Lesson Plans

Comment: These plans are for a three day lesson in the middle of a unit on ecosystems and species interactions. Please see related Activity Sequence and Unit Plan.

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Overarching question: Over the last 100 years, the organisms found in the Great Lakes have changed considerably. What has caused this change?

Comment: Each lesson in the unit ties back to this main idea. Students will add their new ideas during this unit in order to support or modify their original claim. This gives them practice in giving scientific explanations supported with evidence and data.

Objectives

Objective	Type
Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.	**NGSS HS-LS2-6**
Identify patterns in data and relate them to theoretical models	**Michigan HSCEs B1.1E**

Comment: Using the Next Generation Science Standards as well as Michigan Biology Content Standards, I am able to ensure that I will cover all the material students will need to know. It gives me a focus for the unit and the subsequent lessons of that unit. Please see the Unit Plan for more information on how this lesson fits into the unit as a whole.

Synthesized Objective

I can use data and evidence to argue that complex interactions in an ecosystem maintain stable conditions within that system.

Comment: The synthesized objective provides focus for each lesson plan. This objective will be unpacked as we progress through the lesson plans through activities and class discussion.

Day 1

Materials

- Chart paper
- Sticky notes
- Isle Royal data set

Activities

Opening- 5 minutes

Journal question: What do you think would happen if there were no consequences for missing school?

Comment: Each day I begin with a journal. At the beginning of a new lesson I make sure that the journal is something that they can relate to their lives but also introduces them to the ideas we are going to cover. In this case it gets them thinking about cause and effect relationships.

Class Discussion- 15 minutes

Students will be able to share what they wrote in their journal and explain their opinion. I would then pose a question to the class to discuss: What do you think school administration would do if students did not come to school regularly?

Comment: By having students share their ideas, I am able to find out what they already know.

- Show of hands: Keep the same policy, change the policy, I'm not sure
- From each of these groups one student would explain why they made that decision

Comment: This is a fast and easy way to have an entire class share their ideas. From there I can choose a person from each group to explain their opinion further.

Hypothesis Checklist- 10 minutes

Class question: What is an example of a "complex interaction" that would take place in the Great Lakes?

- Individuals would have 1 minute to write down an idea then share with their group and discuss for 5 minutes. When they have one solid idea they will add that to their group hypothesis sheet.

Creating the checklist

- Each group would share their best idea of a "complex interaction" in the Great Lakes and I will write them down on a class hypothesis list.

Data Set- 25 minutes

Show data set on overhead

- Discussion of what types of questions could be asked of data sets
  - Can we ask what type of moose is being measured?
  - Can we ask for ideas on why the moose decreased?
- Have students write down one question they think that this data set could answer. They will post their question down on the board as they leave the class.

Data Set Handout

- Hand out the data set and graphing paper
- Review the data and ask the class what would go on each axis and what a title should be. I will write down their answers on the overhead so that they have a model to go from when they begin working.
- Students will be given time to complete their graphs

Closing- 10 minutes

Whole class discussion of the data

- Have students show their graphs on the overhead and point out one thing that they noticed as they were creating their graphs
- Does this seem like a complex relationship? Look back at the hypothesis checklist and see if there is anything that we want to add as a class.

Put away all materials used: rulers, colored pencils, etc.

Assessment

- Pre-assessment: sticky notes on hypothesis
- Data set graphs

Day 2

Materials

- Wolf/moose graphs
- Review worksheet
- Sticky notes
- Simulation outline

Activities

Comment: I make sure that students frequently go back and modify or add to their original hypothesis that they made at the beginning of the unit. At the end of the unit they will be able to see how their thinking has changed.

Comment: The class hypothesis list gives the whole class ownership of their ideas. Seeing all ideas up and at the forefront of the class shows that all ideas have value, whether they are right or wrong. As we go through the lesson plan we will work to improve the list with the knowledge that students are gaining.

