Integrating an Authentic Wetland Classroom into the Ashland School District

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Abstract

Five of the seven public schools in Ashland Oregon are located within one half mile of the Southern Oregon University (SOU) campus farm. On the farm, there is a small wetland meadow that is under current restoration efforts and a perfect location for an outdoor classroom for the K-12 schools in the near vicinity. Outdoor education has been shown to offer many benefits to educational systems. Long term memory retention, attendance, cooperation, team building skill, teaching skills and more, have been shown to improve when outdoor education is included into the educational system. Current progress on this applied project includes removal of many crowding blackberry and cattail plants to make space for new native species. There has been 5th -8th grade students and also two high school seniors that have helped in this process. Very recently construction of a pavilion has begun with excavation of a French drain that is diverting water away from the construction site. This does seem to be effecting the hydrology of the wetland. At this time, it is hard to assess whether the French drain will have a lasting impact and inhibit the space for education use or actually contribute to the space functioning as an outdoor classroom for wetland science.

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Problem Statement/Introduction

Students in the United States educational system have fallen behind in mathematics and science when compared to other countries around the world (Cwikla, et al 2009). Outdoor education programs have shown to improve learning behaviors and are gaining traction throughout the United States, and Ashland Oregon is no exception (Cwikla, et al 2009; PR Newswire 2016). Southern Oregon University (SOU) located in Ashland, offers the only accredited master's program dedicated to environmental education (EE) on the United States west coast. The SOU campus has a five-acre active farm that currently hosts the Rogue Valley Farm to School program, which for the duration of this paper will be referred to simply as Farm to School. Farm to School interacts with children, teaching them about food systems and offers hands-on farm and garden programs. They also work to promote and increase the use of local produce used in school meals.

Along with Rogue Valley Farm to School, EE graduate students use the farm space to engage the local K-12 students in various activities from weeding beds to sowing seeds. The Ashland Public School District consists of seven schools: Ashland High School (AHS), Ashland Middle School (AMS), Helman, Walker, and Bellview elementary schools, John Muir Magnet School, (JMMS) and Willow Wind Community Learning Center (WWCLC). JMMS and WWCLC are progressive schools with JMMS structured as a K-8 focusing on the arts and sciences, and WWCLC is designed to support K-12 home schooling families. There is also Siskiyou School, a Waldorf private school catering 1-8 and Lithia Springs private high school. Five of the seven public schools mentioned are within a ½ mile of SOU. While the SOU farm is utilized by Farm to School and EE students one feature of the SOU farm has not been utilized as an outdoor classroom. That is a small wetland that has been primarily overrun by Himalayan blackberry and other non-native and native invasive plants. This wetland has the potential to be an authentic learning environment for K-12 students to do scientific observation and data collection.

Many studies have explored the benefits of learning and teaching in an outdoor classroom. Benefits include cognitive reactions relating to memory retention, improved test scores, attendance and attitudes toward all natural sciences (Ahn 2015; Smeds et al., 2015). The wetland at the SOU farm can provide to the surrounding K-12 schools and the undergraduate and graduate students at SOU. For my capstone am doing an applied project that includes the initial restoration work on the wetland, developing curriculum for Ashland's K-12 schools and SOU students, and attempting to pass along the management and maintenance responsibilities to another student or group on campus. The purpose of this project is to establish the wetland as an asset to the local learning community. Doing so will provide the foundation to develop multiple curriculums that can be used for K-12 students and Education majors at SOU by the end of spring 2017.

Children who study in authentic outdoor classrooms and interactive learning environments have been found to test higher and have enhanced long-term memory retention than children taught in traditional classrooms (Smeds et al., 2015). Authentic outdoor classrooms are defined as an environment where students learn a subject by interacting in its "…genuine and original surroundings including the actual actors and

activities, with their interactions. All three parts must be present to be an authentic learning environment" (Smeds et al., 2015). On a farm environment the actual actors described are the farmers themselves and perhaps the transport employees. Outdoor education has also been shown to boost learning cognitions, shape attitudes, and help educators teach children and young adults (Collins et al., 2016).

Wetlands exist on all continents and are considered biodiversity hot spots (Sousa et al. 2016). They can host more species than many other freshwater ecosystems as well as rare plants (Sousa et al., 2016). Even though they have more ecosystem services, the number of these hotspots are declining due to public neglect, and degradation from urban development and intensive agriculture (Sousa et al., 2016). There is specific concern for amphibian species in wetland ecosystems as one third of amphibian species are threatened globally. (Sousa et al., 2016) Amphibians have been found to be the component of a wetland ecosystem that is most appreciated by children that have studied wetlands (Sousa et al., 2016). Biodiversity loss is a major concern in the scientific community, therefore, it is important to incorporate hands-on curricula in grade schools and promote positive attitudes towards conservation, sustainability concepts and the protection of natural systems. (Sousa et al., 2016).

