Elementary Science Methods
Syllabus

Course Description

This course is designed to support both new and experienced elementary science educators in refining and focusing their instructional skills. Course participants will incorporate research and National Science Education Standards as they practice developing, implementing, and assessing elementary science lessons. Using cases and online resources as a launching point, teachers will be given the opportunity to participate in on-line discussions regarding beliefs, best practices, challenges, current research, and examine ways to apply them to their own teaching practice.

Competencies

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

- Apply, evaluate and reflect on a range of elementary science teaching methods;
- Evaluate and select appropriate resources to assist in designing, implementing, and assessing elementary science lessons;
- Design and implement developmentally appropriate science lessons;
- Engage students in building understanding of science concepts; and
- Use science content knowledge to plan, teach, assess, and reflect on science methods, ideas, and materials using the National Science Education Standards as a guide.

Materials

All materials are accessed via the CaseNEX website using the PIN provided and the user name/password you create.

All readings listed can be found by going to *Class Materials→Virtual Library→Readings (Search)*.

If you do not have the most recent versions of the following software, please download each from the given sites.

- Windows Media Player
- RealPlayer
- Adobe Reader
- QuickTime

Cases Used

- Room To Grow
- The Webs We Weave
- Whose Class Is It

Course Schedule

Find session dates by selecting *Syllabus* on the top menu bar. For typical courses, final Discussions, Journals, and Workbooks are due by Saturday at midnight unless otherwise noted. Please see the News Flash for any alterations of the course schedule posted by your instructor.

Course Requirements and Grades
http://www.casenex.com/casenex/syllabus/Generic2/CourseRequirements_generic.pdf

Introductory Session
Exploring the CaseNEX Site

Complete these tasks prior to the beginning of Session 1.

Readings

Read the course requirements, paying special attention to the Case-Analysis and Workbook Assignment Rubrics. They will be used by your instructor throughout the course to evaluate assignments where appropriate.

Discussion

Post one entry introducing yourself to your classmates. You may choose to describe your professional background and experience, relevant personal information, or why you are taking this course. (100 words or fewer)

Journal

What do you find inspiring and challenging about teaching science in an elementary classroom? (100 words or fewer)

Note

Use CaseMail to send a note to your instructor stating that you will be taking this course. To do so, click on CaseMail on the top menu bar and then 'Click here to create a new message.' Use the marked link to look up an address. Continue linking down until you see the class list. Select the instructor's name and then compose your message and hit 'Post Message.'

Session 1
Applying Cognitive Theories to Deepen Scientific Understanding

Case
Room To Grow

Readings

- A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas /2 Guiding Assumptions and Organization of the Framework
- Science in Early Childhood Classrooms: Content and Process
- How Students Learn: Science in the Classroom; Chapter 9

Discussion

Organizing instruction around themes and process skills supports student understanding of science content. What themes and process skills have Christine's students in this session's case learned and applied? Using **knowledge** from the readings, explain how this unit helped Christine's students develop their skills and understanding. What additional **actions** might you suggest Christine take to further support her students' understanding of themes and application of process skills? What might be her students' **perspectives** on following your and your colleagues' suggestions?

Journal

According to the "Science for All Children" reading, there are four steps to the learning cycle. Consider a science unit that you have taught in the past and will likely teach again. Cite the objectives and provide some context for where the unit fits within your curriculum. Reflect on the strengths and weaknesses of this unit, using **knowledge** from the reading about the learning cycle and children's cognitive development. What **actions** do you take to balance "didactic instruction and inquiry-centered experiences" in that unit and in your classroom in general? What are your students' **perspectives** on the range of learning experiences your offer?

OR

Using **knowledge** from the "Guiding Assumptions and Organization of the Framework; Chapter 2" reading, discuss the **issues** teachers face

as they balance these components. Consider demands on the teacher, access to resources, support from administration, adherence to curriculum, etc. What **actions** can one take to ensure lessons include all four steps of the learning cycle (focus, explore, reflect, and apply)?

Note

Check your CaseMail (linked from top menu bar) and News Flash (on the right when you login) for notes from your instructor every time you log on to the site.

Workbook

None this session

Session 2
Understanding the Nature of Science & Project 2061

Case
Whose Class Is It?

Readings

- Teaching Science Literacy
- "Best Practices" of Science Teaching
- Identifying Curriculum Materials for Science Literacy: A Project 2061 Evaluation Tool

Discussion

Miss Lowry's lesson plan (Scene 6 of this session's case) reinforces several misconceptions about the nature of science. Evaluate the lesson plan, using **knowledge** from the Science for All Americans reading. Which components of the lesson are congruent with the Project 2061 recommendations for science literacy? Suggest **actions** Ms. Lowry might take to meet these guidelines. What might be her – and her students' – **perspectives** on these revisions?

