Virtual Learning Prize Application

Endangered Ecosystems - The Virtual Salt Water Marsh
(Part 1 - The Physical Environment)

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Abstract: - 100 words

Multi-user, persistent virtual environments have shown promise in providing immersive, collaborative, simulations similar to those found in real world contexts. This project proposes to recreate a virtual learning environment based on a key endangered ecosystem, the salt-water marsh, with the focus on providing an environment for rich collaborative inquiry-based exploration. The marsh is simulated to present a variety of real world challenges in coastal zone management.

Description of the Tool, Resource or Experience:
In 2006, Seton Hall entered into a development partnership with the New Media Consortium to develop plans for the creation of environmental learning spaces inspired by actual endangered eco-regions found both locally and around the world, within the online, virtual world of Second Life. Two science faculty, along with the instructional design staff, collected resources, identified flora and fauna and developed learning activities with the intent to pilot the effectiveness of these spaces and experiences on teaching and learning in Biology, Earth Science and Ecology courses. Design emphasis centered on creating a space for collaborative learning, advanced problem solving and the application of research and scientific thought that closely resembled authentic real world contexts.

This project proposes to develop one of those plans, specifically the salt-water marsh learning ecosystem, within a virtual world with the goal to explore, assess and document the effectiveness of using virtual environments to enhance teaching and learning in the sciences. Inspiration will be drawn from the Sandy Hook salt marsh at Horseshoe Cove, an area that provides field experiences to students of all ages. This marsh ecosystem within the Gateway National Recreation Area supports a large number of regionally important flora and fauna species that have been extirpated elsewhere through development. The New Jersey shoreline of Sandy Hook composes some of the last remnants of indigenous coastal habitat along the eastern urban core. Restoration, monitoring and conservation plans, along with multiple stakeholder concerns and jurisdictions pose challenging and complex issues applicable to other biologically rich and endangered terrestrial ecoregions.

This proposal, Part 1 of 2 - ***The Physical Environment***, focuses on the recreation of the marsh ecosystem itself:

- topography (i.e. shallow estuarine waters, sandy beaches, mudflats and maritime forest)
- vegetation (upland, marsh, beach)
- animals (microscopic and macroscopic terrestrial and aquatic life)
- structures and objects (i.e. man-made and natural to include physical elements such as access walkways, visitor center, research hut, nests, lairs, nets)
- natural simulations/seasonal changes/tidal flow/weather events (if and when possible)

Links to outside supporting documentation, references, images, and multimedia would be embedded throughout to provide a rich, deep, immersive experience, encouraging detailed exploration of this complex ecosystem.

A companion application, ***Endangered Ecosystems – Hidden Secrets of the Salt Marsh (Part 2 - A Case-Based Learning Scenario)*** proposes to develop this environment even further into a problem-based learning platform that allows students to further develop complex problem-solving skills and the “ways of thinking” found in the scientific research community to solve a mystery based on real-world contexts. When paired together, these two proposals allow for the achievement of multi-level learning objectives while offering the educational community the opportunity to study how the use of virtual world technologies can encourage and support teaching and learning in the sciences. Findings will be published.

Why is this idea especially suitable within a virtual space?

Popular learning theory today is anchored in the principles that knowledge is individually constructed and socially co-constructed by learners based on their

interpretations of experiences in the world. Ideally, instruction should consist of activities and experiences that facilitate such knowledge acquisition (Jonassen, 1999). This approach to teaching and learning has a long history of support from research in developmental psychology, Dewey in 1938, and was originally practiced through a system of apprenticeship in education.

Today, field trips and traditional student internships can offer students authentic learning contexts. However due to limitations of time and expense this is not always possible. In addition, these experiences are often short in duration with limited time for in depth or on-site problem-solving. Little opportunity is available for collaborative learning and the quality and depth vary greatly. Multi-user, virtual worlds have shown promise in the replication of authentic contexts and supporting situated and collaborative learning. By simulating a popular field trip destination, we will create an engaging medium in which students can explore the area without the restrictions of time, weather safety or impact on the environment.

Unbridled by the confines of physics and fueled by opportunities for creativity, students now have additonal opportunity to view and experience the marsh ecosystem from unique and different perspectives. These experiences and perspectives include those that are not possible in real life such as examining plantkon beds, exploring deep under the water and engaging with life that they would only read about in a text book.

Additional concepts could be built into this environment to include:

- The ability to gather data on water quality to show the effects of storm water runoff into the bay.
- Animal habitats could be studied by exploration of different areas of the marsh.
- The diversity of plankton could be studied across different seasons and areas.
- Food webs could be discovered by listing stomach contents of animals.

These are management-relevant parameters that would require months of fieldwork to gather data first hand. While such data could be provided in paper format, the virtual marsh offers students the visual and experiential context to connect these exercises with course content and possible field experiences. Reinforcing each other, virtual exercises lengthen student's time on task and deepen their connection with the topic. Exercises aimed at various learning styles and providing collaborative activities further enhance the possibilities for student knowledge acquisition.

The creation of this virtual environment in an "open" system such as Second Life (as opposed to closed course management systems) is that learners from all over the world can access and explore this space. In addition, other institutions and organization can take the contents of this environment, place them on another educational sites and make modifications as needed based on their

educational goals and objectives. The ability to access this space and repurpose or edit copies of the contents (i.e. SL objects and scripts) promotes and supports educational learning goals that would be similar for the creation of other learning environments and ecosystems.

What are the key outcomes for the participant or user of this tool or experience?

At the end of a participant's visit to the virtual salt-water marsh they will be able to:

- Describe the factors that contribute to the longevity of the salt-water marsh.
- Identify the ecological benefits of these areas to wildlife and people.
- Explain the role of geography in the formation of a salt-water marsh.
- Reflect upon on the need to sustain these natural environments on multiple levels including individual, community, and government.
- Explain the short and long term effect of storms, agricultural runoff, garbage and debris on the flora and fauna of the area.
- Identify rare and important flora and fauna and their interconnectedness in the food web.

Please describe which disciplines/and or courses this idea is applicable to and why?

Ecology, Biology and Geology

The Salt Marsh is a rich ecological region that is studied by Earth Science and Environmental Science students. On first glance, the salt marsh appears as just a muddy tangle of weeds however, it is a dynamic system that constantly gives and receives to wildlife and to people, offering significant ecological benefits. Acting as a giant sponge, the salt marsh can absorb large volumes of water, protecting shorelines from erosion and damage during storms. Moreover, the area aids in maintaining coastal water quality by acting as a filter by absorbing toxins, diluting pollutants, and in some cases metabolizing toxic substances into harmless substances. Perhaps most importantly, this area where steams and rivers merge with ocean water provides nursery and spawning grounds (Miller, 1996) that provides the basis of the estuarine food chain.

This endangered ecosystem is one region that encompasses research in both physical and historical Geology. It is a part of the study of geologic time as well as current event issues such sea level rise and on going geologic processes like the formation of future sources of fossil fuels and beach dynamics. As the earth reacts to the effects of global warming, there is every indication to believe that more salt marshes may be created along the submerging coastlines, while the

existing marshes will become overburdened with water and die. Human activity in the forms of agricultural waste, urbanization, climate change and pollution threaten the existence of these vital and important areas. Understanding them may be the best way to protect and preserve them. A Second Life Marsh will provide a model for students to observe and study this region, providing an ideal virtual laboratory to conduct student research and enhance their appreciation of this delicate ecosystem.

(See: http://www.nmc.org/virtual-learning-prize)