

C6 BioFarm iPad Game and Curriculum Workshop

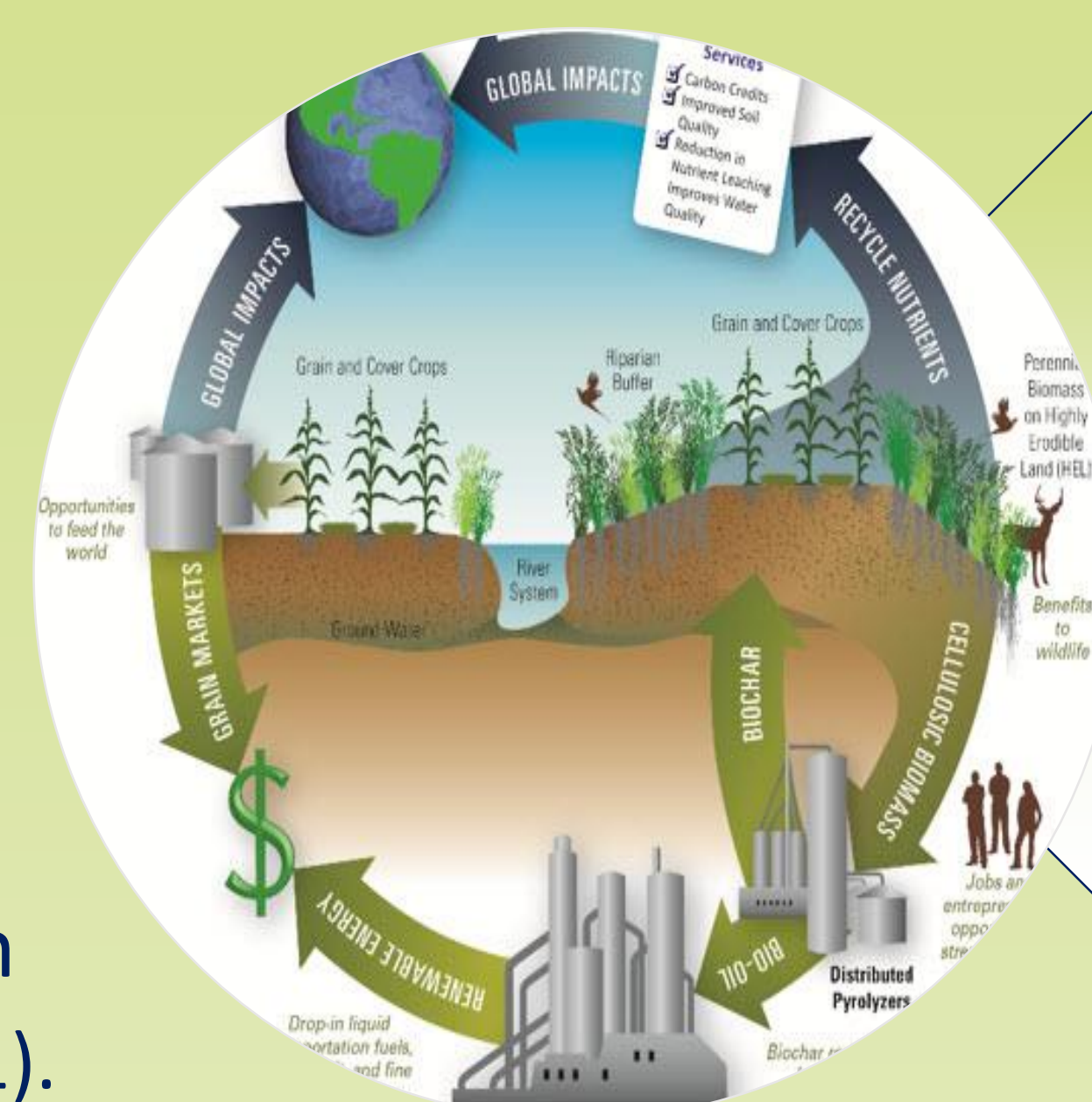
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Introduction & Need for Innovation

- The U.S. 2007 Energy Independence and Security Act called for a transition from fossil fuels to renewable energy (U.S. Environmental Protection Agency, 2017).
- Bioenergy industry has boosted economy and employment. Bioenergy sector created 130,677 jobs in the nation in 2016 (U.S. Department of Energy, 2017).
- This burgeoning industry needs educational force to train more professionals with STEM skills (Jennings & Lund, 2001).
- AAEE research priority number three: "Sufficient scientific and professional workforce that addresses the challenges of the 21st century (Roberts, Harder & Brashears, 2016, p. 29)

Workshop Program



Day 1

- Overview of the workshop.
- Economical, ecological, and sociological influences of fossil fuel and bioenergy.
- CenUSA's solutions.
- Assignment: Team Teaching / Lessons Plan / Reflection and Implementation Plan.

