

**EDUC 323 PreK-4 Instructional Strategies for Scientific Reasoning
EDUC 331 Science for Middle Level Learners**

**MORAVIAN COLLEGE
FALL 2015**

INSTRUCTOR:

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PPHAC 324

CLASS HOURS/LOCATION:

M, W, & F 1:10 - 2:20 P.M., PPHAC 302

OFFICE HOURS:

M & F 10:00–12:00 p.m., W 4:00–6:00 p.m.,

and by appointment

“Science is a way of thinking much more than it is a body of knowledge.”

Carl Sagan

“[The teacher’s] task is rather to keep alive the sacred spark of wonder and to fan the flame that already glows. His problem is to protect the spirit of inquiry, to keep it from becoming blasé from overexcitement, wooden from routine, fossilized through dogmatic instruction, or dissipated by random exercise upon trivial things.”

John Dewey

OVERVIEW

This course will prepare pre-service educators to interpret early childhood or middle level students’ science experiences and guide their understanding of scientific concepts. The course involves a study of science content material and curricula that underpin the teaching of science. Students will gain a solid understanding of scientific topics while they are learning how to implement activities with children using constructivist, hands-on, inquiry-based methods. Preparation will include integration of literacy, mathematics, and other content areas as fundamentally related to successful science instruction.

ESSENTIAL QUESTIONS

1. Why is it essential to engage all students in scientific inquiry?
2. How can learning become more authentic by integrating science with other content areas?

OBJECTIVES

- To appreciate the nature and importance of science and of teaching science to all learners
- To understand the concepts and processes of Earth/space, life, and physical science curricula
- To develop, plan, implement, and reflect on science units, lessons, and activities based on effective teaching methods, use of appropriate resources/materials/technology, and selection of meaningful assessments that address state and national standards
- To demonstrate teaching strategies that promote students’ scientific inquiry, active involvement, and higher order thinking

- To investigate, discuss, and apply the PA Science Standards and the Next Generation Science Standards
- To understand strategies appropriate for differentiating instruction to meet the needs of all learners
- To integrate other content areas (mathematics, engineering, technology, literacy, social studies, art, and music) within science lessons
- To understand the nature and importance of environmental and ecological issues
- To implement effective classroom management and appropriate safety practices

REQUIRED TEXTS

This course requires one customized text, *Teaching Science through Inquiry*, which integrates chapters from:

Contant, T.L., Bass, J.E., & Carin, A.A. (2014). *Teaching science through investigation and inquiry*. Boston, MA: Pearson.

DeRosa, D.A. & Abruscato, J. (2015). *Teaching children science: A discovery approach*. Boston, MA: Pearson.

ATTENDANCE

Due to the nature of this course, attendance and participation are essential. If you must miss a class, please call the instructor to explain the situation and submit all work due *prior* to the start of class or, in the case of an emergency, *as soon as possible*. If you are absent, you are responsible for obtaining any notes, assignments, readings, etc. given during the class session missed. Absence cannot result in missing or late work. Missing more than two class sessions or a pattern of late arrivals may, at the discretion of the instructor, result in a reduced or failing grade for the course. Please see the *Secondary Field Experience Handbook*, available on the Moravian College Education Department's website for field experience attendance guidelines.

FIELD EXPERIENCE

The purpose of the field experience is to provide students with appropriate classroom experiences in a developmental and sequential manner. All field experiences are directly related to coursework and must be successfully completed to pass the education course.

EVALUATION

Each assignment will be graded based on specific criteria that are indicated generally in the syllabus and specifically in assignment guidelines distributed during the semester. Please note that unless a mutually agreeable revised due date is negotiated with the instructor, any late assignment will lose five percentage points for each day it is late. Any assignment not submitted within two weeks of the due date will receive zero points. It is within the instructor's purview to apply qualitative judgment in determining grades for an assignment or for a course.