Journal

How has your understanding of science as a discipline changed as a result of the **knowledge** presented this session? Reflect on your own learning process and the **consequences** for your teaching. What **actions** will you take in your classroom, as a result of this experience?

Workbook

Lesson Evaluation

Quality instructional strategies must accompany quality curricular materials. Choose two science activities or lessons to evaluate, preferably from your curriculum (or you may find examples online). Cite the source of the lesson/activity. Then, evaluate each lesson/activity using Appendix A of the Project 2061 Evaluation Procedure. For each activity, first answer the questions from the Content Analysis and Instructional Analysis sections. Then, write a summary statement about the overall quality of the activity, including its strongest and weakest components. Revise the activity and provide

a rationale for your suggested changes, based on knowledge from course readings.

Due by the end of Session 3

Session 3
Understanding the Standards

Case
The Webs We Weave

Readings

- Integrated Studies Research: Evidence-Based Practices and Programs
- National Science Education Standards: K-4
- Doing Science; The Process of Scientific Inquiry
- Locate and review your district or state science standards for the grade you teach.

Discussion

Inquiry, the systematic process of answering research questions through data analysis, asks students to solve problems, either teacher-presented or student-formulated, and make generalizations about broad, fundamental concepts. In order to do so, students are involved first in gathering, analyzing and interpreting qualitative or quantitative data, and finally in communicating information. In the Webs We Weave case, the spider unit was a valuable learning experience for the students, but it does not constitute inquiry. What **actions** could Sarah and Michael take to alter or extend their lesson plan in order to involve their students in inquiry? Use specific **knowledge** of the elements of the inquiry instructional model (engaging, exploring, explaining, elaborating, and evaluating) as you suggest modifications to their unit.

Journal

Review the "National Science Education Standards: K-4" reading and reflect on the **issues** raised that are most relevant to your own classroom and district. How do these standards match those promulgated by your district or state? Pick one standard from the reading and describe how that standard is (or is not) covered in your classroom. How might you incorporate **knowledge** from this reading as you plan future classroom instruction?

Workbook

Lesson Evaluation due by the end of this session.

Session 4
Implementing Units of Inquiry

Case
Room to Grow

Readings

- How to Use Classroom Observation More Effectively
- Inquiry and the National Science Education Standards: A Guide for Teaching and Learning, Chapter 3
- The 5 Features of Science Inquiry: What Questions Do You Have?

Discussion

Define inquiry and what it means to you as a teacher of science. Then, considering the **perspectives** of teacher and students, reflect on Ms. Flores's classroom and her unit (described in Chapter 3 of this session's reading). Compare Ms. Flores's unit on earthworms from Chapter 3 of this session's reading to Christine's unit on earthworms from the Room To Grow case. Using **knowledge** from the readings, discuss each unit's goals and objectives, grouping of students, assessment, student engagement, student ownership and responsibility of learning, and the five elements of the inquiry instructional model. What are the positive and negative **consequences** of each teacher's choices?

Journal

This session, provide your students an opportunity to make observations and engage them in "creative questioning" as described in the reading. Reflect on the learning **consequences** (expected and unexpected) that resulted for you and for your students. What was their **perspective** on these activities, and how did this differ from your expectations?

OR

Consider the **perspective** of a teacher planning an inquiry-based lesson, such as those described in the readings. What **issues** do you foresee? What **actions** can you take to overcome these challenges in your own classroom?

Workbook

Lesson Plan

Focus on your district's science standards and inquiry in the science classroom, as presented in the course readings. Develop a lesson that you can implement in the next two weeks that targets objectives from your science curriculum using inquiry. Include the following information:

- Description of classroom, students, grade level, content, languages spoken, and any other relevant information;
- Goals and objectives, including local and state standards;
- Grouping of students;
- Materials;
- Procedures, including specific research-based methods from course readings;
- Assessment (formative and/or summative);
- Rationale for your choices;
- Reflections on your implementation of this lesson and ideas for its refinement. (Complete this portion after you have delivered the lesson).

This Workbook assignment is due by the end of Session 5.

(Note: If you are taking this course during the summer you are expected to make every effort to involve students in your assignments as noted. Accessing students in summer school programs, or working with those you know socially are acceptable alternatives to implementing assignments with your own class when that option is not available. If you cannot arrange access to students, the student feedback and reflection portions may be omitted at the instructor's discretion).