The current level of biodiversity decline has been described as the sixth mass extinction (McCallum 2015). For these reasons, and more, interactive outdoor education has gained more attention in the past decade as a great way to teach our kids. In August 2016, it was reported that Dominion Industries, a large power company in the U.S., is providing one million dollars across 11 states with 66 k-12 and 30 higher education schools receiving grants to help fund environmental studies, energy, engineering and workforce development. The president of The Dominion Foundation Hunter A. Applewhite, is quoted saying, "This year's grants will support a variety of innovative programs encouraging young people to learn the essential skills needed to tackle real-world issues. They will help students gain knowledge and experience with technologies that are leading the way to a greener energy future" (PR Newswire 2016). Providing education in a nature setting creates more cooperation among kids, a greater ability to problem solve and increases physical health through the interaction with the outdoors (Collins, et al., 2016).

A study that looked at fifth and six graders' questioning abilities when immersed in a hands-on curriculum described as a problem-based learning environment. It was found important to place children in a questioning practicing environments so children could practice problem solving without preparations; encouraging them to make personal inquiries and investigations to solve problems (Hung et al. 2014). Over 138 studies between 1984 and 2002 determined that a hands-on learning approach that allows students to draw conclusions from data improved the student's understanding of the sciences studied (Gilman et al., 2015).

In 2003, a study done on tenth graders showed a correlation between curriculums that incorporate hands-on interaction in the science class improved attitudes, test scores and achievements with science (Gilman et al., 2015). Likewise, 1500 eighth graders showed significant gains to performance, engagement, and goal orientation when compared to

traditionally taught control groups (Gilman et al., 2015). Studies done on the benefits of theme-based project learning, comparing fieldwork studies versus laboratory studies found repeatedly to be more effective in teaching the sciences than traditional classroom and laboratory settings. Field work has been viewed by students to more challenging yet enjoyable; learning more from these settings than from classroom work (Chun et al., 2015).

Not only does outdoor education improve the k-12 children's cognitive process it has been found to enhance undergraduates research when they facilitate workshops with k-12 students in the field (Ahn, 2015). Working with k-12 kids forces undergraduate students to translate scientific jargon into layman's terminology so the children can understand what they were teaching. Thus, undergraduates that facilitated ecological sustainability workshops for k-12 kids using wetlands as their focus, had a better understanding themselves of the subject that they were studying at the university level. In turn, they became more apt to communicate the sciences to the public (Ahn, 2015).

Science education for undergraduates that presented to k-12 classes was enhanced by this interaction (2015). The wetland on the SOU farm has the potential to provide opportunities like this to SOU undergraduate science majors and graduate students alike. In 1999 the National Science Foundation's (NSF) Science Technology Engineering and Mathematics (STEM) education program was initiated and was conducted through 2012 when the program ended due to lack of funds. Over this period the program funded over 200 projects more than 140 universities, helping graduate students implement an effective strategy to teach sciences in the k-12 environment (Gilman et al., 2015). The three objectives of the program were 1) to improve collaboration, communication, teaching and team building skills; 2) professional development and 3) enrich the learning for k-12 students. Its findings were that hands-on learning provide opportunities for teachers and students to integrate learning experiences into authentic practical applications, improving teaching and learning outcomes. (Gilman et al., 2015).

Kerry Santos, a fourth-grade teacher in South Carolina founded the Weekend Science Project developed around a small wetland on the campus she teaches at. With three sets of research supplies, students use the wetland as part of their ecology lab; studying hydric soil, turbidity, flow, temperature, pH, dissolved oxygen and biological indicators of the campus wetland. By October of a given school year, students are familiar with how the tools work and may check out one of three backpacks available, loaded with all the instruments needed for exploration and data collection off campus. Assessment of how impactful the project is on students is soley determined by their participation. However, the project has provided an opportunity for students to share their wetland knowledge and experiences with their family, in some cases allowing families to bond over the weekend projects. The project is inspiring and offers a great example how to incorporate on campus wetlands into a local curriculum.

My Two Boots is an afterschool program in Pascagoula, Mississippi where local, state and federal scientists, district teachers, Audubon Master naturalists, along with some high school students, immerse themselves, and most of the 6th graders in the district, in a daylong event studying coastal wetlands. (Cwikla et al., 2009). The goal is to promote

environmental awareness and increase academic performance in middle school and high school students (Cwikla et al., 2009). While this article does not provide empirical evidence that the program generates more knowledge, higher test scores or improved attitudes toward wetland ecosystems, it does provide statements from students that did attend the work shop, all of which are positive (Cwikla et al., 2009).

No Duck Left Behind is another program that combines the efforts of scientists, students, grade school teachers and university professors to engage in wetland studies through a hands-on learning approach while also using internet resources. The scope of this project was to follow satellite-tracking data on pintail ducks while also observing the quality of wildlife support in their community. "This real-world application of scientific research with elementary students' desire to apply scientific knowledge to their everyday lives as well as help build the relationships with scientist" (Cooper et al., 2011). Collaborative projects such as this benefit all parties involved. Students could incorporate the math skills when they visited University campus wetland. Under the guidance of research scientists, teachers or professors the students were broken up into specific disciplines including botany, hydrology, soil science, entomology and wildlife biology. It was reported to be a very profound experience for teachers offering various disciplines to be covered with data collection and analysis. Students felt like they were a part of something big and the project highlighted how this type of real world learning encourages young people to take responsibility for their future and consider careers in the environmental sciences (Cooper, 2011).

