & Demonstrations**
General topics found in each module	*Learning objectives for each module*	*What will student complete to demonstrate mastery? How can you make the task authentic to mimic a real-world situation or skill?*	*Are there concepts, applications, case studies, etc. might be appropriate for discussion, analysis, and/or debate with others?*	*What resources and text-based content do students need to complete their work?*	*Are there any videos that can support students' outputs? Which concepts will you need to support through your own micro-lectures?*

Module 1: A Vision for Science Education	MLO1.1 Identify the challenges of enacting inquiry-based science practices in classrooms and schools. (CLO1)
	
	MLO1.2 Describe the relationship between literacy and students' understanding of science and the ways that literacy strategies may be used in assessing student learning. (CLO2)
	
	MLO1.3 Research current best practices in science instruction in order to compare to current implementation practices in a school. (CLO7)
	
	MLO1.4 Discuss the social, cultural, or ethical
		Individual Assignments (MLO1-3)
		• Pre-course self-evaluation
		• Analyzing Best Practices and Implementation
		  ○ NSTA
		  ○ ED
		  ○ DOE
		• Module Quiz
		
		Practice (MLO1-3)
		• Reading Progress Monitor
		• Presentation Progress Monitor
			Module Discussion (MLO1-3)
			• Discuss the challenges of enacting inquiry-based science in classrooms and schools.
			• Describe the relationship between literacy and students' understanding of science. Include ways that literacy strategies may be used in assessing student learning.
				Readings (MLO1-3):
				• Robelen, E. W. (2013). Standards in science unveiled. *Education Week*, *32*(28), 1-13.
				• Dejarnette, N. J. (2013). America's children: Providing early exposure to STEM (science, technology, engineering, and math) initiatives. *Education, 133*(1), 77-84.
				• Corder, G., & Slybuis, J. (2011). Shifting to an inquiry-based experience. Science and Children, 48(9), 60-63.
				• Robertson, B. (2007). Q: How much overlap is there across science disciplines? Science and Children, 44(6), 54-57.
				• Harris, C. J., & Rooks, D. L. (2010). Managing inquiry-based science: Challenges to enacting complex science instruction in elementary and middle school classrooms. Journal of Science Teacher Education, 21, 227-240.
					Lectures (MLO1-3):
					• Thinking Like a Scientist
					• Essential Features of Inquiry-Based Science
					• Inquiry-Based Learning
					• Best Practices in Inquiry-Based Science
					• Literacy in Inquiry-Based Science Lessons
					• Common Core
					• Conversation with Seymour Simon (Author)
					• Trade Book Center
					• Module Review

	aspects of enacting inquiry-based science education. (CLO5)			• Barrow, L. H. (2010). Encouraging creativity with scientific inquiry. Creative Education, 1, 1-6. • Aschbacher, P., & Alonzo, A. (2006). Examining the utility of elementary science notebooks for formative assessment purposes. Educational Assessment, 11(3 & 4), 179-203. • Vannest, K. J., Soares, D. A., Smith, S. L., & Williams, L. E. (2012). Progress monitoring to support science learning for all students. Teaching Exceptional Children, 44(6), 66-72.	

Module 2: Physical Science by Inquiry	MLO2.1 Develop and critique lesson plans that incorporate standards, assessment strategies, resources, and Response to Instruction (RtI) strategies for physical, Earth and space, and life science and engineering and technology. (CLO3)
	
	MLO2.2 Review the physical science standards to identify the content strands that elementary students are expected to know, understand and apply. (CLO7)
	
	MLO2.3 Identify the components of an exploration-explanation instructional sequence. (CLO4)
		Individual Assignments (MLO1-2)
		• Designing a Physical Science Lesson Plan
		  ○ Topic Arrangements of the Next Generation Science Standards
		  ○ Lesson Plan Template
		  ○ Lesson Plan Exemplar
		• Module Quiz
		
		Practice (MLO1-2)
		• Reading Progress Monitor
		• Presentation Progress Monitor
			Module Discussion 1 (MLO1-2)
			• Next Generation Science Standards
			• How do the Next Generation Science Standards reflect new ways of thinking about science education?
			• What differences do you notice about the organization of the Next Generation Science Standards as compared to your current state standards?
			• How might these differences influence changes in instructional strategies and assessments currently in use?
			