Comment: Students will revisit these questions at the end of the unit. It is important that students know the limits of data and that data sets can only give us specific types of information. By writing down the questions I can review what are and what may not be a good question to ask of the data. When we revisit the questions we can discuss why there are only some questions that we can ask of the data.

Comment: I have found that some students struggle with graphing. Their main issue is how to set up the graph, after that they do well. By modeling the graph set-up as a class, those students will have a scaffold to build from rather than being overwhelmed by trying to make the graph.

Comment: Occasionally, sharing work can open the door to ridicule by other classmates. To prevent this we always discuss how we share work. I remind students to be respectful of what someone else has done and not everyone's work will look the same, which is fine. Additionally, I only take volunteers to share their work so if a student is shy or does not feel like it is their best work, they are not pressured.

Comment: Based on what they learned from the graph we can make modifications to our original list. If there were any hypothesis that were refuted or confirmed students can make those changes.

Comment: Each day I have students turn in some informal assessment. The assessments are designed to give them practice with sharing their ideas and allow me to assess the progression of the ideas. When I review their assessments, I am able to find out what they are thinking and I can make an necessary adjustments.

Opening-5 minutes

Journal: What is one trend you noticed when you graphed the wolf-moose population yesterday?

Comment: Again we do a journal to activate students minds and bring them back to what we had discussed before. In this case the journal also serves as a gateway into our class discussion. Because they are writing this in their journal, everyone should have something to share with the class.

Class discussion- 5 minutes

Random selection-popsicle sticks

- What trend did you see? Why do you think you saw this?
- Did your trends seem opposite of what you thought would happen? Why?

Comment: As a class we will be doing some analysis of the data. I am able to randomly call students since they have answered the question in the journal and would not be put on the spot by random selection.

Data Set Analysis- 10 minutes

Students will work on a worksheet that has them analyze the patterns in the data that they graphed. They will make inferences as to why certain patterns exist.

Comment: The discussion has primed their thinking so they are able to do a more in-depth analysis. In their analysis they are going to be determining patterns and thinking about why they are seeing those patterns.

Discussion of Analysis- 5 minutes

- One trend you saw? Why do you think you saw this?
- Were there times the data did not fit your trend? Is this important to note?
- Ideas as to why certain anomalies are seen?

Introduction of Simulation- 5 minutes

We saw the interactions of two species, what happens when we add a third?

- Pass out simulation introduction
- One group of students are lions, another giraffes, and the final trees. Trees cannot move and if two giraffes eat them, they die. If giraffes don't eat 2 trees, they will die. Lions need to eat two giraffes to survive. Each simulation will run for 2 minutes and we will change the number of each species for the simulation. At the end we will count the number remaining and write this on the data table.
- Remind students that they cannot make noise so they don't attract predators toward themselves

Comment: When it comes to simulations I make sure that I plan the logistics in detail. Then I review these details with the class verbally and provide them a sheet they can read with the information. Reviewing the simulation in two ways helps me make sure that all students will understand what they are supposed to do.

Comment: Since we will be in the hallway, I want to make sure that students are not disturbing the other classes. By making the quite rule part of the "game" we are playing, students are much more likely to make sure they and their classmates are not talking.

Simulation- 20 minutes

- Run simulation and collect class data

Class Discussion- 5 minutes

- What were some patterns you noticed?
- How can you explain these patterns?

Comment: These facilitation questions are not the only questions that I will pose to students, however by planning some questions ahead of time, I will be able to get the discussion going. Planning ahead also helps me find any issues students may have and plan how I can scaffold their understanding.

Simulation Analysis- 10 minutes

Students will complete a short analysis showing patterns and explaining their ideas.

Closing- 5 minutes

- Based on the simulation, what could you add/modify/or change about your Great Lakes hypothesis? Discuss with your group.
- Post your sticky note on your hypothesis before leaving

Comment: I want students to continue coming back to their hypothesis. Each day of the lesson they will learn something new that pertains to their original problem so it is important for them to track new and changing ideas.