Session 5
Implementing Cooperative Learning Groups

Case
Room To Grow

Readings
- 10 Elements of Effective Cooperative Learning in the Classroom
- A Brief Introduction to Cooperative Learning
- Taking Science to School, Part II: How Children Learn Science

Discussion

Using **knowledge** of the strategies in the readings, evaluate the partner work that Christine assigned to her students in Scene 4 of this session's case. Consider both the **perspectives** of Christine and a range of students. What goal was Christine attempting to accomplish and how did her students respond? What other **actions** might Christine have taken to incorporate cooperative learning into this unit? Discuss the **consequences** (planned and unplanned, positive and negative) of how she organized cooperative learning for this unit.

Journal

Describe **issues** you have faced using cooperative learning groups to deepen students' understanding of science content. What additional **knowledge** would help you in implementing cooperative learning groups? What **actions** might you take to prepare your classroom for cooperative learning groups? What are the positive and negative **consequences** of using cooperative learning groups in the science classroom?

Workbook

Lesson Plan due by the end of this session.

Session 6
Engaging Students through Technology

Case
Whose Class Is It?

Readings

- Beyond Q&A: Six Strategies That Motivate ALL Students to Participate
- Why Integrate Technology into the Curriculum?: The Reasons Are Many
- Real Science for Younger Scientists

Additional Resource

- Journey North: A Global Study of Wildlife Migration and Animal Migration

Discussion

Review the six strategies for designing encouraging student participation from this session's first reading. Provide specific examples of **actions** Miss Lowry could take to incorporate these suggestions in her classroom. Explore possible **issues** she might face if she followed these suggestions.

Journal

Consider the **perspectives** of your school faculty and your student population about the integration of technology into the curriculum. How much access do your students have to the Internet and computers? What **actions** have you taken to use technology to teach science content? What **consequences** have you seen as a result of these actions?

OR

How do you currently incorporate technology in your science lessons? In your experience, what **consequences** has technology integration had for student engagement and learning? What further **knowledge** would help you to make better use of the technology resources you have?

Workbook

None this session

Session 7
Assessing Student Understanding

Case
The Webs We Weave

Readings
- All About Assessment / A Process—Not a Test
- Self-Assessment Helps Classroom Focus on Learning and Understanding
- Priorities in Practice: The Essentials of Science, grades K-6: Chapter 1: Trends in Elementary Science Education
- Formative and Summative Assessments in the Classroom
- National Science Education Standards: Assessment (explore each link)

Discussion

In this session's case, Sarah uses a variety of assessment methods as her students' work through the spider units. Using **knowledge** from the readings, what specific **actions** might you recommend she take to strengthen her use of oral presentations to build student content understanding? What assessment strategies from the unit as presented in the case would you suggest she retain? Provide a rationale for your choices

Journal

Discuss three assessment **issues** detailed in the readings. Which of these have you faced in your own classroom experience? What specific **actions** might you take to make assessment more meaningful and productive for you and your students? What might be the instructional **consequences** (both positive and negative, long- and short-term)? Consider a range of student **perspectives** as you frame your response.

Workbook

Authentic Case Analysis

Use the 5-Step Case-Analysis Method to reflect upon a specific situation in your school or classroom related to science instruction and focusing on assessment. Describe the situation in one or two paragraphs. Address each of the 5-Steps in turn, referring to the

Course Tutorial and the Case-Analysis Rubric to guide your thinking. Draw upon the methods, concepts, and ideas presented in this course throughout your analysis. Research (and cite) at least two other sources related to elementary science assessment to support your analysis.

Due by the end of Session 8

Session 8
Building Students' Concept Knowledge

Case
The Webs We Weave

Readings
- Outstanding Science Trade Books for Students K-12
- The Trouble with Textbooks
- Tools to Enhance Young Children's Thinking

Discussion

In Scene 8 of this session's case, Sarah uses a KWL chart to ascertain her student's prior knowledge. How could Sarah have incorporated ideas presented in this session's readings in her lesson? Using **knowledge** from the readings, what suggestions would you offer to help her structure a lesson that addresses students' alternative conceptions? Explain your reasoning for implementing these strategies and discuss their **consequences** for teaching and learning. Then, discuss alternative conceptions you have discovered in your students and/or yourself. What **issues** did you face as you encountered these strongly held conceptions?

Journal

In the "The Trouble with Textbooks" reading, the author states that "The only thing the books utterly fail to do, according to scientific and educational experts who have examined them closely, is teach science." What **issues** does she raise in support of this thesis? What is your **perspective** on this subject, based on your professional experience and **knowledge**? What might be your students' and their families' perspectives?

Workbook

Authentic Case Analysis due by the end of this session.