SCULPTING STREAMS: HOW CAMPUS WATER RESOURCES HAVE HELPED SHAPE AND TRAIN UGA'S FUTURE WATER RESOURCE PROFESSIONALS

Kelsey E. Morton[1, 2], Matthew L. Thibodeaux[3], and James B. Deemy[3]

AFFILIATION: [1]College of Agricultural and Environmental Sciences, [2]Odum School of Ecology, [3], and Warnell School of Forestry and Natural Resources, University of Georgia, Athens GA 30605
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Abstract. Experiential learning is critical in the training of future water resources professionals at the University of Georgia. Many of the upper level courses taken by these future professionals take advantage of water resources on the UGA campus, including Lake Herrick and a variety of streams. Field experiences with these resources provide valuable opportunities for students to gain lab skills, engage in research with a team, implement the scientific theory they have learned in class, and gain a concrete understanding of anthropogenic impacts on water resources. We used experiences of students across a range of water resource interests to create a conceptual model demonstrating the role of campus water resources in training future water resource scientists. This model demonstrates how field learning experiences, such as skills, content knowledge, and application, compound with further coursework to prepare students for their future research and career goals in water resources. This holistic educational framework both highlights and justifies the use of campus water resources to provide experiential learning opportunities augmenting water resources education at UGA.

INTRODUCTION

Student learning in higher education is often regarded as a fluid process with many different aspects. One such aspect centers around the concept of experiential learning, a process that involves synthesizing knowledge through the transformation of experience and the integration of concepts based on previous knowledge. (Kolb 1984; Kolb & Kolb 2005). Many undergraduate courses train future water resource professionals at the University of Georgia (UGA) make use of campus water resources (CWRs) to provide critical experiential learning opportunities. These opportunities can enforce complicated concepts first introduced in the classroom and appeal to students with diverse learning styles (Cantor 1997). They allow students to gain useful skills for their future and develop research proficiency.

UGA's CWRs include several urban streams, Lake Herrick, and a section of the Middle Oconee River flowing through Whitehall Forest, an undeveloped forest that the Warnell School of Forestry and Natural Resources utilizes as a teaching resource. Many of these resources have impaired water quality as a result of county and campus urbanization, with actions on campus affecting the water quality, which makes them ideal tools to understand problems affecting water bodies today.

Our objective was to develop a model of how campus water resources can be used to train future water professionals based on the experiences of a small subset of students who have participated in advanced water resources classes. We acknowledge the small samples size but believe the model has merit due to the range of interests exhibited by these future professionals. This model demonstrates how experiential learning compounds with coursework to prepare students for their future research and career goals in water resources.

MODEL DEVELOPMENT

The model was developed using reflective survey responses from a variety of who have taken advanced courses using CWRs as a part of their curriculum (Table 1).

Table 1. Characteristics of students surveyed to build model.

Student	Major	Career Goal	Courses
A	Ecology & Environmental Chemistry	Biogeochemistry Research	CRSS 3060 CRSS 4660 ECOL 3500
B	Water and Soil Resources - Warnell	USGS Hydrologist	CRSS 3060 WASR 4110 WASR 4310 WASR 4400 WASR 4700
C	Water and Soil Resources - Plant Science	USGS Hydrologist	CRSS 3060 WASR 4110 CRSS 4660
D	Environmental Chemistry & Marine Chemistry	EPA Research	CRSS 3060 CRSS 4660 WASR 4030

Each student gave feedback about the different areas where they benefitted from the use of these water resources, such as in skills or knowledge gained, and how the experiences they had with CWRs have aided them in future classes, research, and career goals**.** Students provided feedback on how their perspectives and involvement with water resources in general have changed due to their experiences at UGA**.** Common experiences were then used to create a model displaying experiential learning using CWRs and how students benefitted in their current and future academic and career development.

RESULTS

There were a total of seven courses that used CWRs and other local water resources as an experiential learning tool (Table 2). Through this utilization students learned water sampling skills and techniques such as how to use multiparameter probes, experimental design and report writing. They also reinforced knowledge originally introduced in the classroom, like general lake and stream ecology and the effects of urbanization on watersheds. This led to a more in depth understanding of water concepts through research experience. Working with CWRs significantly helped students gain more from future classes and research because of the firsthand skills and knowledge demonstrated through the experiential learning process. Direct student feedback also indicated that these experiences made them more likely to become involved with water-related volunteer work, engage in independent research on local water resources, and encouraged them to pursue careers in water resources.

DISCUSSION

Overall, it was clear that the utilization of CWRs for experiential learning enhances a student's learning environment and provides comprehensive learning feedback through hands-on demonstrations of physical and abstract concepts. This process of social learning combines subjective intuitive understanding and the processing of factual knowledge which allows students to embrace the essential components of adaptive natural resource management (Pahl-Wostl 2002).

