

Improving Undergraduate Geographic and Information Literacy by using GIS software

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Americans ages 18 to 24 came in next to last among nine countries surveyed by the National Geographic-Roper 2002 Global Geographic Literacy Survey. This trend can be altered by including geographic literacy components in a multi-disciplinary approach through not only print maps but also by utilizing Geographic Information Systems (GIS) software. GIS software enables undergraduate students to develop an understanding of past, present and future patterns and events by visualizing historical and current events.

Utilizing ESRI's ArcGIS and ArcIMS software, Miami University (of Ohio) Libraries are promoting active learning, improving geographic literacy, enhancing information literacy and critical thinking among undergraduates by instructing and assisting students with creating maps from numeric and geospatial datasets. Through map creation students further enhance their knowledge of a topic by visualizing events and critically evaluating information in a spatial context to discover fallacies in their own geospatial perception of events.

Keywords: geographic information systems (GIS); Geographic Literacy; Information Literacy; GIS instruction; Library Services; GIS training and access.

Introduction

Undergraduate students on college and university campus nationwide are faced with an overwhelming array of information in multiple formats but are unsure how to manage this sea of information. Students encounter everything from numeric data, maps, to journal articles but while each of these formats has its strengths one format lurks in the depths of libraries that most students are unfamiliar with using, that format is geospatial data for use with Geographic Information Systems (GIS) software.

This all-you-can-eat information buffet that libraries provide students can be overwhelming and generally does not appeal to the cognitive processes of this new generation of students. So how can libraries grasp the attention of undergraduate students while also helping to improve their critical thinking and information seeking and

evaluation skills? Well the answer to this question includes a series of possible solutions each of which appeals to a variety of learning styles and focuses on visual display methods that invoke critical thinking.

As libraries continue to enhance information literacy instruction, information literacy needs to promote numeric, geospatial, technological and information evaluation to provide students with critical thinking skills that apply to all formats of information. By adapting this holistic approach to information literacy, libraries can help students develop lifelong information evaluation skills.

Geographic Literacy as a part of Information Literacy

According to the 2002 National Geographic: Roper Geographic Survey Americans between the ages of 18 to 24 came in next to last among the following nine countries surveyed: Canada, France, Germany, Great Britain, Italy, Japan, Mexico, Sweden, and the United States (National Geographic: Roper Geographic Survey 2002). The findings of this survey have great importance to college and university campuses within the United States as the age group survey includes undergraduate students. How can we improve undergraduate comprehension of geographic information? The answer is for libraries to look at information literacy from a more holistic approach where information seeking and evaluation skills are expanded to not only books and journal articles but also to numeric data and more specifically to geospatial information.

This interpretation of information literacy is in keeping with the Association of College and Research Libraries (ACRL) Information Literacy Competency Standards for Higher Education. Within these standards ACRL has provided the foundation for higher education to improve the information literacy of undergraduate and graduate students by listing standards related to information seeking as well as evaluation skills. These standards provided guidance on how to imbed these competencies within assignments, courses, instruction sessions, and more. Since these standards were drafted to encompass all aspects of information it is easy to associate geospatial and numeric information

evaluation in the same manner. For example ACRL Standard 2 Performance Indicator 5 includes the following:

5. *The information literate student extracts, records, and manages the information and its sources.*

Outcomes Include:

- a. *Selects among various technologies the most appropriate one for the task of extracting the needed information (e.g., copy/paste software functions, photocopier, scanner, audio/visual equipment, or exploratory instruments)*
(ALA - Information Literacy Competency Standards for Higher Education)

While the wording of these standards are general we can easily interpret this as well as other parts of these standards to include exploratory programs like Geographic Information Systems (GIS) to help students extract information from maps and geospatial data sets.

Information literacy encompasses all aspects of information seeking and evaluation and integration but how does geographic literacy fit into this concept? Just as information literacy has a variety of definitions so does geographic literacy. Depending on the focus of a curriculum, course, or and assignment this definition can vary but at Miami University Libraries geographic literacy includes the seeking, evaluation and use of geospatial data as numeric data as well as maps. As students interact with the geospatial data they begin to critically think about the information not only numerically but also within the context of space. By looking at data graphically on a map it may be clearer to detect patterns and distributions between countries, states, or cities than by looking at the raw data alone. These aspects of geographic literacy are directly related to information seeking and usage and thus librarians can help reverse these geographic literacy deficiencies of today's students by providing a series of tools and datasets in conjunction with instruction to enhance student's geographic knowledge and spatial understanding.

