Fish Go To School?

Evidence of Social Learning in Embryonic Minnows

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Context for Educators

This lesson is designed using a framework called "Argument Driven Instruction," a model developed at the University of Texas Austin (ADI Project, 2024). The goals of the lesson are to help learners put the Science Practices into action by engaging in an authentic inquiry about learning in fish embryos.

Grade Level: Middle or High School – Grades 7-10
Class Periods: 4-5 class periods (recommended)
Materials:

ADI Activity Template (attached)
"Learn to Survive" card sets for groups of four students
Access to online videos displayed for students to see, with audio
Lab journals or notebooks for keeping records, writing ideas and explanations

Standards (NGSS Lead States, 2015):

Performance Expectations:

MS-LS1-8 - Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

HS-LS2-8 - Evaluate evidence for the role of group behavior on individual and species' chances to survive.

Science and Engineering Practices	Disciplinary Core Ideas	Crossing Concepts
1. Asking questions 2. Developing and using models **3.** Planning and carrying out investigations **4.** Analyzing and interpreting data 5. Using mathematics and computational thinking 6. Constructing explanations 7. Engaging in argument from evidence 8. Obtaining, evaluating and communicating information	**LS1.D: Information Processing** **LS2.D: Social Interactions and Group Behavior** **LS4.C: Adaptions**	**Patterns** **Cause and Effect** **Scale, Proportion & Quantity** **Stability and Change**

References

ADI Project. (2024). *The ADI Investigation Model*. Retrieved June 17, 2024, from https://www.argumentdriveninquiry.com/the-adi-model/the-adi-investigation-7-stage-model

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For Teachers: The information below describes the inform to share with your students in each of seven "stages" of the ADI process. The teacher can create a set of PowerPoint slides, a website, a Google Doc, or a module in a Classroom Management System program with each of these steps.

STAGE 1: Task – Part 1

1.A. Phenomenon:

Fish can sense things in their environment by smell. Chemicals given off by other fish float around in the water, and other fish use those chemicals to know what is going on around them. What would be important for a fish to sense their environment? Discuss some initial ideas before you watch the video.

After you record your initial ideas, Click to view Video #1.

"Fish Go To School?" Video 1 - https://youtu.be/sjSZYac0TTc

IDEAS: Reflection #1

After watching Video #1, write your reflections using the Stage 1 page of the Student Packet!

STAGE 1: Task – Part 2

After your reflecting on your initial ideas and things you wonder about, click to view Video #2

"Fish Go To School?" Video 2 - https://youtu.be/muaOvzqcIsw

IDEAS: Reflection #2

After watching Video #2, write a new set of reflections, and share them with another group. Use their feedback to add any new ideas you want to add to your reflections.

STAGE 2: Ideas

After your group watches Videos #1 and #2, look at the "Core Ideas" in the Student Packet, and discuss/write how each of those ideas is important in planning an investigation.

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STAGE 3: Plan

Plan Your investigation

3.A. Materials – Fish eggs, AC chemical, PC chemical, Microscope and camera to observe embryo.

3.B. Plan an investigation – Working in your group, use the Investigation Plan on the next page to PLAN an investigation to answer the Driving Question. Provide enough details to let others understand how you plan to do the investigation.

Because it will be difficult for you to carry out the full experiment with fish embryos, you will see some embryos studied by the animal behavior researchers in the videos.

In their experiment, they collected newly-laid eggs from minnow, and in the first two days in after the eggs were laid, they added drops of Alarm Cue (AC) and drops of Predator Cue in the water. This helped the embryos make an association – a connection – between the smell of the predator and their instinctive "danger" response.

You will see TWO videos of those same embryos – each about 1 minute long. These videos were recorded when the embryos were 4 days old.

In the first video, you will see the embryos in water. There is no AC or PC in the water.

In the 2nd video, you will see the embryos AFTER a couple of drops of the Predator Cue (PC) were added.

You need to write a plan for how you will COUNT the movements of the embryos to compare the BEFORE and AFTER videos.

3.C. Peer Review – When you have written your plan, share it with 3 classmates who will provide feedback.

3.D. Reflect on what you learned from peer feedback – Read the feedback from your classmates, and discuss how you might change the plan based on the feedback. Write your ideas for changing the plan.

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STAGE 4: Do

Carry out an Investigation

4.A. Investigation Form –
You wrote a plan for how to collect data. Use the Stage 4 template in the Student Package to record the data as you planned.

4.B. Do the investigation/experiment –
When you have prepared a data table for recording observations, click on Video #3. Use the next page to record your observations or measurements.

"Fish Go To School?" Video 2 - https://youtu.be/5Hqezcrw554

4.C. Make Sense of your Data –
After you collect your data, your group needs to organize and analyze the data to make sense of it. You may need a data table and/or a graph. Use the "Make Sense of Your Data" page in the Student Packet to create a table and/or graph. Write some ideas about patterns you find in the data..

STAGE 5: Share

Create a "Draft Argument Board" using the image on the Stage 5 page in the Student Packet as a guideline. Make the Argument Board on a white board.

Then share your board with the class. Use the feedback you get from your peers to write some ways your group could improve your argument.

STAGE 6: Reflect

In your group, discuss ways to do your investigation better. Include some discussion of possible sources of error or variation, or different ways to collect data that might improve your argument.

Write those ideas on the Stage 6 page in the Student Packet!

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STAGE 7: Create a Report

7.a. – Create a Report
The Stage 7 page in the Student Packet is a packet on which your group can write your Draft Report. Your report will include an Introduction, a Methods section, and your Argument.

7.b. – Peer Review
Share your report with another group to get their feedback on the Report Peer Review Guide. They will rate the three sections of your report, and offer comments about what you could do to improve the report.

7.c. – Revision
Your group will have a chance use the feedback from your peer reviews to revise the report, and create your Final Report.

Revise your report in the Stage 7 page, and write in the Peer Review Guide how you used peer review feedback to make the revisions.

Then turn your Final Report to the teacher, who will grade your report using the rubric on the Peer Review Guide.

Note to Teachers:
The following pages are a Student Packet that can either be printed or uploaded in a Classroom Management Software program. Our recommendation is to wait to hand out each "Stage" when your students are ready to begin each stage.

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