Day 2

- Lesson 1 taught by team 1: Carbon Comparison/ Energy Cycle / Fermentation Lab.
- Lesson 2 taught by team 2: Agriculture Production / Engineering Design.
- Field trip to STRIPS Project (perennial grass plots).
- Assignment: Reflection and Implementation Plan/Lessons Plan.

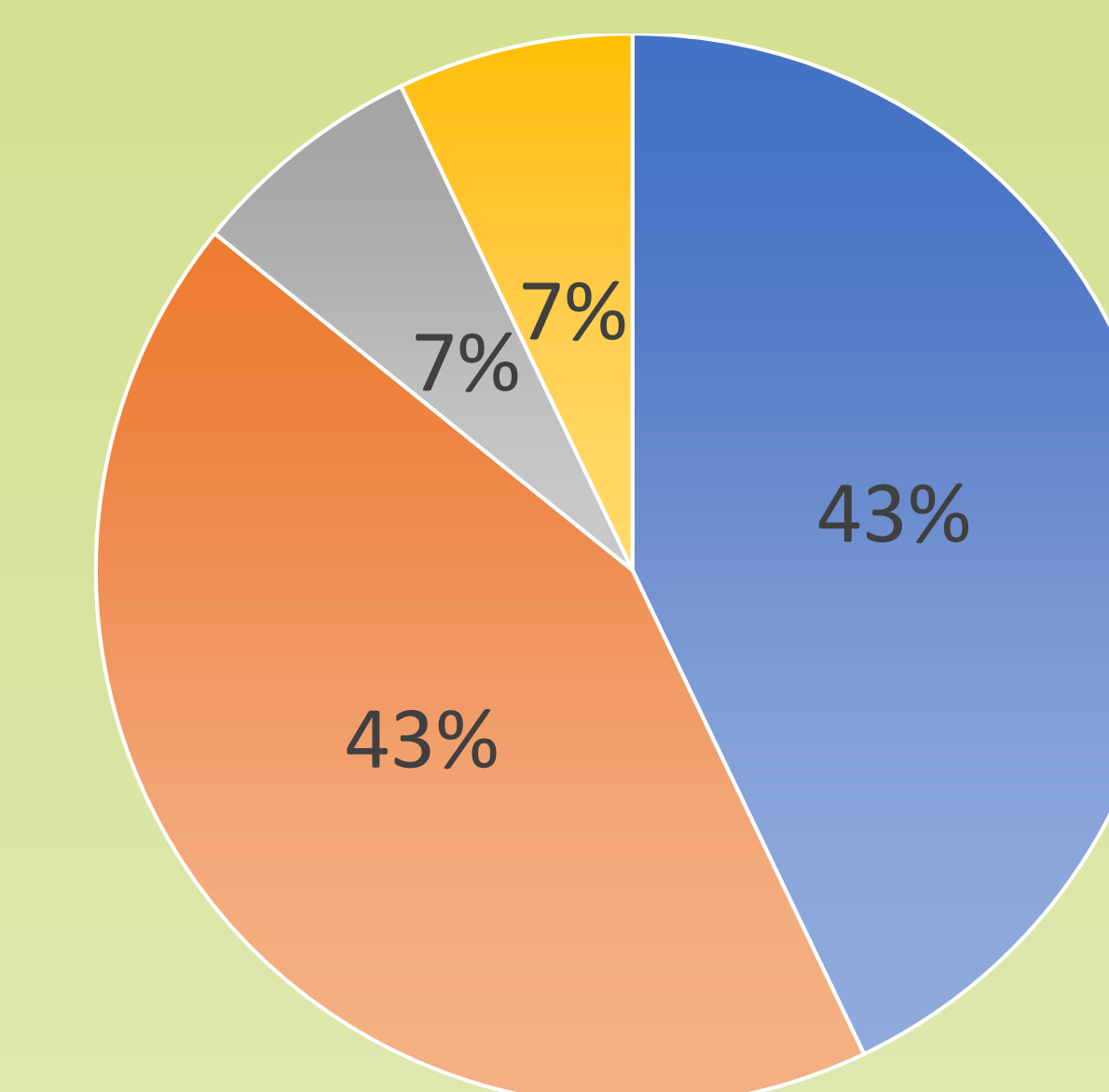
Day 3

- Lesson 3 taught by team 3: Biomass and Biofuel Conversation / Food, Fuel, and Fiber Lab.
- Lesson 4 taught by team 4: Ecological Footprint/ Biorenewables Brochure .
