ELED 560 Special Topics:
Developing Scientific Arguments in the K-12 Classroom

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Course Description:
In this course, teachers will examine science news stories, lesson plans, state and national standards, and educational research to learn how to help their students develop scientific arguments. Teachers will learn the claim-evidence-reasoning framework for scaffolding their students’ scientific arguments and consider how to implement this with the variety of learners in their classrooms. As a culminating project, teachers will revise a current lesson plan to include a scientific argument by their students.

Course Goals:
The course goals are written as essential questions, with the expectation that teachers will be able to answer these questions with detail by the time the course is finished.
1. How and why do scientists create and present arguments?
2. What does a scientific argument look like in a K-12 classroom?
3. How can you scaffold your students’ development of a scientific argument?

Course Learning Outcomes:
1. After researching current scientific theories through news stories and internet sites, teachers will be able to point out the claim, evidence, and reasoning that scientists use to make the argument for the validity of their findings.
2. After looking at examples of science lessons that incorporate argumentation, teachers will be able to describe what a scientific argument should look like in the grade level that they teach and for the skill level of their students.
3. Using their current curriculum expectations and/or current state/national science standards, teachers will be able to revise a current lesson to show how they plan to teach and scaffold their students’ construction of scientific arguments.

Required Course Materials:
Access to Moodle at http://moodle.bridgew.edu is required. You will log in with your BSU username and password. You should already be auto-enrolled in this course. All other course materials will be accessible on our Moodle site via instructor posts or websites.
Outline of Course Topics:
All modules will open and close on the dates indicated below. You may progress at your own pace during the dates each module is open. However, some assignments require you to respond to classmates’ posts, so if you are working faster than others you may have to check back to fulfill some assignment details. It is highly recommended that you wait to receive your grade on each major assignment before completing the next major assignment. More information about each item described below will be on Moodle when the module opens.

Introduction: (July 7-9)
What is your background? (and practice using Moodle)
  1. Introduce Yourself: Teachers will log into Moodle and post information about themselves, including name, school and district, grade level teaching, and experience with scientific argumentation.
     a. participation points = 3 points

Module One: (July 7-16)
How and why do scientists create and present arguments?
  1. Characteristics of Science: Teachers will read online and posted descriptions of how scientists use argumentation to defend their theories. Articles will be differentiated based on grade level taught.
     a. online discussion = 6 points (2 posts x 3 points each)
     a. online discussion = 6 points (2 posts x 3 points each)
  3. Current Scientific Arguments: Teachers will read and/or listen to current changes in scientific understandings and point out the claims and supporting evidence.
     a. participation points = 6 points

Major Assignment One: After researching current scientific theories through news stories and internet sites, teachers will be able to point out the claim, evidence, and reasoning that scientists use to make the argument for the validity of their findings. (17 points)
  a. Find information about a scientific discovery, theory, or explanation that has been made in the last 5 years that is related to a science topic that you teach and that will be relevant to share with your students. (1 point)
  b. List the state standards and topic that you teach that your scientific discovery/theory/explanation is related to. (1 point)
  c. Explain why you think the information you found will be relevant to your students. (3 points)
  d. Explain in your own words the claim that scientists are making, the evidence that supports their claim, and reasons why the scientists believe the evidence supports their claim. (9 points = 3 for claim, 3 for evidence, 3 for reason)
  e. Provide a list of all resources used for research. Include title, author, date, and website. (3 points)
Module Two: (July 16-27)

What does a scientific argument look like in a K-12 classroom?

1. Webinar/Podcast: Teachers will listen to a webinar and podcast posted free at the National Science Teachers Association and differentiated by grade level.
   a. online discussion = 6 points (2 posts x 3 points each)
2. Example Lessons: Teachers will view/read high-quality examples of lessons that incorporate scientific arguments.
   a. online discussion = 6 points (2 posts x 3 points each)
3. Practicing Scientific Argumentation: Teachers will use weather data, animal migration data, or plant growth data to create their own scientific arguments.
   a. participation points = 6 points

Major Assignment Two: After looking at examples of science lessons that incorporate argumentation, teachers will be able to describe what a scientific argument should look like in the grade level that they teach and for the skill level of their students. (16 points)
   a. Choose a topic that you usually teach in science during your year and that you are comfortable with the scientific information about. (1 point)
   b. Using that topic, create an appropriate inquiry question that your students could investigate and answer and explain why this question is appropriate given your grade level and topic. (3 points)
   c. Based on the inquiry question, explain what you hope students’ claim, evidence, and reasoning would be. It should be stated as you hope your students might state it. (6 points)
   d. Explain why the desired claim, evidence, and reasoning from your students fit our definition of these parts of a scientific argument. (3 points)
   e. Provide a list of all resources used for research. Include title, author, date, and website. (3 points)

Module Three: (July 27 – August 8)

How can you scaffold your students’ development of a scientific argument?