Assignment of grades will follow these Moravian College Catalog definitions, quoted here:

A, A-:	These grades indicate achievement of the highest caliber. They involve expectations of independent work, original thinking, and the ability to acquire and use knowledge effectively.
B+, B, B-:	These grades indicate higher than average achievement. Evidence of independent work and original thinking is expected.
C+, C, C-:	These grades are given when the student has devoted a reasonable amount of time, effort, and attention to the work of the course and has satisfied the following criteria: familiarity with the content of the course, familiarity with the methods of study of the course, and active participation in the work of the class.
D+, D, D-:	These grades indicate unsatisfactory work, below the standard expected by the College, in which one or more important aspects falls below the average expected of students for graduation.
F:	This indicates failure.

The Moravian College policy on academic honesty will be followed. Collaboration with peers is valuable in understanding various aspects of your work. However, the work you submit must be the result of your individual effort, apart from the collaborative process. To avoid plagiarism, properly cite (using APA 6th ed. guidelines) all sources used to develop your work. Note that academic dishonesty will result in a zero for the assignment and notification of the Academic Dean, in accordance with Moravian College policy.

Students who wish to request accommodations in this class for a disability should contact Elaine Mara, Assistant Director of Academic and Disability Support, located in the lower level of Monocacy Hall, or by calling 610-861-1401. Accommodations cannot be provided until authorization is received from the Academic Support Center.

Class Preparation & Participation	10%
Reflective Responses	10%
Professional Resource Reports	15% (3 at 5% each)
Microteaching	20% (2 at 10% each)
Unit Plan (Final Project)	20%
Exams	25% (3 total)

Class Preparation & Participation

Preparation. Reading assignments will include chapters in the texts and additional relevant materials. As part of each reading assignment, consider these questions and be prepared to discuss them in class:

1. What is my understanding of the science concepts and processes?
2. What is my understanding of the science teaching methods?
3. How does the reading connect to my experiences in the field?
4. How does the reading inform my teaching to ensure science learning for all?

Most readings assignments will require you to prepare answers to specific Discussion Questions, Explorations, or Activities from the text that will require you think deeply about the material, connect it to your field experience, and thoughtfully participate in class. Preparation can take many forms: paragraph, detailed bulleted list, outline form, visual model, etc. Whether typed or hand-written, bring prepared answers to each class.

Participation. Your participation is essential to our learning community. Appropriate class participation includes several attributes. Prepare for each class session by completing assignments and considering ideas and questions that emerge. During class, remain actively involved by paying attention and sharing your relevant and thoughtful responses and questions. Class participation on a regular basis is expected to ensure your grasp of textual materials and important concepts. Participation will be assessed on evidence of completed work, the relevance and quality of your responses, and your contributions that enrich our community dialogue. Be present in class.

You will participate in *discrepant events* so that you will be able to use them to arouse students' natural curiosity and develop their skills and knowledge in the sciences. Discrepant events will provide one method for examining students' preconceptions and reasoning patterns in order to establish prerequisite skills. As you participate in *experiments, demonstrations, and subsequent discussions*, you will appreciate the importance of engaging students in these learner-centered activities to develop scientific reasoning and investigative strategies. Explicit rules and routines for class management will include methods for safety in the science classroom.

Written Assignments

Written assignments may require the use of outside texts and journals; these will serve to extend your understanding of teaching concepts and provide familiarity with educational resources. Assignments should be professional in substance and appearance, using APA (6th ed.) format: double-spaced, 1" margins, and standard font (Times, Arial, etc.). Quality writing is expected; papers should have a logical sequence and structure with no errors in spelling or grammar. Identify the resources you use on a reference list at the end of your assignment using APA (6th ed.) guidelines.

Reflective Responses. Reflective responses are opportunities to think about how the course content connects with your experiences in the classroom (as a student and in the field as a pre-service teacher). Construct reflective responses that are 2 pages in length. Share your reflective responses to weekly prompts with learning community members via Google Drive and/or class discussion. Describe specifically how certain theoretical and practical strategies (be sure to properly cite sources!) promote science learning for all students, including students with disabilities in an inclusive setting and ELLs. There will be 10 Reflective Response prompts this semester. Responses are typically due Mondays.

