Ossabest: E-Exploration of Ossabaw Island for Students and Teachers: Information Technologies Education Meets Georgia Performance Standards

Lei He  
Department of Information Technology, Lei.He@armstrong.edu

Joy Reed  
Department of Computer Science, Joy.Reed@armstrong.edu

Ashraf Saad  
Department of Computer Science, Ashraf.Saad@armstrong.edu

Jack Sinopoli  
Department of Computer Science, jacksin3@bellsouth.net

Patrick Hannigan  
Department of Middle and Secondary Education, Patrick.Hannigan@armstrong.edu

Ed Strauser  
Department of Middle and Secondary Education, Ed.Strauser@armstrong.edu

Armstrong Atlantic State University, Savannah, GA

Abstract: This paper highlights the need for the integration of information technologies into education. We present an overview of the Ossabest project which provides opportunities for students and teachers to move beyond a traditional classroom setting for inquiry-based learning. Project participants gain hands-on experiences with a range of information technologies embedded in ongoing field work based on a Georgia barrier island. Teaching and learning experiences are enhanced by educational materials designed to meet Georgia Performance Standards. A project web portal offers custom sub-systems created for defined user groups.

Introduction

We live in an information age where information technologies have transformed almost every aspect of daily life. Information technologies are essential to the overwhelming majority of businesses that operate in the 21st century. Computers are becoming increasingly pervasive in the lives of people for a range of activities from social networking to education. Computer support is indispensable for conducting most formative research or education in any discipline. Any society that operates effectively in the global economy must rely on information technologies.

These observations suggest that people need to be comfortable, indeed proficient, with information technologies to adapt to and to compete in the information age. Motivation and self-confidence by both students and teachers are required to transfer information technology skills, and to attract and prepare future professionals for work in science, technology, engineering, and math (STEM) careers. Recent evidence supports the idea that effective use of technology combined with inquiry-based education focusing on problem solving and critical thinking skills can positively impact student academic outcomes (Brew 03, Lee et al 04, Justice et al 2007). The objective of the Ossabest project is to provide opportunities for students and teachers to move beyond the traditional classroom setting by providing hands-on experiences with a range of information technologies. Inquiry-based
learning is embedded in ongoing field work and enhanced by educational materials designed to meet Georgia Performance Standards (He et al 2008b).

The Ossabest project provides comprehensive and customized experiences with information technologies for local K-12 science and mathematics students and teachers. The $1.2 million project, funded for three years by the National Science Foundation, is a collaboration among co-investigators and student assistants from the College of Science and Technology and College of Education at Armstrong Atlantic State University (AASU). The purpose of Ossabest is to encourage students in middle and high schools to take up computing-based careers. There are two tracks of the project: the field guide track and the sensor network track. A project portal and content management system provides the foundation for the field guide track and the electronic exploration of Ossabaw Island, a unique barrier island on the coast of Georgia. Ossabaw is to be the site of the Georgia Power Barrier Island Observatory that offers additional opportunities for electronic exploration through a sensor network.

The discussion topics in this paper are organized as follows: background, technology tracks, teacher and student workshops, project web portal, and a report on the first year of the project.

**Background**

Many information technology education projects have been developed and implemented for middle and high school students during past decades in order to prepare students to become IT professionals to meet the demand for computer-related jobs in the US. (Saad, Boisvert 2005) gives an overview of current information technology education in the US. The National Science Foundation offers funding specifically to involve US students and teachers in various computer related programs through Innovative Technology Experiences for Students and Teachers (ITEST) (National Science Foundation 2008). One such example is the Arctic Climate Model Program (ACMP) which uses Geographic Information System (GIS) data with STELLA numeric modeling software. ACMP combines mathematical and physical science subjects for classroom instruction that focuses on climatic impacts to Alaskan communities, particularly those native communities found in the northeastern peninsula of the state (Arctic Climate Modeling Program 2008). Similarly, a group of researchers in southern California invite students and teachers to take part in GIS workshops and summer trips to Santa Cruz Island. The IT skills acquired by participants are designed to support national and state standards for science and mathematics education (Ocean Explorers Exploring the Ocean with GIS 2008). The NSF ITEST Learning Resource Center is a good source for information about related educational projects. (ITEST Learning Resource Center 2008)

