Integrating Agriscience: Using Hands-on Teaching to Develop Hands-on Teachers

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Introduction/Need for the Idea

Science, Technology, Engineering and Math (STEM) concepts have been identified as beneficial to increasing student knowledge in science (Ricketts, Duncan, & Peake, 2006) as well as being seen as an integral part of agricultural education (Stubbs & Myers, 2016). In a national study conducted by Shoulders and Myers (2013) it was reported that agriscience teachers spend approximately 43% of their time providing concrete experiences and only 12% of their class time engaging learners in active experimentation.

Kolb's (1984) Experiential Learning Theory (ELT) is a method by which learners use experience to enhance learning. According to Kolb, ELT can be defined as "the process whereby knowledge is created through the transformation of experience. (Kolb 1984, p. 41). Kolb's ELT allows for learning through four modes with the facilitator or instructor being responsible for guiding learners through the experiences. The model consists of grasping learning through concrete experiences and/or abstract conceptualism and then transforming that learning through reflective observations and/or active experimentation (Kolb & Kolb, 2017). The completion of all four stages of experiencing, reflecting, thinking, and acting provides a complete learning cycle by which learning can occur (Kolb & Kolb, 2005). However, in a study conducted by Shoulders & Myers, only 30% of teachers surveyed reported using all four stages of ELT to support learning within their classrooms (Shoulders & Myers, 2013).

In Louisiana, few teachers were implementing STEM content or lab assignments in their courses, and many expressed discomfort since they were relatively unfamiliar with conducting the labs themselves (Personal correspondence, Smith, H., 2019). To develop divergent knowledge, teachers should not only provide opportunities for students to grasp new knowledge but must also experience that knowledge actively (Knapp & Benton, 2006). With that in mind, Louisiana State University developed a course focused on teaching scientific concepts, as well as encouraging hands-on participation in agriscience laboratories.

How It Works

The purpose of the Agriscience Applications course was to assist students in developing teaching strategies needed for teaching agriscience and STEM laboratories. The instructor provided lectures on agriscience content, including ways to implement content into school based agricultural education courses, followed by student engagement in a relevant laboratory assignment the subsequent class period. Students were also required to submit two laboratory reports on labs of their choice throughout the semester, which encouraged students to develop skills in scientific writing and communications that can be used to discuss scientific content with formal and non-formal audiences.

In Fall of 2020 and 2021, the course was offered as a special topics course for six students. In Fall of 2022, the course was expanded and offered as a full course with 12 students enrolled. In total, 12 scientific methods laboratories were offered as part of the course with content including scientific methods introduction laboratories, plant science laboratories, animal science laboratories, microbiology laboratories, and entomology laboratories.

In addition to required laboratory participation and laboratory reports, students were asked to complete an Agriscience Fair project for their final exam grade which included a scientific paper, a poster, and a presentation of their project. Students were instructed to follow the National FFA Agriscience Fair handbook when developing their projects, and the final project was graded using the National Agriscience Fair rubrics. Sections of the paper were due throughout the semester to allow students to get feedback on their writing which could then be applied to their final paper.

Results to Date

When asked about the impact of the class, students reported a highly favorable attitude about the course and the course content. Selected comments included:

"I loved this course and it created new passions for me to use in my classroom"
"A project heavy class that requires a lot of hands–on work but is a very fun class"
"I loved the opportunity to do an agriscience fair project. I never did this in high school but feel like I could have my students participate in it now."
"This class gave me a ton of ideas to use in my own classroom"

Future Plans/Advice to Others

The course will continue to be offered in alternating fall semesters to help support STEM integration for students at Louisiana State University along with professional development trainings of the labs included in the course for in-service teachers. Additionally, follow-up data will be collected to determine if labs are being implemented once students begin teaching and if not, identify barriers to implementation.

Before beginning a similar course, universities should identify essential lab content that their teachers may be able to integrate as part of their state curriculum. In Louisiana a new curriculum and laboratory guide was recently developed for teachers that works in conjunction with state credentialing requirements. Therefore, lab assignments were designed to tie into that curriculum. Also, since school budgets and space vary, laboratories that are easy to run without extra equipment and with inexpensive materials, should be used primarily within this course to make the laboratories usable for the majority of teachers when they enter the classroom as well as discussions on how to implement laboratories with limited space or equipment.

Cost/Resources Needed

The overall cost of the course is dependent on which labs are being conducted during the semester. Most labs are designed to use materials that can be found at a grocery store or obtained inexpensively through online supply companies such as Lab-aids or Carolina Biological. Ideally, the labs for this class should be ones that students can easily replicate in a classroom environment with a very low budget. In 2022, the course cost was $657 of which, the largest cost of materials for gel electrophoresis lab ($384). It is important to note that many of the higher costs associated with scientific labs are one-time costs for materials, equipment, or kits and that the cost of the classes is lower once you only need to purchase refills or perishable supplies from year to year.

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