C6 BioFarm: Developing a curriculum, professional development, and research tools to educate youth about biofuels and agricultural industries

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Introduction

Bioenergy is a growing industry within the agriculture, food, and natural resources (AFNR) sector of the economy. Since 2005, employment in the biofuels industry has increased by 147% (United States Department of Energy, 2016). This includes the creation of 357,400 jobs in this industry in 2015. It is predicted that the industry will continue to grow in the future, with nearly two million new jobs in bioenergy created in the next nine to fifteen years. Biofuels are defined by as, "energy generated from the conversion of solid, liquid, and gaseous products derived from biomass" (International Energy Agency, Food and Agriculture Organization of the United Nations, 2017, p. 7). Additionally, the American Association for Agricultural Education (AAAE) has stated that it is important for today's youth to become involved in the AFNR industry, with several of the 2011-2015 priorities relating to how to get young people involved, including creating a classroom curriculum that shows the importance of agriculture, creating a diverse workforce for the AFNR industry, generating active and emotional engagement in agricultural education learning, and meeting the needs of different types of learners (Doerfert, 2011).

A workforce needs to be prepared among today's youth to get individuals interested in, and excited about, careers in the AFNR and bioenergy industries, which may increase the likelihood that future production needs are filled. Though not everyone will enter these industries, it is important that we educate today's youth about the fuels that will be a part of their future consumption practices. By teaching youth about biofuel use and production, it is likely they will be better informed as future consumers and citizens.

C6 BioFarm is a curriculum and iPad app created and implemented to educate youth about the biofuels and agricultural industries. Because bioenergy is predicted to have two million position openings in the next nine to fifteen years, it is important for youth to understand how they will be involved in this industry in the future (United States Department of Energy, 2016). By teaching youth about the background of biofuels, they will be educated consumers and citizens. There were three main goals when going through this process: (1) create a youth curriculum and iPad app, (2) develop and deliver a teacher training program, and (3) build evaluation tools to use when educating youth and educators about C6 BioFarm. The AAAE poster will focus on how C6 BioFarm was implemented and used with today's youth to create interest in agriculture and biofuels.

How It Works

In response to preparing today's youth for the bioenergy and AFNR industries, C6 BioFarm was developed. C6 BioFarm is a curriculum for middle and high school youth that teaches about the important aspects of bioenergy, while getting youth involved in, and excited about, the AFNR and bioenergy industries. The curriculum is aligned with (1) Common Core English Language Arts, (2) Agriculture, Food, and Natural Resources Career Clusters Standards, and (3) Next Generation Science Standards. It includes an iPad app in which youth design and manage their own farm, while dealing with the risks and rewards associated with farming. In conjunction with the curriculum, a teacher training program and program evaluation tools were developed.

Results to Date
To date, many C6 BioFarm related tools have been created and implemented around the state of Iowa. These include a six lesson curriculum for middle and high school classrooms, an iPad app to educate youth about the real life risks and rewards of operating a farming operation, an outline and framework for teaching educators about how to use C6 BioFarm in their learning environments, and evaluation tools to learn about how teachers are implementing and learning from C6 BioFarm.

C6 BioFarm was used at the AppleJack Festival in September 2016, a celebration of the apple harvest in Nebraska City, Nebraska. Results from the 325 youth surveyed indicated that:

1. 91% of youth surveyed indicated that they learned something when playing the game.
2. 81% correctly indicated that switchgrass would grow back every year.
3. 88% indicated that they learned that farmers don't make money each year. (Many youth had this knowledge confirmed by a parent or grandparent involved in the industry.)

In addition, more than 3,000 youth and 350 adults participated in C6 BioFarm related activities between 2012-2016. Teacher training programs were also implemented in summer 2017. These include a 45-hour teacher training (for teacher certification and graduate credit) at Morningside College in Northwest Iowa and training session at the National Agriculture in the Classroom conference in Kansas City.

Advice to Others
C6 BioFarm program planners recommend that C6 BioFarm should be used in the future, in both formal and nonformal learning environments, to get youth excited and knowledgeable about careers in the bioenergy and AFNR industries. When implementing C6 BioFarm, it is recommended that educators consider the type of learning environment and existing knowledge of the audience, especially their background knowledge of agriculture and bioenergy industries.

Future Plans
The C6 BioFarm team also recommends that more curriculum is developed, based on what teachers report as important and needed as it is implemented in the classroom and other learning environments. Though there are many directions that curriculum development could go in the future, it is important to consider what educators are identifying as needs for their learning environment. This should be considered because, if the educator does not see the curriculum as valuable to their learning environment, they are unlikely to use it or share the information with others. For this reason, future curriculum development should to be focused on meeting the needs that educators describe. Program planners may find other valuable ideas and knowledge from educators when considering how to further refine teacher development and research tools, based on their past experiences in the field or with similar workshops or research tools.

Resources
The C6 BioFarm six-lesson curriculum can be downloaded for free on the program website (http://www.extension.iastate.edu/4h/content/classroom). Anyone can use the curriculum how they see fit in their learning environments. The C6 BioFarm iPad app is also available for free on the Apple App Store (https://itunes.apple.com/us/app/c6-biofarm/id1034991303?mt=8).

References

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