The skills, knowledge, and research experience that these students gained from using CWRs directly contributed to them becoming competitive applicants to UGA water resource labs and internships, therefore culminating in water resources monitoring and research careers (Figure 1).

Furthermore, students can also be brought closer to their communities, and these newly formed linkages can produce positive economic development through better educated and trained students more likely to have a positive contribution to local water resources (Cantor 1997).

CONCLUSIONS

Experiential learning opportunities using CWRs effectively guide students towards careers in water resources and provide them with skills and knowledge critical in achieving their academic and career goals. Use of CWRs helps students become more involved with water resources through independent research, volunteer work, jobs, and internships.

Experiential learning through CWRs was instrumental in students aspiring to, achieving, and successfully becoming water resource professionals. The skills, knowledge, and research experience gained directly from working with CWRs and subsequent opportunities help students achieve their water-resources related career goals**.**

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Table 2. A selection of classes utilizing CWRs, which CWRs they used, and benefits gained by students in that course.

Course #	Course Name	Resource Used	Skills Learned	Knowledge Gained	Research Experience
CRSS 3060	Soils and Hydrology	Campus Streams, Lake Herrick, Middle Oconee, Streams in Botanical Gardens	Using multi-parameter probes, quantifying discharge and velocity	Soil and water interactions, quantifying water health with chemical and physical measurements	Teamwork, data collection and analysis
CRSS 4660	Environmental Measurements	Campus Streams, Lake Herrick & Tributaries, Middle Oconee and Streams in Whitehall	Using multi-parameter probes, identifying physical characteristics of waterbodies	Quantifying water health, structures to measure discharge accurately, influence of environment on waterbodies	Research design, data collection and analysis, scientific writing, presentation skills
ECOL 3500	Ecology	Streams in Botanical Gardens, Lake Herrick	Using multi-parameter probes, surveying macroinvertebrates	Which invertebrates indicate good/poor stream health, effects of water quality on invertebrates	Research design, data collection and analysis, scientific writing
WASR 4310	Freshwater Ecosystems	Campus Streams, Lake Herrick	Using multi-parameter probes, surveying macroinvertebrates	How urbanized and natural streams differ, how to quantify these differences	Data collection and analysis
WASR 4400	Introduction to Wetlands	Whitehall Forest's Wetlands	Wetland delineation	Understanding of hydric soils, hydrology, and wetland ecosystem niches	
WASR 4110	Forest Hydrology	Middle Oconee, Campus Streams	Determining stream order	How human activities influence water and groundwater pollution	
WASR 4030	Quantitative Hydrology	Campus Streams, Lake Herrick tributaries	Using multi-parameter probes, quantifying discharge and velocity	How discharge impacts engineering decisions	

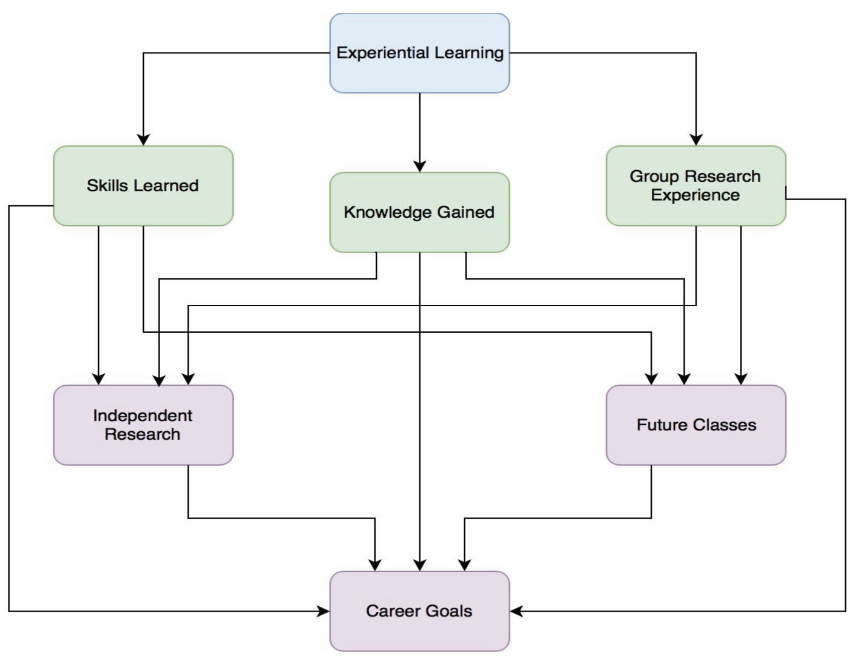

Figure 1. Conceptual model demonstrating the direct and indirect benefits of experiential learning through the utilization of campus water resources.