Geographic Literacy at Miami University Libraries

At Miami University (Ohio) Libraries, partnerships for furthering student's awareness of geospatial data and the power of tools such as GIS software have been the primary method for improving geographic literacy campus wide. To exposure students to the possibilities and many uses of geospatial data and GIS software, projects and instruction sessions have been developed to provide students with hands on experience with using geographical data. The Libraries also provides one-on-one assistance to faculty interested in developing GIS projects, manipulating current datasets to support faulty as well as student research. Depending on the project and topic there are 3 main software packages that are utilized for providing hands-on exercises and assignments with geospatial data which includes ESRI's ArcExplorer, ArcGIS 9, and ArcIMS 9 software packages.

ArcGIS 9

The ArcGIS 9 ArcInfo software is currently the most popular way on campus to utilize and manipulate geospatial data to generate maps for projects, research, presentations and more on the Miami University campus. Since the Libraries manage the ESRI campus wide software license we are able to assist multiple departments with using this software for various projects. From field work on elephant herd migration in Kenya to watershed analysis, to seat belt usage mapping, to student distribution mapping ArcGIS is used by students and faculty to analyze issues and to create maps for a variety of purposes.

Within the Interactive Media Studies Information Studies in the Digital Age course (IMS201) at Miami University students are provided an opportunity to explore geospatial questions using the ArcGIS software. After a quick overview of the basics of GIS students are asked to perform two main tasks: geocode a listing of addresses, and to analyze the spatial relationship between businesses and age distribution within the Oxford area. Students are quick to grasp the power of this software and within a matter of a few minutes possible

answers to the questions asked are provided. This brief 75 minute session is a great opportunity to expose students to this technology that would otherwise not use this software.

Another application of ArcGIS at Miami University is to assist faculty with developing projects for classroom as well as research usage. Upon completion of a brief one-on-one instruction session with the GIS librarian, collaboratively the goals of the project are outlined and the basic structure for the project is developed to enable that goal to be achieved. Because of the multidisciplinary nature of GIS projects can be from a variety of disciplines with the majority of these projects focusing on historical, anthropological and archaeological topics. As these projects develop some of them migrate from the ArcGIS to ArcIMS or ArcExplorer to enable students and others to more easily interact with the data.

Faculty are not the only GIS users on campus as an increasing number of students in various disciplines are interested in using this technology for research and for class projects/assignments. Students from disciplines such as anthropology, urban planning, zoology, botany, mathematics, geography as well as other disciplines have consulted with the libraries for assistance for everything from locating data, software troubleshooting, instruction, to cartographic assistance in order to create maps using the ArcGIS software. Student usage of the ArcGIS software at Miami University is on the rise as access to the software is being increased and as faculty encourage students to consider using this technology to analyze problems. With over 200 machines on campus having the ArcGIS software installed, the demand continues to increase as GIS technology infiltrates the literature of more and more disciplines.

ArcExplorer

During the spring 2005 semester a pilot project was conducted which enabled students to use the ArcExplorer interface to access geospatial data on

migration patterns and statistics worldwide for 1990 and 2000. The ArcExplorer program was selected for this project since it enables both PC and Macintosh users to interact with the GIS data and to develop customized maps. This project enabled student's with a section of the World History 198 course to analyze the emigration and immigration patterns of a particular country or region and to generate a customized choropleth map of the region to show potential patterns as well as distribution of the data.

