Water Quality Experiential Learning Utilizing ARCS Pedagogical Model: Motivating Student in Undergraduate Chemistry Essentials Courses

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Statement of Problem:
Undergraduate chemistry education can demand a boring and overly technical exercise in memorizing disembodied facts, abstract principles, and obscure relationships. Unfortunately this can result in limited student motivation and failing to equip students to apply learning to real world scenarios.

Research Objective:
This educational study seeks to demonstrate that an experiential learning field trip focused on applying chemistry to real world scenarios can effectively motivate student learning by capturing student attention, connecting content with relevant real world issues, developing confidence in technical skills, and increasing learning satisfaction.

Method:
Participants were community college students enrolled in CHEM102, (n=38), the essentials of organic and biochemistry. The class included science majors and applied health and biology natural resources.

Evaluation:
Students were surveyed and comments evaluated for trends in perceived relevance, content confidence, and learning satisfaction.

Experiential Learning Description:
Groups of two or three students were asked to obtain water quality measurements related to a local lake known to be impaired for phosphorus and toxic blue green algae.

Week 1: Groups met at their chemistry laboratory and were provided with a surface water sample obtained from the lake and the equipment and procedure to obtain common water quality measurements. It was emphasized that the time constituted preparation for a field trip where the students would act independently.

Week 2: Students were provided with coordinates to their previous samples source location and tasked to complete their measurements in the field.

Experiential Learning Description:
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Week 2: Students were provided with coordinates to their previous samples source location and tasked to complete their measurements in the field.

Feedback from the pre- and post-lab survey indicated that students reported feeling 30% more confident over the course of the exercise.

Overall, feedback from students was positive.

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A: Attention
Social/Environmental Issue: Inviting students to contribute to a real world local issue was empowering and engaging.
Change of Context: Transferring the traditional indoor chemistry lab to an outdoor experiential learning site infused excitement and cut boredom.
Inspire Individual Responsibility: Raising the stakes by impressing on the class that the group data would only be as quality as their individual work.

R: Relevance
Choosing a location that is publicly accessible and within 20 minutes walking distance provided room for personalization and enabled the possibility of continuing involvement.
Many students commented that this was the first time they had been to the lake, increasing their connection to their community and environment.

C: Confidence
I observed greater willingness to engage and increasing self-assurance over the course of the exercise.
Feedback from the pre- and post-lab survey indicated that students reported feeling 30% more confident in their abilities after the field exercise.

S: Satisfaction
I have several students contact me asking if they could continue to be involved in water quality research.

This lab was actually pretty cool to take part in. Now I can say I know a little bit about water testing and can volunteer in the future with more experience.

Understanding the chemical vocabulary helps to know if water is safe or not for the environment, animals, and humans.

The healthier our river is, the better quality of life our valley will have. We eat fish out of the river, swim in our river, and the water fills our aquifer. We want to assure that the quality of our waters stays high so we are not adversely affected by our misuse of the resource.

“Going out to the lake was fun and it made the experiments much more realistic.”

“Thank you for this opportunity. I would have never done this without a bit of a push from you. I hope to continue to participate in the future. It... was very fun and I like participating in our planet’s longevity.”

“I am extremely interested in helping collect samples [in the future]. The cross between chemistry and ecology is awesome and the subject is definitely something I would like to explore further. If you need volunteers, let me know.”