Professional Resource Reports. There are extensive resources available to support your mastery of content and method. During the semester, report on:

- a professional journal article, such as *Science and Children* or *Science Scope*
- a website relevant to a science topic
- a science book OR current event suitable for use at your grade level/band

Use the proper APA reference format as the heading. In approximately 2 pages:

1. summarize the information
2. connect the information to course readings, discussions, and your field experience
3. explain how you might use the resource to inform your teaching practice

Papers will be shared with members of the learning community.

Teaching & Learning

Microteaching. You will prepare lesson plans for and present two microteaching sessions to the class. One lesson will focus on physical or life science and the other lesson will focus on Earth or space science. Microteaching will give you an opportunity to implement the methods you are learning. For EDUC 323/523 students, one lesson will be directed at grade Pre K-2 learners, and one at grade 3-4 learners. For EDUC 331 students, one lesson will be directed at grade 4-5 learners, and one at grade 6-8 learners. One of the lessons must integrate a literature book, and the other lesson must integrate another content area (e.g. mathematics, engineering, technology, social studies, art, or music). Students must be actively involved in both lessons through a demonstration, activity, or experiment. Lessons will be 25 minutes in length. The lesson plan must indicate the learning objective(s), cognitive level(s), and the PA science standard(s) addressed. Follow the Moravian College lesson plan format.

Final Project. You will design a thematic unit plan focusing on a science topic. Select a science topic (theme) and grade level; list the specific PA science standard(s) the unit will address. Design the curriculum for the unit, which must integrate other content areas (literacy, social studies, mathematics, and music or art). Write detailed lesson plans for five science lessons, all of which include inquiry-based activities that engage all learners. Describe the science content for each lesson in a way that demonstrates your understanding of the content. Label each lesson objective with its cognitive taxonomy level; all lessons must include an objective at the application level or higher. Incorporate the 5-E model of science instruction. Use the Science and Literacy Framework for planning the lesson that integrates literacy and explain how other content areas will be integrated. Follow the Moravian College lesson plan format. You may select a topic other than those used for your microteaching experiences. As part of your Unit Plan, you will create a Learning Center that provides student-led activities related to your science topic/concept. The Learning Center should provide all instructions and materials for at least 2 activities. There will be a sign-up sheet for final project topics.

Examinations

There will be three examinations during the semester. Exams will include science content, science processes, and pedagogical concepts.

COURSE OUTLINE

Unit 1: Physical Science

Week	Methods for Teaching Science through Inquiry	Science Content
1	Framing Science and Science Education	matter and motion
2	Involving Learners in Doing Science	energies and machines
3	Learning Science with Understanding	sound and light
4	Making Science Accessible for All Learners	magnetism and electricity

Unit 2: Life Science

Week	Methods for Teaching Science through Inquiry	Science Content
5	Engaging in Inquiry-Based Instruction (5-E Model)	classification of living things
6	Assessing Science Learning	plants
7	Planning and Managing the Science Classroom	animals
8	Questioning Effectively	the human body
9	Using Technology Tools and Resources	health and nutrition
10	Microteaching #1	physical and life science

Unit 3: Earth & Space Sciences

Week	Methods for Teaching Science through Inquiry	Science Content
11	Connecting Science with Other Subjects	universe and our solar system
12	Integrating and Applying Science	Earth
13	STEM, STEAM, and STREAM Education	Earth and environment
14	Microteaching #2	Earth and space science
15	Teaching Science Through Inquiry	water, weather, climate
16	Unit Plans	general science

COURSE SCHEDULE

(Note: This part of the syllabus is subject to modification, as the instructor deems necessary, to ensure course objectives and needs of the learning community are met.)

Unit 1: The Physical Sciences

Week 1: Welcome!

Introductions - Learning Community of Inquiry, Course Information

Framing Science and Science Education

What is science?

What is science education?

Is science education important?

How has science education changed over time?