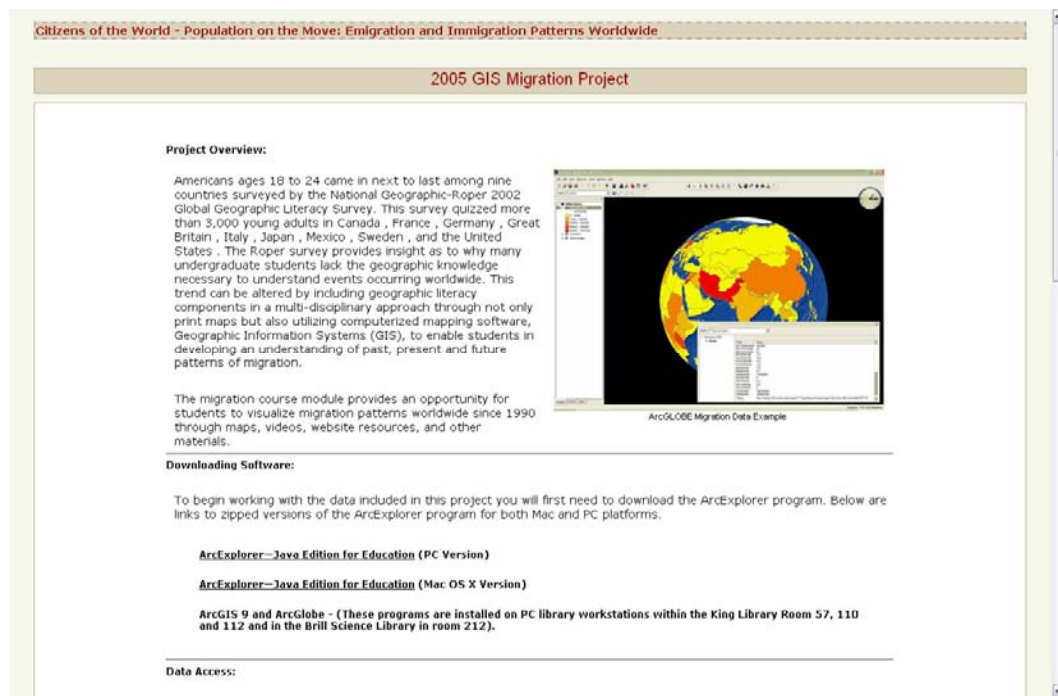


Figure 1 - 2005 GIS Migration Project Website

Each student was provided a link to the project's website (see figure 1). This website included a handout which outlined the ArcExplorer program and provided insight into how to generate a customized map for inclusion within their research paper. Students were also provided with access to the data and a data code book was also provided via the project's website. This project proved to be a great way to enable students to interact with geospatial data and to critically think about migration causes and relationships globally as well as regionally.

ArcIMS

During spring semester 2005 the Miami University Libraries completed the installation of the ArcIMS server to enable students, faculty and others to view and interact with geospatial data without installing software while also providing both PC and Macintosh users access to these resources. In collaboration with anthropology professor Jim Aimers and geography student Ryan Cook the libraries developed an ArcIMS interface that would enable researchers and students alike to view and analyze data for the Tipu, Belize archaeological excavation site. To provide users with an overview of the region a map was created which includes Archaeological sites within the Mesoamerica region (see figure 2).



Figure 2 – Interregional Maya Pottery Project Website

This project, later named the Interregional Maya Pottery Project, is still being developed an enhanced with the overall goal of not only mapping the distribution of pottery shards excavated at the Tipu site but also to include images of the shards. Since the excavation data also includes pottery types, groups, and wares

visitors will be able to analyze various pottery distributions at the site via the ArcIMS interface. Currently visitors to the project can look at a site map of Tipu which includes the outline of buildings and a generalized distribution of some of the pottery excavated at the site. To see additional information related to this project visit: <http://columbia.lib.muohio.edu/arcims/Tipu/> .

With the ArcIMS pilot project well underway, the Libraries are developing additional projects that will be student accessible via this interface for fall semester 2005. This interface provides users with a simple easy to use interface that includes several powerful tools that enable critical thinking about the relationships of data from one region to another. As this interface continues to develop to meet the needs of the Miami University community we anticipate more users will be exposed to GIS and thus help with improving geographic literacy campus wide.

Geospatial Literacy Instruction

One of the major issues with providing GIS services is instruction. To fulfill this need for instruction Miami University Libraries employs a tiered approach to instruction where clients have the option to receive instruction in a workshop, classroom, individual, group, or within the ESRI virtual campus environment (see figure 3). By providing several different options for instruction clients can select which method(s) work best for them and their particular learning style. Upon completion of any instruction session participants are encouraged to utilize the ESRI virtual campus training courses to further enhance their GIS familiarity.

