Innovative Idea

Encouraging Students to Question: Inquiry-based Learning in the Agriculture Classroom

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Introduction

Inquiry-based learning is not new; in fact, reference to current use of inquiry as a teaching strategy can be traced to Comenius (1592-1670), Dewey (1859-1952), among others. Inquiry is an approach to instruction that has been reported as valuable but accompanied with challenges (Edelson, Gordin & Pea, 1999). The way in which inquiry-based learning is disseminated and implemented will impact learning (Maaß & Artigue, 2013). Scientific inquiry according to the National Science Standards (1996):

> Refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Inquiry also refers to the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world. (p. 23)

Minner, Levy, and Century (2009) synthesized 138 different studies using inquiry-based learning and found that inquiry-based learning had a positive effect on the learning of content, retention of content, and the conceptual understanding of students. An additional study found that teachers who received training in inquiry-based instruction reported that although the teachers and students struggled in the beginning of implementing such instruction into the agriculture classroom, once the students got used to the method they reported learning more than with other teaching strategies (Blythe, DiBendetto, & Myers, 2015). Thus, this innovative idea poster documents one example of inquiry-based learning in an effort to encourage use of this instructional approach.

How it Works

Inquiry in the agriculture classroom, as implemented in this example, follows the guidelines developed by the National Research Council (2000) for scientific classrooms which outlines specific activities in order for classroom inquiry to occur. The first step in an inquiry-based learning activity is engaging the learners in a scientifically-oriented question. The teacher can either develop these questions in a more structured lesson, or the learner can develop the question in a more student-driven lesson. Often these questions are “how” or “why” questions. For example, a horticulture inquiry lab might ask students if a garden can be grown from the ingredients used to make salsa. Next, depending on the amount of structure within the lesson, the students will either analyze data provided by the teacher or the student will determine what evidence is needed and conduct an experiment to collect the proper data for analysis. With the salsa example, students are provided the ingredients for salsa and then asked to create an experiment to determine if a garden can be grown. Students then complete their experiment and collect data. Once data has been analyzed, the students will utilize the data to construct explanations for the data collected. In the salsa lab none of the students’ jalapeños grew. Therefore, the students then had to conduct further research to come up with reasons for this failure. Students then evaluate whether their explanations adequately answer the question or determine if there were flaws with what had been discovered. During this step, students compare their findings with findings of classmates, as well as with other sources of information. The final step in the inquiry-based lesson is for the student to communicate and justify their findings.

Results to Date/Implications

A total of 10 inquiry-based lessons have been implemented in the high school agriculture classroom of the lead author which has resulted in a total of 50 students being engaged in the process. The first few inquiry-based lessons implemented were chaotic with the majority of students complaining about the tasks. Students wanted the answers to be given to them, rather than taking the time to complete the necessary work to determine the answers. Initially, the inquiry-based lessons were designed with a teacher-created "question to be answered." However, following several implementations of inquiry-based lessons in which students had multiple opportunities to participate, students were engaged in the development of the questions. Throughout the inquiry-based process, students were allowed to fail, and through these failures students learned critical information about the problem being studied. Students had the opportunity to portray their data in any manner they chose and present the data to the class. Peer critiques were an important component. Upon being questioned by the class, the students often began to see whether or not their data was truly representing their findings. This process allowed students to comprehend the importance of data presentation. Students not only learned content but also practiced critical thinking.

An amazing discovery was how students began to truly question processes and commonly agreed upon facts following the completion of the inquiry-based learning activities. With the completion of each inquiry-based lesson, students' questions became increasingly in-depth and inquisitive. The inquiry-based approach allowed students to improve their ability to defend their findings and take ownership in the learning process.

Advice to Others

Explanation of the reasoning behind inquiry-based learning is critical; students must understand and be aware of why inquiry-based learning is being utilized. It is also necessary to continually monitor students' lab books which should resemble scientific journals used in research laboratories. Students conducting the salsa lab recorded all processes so the information could be used in justifying their results. Implementation of inquiry-based learning activities in the agriculture classroom requires that teachers be prepared for students to arrive at different answers and use different methods to find answers. For example, students approached the salsa activity differently -- some students planted the whole tomato, while others planted slices. An important aspect of inquiry-based learning is freedom to learn.

Costs/Resources Needed

Direct costs associated with the implementation of the inquiry-based learning activities were the supplies related to completion of the lessons. For example, ingredients for salsa, along with planting containers, soil, and water, were needed for the lesson focused on germination. The most critical resource was the time invested in the learning process in both preparation and implementation.

References

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