Ossabest is an innovative NSF ITEST project which provides computing-based workshops and summer institutes to 120 students and 90 teachers from middle and high schools in the Savannah Chatham County Public School System (SCCPSS). In a fashion similar to other ITEST projects, Ossabest uses a unique local environment as the setting and focus for research and learning. Ossabaw Island, one of several undeveloped islands off the coast of Georgia, was designated a State Heritage Preserve in 1978. This designation mandates that the island be used for natural, cultural or scientific study, research, or education. Ossabest provides SCCPSS middle and high school students and teachers opportunities to explore Ossabaw Island using information technologies. Summer Institutes feature a three-day on-island residential program plus an additional two days in computer labs at AASU. While on Ossabaw, students and teachers collect data (digital images, groundwater sensor data, and GPS co-ordinates) that may be used for field guide entries, and learn to use basic GPS navigational tools. On-island field work includes instruction on the retrieval, and transfer of data from a ground-water sensor to files that may then be used for classroom instruction and web distribution. While on the AASU campus, students and teachers learn to incorporate collected data into a web-based multimedia field guide. Additionally, teachers participate in a week-long lesson plan development workshop at AASU.

To appeal to a broad spectrum of individuals with diverse interests, the project specifies two information technology tracks: the sensor network track transfers knowledge about information technologies for real-time environmental modeling using in situ sensors, and the field guide track transfers knowledge about dynamic web-interaction through hands-on development of a multimedia field guide. Both IT tracks make use of data collected during Summer Institutes, and most importantly, they offer participants an opportunity for hands-on learning of a
broad range of information technologies. Exposure to a wide variety of information technologies was chosen in order to give students the knowledge, encouragement, and self-confidence needed to pursue higher levels of information technology competency when they enter high schools and/or universities.

Ossabaw Island is comprised of about 26,000 acres. The wish-bone shaped island has distinct Pleistocene and Holocene land masses which combined represent about 8,000 acres of high-ground characterized by maritime Live Oak forest and stands of loblolly pine. The remaining 18,000 acres of Ossabaw is comprised of wetlands including salt marshes, fresh water ponds, brackish water impoundments, creeks and rivers. The diverse ecosystems found on Ossabaw support a wide variety of wildlife including the American Bald Eagle, Wood Storks, and nesting Loggerhead sea turtles.

Summer Institute participants explore Ossabaw first-hand while using information technologies to document their experience in this vast and wild coastal setting. AASU campus workshops for students and teachers focus on imparting knowledge about dynamic web-development by providing hands-on activities for them to incorporate their data into a web-based field guide. Additionally, teachers attend a week-long workshop focused on the creation of curriculum driven educational lesson plans that meet Georgia Performance Standards. These project components provide a wide range of information technology experiences in unique settings. Each is designed to attract students to the fields of Information Technology and Computer Science.

**Technology Tracks**

Field data gathered by project participants will be transmitted over a wireless local area network (LAN) to a server on Ossabaw, then transmitted from the island to a Savannah College of Art and Design (SCAD) tower in downtown Savannah, and finally transmitted to AASU. Data gathered by the meteorological station on Ossabaw will be transmitted via internet to AASU. All data collected from Ossabaw will be stored and archived in the content management system, and made accessible though the Ossabest web portal.

**Sensor Network Track**

A sensor network established on Ossabaw will allow project participants to collect data from an atmospheric weather station, ground water monitoring wells, video cameras and surface water quality stations. Figure 1 shows the proposed sensor network for the island. Data collected from the sensor network will be available to students and teachers for use in field guide entries and in the classroom. Data will be captured from the following sensors to be placed on the island:

- A meteorological station: comprised of temperature, barometric pressure, rain gauge, and wind direction sensors.
- Water sensors: to monitor both subsurface and ground level water, including water level, temperature, and pH value, turbidity, etc.
- Digital video cameras: streaming video to monitor beach activity, including turtle nesting activity and subsequent nest predation.
The Georgia Power Barrier Island Observatory (GPBIO) underlies the sensor network track. The GPBIO is being constructed through cooperative and collaborative efforts of the Ossabaw Island Education Alliance (TIOEA), the Skidaway Institute of Oceanography (SkIO), AASU, and Seimitsu. Still in its infancy, GPBIO currently collects data from a meteorological station and two groundwater monitoring wells. Video sensors have been installed and are being tested at the north end of Ossabaw. The Department of Natural Resources, which provides logistical and management support for Ossabaw, recently aided SkIO in barging two telescoping towers to the island. Seimitsu and The Ossabaw Island Foundation (TOIF) have identified appropriate locations for tower placement. Once the towers are erected, additional sensors will be added to the GPBIO, and data collected from the sensors will be transmitted from the towers, stored, archived and made available for use by students and teachers. The hands-on in-field experience of collecting sensor data and uploading it to the AASU server from Ossabaw, combined with information technologies training at AASU workshops, gives students a basic introduction to the concepts for a variety of information technologies including: electronic transducers, data acquisition and transmission, wireless communication and LAN, and database planning and implementation.

