Connecting Curriculum, the Scientific Method, and Animal Behavior using Amphibian Models



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Background: Although K-12 students learn about broad topics in the classroom, their knowledge can remain disconnected from real-world contexts. As a result, students may not fully recognize the implications of environmental changes on other species, despite their known direct effects on organismal behavior, physiology, and survival.

Engaging students in application based activities that connect classroom content to real world research is a way to enhance student learning while helping them understand how these concepts apply to real-world issues.

Therefore, for the past year, we have been conducting a hands-on, inquiry-based outreach activity titled 'Ectotherm ER' that centers on the **learning objective** of **integrating animal behavior science into topics learned about in the classroom, as well as engaging students in the scientific method.** This module, developed by amphibian researchers at RIBBiTR, has been utilized by many scientists in outreach events to better explain complex research questions and to provide students the opportunity to participate in research techniques. While this method has been successful in providing hands-on, immersive activities that teach students content related to state teaching standards, the project is limited by the scientists own ability to travel to educator classrooms to lead the module.

Our next step, with support from the ABS outreach grant, is to develop mobile kits with all necessary supplies and information for educators to check out to implement the Ectotherm ER module on their own schedule.

'Ectotherm ER' Description: In this module, students learn about the rapid, worldwide decline of amphibians and associated environmental stressors, such as climate change, habitat degradation, and the spread of infectious disease. They also learn how amphibians regulate their body temperature via behavior. Students then go beyond what they learned in the classroom by:

- Making model agar frogs
- Brainstorming what variables could impact amphibian body temperature
- Creating a testable hypothesis and prediction
- Collecting agar frog temperature data using IR thermometers at designated intervals
- Visualizing and interpreting data using histograms
- Discussing what behaviors could be impacted by thermal stress and what behaviors could reduce stress
- Relating their experience back to classroom content





Figure 1. (top) Agar frogs in a puddle microhabitat; (bottom) a student writing down the temperature data of their frogs

Ectotherm ER was developed by a team led by Dr Cori Richard-Zawacki at the University of Pittsburgh, including Dr. Michel Ohmer at the University of Mississippi, and funded by NSF: Gonda, R., Ohmer, M., Brannelly, L., Kassimer, J., Kubik, S., Legg, A. S., & Richards-Zawacki, C. (2021). Ectotherm ER: Frogs Under the Weather. Science Scope, 44(4), 64–71. https://doi.org/10.1080/08872376.2021.12291401

Project Steps

1) **Implementation of the 'Ectotherm ER' Module in K-12 settings:** Over the past year, we have implemented this activity with almost 250 upper elementary and middle school students. We have gone into classrooms, worked with summer camps, and brought a condensed version of the activity to museum tabling events. We have seen first hand how effective the module is at teaching students about threats to amphibians, animal behavior, and the scientific method, and how engaged students are in the topic at the end of each session

2) **Building a Network of Educators:** We have presented the 'Ectotherm ER' module at two Mississippi Teaching conferences in order to build our network of educators for broader implementation of the module.

3) **Creating Mobile Kits for Independent Application:** The next step of the project is to build mobile kits for educators to utilize for independent application of the module without the need for visits from outreach leaders.



Figure 2. (left) Students learning about amphibian behavior and physiology; (middle) agar frogs after they have set and are removed from the mold; (right) a student placing their agar frogs in the designated microhabitat and preparing to collect data

Mobile 'Ectotherm ER' Kits

Each mobile kit will contain enough materials to conduct the 'Ectotherm ER' module 15 times with a classroom of 24 students. We will provide all the supplies, including frog molds, agar powder, and thermal readers. We will also provide presentation resources for educators, such as powerpoints, workbooks, and informational videos, which teachers can use to guide students through the module. Kits will be placed at the **University of Mississippi Center for Mathematics and Science Education**, which is home to a manipulative library where teachers can check out resources for free. By creating free supply kits for educators, the program has the potential to reach hundreds of students a year, educating on the science of animal behavior as well as improving students' understanding of the scientific method.



Figure 3. Supplies found in the mobile Ectotherm ER kits