1. Examples of Scaffolding Argumentation: Teachers will read articles of how teachers at grade levels similar to what they teach scaffold the argumentation process for their students.
   a. online discussion = 6 points (2 posts x 3 points each)
2. Example Lesson Plans: Teachers will read good and poor examples of science lesson plans that incorporate scientific argumentation and compare/contrast how the procedures helped students argue in science.
   a. online discussion = 6 points (2 posts x 3 points each)
3. Lesson Plan Revision: Teachers will use a provided lesson plan that does not incorporate argumentation and revise it to better include claim, evidence, and reasoning.
   a. participation points = 6 points
**Major Assignment Three:** Using their current curriculum expectations and/or current state/national science standards, teachers will be able to revise a current lesson to show how they plan to teach and scaffold their students’ construction of scientific arguments. (16 points)

a. Using the inquiry question-claim-evidence-reasoning format of scientific argumentation, you will write a lesson plan that outlines how you will implement this in a science lesson for your grade level. Your lesson plan should contain the following details:
   a. title of lesson and how many days it will take to accomplish (1 point)
   b. lesson goal/objective, written as “Students will be able to...” (1 point)
   c. new state science standard(s) and science practice(s) that your lesson teaches (1 point)
   d. outline of the specific procedures you and your students will take to accomplish the science lesson, with the inquiry question, claim, evidence, and reasoning components highlighted; be sure to include as part of your highlights any scaffolding tools/techniques you are using to support their claims, evidence, and reasoning (6 points)
   e. list of resources used for planning and researching as you write the lesson (include title, author, date, and website) (3 points)
   f. list of resources (e.g. media, books, pictures, websites) that might be relevant to share with students that are directly related to this lesson (include title, author, date, and website as relevant) (optional: 1 bonus point)
   g. list of materials (1 point)
   h. brainstorm a list of things that students will need extra help with or that they may not understand in relation to claim-evidence-reasoning, along with how you’ll support English language learners and/or special education students in your class (3 points)
   i. explain how you’ll assess student learning of the science content taught in the lesson (optional: 1 bonus point)

**Grading:**
Grading is on a 3 point scale when possible. Anything that is worth 3 or 6 points above, please refer to these guidelines:

- 3/3 or 6/6 = meets expectations by providing thorough, thoughtful, and relevant responses that clearly connect to content read, watched, and learned
- 2/3 or 4/6 = developing competence due to vague details or loose connections to content read, watched, and/or learned
- 1/3 or 2/6 = below expectations due to incomplete or irrelevant responses or few to no connections to content read, watched, or learned
- 0 = missing a required entry

Anything in an assignment that is worth 1 point means you receive a point for the assignment item being present and correct, or 0 points if the assignment item is missing or incorrect.
Grades will be posted in the Moodle gradebook as assignments are scored. The points you earn for the course will be totaled and a percent will be determined. Overall, your total percentage will indicate the letter grade you will receive for the class:

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<tr>
<th>Percentage Range</th>
<th>Grade</th>
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<tbody>
<tr>
<td>100% - 94%</td>
<td>A</td>
</tr>
<tr>
<td>&lt;94% - 90%</td>
<td>A-</td>
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<td>&lt;70%</td>
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Overall percentages may be rounded up if it falls above the .5 range. For example, a final percentage of 89.6 may be rounded up to a 90% and the student would receive an A- course grade.

**Academic Integrity:**
At Bridgewater State University, academic integrity is expected of every community member in all endeavors. Academic integrity includes a commitment to the values of honesty, trustworthiness, fairness, and respect. These values are essential to the overall success of an academic society. In addition, each member of the university community has a right to expect the highest standards of academic integrity from all other community members. Academic integrity is violated by any dishonest act which is committed in an academic context including, but not limited to: plagiarism; fabrication, falsification, or misrepresentation of data, results, or sources for papers or reports; copying from another student’s work; actions that destroy or alter the work of another student; and unauthorized cooperation in completing assignments or examinations.

The culture of K-12 education in the United States encourages teachers to share materials with each other, and to adopt and adapt commercially published materials for their particular teaching contexts. It may be quite appropriate, therefore, for you to use activities, handouts, and/or lesson plans that you obtained from a mentor teacher, found on the Internet, or developed with another teacher. At the same time, units, lesson plans, and curriculum materials are products used in many College of Education courses, including this one, to gauge your individual mastery of concepts and skills central to your success in the profession. Consequently, you are expected to cite sources, including personal communication or professional development workshops, for any materials in those assignments that you did not create on your own. Please ask me if you have questions about how to do this accurately.