Field Guide Track

The project portal and content management system, discussed below in further detail, underlies the field guide track. The Ossabest portal content management system supports dynamic web interaction that enables students and teachers to contribute to the evolution and development of a multimedia field guide of Ossabaw. The purpose of this work is to allow students and teachers to use a variety of information technologies to document and report the diversified animal and plant life supported by the multiple ecosystems found on Ossabaw while meeting Georgia Performance Standards. Students and their teachers work together with supervision and assistance from Ossabest principal investigators and student assistants. Emphasis is placed on collaboration and learning support. Developed by project personnel, the field guide enables students and teachers opportunities for contribution at various ages and levels of sophistication. The field guide will support classroom instruction throughout the school year. A screenshot of the Field Guide of the Ossabest portal is depicted in Figure 2.
AASU Workshops

Students and teachers participate in a series of workshops that take place at AASU. Initial workshops are provided to give students and teachers an overview of Ossabest project goals and objectives. Later workshops are focused on transferring specific information technology concepts and applications. Students learn the concepts of web-authoring and programming by completing basic tutorials for HTML (HyperText Markup Language), CSS (Cascading Style Sheets), and JavaScript. Both students and teachers participate in tutorials for creating field guide entries. Teachers also participate in a week-long lesson plan development workshop. Georgia Educators are in the process of developing lesson plans to conform to a set of newly adopted K-12 Georgia Performance Standards designed to be relevant to students in the 21st century. These new standards deviate from a prescriptive, content and performance based standard which specifies a list of topics to be covered. Rather, largely influenced by best practices, they provide guidelines for instruction and assessment. Inquiry-based learning is a key component of the new standards. During workshops, project teachers and staff principle investigators will collaborate to create field-based, data-driven, inquiry-oriented, Technology, Science and Mathematics lesson plans that address Georgia Performance Standards. The focus of lesson plan development will be learning and teaching in a technology-rich environment, within the context of the curriculum, and based on student needs (Saad, et al 2008a).

Summer Institutes

During the summer break for SCCPSS, student and teachers attend the Ossabest Summer Institute which features a three-day on-island residential experience followed a two-day workshop at AASU. The Ossabaw Island Comprehensive Management Plan specifies that no roads or bridges to the island may ever be constructed. Hence participants travel to Ossabaw by boat, a first time experience for some. Upon arrival, students and teachers are equipped with digital cameras, GPS (Global Positioning System) units, and journaling supplies before beginning their exploration of Ossabaw. During their three-day visit, teachers, students, and project staff investigate and document plants and animals found in the islands various eco-systems during excursions to salt marshes, beaches and forests. Evenings are reserved for learning how to download and transfer data from digital cameras and GPS equipment. Students then use the collected data to create Power Point Presentations to share with other project
participants. While attending the associated two-day workshop at Armstrong, students and teachers use the data they collected on Ossabaw to construct field guide entries.

**Project Portal, Content Management System and Customized User Subsystems**

The Ossabest portal and content management system is designed to support four user groups: the student group, the teacher group, the administrator group, and the public group. Data analysis and presentation is carefully planned and customized to meet the specific needs of each group. Implemented with bottom-up architecture, modular components for the project portal and content management system are developed and released individually. Designed using a client/server architecture, client devices which include laptops and desktop computers help user groups interface with the central server at AASU which acts a repository for collected data and provides services to the clients (students, teachers, administrators, and the public). A central database residing on the server at Armstrong provides the portal interface for the different user groups. Essentially, each individual has a customized view of the portal provided though a sub-system specific to the user group to which they are assigned. The public view of the Ossabest portal is shown in Figure 3.

