

Evaluation of Cover Crop Science Lessons to Gauge How Prior Knowledge

Relates to Level of Student Engagement

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Introduction

Students show engagement with learning by asking questions, by collaborating with a partner, by working harder when things get tough or even just a silent nod while the teacher is talking. Engagement is a key indicator for a successful lesson, and educators often consider engagement when revising future lessons. Engagement is the level of focus, cooperation, and persistence exhibited by students (Carini et al., 2006; Chung, 2016).

The purpose of this study was to evaluate how students' prior knowledge influences their engagement in the lessons from the Cover Crops Science 4-H project book. Students learn purposefully when educators connect their foundational knowledge with the new topic presented (Bodner, 1986; Ausubel, 1978). To examine the relationship between prior knowledge and engagement, I taught lessons on cover crops using the 4-H *Cover Crops Science* project book, created by IPREFER educators, to address core topics of cover crops using pennycress as an example (Cover Crop Science, n.d.). While farmers have planted around 15.4 million acres of cover crops in 2017, the USDA seeks to reach 100 million acres by 2025 (Wallander et al., n.d.). Therefore, it is imperative for future farmers, including 4-H participants, to learn about cover crops.

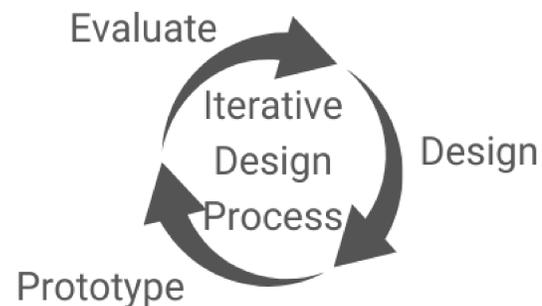


Figure 1. Iterative design process used to evaluate and revise lessons.

Research Question

What is the relationship between students' prior knowledge and their level of engagement during *Cover Crop Science* lessons?

Methods

Lessons

Each lesson was evaluated through the iterative design process (Figure 1). This process allows ideas and concepts to weave together building a sequence of learning throughout a curriculum (Guru, 2017). After each teaching iteration in which data were collected, additional questions arose that furthered lesson revision process. After the first round of teaching, a better understanding of how to measure students' prior knowledge was gained. This evaluation addressed Lessons 1A, 2A and 2C in the *Cover Crops Science* project book (Figure 2), which taught topics including pollination, soil erosion, and flower anatomy.

Data Collection

To measure prior knowledge and engagement, each student received two surveys. The first was a pretest that asked questions to gauge their prior knowledge about cover crops, specifically questions pertaining to pollinators, soil erosion, or harvesting practices, depending on the topic of the lesson (Figure 3). The second measured student engagement (Chung et al., 2016), administered after the lesson. Both surveys used a 4-point Likert scale.

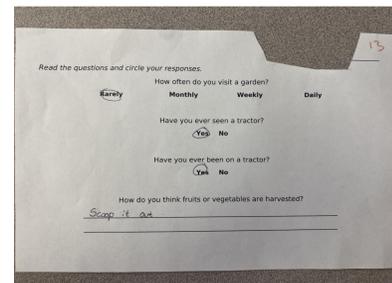


Figure 2. Prior knowledge questions asked of students before the agricultural engineering lesson.

Data Analysis

To analyze these data, engagement and prior knowledge scores were totaled for each student. To evaluate the relationship between these two variables, a regression analysis was performed to yield a p-value and r-squared, which was used to gauge whether the relationship was statistically significant and the strength of the relationship, respectively.

Results

The regression analysis indicated no statistically significant relationship between prior knowledge and level of engagement among students ($p=0.171718769$; Figure 3).

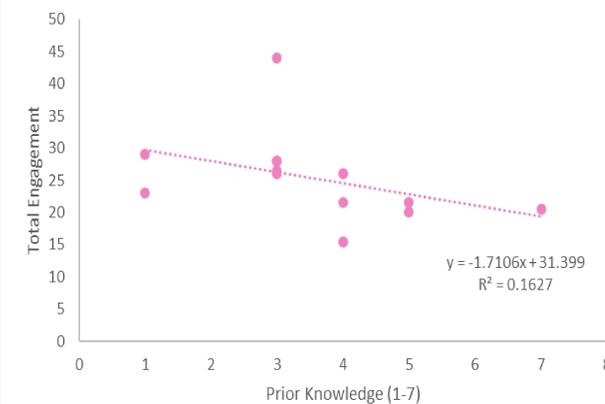


Figure 3. Relationship between prior knowledge and total engagement (NS).

Future Work

In the future, this research will be helpful to 4-H and other agriculture educators to know that prior knowledge is not essential for a student to be engaged in and learning cover crop science. This is also beneficial to 4-H project book creators when revising and developing the second edition of this book, which will be submitted for national 4-H adoption in the fall of 2022 (Figure 4).



Figure 4. Excerpt from the *Cover Crops Science* 4-H project book.

Conclusion

It is important to study how prior knowledge affects levels of engagement because engagement is necessary for meaningful learning (Bodner, 1986). Educators should know about a student's previous insight on a topic so they can help them bridge the old and new ideas to foster learning. This can then help them create different lessons to increase engagement levels.

The nonsignificant relationship between prior knowledge and engagement indicates that the *Cover Crops Science* project book can be utilized to teach cover crop science to a variety of students with varying levels of background knowledge.

Acknowledgements

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