- Field trip to Little Sioux Corn Processor ethanol plant.
- Assignment: Reflection and Implementation Plan/Lessons Plan.

Day 4

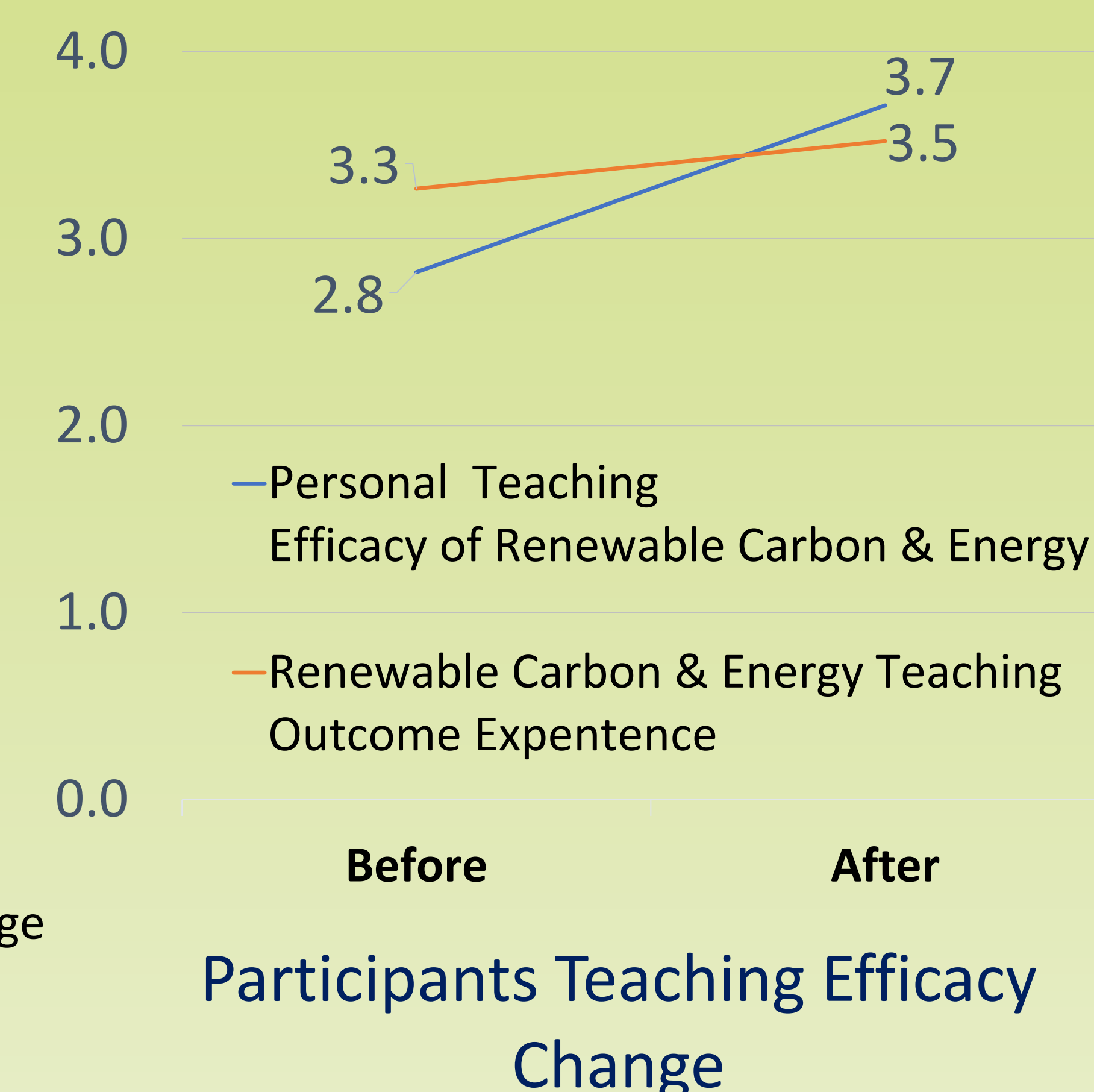
- Lesson 5 taught by team 5: STEM Career Videos/ STEM Career Posters.
- Lesson 6 taught by team 6: Agriculture 360/ The Triple Bottom Line.
- Discuss Reflection and Implementation Plan.
- Program Evaluation Survey.
- Other paperwork (Stipend/Credit).