![Figure 3: Ossabest portal: public view](image)

**Students** make use of seven modules: Login, Help, Portfolio, Query, Forum, Field Guide, and Report modules. The Student Login Module provides students a way to manage their account and the Student Help Module enables a student to interact with the system using animated demos and static hypermedia files. The Portfolio Module consists of all task-related records about a student, including other team members and the tasks to be accomplished in the summer institute. Each student has a customized view of assigned tasks. The Query Module allows a student to search team members by name, school, and task, and to search tasks by author, time, topic, and school. For each task, students can view the details through the report module. Through the Forum Module, students can share their experiences from workshops and the Summer Institute with one another. The Field Guide Module allows students to develop multimedia field guide entries, using the data they collected on Ossabaw. Through this module, students practice tag-based hypertext development techniques, which are similar to the HTML techniques that they explore in one of the Armstrong campus workshops. Once submitted field guide entries are approved for publication by teachers, they are posted under the ‘Field Guide’ link of the Ossabest Project Portal.

**Teachers** have access to six modules: Login, Help, Portfolio, Query, Task Creation, and Report modules. With the Login Module, a teacher can set up personal identification information including grade, major, school, and contact information. The Help Module provides two forms of guidance on system usage: animated demos and HTML files. The Portfolio Module shows all of the prior tasks a teacher has created and the student participants assigned to the teacher. This information can be retrieved using the Query Module. Using the Portfolio Module, teachers can assign new tasks to students, approve a student's field guide entry, or return a student's field guide entry
with notes for improvement. Teachers make use of a customized calendar to assign tasks to students. The Query Module allows teachers to search tasks by author, created time, course and topic, etc. The Task Creation Module enables a teacher to create a task by generating a new set of questions or by selecting an existing set of questions. The report module produces comprehensive reports of individual tasks and students’ data and field guide entries.

The **Administrator Subsystem** includes seven modules: Login, Student, Teacher, Task, Forum, System, and Export modules. A system administrator manages (adds, removes, updates, and deletes) student and teacher accounts in the Student and Teacher modules respectively. Additionally, a system administrator may use these two modules to query and sort students and teachers by named, course and school, and created time. The Task Module allows the administrators to manage the task and event database by deleting expired and/or completed tasks or by querying tasks by author, topic and created time. The Forum Module allows the administrator to moderate project forums. At a teacher’s request, an unsuitable post can be deleted. The System Module is provided as a means for the administrator to maintain the system, creating log files and generating a system configuration backup. Finally, the Export Module is used to generate customized reports based on requests, such as daily, weekly or monthly system usage or error caching.

The **Public Subsystem** is provided to present published information to the general population of internet users not assigned to a student, teacher or administrator user group. Information includes: project news, events, people, and forums. The Help module provides a demonstration of how to use the project Portal.

**The First Year of Ossabest**

During the first project year of 2008, participants from 11 middle schools and 7 high schools of the Savannah Chatham County Public School System completed Ossabest workshops and the Summer Institute. A total of 47 students participated in the one-day workshop. 26% of the students were from SCCPSS middle schools (grades 7-8) and 74% were high school students (grades 9-11). The demographics of the student participants were as follows: 74% female, 26% male, 94% African American, 6% Caucasian. A total of 37 students participated in the 5-day Summer Institute for students. A total of 29 teachers participated in the workshops and 10-day Summer Institute. 55% of the teachers were from SCCPSS middle schools and 45% high school teachers. The demographics of the teacher participants were as follows: 79% female, 11% male, 27% African American, 58% Caucasian, 15% Asian.

Greater than 90% of participants reported the Ossabest project effectively provided helpful, beneficial, and challenging instruction for a wide range of information technologies. Since the project began in January 2008, Ossabest project staff has designed, developed, and implemented the project portal and content management system which provides customized user subsystems. Responses to evaluation and feedback forms regarding the Ossabest project portal and content management system reveal that participants find the system intuitive.

This positive affirmation of the success of Ossabest propels the project staff into the remaining two years of the project with an impetus to continue developing innovative information technologies learning opportunities for students and teachers. The arrival of the telescoping towers on Ossabaw signals further development of the sensor network and provides opportunities for the expansion of information technologies education provided through the sensor network track of the Ossabest project. We will continue to work closely with the project evaluator to assess project impact on teaching, learning, and perception of information technologies in public middle and high schools.

**Acknowledgements**

The work reported herein is supported under the NSF Innovative Technology Experiences for Students and Teachers (ITEST), Award Number 0737372. Dr. Tim McKlin of Georgia Tech's Center for Education Integrating Science, Mathematics, and Computing (CESIMC) has provided valuable feedback for project evaluation. We would like to thank our partners in the collaborative development of the sensor network: The Ossabaw Island Foundation
Education Alliance (TOIEA), the Skidaway Institute of Oceanography (SkIO), and Seimitsu. A special thanks is offered to Dr. Herb Windom of SkIO who graciously provided the figure of the sensor network.

References