Assessment

- Pre-assessment: sticky notes
- Simulation Analysis

Day 3

Materials

- Wolf/moose graph and worksheet
- Simulation worksheet
- Graphic organizer

Opening- 5 minutes

Journal: Describe one type of density-dependent limiting factor experienced during the simulation on Friday.

Comment: This question has students using prior knowledge from the previous unit to describe a phenomena they experienced. It is a great way to keep students reviewing old material and show the connection between each unit.

Data Analysis Review- 10 minutes

Questions that students originally said could be answered using the data will be posted on the board.

- Why can we answer these questions?
- What makes these questions, good questions?

Students will work in groups to answer one of the questions. They will present their answer to the class.

Comment: Students at this point will be able to answer their own questions from the beginning of the lesson. This is also an opportunity to discuss the limitations of data. Data is a key component of the ACT Science testing so it is important that they understand that only certain information can be gained from a particular set of data. I know that my students tend to struggle with this portion of the ACT so I use that data to inform my lesson plans. This means integrating more data analysis into each of my lessons. I want them to learn that these skills are constantly utilized in the scientific process, they are not just something they will be tested on during a standardized test/.

Class Discussion- 10 minutes

- Using the data from the wolf/moose population and the population simulation, explain what a "complex interaction" is.
- Why would we consider these interactions complex?
- Can you think of relationships like these that you have seen before? Any other examples?

Comment: I am having students return to our original discussion of the complex interactions but this time the have seen what a complex interaction looks like and are going to be equipped to answer in a more formal way.

Comment: Asking for students to share other ideas is helpful in checking for their understanding and giving students more examples.

Introduction of the Diagram- 5 minutes

Students will be creating a diagram showing the relationship of the wolf and moose populations using a flow chart/food web. They will explain what happens when one population increase or the other decreases. Once they finish the first part they will show me the graph, then I will give them 3 new species to add in and explain the relationships.

Diagram Work Time- 30 minutes

Students will have time to work on their diagrams.

Comment: Creating diagrams is helpful for all students because it provides both a visual and written explanation of phenomenon. Since this is a more complex idea, it is beneficial for students to have some way of representing the general idea that we have learned and showing examples.

Closing- 5 minutes

- One student will share their diagram
- Make any changes/modifications to hypothesis based on their diagram

Assessment

- Pre-assessment: sticky notes
- Graphic Organizer

Day 4- Assessment

Materials

- Proposal Worksheet
- Computers

Opening- 5 minutes

Journal: Should hunting be allowed on Isle Royal?

Introduction of Project-5 minutes

- Take a stance for or against hunting on Isle Royal
- Write at least 3 paragraphs supporting your position. Support should come from information covered in class.
- Create a poster to support your position on Google Docs
- Will be sharing your poster with the class in a Gallery Walk

Comment: When I give my students projects I make sure to add a visual and writing component. In having these components, it provides a visual outlet for those more artistic students and the writing component for the students who excel at writing. I have found this increases student motivation because both types of students find value in what they are doing and feel that they can succeed at the task.

Work Time- 40 minutes

- Students will show me their paragraphs before being able to work on the computer
- Complete paragraph and poster

Gallery Walk- 10 minutes

- Students will position their laptop on the side of the room according to their position, one half will be for yes and the other for no
- They will nominate the poster that they think is the most persuasive and explain why

Comment: It is important for students to understand that there are two sides to all issues and to take time to reflect on the opinions that differ from their own. When viewing other posters they will be exposed to other arguments and be more open to discussing new ideas and thoughts they have because of the other arguments.

Closing- 5 minutes

Class discussion of the most persuasive poster and what made it so effective.

- Discuss ways to debate
    - Everyone takes a turn, don't interrupt, be respectful of all ideas

Comment: Debates are an excellent tool to use in the classroom, however it is always important that I review the proper ways to debate before. In doing so, I can reduce the number of outbursts by opposing students and make sure that all students feel comfortable sharing ideas.

Assessment

- Isle Royal proposal
- Isle Royal poster