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Creating and Implementing a Teaching Module for the High School Biology Classroom

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Creating and Implementing a Teaching Module for the High School Biology Classroom

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Introduction

The implementation of hands-on experiments in the science classroom allows students to actively learn, comprehend, and retain more information by making observations, developing and testing hypotheses, manipulating variables, analyzing data, and coming to their own conclusions based on acquired evidence. As a future high school biology teacher, I created an inquiry-based teaching module that can be implemented into my biology classrooms. Egg masses from Physa acuta (Figure 1), a locally common freshwater snail, were utilized as a model to test the effect of rearing temperature on the rate of embryo development and survival. All Physa acuta are hermaphroditic; each individual is simultaneously male and female. Each snail lays egg masses; within each egg mass embryos are individually contained within capsules (Figure 2). Materials present within the capsule provide nourishment for the developing embryo prior to hatching from the capsule as a juvenile snail.

Methods

Students in Biology 209, Biostatistics and Experimental Design implemented the protocol. In this protocol, groups of 3-4 students:

- Collected egg masses (<24 hours old) and divided each mass into two pieces with a similar number of egg capsules.
- Photographed and measured each capsule.
- Reared each ½ egg mass at a reference temperature (23 °C) and either a lower (20 °C) or higher (26 °C) temperature.

Results

86.7% (13 of 15) of students in Biology 209 completed the survey. The majority of students reported that through this exercise they learned more about the components of the scientific method (Table 1). However, the completion of this protocol did not significantly improve students’ understanding of the value of experimental replication and sampling frequency.

Free Responses

46.2% of students support the inclusion of a class project in future Biology 209 classes, 38.5% of students would not support a project, and 7.7% of students would support the project only if there was a required laboratory session.

References


Acknowledgments

I would like to thank the Biology 209 class for participating in this experiment.

Table 1. Summary of results of student survey. Each value represents the percent of students who agreed, disagreed, or neither agreed nor disagreed.

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The expectations of the protocol were clear</td>
<td>92.3</td>
<td>7.7</td>
<td>0</td>
</tr>
<tr>
<td>Completing this project increased my understanding of:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the importance of the scientific process</td>
<td>61.5</td>
<td>30.8</td>
<td>7.7</td>
</tr>
<tr>
<td>the importance of experimental design</td>
<td>69.2</td>
<td>23.1</td>
<td>7.7</td>
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<td>the importance of standardizing methods</td>
<td>84.6</td>
<td>0</td>
<td>15.4</td>
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<tr>
<td>the importance of replication</td>
<td>46.2</td>
<td>35.8</td>
<td>15.4</td>
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<td>the importance of sampling frequency</td>
<td>38.5</td>
<td>53.8</td>
<td>7.7</td>
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<td>the importance of sample size</td>
<td>61.5</td>
<td>23.1</td>
<td>15.4</td>
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<td>the appropriate selection and use of statistical tests</td>
<td>61.5</td>
<td>38.5</td>
<td>0</td>
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