Matter and Motion

date	assignment(s) due
31-AUG-2015	
2-SEP-2015	1. chapter 1 (Framing Science and Science Education) 2. Exploration 1 (p. 3) #1-4
4-SEP-2015	1. section 1 (Physical Sciences) introduction and chapter 16 (Matter and Motion)

Week 2: Involving Learners in Doing Science

What does doing science mean?

Tasks of Scientific Inquiry

Scientific Processes

Common Investigations (Early Childhood-Grade 8)

Integrated Science

Energies and Machines

date	assignment(s) due
7-SEP-2015	1. chapter 2 (Involving Learners in Doing Science) 2. Exploration 1 (p. 30) #2 and Discussion Questions (p. 65) #2 & 4 3. Reflective Response - Prompt #1
9-SEP-2015	1. chapter 17 (Energies and Machines)
11-SEP-2015	1. explore NSTA website https://www.nsta.org/

Week 3: Learning Science with Understanding

How do students construct science knowledge and learn science with understanding?

What is the difference between knowledge and understanding?

Constructivism, Prior Knowledge, and Misconceptions

Teacher Beliefs and Practice

Sound and Light

date	assignment(s) due
14-SEP-2015	1. chapter 3 (Learning Science with Understanding) 2. Discussion Questions (p. 88) #1-4 3. Reflective Response - Prompt #2
16-SEP-2015	1. chapter 18 (Physical Science Lesson Ideas)
18-SEP-2015	

Week 4: Making Science Accessible for ALL Learners

Who are the learners in your classroom?

Equity in Science Education

Teaching Effectively in an Inclusive Classroom

Supporting Science Learning for ALL Students

Differentiation: Why and How

Teacher Beliefs and Practice

Magnetism and Electricity

date	assignment(s) due
21-SEP-2015	1. chapter 10 (Making Science Accessible for All Learners) 2. Discussion Questions (p. 290) #1-5 3. Reflective Response - Prompt #3
23-SEP-2015	1. Professional Resource Report #1 2. Activities for Physical Science
25-SEP-2015	1. Exam #1

Unit 2: Life Science

Week 5: Engaging in Inquiry-Based Instruction and Using the 5-E Model

What is Inquiry-Based Instruction?
Research on Inquiry-Based Instruction
Essential Features of Inquiry-Based Instruction
Levels of Inquiry
Instructional Models
Classification of Living Things

date	assignment(s) due
28-SEP-2015 FIELD EXPERIENCE BEGINS!!!	1. chapter 4 (Engaging in Inquiry-Based Instruction and Using the 5-E Model) 2. Discussion Questions (p. 121) # 1, 2, and 6 3. Reflective Response Prompt #4
30-SEP-2015	1. section 2 (Life Sciences) introduction and chapter 13 (Living Things)
2-OCT-2015	1. Professional Practice Activities (p. 122) # 1 and 5

Week 6: Assessing Science Learning

What is assessment?
What are the types of assessment?
How can assessment become not merely an end of, but rather a means to science learning?
PA Assessment Anchors
Plants

date	assignment(s) due
5-OCT-2015	1. chapter 5 (Assessing Student Learning) 2. Discussion Questions (p. 162) # 1-3 3. Reflective Response Prompt #5
7-OCT-2015	1. visit PDE and read the summaries for the types of assessment
9-OCT-2015	1. talk with your Cooperating Teacher about a science lesson you will teach; incorporate this lesson into your Unit Plan

Week 7: Planning and Managing the Science Classroom

Curriculum and Instruction
What science to teach and how to teach it?
Standards
Acronyms to Know (PA, NSES, NGSS, NSTA, NRC)
Science Lesson Design
Safety in the Science Learning Environment
Animals

date	assignment(s) due
12-OCT-2015	FALL RECESS - NO CLASS
14-OCT-2015	1. chapter 6 (Planning and Managing Inquiry Instruction) 2. Discussion Questions (p. 186) # 1, 5, and 6 3. research PA Core Science Standards at your grade level http://www.pdesas.org/Standard/Views#108,109,110 14124 0 0 4. watch The NGSS Overview and Why NGSS video clips http://www.nextgenscience.org/next-generation-science-standards 5. research the NGSS at your grade level http://www.nextgenscience.org/next-generation-science-standards
16-OCT-2015	1. Professional Resource Report #2