			Module Discussion 2 (MLO1-2)
				Readings (MLO1-2):
				• Krajcik, J. (2013). The Next Generation Science Standards: A focus on physical science. Science Scope, 36(7), 13-21.
				• Brown, T. M., & Brown, P. L. (2010). Enhancing elementary students' experiences learning about circuits using an exploration-explanation instructional sequence. Science Activities, 47, 54-57.
				• Brown, P. L., & Abell, S. K. (2007). Examining the learning cycle. Science and Children, 44(5), 58-59.
				• Ashbrook, P. (2010, March). Building with sand. Science and Children, 17-18.
				• Palmeri, A., Cole, A., DeLisle, S., Erickson, S., & Janes, J. (2008). What's the matter with teaching children about matter? Science and Children, 46(4), 20-23.
				• McPherson, S. (2009). A dance with butterflies: A metamorphosis of teaching and learning through
					Lectures (MLO1-2):
					• 5Es Revisited
					• UDL and Science Curriculum
					• Trade Book Center (Cool stuff and how it works)
					• Motivating Inquiry

	MLO2.4 Describe how the Next Generation Science Standards unify the concepts of science, engineering, and technology. (CLO5)		• How does the lesson plan convey the fundamental concepts and processes of physical science? • How does the lesson plan demonstrate the application of inquiry-based science and literacy strategies? • How does the lesson plan integrate technology? • How does the lesson plan use Response to Instruction to accommodate the needs of all learners?	technology. Early Childhood Education Journal, 37(3), 229-236.	
Module 3: Hands-On, Minds-On Earth and Space Science	MLO3.1 Describe how the integration of reading and writing into elementary-level science classes can foster a deeper understanding of science content for elementary students. (CLO2) MLO3.2 Provide examples of how to integrate trade books to encourage reading in a science lesson or unit. (CLO2) MLO3.3 Provide examples of writing strategies and activities that can be integrated	**Individual Assignments (MLO1-4)** • Designing an Earth and Space Science Lesson Plan. ○ Topic Arrangements of the Next Generation • Module Quiz **Practice (MLO1-4)** • Reading Progress Monitor • Presentation Progress Monitor	**Module Discussion 1 (MLO1-4)** • Describe how the integration of reading and writing into elementary-level science classes can foster a deeper understanding of science content for elementary students. • Provide examples of how you might integrate the use of trade books to encourage reading in a specific science lesson or unit. • Provide examples of writing activities/strategies that you have integrated, observed being integrated, or would feel comfortable integrating into a specific science lesson/unit.	**Readings (MLO1-4):** • Wysession, M. (2013). The Next Generation Science Standards and the earth and space sciences, Science Teacher, 80(4), 31-37. • McNeal, K. S. (2010). Editorial: The geosciences gap in K-12 education. Journal of Geoscience Education, 58(4), 197 • Riggs, E. M., & Alexander, C. J. (2010). Broadening participation in the earth sciences. Journal of Geoscience Education, 55(6), 445-446. • Aschbacher, P., Li, E., & Hammon, A. (2008). Reading, writing, and rings. Science and Children, 46(1), 46-50. • Ueckert, C. W., & Gess-Newsome, J. (2008). Active learning strategies. The Science Teacher, 75(9), 47-52. • Bodzin, A. M., & Cirucci, L. (2009). A land-use-planning simulation using Google Earth. Science Scope, 32(7), 30-38.	**Lectures (MLO1-4):** • Response to Instruction • Instructional Process and Intervention Model • Trade Book Center • Motivating Inquiry

