"What do you think?": Demonstrating Inquiry-Based Instruction Using Wisconsin Fast Plants®

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Introduction/Need for Innovation or Idea

Defined as "the scientific process of active exploration by which we use critical, logical, and creative thinking skills to raise and engage in questions of personal interests" (Llewellyn, 2002, p. 26), inquiry as a method of instruction has been emphasized by science education and agricultural education researchers as an effective means for raising student achievement (Parr & Edwards, 2004; Thoron & Myers, 2011). The 2015 National Assessment of Educational Progress (NAEP) showed that 88% of 12th-grade students scored below the proficient level on the science assessment, revealing no significant change from 2009 scores (USDE, 2015). Thus, Oklahoma State University teacher-education faculty recognized the need to introduce pre-service teachers to effective inquiry-based instruction (IBI) strategies in an agriscience context.

There is a seemingly endless amount of activities that can be used within IBI, many of which commonly require increased time for preparation and understanding on behalf of the teacher (Blythe, DiBenedetto, and Myers, 2015; Wolpert-Gawron, 2016). The Fast Plants® life cycle kit and manual can alleviate instructors' time spent planning and gathering materials and provide tools for teaching a variety of biology lessons using IBI. According to the Fast Plants Manual (2011), "By looking at the life cycle of Fast Plants from the perspective of the stages of growth and development from seed germination to seed production, students can understand the nature of the dependency among organisms and their environment" (p.1).

How it Works/Methodology/Program Phases/Steps

Oklahoma State University's Methods of Teaching Agricultural Education course introduces pre-service teachers to a variety of methods and strategies for instruction, including inquiry-based instruction. A goal of the course is to demonstrate a useful example of each method to the pre-service teachers. The inquiry-based learning cycle typically must take place over an extended period of time throughout the semester. Under ideal conditions, Fast Plants can complete their life cycle and produce seeds in as little as 40 days (Teaching with Fast Plants, 2011). The Fast Plants life cycle kit can be used to facilitate 12 different inquiry-based activities within the five chapters of the Fast Plants manual on each major stage of plant growth consisting of (a) germination, (b) growth and development, (c) flowering, (d) pollination, and (e) fertilization to seed. Each student in the methods course was able to grow plants in four different containers to provide unique treatments to test plant growth.

During each activity in class, students were given the opportunity to practice observation, experimentation, and data collection and analysis with their plant subjects. With the exception of some germination activities in the first week, the remaining activities could be carried out with the same set of plants. The plants were placed within an indoor, GROWLAB compact garden that included a grow-light, and moisture grid to provide water to plants on the weekends. At the conclusion of the plants' life cycle, students were given the opportunity to share their findings and experiences from the inquiry activities.

Results to Date/Implications

In the fall semester of 2016, Oklahoma State University began utilizing the Fast Plants life cycle kit in the Methods of Teaching Agricultural Education laboratory section. Equipment adopted for use by the lab was one Fast Plants life cycle kit, GROWLAB II compact garden, and *Teaching with Fast Plants Manual*. To date, a total of 31 pre-service teachers in two different Teaching Methods courses have used Fast Plants curriculum to conduct nine of the 12 life cycle activities. These activities have given students experience in growing their own plant subjects through an entire life cycle, many of which reported to have little or no experience in plant science based lessons. Pre-service teachers in the course were also assigned to teach using an inquiry-based activity, and many reported in their reflections to be more comfortable with the method as a result of their participation in the Fast Plants activities. At least three students from the Fall 2016 course subsequently utilized the Fast Plants curriculum at their student teaching centers in the spring semester.

Future Plans/Advice to Others

Faculty involved with the teaching methods course plan to build upon the success of Wisconsin Fast Plants as a model for IBI. Oklahoma State University recommends the use of the Fast Plants curriculum and materials to other universities as an affordable, time-saving way to foster inquiry-based instruction in a plant science context at any time of year. Course instructors should familiarize themselves with the manual activities and lab instructions prior to teaching pre-service teachers. Outdoor planting or greenhouse space is not necessary with the purchase of a grow light or indoor garden laboratory. Course instructors may choose to adapt their lessons based on number of students and schedule for course. Each activity and chapter of the Fast Plants curriculum may stand on its own, so instructors are encouraged to evaluate each activity to determine what is appropriate for their course. Emphasis should be made to pre-service teachers to consider how they would apply the Fast Plants curriculum in a school-based agricultural education setting.

Costs/Resources Needed

To successfully facilitate the Fast Plants activities, a Wisconsin Fast Plants Life Cycles Kit, Teaching Fast Plants Manual, and Indoor GROWLAB or Plant Light House are recommended. A total budget of just over $400 is necessary to purchase all the materials for the Fast Plants activities, and an additional $62.50 is needed to refill the Fast Plants kit each semester. All of the materials used in Oklahoma State University's methods course were purchased through the NASCO catalog. An approximate cost for individual materials is summarized in Table 1.

Approximate Cost for Fast Plants Curriculum from NASCO catalog

Item	Price
Teaching with Fast Plants Manual	$55.95
Plant Light House (optional)	$147.95
GROWLAB II Compact Garden (optional)	$250.25
Wisconsin Fast Plants –Exploration of Plant Life Cycles Kit	$99.95
Refill Kit for Wisconsin Fast Plants Kit	$62.50

Note. Prices are from NASCO online catalog

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