Results to date / Implications



- High School Only
- Both Middle and High School
- Both High School and Community College
- Middle, High School and Community College

Participants' Teaching Levels



Value and Knowledge Gained

Knowledge topics that were significantly increased after the workshop ($p < .005$)	Value	Knowledge gained
How to reduce personal carbon footprint	4.20	32.6%
Impacts of different agricultural practices	4.13	32.6%
Bio-renewable energy STEM careers	4.13	33.3%
Economic, social, and environmental impacts of food, fuel, fiber production	4.13	60.6%
Role of carbon in the energy cycle	4.07	48.8%
Impacts of climate change	4.07	31.9%
Production of bio-renewable products	4.00	52.4%
Perennial grasses for water quality and biomass feedstocks	4.00	65.8%
Fossil vs. renewable carbon sources	3.93	34.7%
Biomass conversion technologies	3.93	103.7%
Differentiation of starch-based and cellulosic ethanol	3.93	66.7%
Environmental impacts of biomass	3.93	62.1%

Future plans / Advice to others

- A follow-up survey focusing on teaching efficacy and outcome of expectance of bioenergy.
- Identify additional support needed by teachers' instruction on this topic.
- Continue promoting C6 Biofarm Game and Curriculum through Iowa State University 4-H Extension.
- Modify C6 Biofarm Curriculum to suit border elementary school education

References

- CenUSA (2017). About CenUSA Bioenergy. Retrieved from <https://cenusa.iastate.edu/>
- Jennings, P., & Lund, C. (2001). Renewable energy education for sustainable development. *Renewable Energy*, 22(1), 113-118. doi: 10.1016/S0960-1481(00)00028-8
- Roberts, T. G., Harder, A., & Brashears, M. T. (Eds.). (2016). *American Association for Agricultural Education national research agenda: 2016-2020*. Gainesville, FL: Department of Agricultural Education and Communication.
- U.S. Department of Energy. (2017). *U.S. Energy and Employment Report*. Retrieved from <https://energy.gov/downloads/2017-us-energy-and-employment-report>
- U.S. Environmental Protection Agency (2017). *Summary of the Energy Independence and Security Act*. Retrieved from <https://www.epa.gov/laws-regulations/summary-energy-independence-and-security-act>

C6 Biofarm game & curriculum

- iPad C6 Biofarm Game Farming Stimulation Game
- Lesson 1 What and Where is Carbon
- Lesson 2 Agriculture Production and Environmental Impacts
- Lesson 3 Bioenergy and Biomass Conversion
- Lesson 4 Carbon in Your Neck of the Woods
- Lesson 5 STEM Careers
- Lesson 6 The Triple Bottom Line
- Standards AFNR NGSS CCSI



Costs/resources needed

- C6 Biofarm Game free download at AppStore
- C6 Biofarm Curriculum free download at <https://www.extension.iastate.edu/4h/c6-biofarm>
- Cenusa sponsored teacher stipend: \$1,500 X 15=\$15,000; facility: \$400; meals: \$1,545; logistics: \$270; supply materials:\$560. Total Cost: \$17,775.
- Teacher licensure renewal credit by Northwest Iowa Area Education Agency.
- Graduate credit at Morningside College.