From June 2008 to 2011a program titled the RESTOR project, in Ventura County, California, included over 1500 multicultural mostly low-income 6th -9th graders and 33 teachers (Myers, 2012). Students and teachers involved in the project learned about the Ormond Beach restoration project directly from experts that were involved in the project (Myers, 2012). They were also engaged in water quality monitoring in their local watershed. The overall results found that place-based learning is beneficial for students that live in urban communities and learning is improved through a participatory approach to restoration efforts. This approach provides a sense of ownership and pride to the students participating in such projects (Myers, 2012). The previous research and citizen science projects described above highlight why the wetland at SOU is going to be a benefit to the Ashland school district and SOU teaching community.

Methodology

As an Education Assistant at JMMS I have coordinated two fieldtrips of 5th - 8th graders to come to the farm and help with restoration work. This involved raking leaves and piling debris that was removed from the wetland. I have also recruited two high school students, in need of community service hours, to help dig black berry roots and the overabundance of cattails that are in the wetland. I have successfully cut back over 90% of the crowding black berries and cattails to make room for replanting. I was successful in tilling a small area of the wetland using the farm tractor in early February and again in April. Many cattails have regrown to heights over five feet.

Plants that were used for replanting include Spirea, Red twig Dogwood, Douglas Hawthorne, Big leaf maple, Oregon Ash, Sitka alder. Curriculum will be written to describe plant characteristics and obligate versus facultative status. These plants were recommended as local wetland species by Plant Oregon a local nursery in Southern Oregon that specializes in native plant cultivation along with riparian and forest restoration projects. Plant Oregon has generously donated resources to many SOU projects with little return energy to them. Signs are in the process of being made to label various species in the wetland and will be installed early summer. The wetland will also be included in the botanical tour of SOU through the landscape department.

Water test kits as well as soil test kits can be used to study ph, nutrients, loam, and temperature of the soil. With this equipment students will be able to record the data on a spreadsheet provided to them when they come to the farm. Soil science, hydrology and phenology and general wetland ecology are subjects that will be foundational to building of curricula. Data can be collected throughout the whole academic year to track the changes and phenology data will be shared through the Natures Notebook app. The Farm, or the EE department will need to keep these tools stocked. Over time I hope scientists will use the data recording the ebb and flow of the water table and delineation of the wetland to better understand the hydrologic patterns of the SOU wetland and maybe one day determine its source.

Results and Discussion

Currently the hydraulic source is unknown with rumors of its origin ranging from leaks in the open ditch irrigation canal known as the Talent Irrigation Ditch (TID), to a warm spring or artesian well. Maybe one day this wetland could even be an indicator of climate change, depending on hydrological and phenology data collection. These studies are not in the scope of goals for this project but will be available for future students or scientists to study as they wish. It will be up to the various science and education departments along with the farm staff to ensure the longevity of this wetland.

From the research presented it is safe to say that many studies have shown that outdoor interactive education that takes place in an authentic environment promotes increased proficiency for students young and old. The SOU wetland is under current restoration efforts by SOU students, SOU farm staff and other community members. There are plans to construct a pavilion on the edge of the wetland to be used as a covered outdoor classroom, community stage, or general use area to study or socialize and enjoy the wetland and other farm amenities. The ground-breaking ceremony for the pavilion took place on March 9th, with excavation using heavy equipment beginning a month later. The digging for the pavilion encroached into the wetland delineation approximately 15 feet and a trench was dug to divert water from the construction site. A continuous stream of water flowed from the wetland into a hole outside the delineation of the wetland. There was an attempt to backfill the trench with the soil that was removed which resulted in the construction site being flooded. The trench was re-dug and filled with a perforated pipe and drain rock. Excavation is still underway and the French drain remains in place.

The plans for the pavilion have been designed by Christopher Brown, owner of Arkitek: Design & Architecture, an Ashland based business. This pavilion in meant to be an asset to the wetland classroom though construction may inhibit wetland use and final restoration this spring. For my capstone to be successful, it is important to ensure the continuation of the restoration efforts and maintenance of the wetland and allow students to foster a connection with the environment. As water has been drained from the wetland, a large portion is much drier than one year ago when restoration began. There are concerns about the future of the wetland if the French drain remains. There is also concerns for the pavilion foundation as it will sit partially on hydric soil. Time will tell how the wetland bounces back after construction is done.

There is also grand ideas to build an observatory board walk that will access different areas in the heart of the wetland. The design of the board walk is currently in progress with thoughts of having a local welder fabricate raised platforms that can be moved and bolted together or a more permanently fixed boardwalk using wood milled from trees that were felled from another construction site on campus. Restoration work will not be complete by the end of spring but the foundation for further work and curriculum development will be in place.

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