A COLLABORATIVE RICH INTERNET APPLICATION IN EDUCATION: THE GK-12 WATERSHED INTERDISCIPLINARY SCIENCE EDUCATION (WISE) SYSTEM

William Hanson*, Roberto A. Flores
Physics, Computer Science & Engineering, Christopher Newport University
1 University Place, Newport News, Virginia USA 23606

Geoffrey Klein, Michael Meyer, Lisa S. Webb & Gary Whiting
Biology, Chemistry & Environmental Science, Christopher Newport University
1 University Place, Newport News, Virginia USA 23606

ABSTRACT
Although many GK12 science educators believe GIS to be an excellent tool to teach spatial analysis and reasoning, few educators successfully implement it in the classroom. To help solve this problem we are developing a generic ArcGIS web interface implemented as a Rich Internet Application. By emphasizing a web-based and an easy to customize platform, we aim at lessening the technological bar preventing GK12 educators from adding GIS projects to their science education curricula. The first implementation of the software has been implemented and is currently tested in G9 classes in Newport News, Virginia, as part of an interdisciplinary project to collect and analyze environmental watershed data. The software enables students to input and visually analyze data based on their geographical relations to previously measured variables.

1. GIS IN GK-12 EDUCATION
Today, geographical information systems (GIS) are used on a daily basis by nearly everyone (from aeronautical engineers to soccer moms), for many purposes (from analyzing terrain features to finding the shortest route home), and in many platforms (from standalone computers to mobile phones). Given the benefits of GIS for analysis and visualization, is no wonder that the educational system has found the need to expose students to basic concepts on spatial literacy, as they are used in nearly all disciplines (NRC, 2005).

Despite the numerous benefits of using GIS as an educational tool, relatively few educators successfully implement them in the classroom, and if they do it is mostly by those who are seasoned veterans of both their subject areas and GIS technologies (Kerski 2009). There are four barriers that teachers find to integrate GIS in the classroom: lack of time, inadequate facilities, lack of administrative support, and lack of GIS resources (Kerski 2009, Audet & Paris 1997, Gatrell 2001). The most significant of these is the time needed by teachers to become spatially literate and to master GIS technologies (Gatrell 2001, Baker & Bednarz 2003).

2. GK-12 WISE PROJECT
The GK-12 Watershed Interdisciplinary Science Education (WISE, 2009) is a NSF-funded project that has as one of its goals to promote spatial literacy in grade 9 Earth Science students. Currently the project involves 5 high schools from the Newport News Public Schools System (involving 6 science teachers and approximately 350 students) and 8 graduate students and 5 faculty members from Christopher Newport University. Graduate students work together with teachers to guide high school students in the process of collecting data from watershed in the Newport News area and identifying their level (and perhaps sources) of pollution. High school students collect 3 types of data: bug data (leading to a biotic index that is based on the kind of bugs gathered, which varies according to their tolerance to pollution), sedimentation data (where heavy sedimentation impacts negatively the health of the watershed by displacing the amount of light that

* M.Sc. student.
can enter the water, preventing its oxygenation), and chemical data (in particular, ammonia (NH3), Nitrate (NO3), Nitrite (NO2) and acidity (pH), which are indicators of water quality). Students input these data into a GIS system with the aim at collecting, analyzing and disseminating results.

3. W-DCI GIS SOFTWARE

To cover the needs of the project (collecting, analyzing and disseminating data) in a distributed environment (students input data from schools spread across the city, and users access this data from different locations) we have developed a client/server GIS program that students and users can access over the web. On the server side we deployed ArcGIS server (ESRI, 2010) and on the client side we developed a downloadable Rich Internet Application (RIA) programmed in Adobe Flex (Adobe 2011b). This client is executed within the boundaries of a web browser using Adobe Flash (Adobe 2011a). A snapshot of the initial screen of the client, which we call the WISE data collection interface (W-DCI), is shown in Figure 1. Users can view all the data that has been inputted (either as individual collection points in the map or using a tabular component) and can export this data in CSV (comma-separated value) format for further analysis in other tools, such as spreadsheets. W-DCI has been programmed with 3 incremental access modes: general user (who can access all data but cannot add, delete or modify it), student user (who in addition to viewing can add and edit data in the context of his/her teacher’s approved collection sites) and staff/teacher user (who in addition to viewing and editing data can add collection sites for their class, and must verify student data before it attains permanent status). While general users gain viewing access to the data without restrictions, student and staff/teacher users are provided a username and password by the server administrator. Figure 2 shows a snapshot of the staff/teacher user editing view. Although this figure shows (for the most part) the view of adding a collection site, there are tabs that he user can access to add a GPS point (each of which is associated with one collection site, which can have many GPS points), and bug, sediment and chemical data (each of which is associated with one GPS point, which can have many data).

4. FUTURE WORK & CONCLUSIONS

In this paper, we give a very brief overview of the purpose and functionality of the WISE GIS client program W-DCI. Although the program still has ample room to grow on its user interface and functionality (e.g., it currently does not provide more than addition and basic management of counted features), it has proved to be both an adequate proof of concept and a deployable prototype. However, our aims are not placed only on completing and perfecting this software but
rather on using it to identify generic software components that could be assembled to build educational RIA GIS applications. The intent is to shield users from the sometimes intimidating interfaces in expert-mode systems and facilitate the development of web GIS client programs by casual programmers catering to their own needs. This is an ambitious project, and we’re hoping to begin designing a framework to seamlessly integrate customized RIA client/server systems in the future.

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REFERENCES