Week 8: Questioning Effectively

How do effective questions to promote learning?
The Role of the Teacher and Classroom Discourse
Types of Questions
Strategic Questions Throughout the 5-E Model
The Human Body

date	assignment(s) due
19-OCT-2015	1. chapter 7 (Questioning Effectively) 2. chapter 14 (The Human Body) 3. Discussion Questions, p. 217 #1 and 5 4. Reflective Response Prompt #6
21-OCT-2015	1. chapter 15 (Life Science Lesson Ideas) and Activities for Life Science
23-OCT-2015	1. notes on IEP/Section 504 Learner and ELL student from your field experience

Week 9: Using Technology Tools and Resources for Science Learning

How can technology and other resources enhance the learning experience?

Websites, Online Tools, and Journals

Health and Nutrition

date	assignment(s) due
26-OCT-2015	1. chapter 8 (Using Technology Tools and Resources for Science Learning) 2. Discussion Questions (p. 234) # 1 and 2 3. Reflective Response #7
28-OCT-2015	
30-OCT-2015	Exam #2 HAPPY HALLOWEEN!!!

Week 10: Putting Pedagogical Content Knowledge into Action

date	assignment(s) due
2-NOV-2015 4-NOV-2015 6-NOV-10215	Microteaching #1 - Physical or Life Science

Unit 3: Earth and Space Science

Week 11: Connecting Science with Other Subjects

How will you connect science to other content areas in an authentic and meaningful way?
The Science and Literacy Framework
Universe and Solar System

date	assignment(s) due
9-NOV-2015	1. chapter 9 (Connecting Science with Other Subjects) 2. Discussion Question (p. 254) #2 3. Professional Practice Activity (p. 255) # 1 4. section 3 (Earth/Space Sciences) introduction 5. Reflective Response Prompt #8
11-NOV-2015	1. chapter 11 (The Cosmos)
13-NOV-2015	1. Professional Resource Report #3

Week 12: Integrating and Applying Science

How will you integrate science with other content areas in an authentic and meaningful way?
“Big Ideas”
Earth

date	assignment(s) due
16-NOV-2015	1. Chaille & Davis (2016) pp. 2-17, 50-69 2. Discussion Question: How does the theoretical framework presented in these chapters align with Inquiry-Based Instruction and the 5-E Model? Be specific and cite pages! 3. Discussion Question: p. 69 #2 and 6
18-NOV-2015	1. chapter 10 (Earth’s Surface, Atmosphere, and Weather)
20-NOV-2015	1. chapter 12 (Earth/Space Science Lesson Ideas) 2. Activities for Earth and Space Science

Week 13: Unit Plan - Community Workshop

STEM, STEAM, STREAM and Beyond
Earth and Environment

date	assignment(s) due
23-NOV-2015	1. Unit Plan - polished draft
25-NOV-2015	HAPPY THANKSGIVING!!!
27-NOV-2015	HAPPY THANKSGIVING!!!

Week 14: Putting Pedagogical Content Knowledge into Action

date	assignment(s) due
30-NOV-2015 2-DEC-2015 4-DEC-2015	Microteaching #2 - Earth or Space Science

Week 15: Teaching Science Through Inquiry

Why is it essential to engage students in scientific inquiry?
How can learning become more authentic by integrating science with other content areas?
Water, Weather, and Climate

date	assignment(s) due
7-DEC-2015	1. section 4 (Engineering, Technology, and Applications of Science)
9-DEC-2015	1. article: <i>History of STEM</i> 2. What is something new you learned from reading the article and how can it help you integrate the STEM subjects in a meaningful way?
11-DEC-2015 FIELD EXPERIENCE ENDS	Exam #3

Week 16: Course Reflections

date	assignment(s) due
14-DEC-2015	1. Unit Plan - due at noon 2. Reflective Response #9 3. Reflective Response #10 (completed in class)