	into a science lesson or unit. (CLO3) MLO3.4 Identify best practices of Response to Instruction and the technique is used to accommodate the needs of multiple learners. (CLO1)		**Module Discussion 2 (MLO1-4)** • How does the lesson plan convey the fundamental concepts and processes of Earth and space science? • How does the lesson plan demonstrate the application of inquiry-based science and literacy strategies? • How does the lesson plan integrate technology? • How does the lesson plan use Response to Instruction to accommodate the needs of all learners?	• Hubbard, L. (2008). Bringing moon phases down to earth. Science and Children, 46(1), 40-42. • Tedford, R., & Warny, S. (2006). Layer-cake earth. Science and Children, 44(4), 40-45. • Ansberry, K., & Morgan, E. (2006). Teaching through trade books: Imaginative inventions. Science and Children, 43(8),12-25.	
Module 4: Inquiry-Based Life Science and Ethics	MLO4.1 Identify content and inquiry-based strategies that motivate and engage students in the study of physical science, Earth and space science, life science, and engineering and technology. (CLO1) MLO4.2 Describe the characteristics of multisensory exploration in a science learning environment (CLO4) MLO4.3 Describe what constitutes “humane and ethical treatment” of living organisms in a science	**Individual Assignments (MLO1-4)** • Designing a Life Science Lesson Plan. ○ Topic Arrangements of the Next Generation • Module Quiz **Practice (MLO1-4)** • Reading Progress Monitor • Presentation Progress Monitor	**Module Discussion 1 (MLO1-4)** • Discuss types of technology that could be easily integrated into daily lessons in science. • Have you observed creative uses of technology in teaching science? • Describe the types of technology you have observed and/or discuss the barriers that might prevent the use of technology in science classrooms. **Module Discussion 2 (MLO1-4)** • How does the lesson plan convey the fundamental	**Readings (MLO1-4):** • Bybee, R. W. (2013). The Next Generation Science Standards and the life sciences. Science Scope, 36(6), 13-20. • Ohana, C. (2009). Connecting with technology. Science and Children, 46(9), 6. • Benedis-Grab, G. (2011, April). Sharing digital data: A plant growth experiment is strengthened when students collaborate digitally. Science and Children, 42-47. • Atkinson, T. S., Matusevich, M. N., & Huber, L. (2009). Reading Teacher, 62(6), 484-497. • Straits, W. (2005). Mystery box writing. Science and Children, 43(3), 33-38. • Weiland, I. (2011). Where does our food come from? Third graders become investigators in this problem-	**Lectures (MLO1-4)** • Problem-Based Learning • Ethical Treatment of Living Organisms • Using Tech. to Connect Students and the Environment • Trade Book Center • Motivating Inquiry

	learning environment. (CLO4) MLO4.4 Identify several barriers to integrating technology in the life science classroom. (CLO3) MLO4.5 Discuss the role of creativity in inquiry-based science instruction. (CLO6)		concepts and processes of life science? • How does the lesson plan demonstrate the application of inquiry-based science and literacy strategies? • How does the lesson plan integrate technology? • How does the lesson plan use Response to Instruction to accommodate the needs of all learners?	based learning unit. Science and Children, 48(5), 40-45.	
Module 5: Engineering, Technology, Science, and Society	MLO5.1 Explain why science, engineering, and technology are considered unifying concepts in American society. (CLO5) MLO5.2 Specify strategies teachers can use to motivate and engage science students in ways that prepare them for promising futures. (CLO6) MLO5.3 Discuss what specific benefits science and society receive from the delivery of science instruction developed using an integrated, scientific inquiry-based instructional approach. (CLO7)	**Individual Assignments (MLO1-3)** • Reflection on Learning ○ How do you envision the science instruction that you are providing students serving as a benefit to society? ○ What have you learned in this course that will help you implement or improve an inquiry-based approach to teaching science?	**Module Discussion (MLO1-3)** • Prompt • Why are science, engineering, and technology considered unifying concepts in American society? • How can teachers motivate and engage science students in ways that prepare them for a promising future in our society?	**Readings (MLO1-3):** • Hanuscin, D. L., & Lee, E. J. (2009). Helping students understand the nature of science. Science and Children, 46(7), 64-66. • Lottero-Perdue, P. S., Lovelidge, S., & Bowling, E. (2010). Engineering for all: Strategies for helping all students succeed in the design process. Science and Children, 47(7), 24-27. • Abell, S. K. (2009). Thinking about thinking in science class. Science and Children, 46(6), 56-57. • Colley, K. (2008). Project-based science instruction: A primer – An introduction and learning cycle for implementing project-based science. Science Teacher, 75(8), 23-28. • Mayes, R., & Koballa, T. R., Jr. (2012). Exploring the science framework. Science and Children, 50(4), 8-15. • Trauth-Nare, A., & Buck, G. (2011). Assessment for learning: Using formative assessment in problem- and	**Lectures (MLO1-3)** • Unifying Concepts • 5 year olds pilot project learning • Project-based learning in Elementary Science Classroom • Meeting the Needs of Society • STEM Projects • STEM Education Initiatives • The role of the science teacher. • Science teachers and engaged students • Flipped classroom • Trade book center

	MLO5.4 Describe what it means for the concepts of engineering and technology to be “unified”. (CLO5) MLO5.5 Provide an example of an inquiry-based educational activity which promotes the development of reasoning skills through the use of engineering principles. (CLO6)	• Final Exam • Self-Evaluation **Practice (MLO1-3)** • Reading Progress Monitor • Presentation Progress Monitor		project-based learning. Science Teacher, 78(1), 34-39.	