When providing GIS instruction hands-on exercises are an integral part of bridging the geographic literacy divide. By providing a balance of theory and practical exercises instruction sessions can motivate student to make maps and using geospatial data.

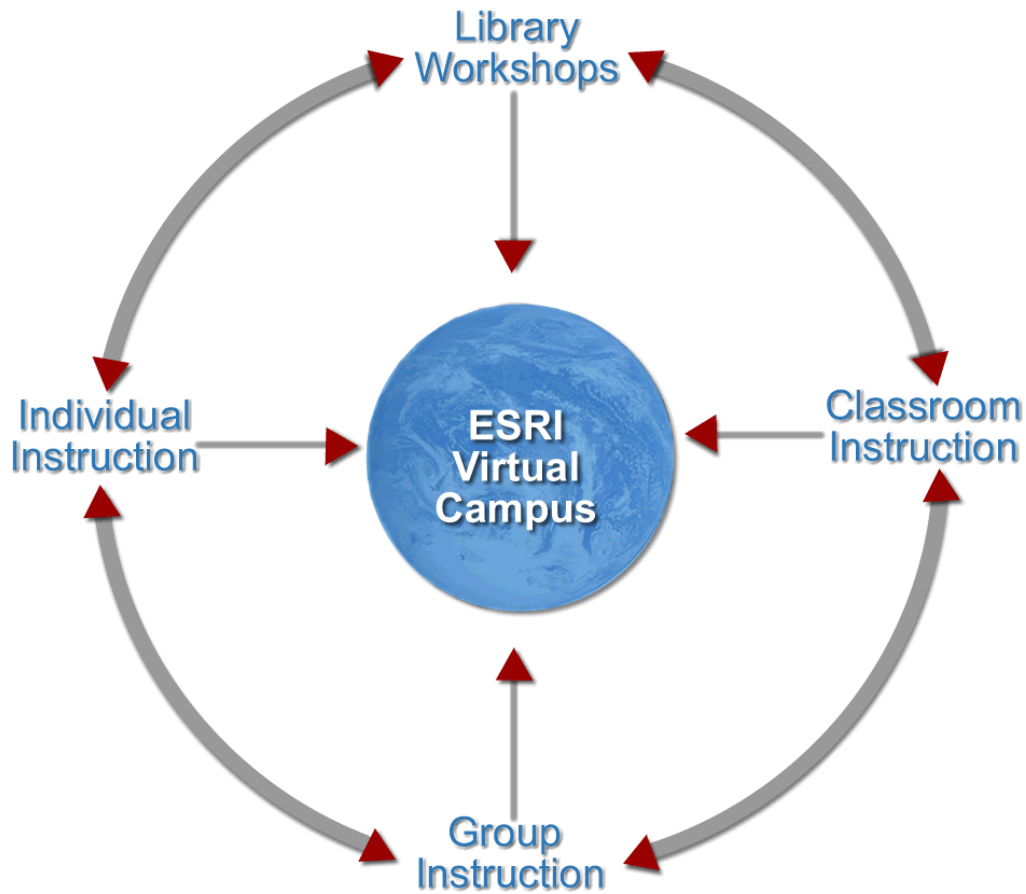


Figure 3 – Miami University Libraries GIS Instruction approach

Conclusion

To meet the needs of today's undergraduate student libraries must provide new tools to encourage critical thinking about geospatial data. With libraries already providing instruction to students on seeking as well as evaluating information it seems only natural for libraries to work with faculty to enhance the geographic literacy of students. By collaborating faculty and libraries can introduce students to a new perspective of thinking, a spatial perspective. With tools like ESRI's ArcGIS, ArcExplorer, and ArcIMS software packages users can not only be provided access to the geospatial information but can also begin to analyze the data and create maps that map portray new ways of thinking about past, current, and future problems.

With an ever increasing interest in learning methods for displaying information visually today's undergraduate students yearn for the opportunity to be engaged in an active learning environment. Libraries and faculty can partner to create GIS projects for classroom usage and together we can help change the geographic literacy statistics on the next National Geographic: Geographic Literacy Roper Survey.

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