

Work in Progress: Multidisciplinary Engineering Project Abroad

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Abstract - The convergence of scientific and engineering disciplines in current applications requires engineers to have multidisciplinary teamwork skills. This paper describes an international experience that brought together students in engineering, science, social science and the humanities to work on a project that requires technical, foreign language, and research skills. The focus of the experience was to have students work in multidisciplinary teams to develop a chronological map of the city of Córdoba, Spain. They used a Geographical Information System (GIS) application to develop the map layers, and they constructed web pages that are linked to the map. This paper summarizes experiences from the first offering in the summer of 2003. We also present planned improvements for the evaluation of the next offering in December, 2004.

Index Terms - International experience, geographical information systems, language study

INTRODUCTION

Union College is an independent undergraduate college, founded in 1795, and the first in New York State to create an engineering degree program within the liberal arts context (1845). Union's new Converging Technologies initiative encourages the development of multidisciplinary projects that bring technology and traditional liberal arts disciplines together to prepare students to understand both new technologies and their global implications. Union also has a long tradition of emphasizing international education, with a strong term abroad program and an "Other Cultures" college-wide general education requirement. Engineering students are encouraged to travel abroad to satisfy this requirement, and several international programs have been developed to give them opportunities to do so. The experience described here is referred to as a "Mini-term" program, and was developed as a multidisciplinary international experience that satisfies part of the Other Cultures section of the general education program. The mini-term normally includes a 10-week preparatory seminar followed by a 3-week trip to a foreign country to complete a project. The development of this program was supported by the Keck Foundation [1].

EDUCATIONAL OBJECTIVES AND MOTIVATION

The need for college graduates, including engineering majors, to have the broad education required to understand technology and engineering in a global social context has been recognized by accrediting agencies and their constituents [2]. Multidisciplinary teamwork is also a critical skill that is listed as a required outcome of engineering programs. The mini-term experience included these general goals, specified more precisely as the following objectives [3]:

- To learn about digital mapping and Geographical Information Systems applications while studying the history and culture of Spain.
- To develop teamwork skills and cooperation among students of different disciplines.
- To research, in Córdoba, the sites and topics each team developed in its pre-departure proposal.
- To document results and to keep journals of work and experiences.
- To further improve Spanish language skills through immersion in the culture.
- To present the results of each teams' work at the host institution in Córdoba.

PROJECT IMPLEMENTATION AND RESULTS

The 10-week seminar that took place during the academic term preceding the mini-term trip served to introduce the students to GIS applications and software and to provide an overview of the history and culture of southern Spain. Students had lectures, films, and discussed readings on the history and culture of Spain. Lectures are also given on GIS applications and students completed tutorials using the ArcView software to learn how to develop maps and GIS databases.

In the last few weeks of the seminar, students were formed into five multidisciplinary teams. Each student was asked to identify their skills in the areas required by the project: Computer skills, Research skills, and Spanish language skills. Once this was done, balanced teams were formed and each team was assigned a time period for which to develop a layered GIS map (Table 1).

The mini-term focused on the city of Córdoba because of its central role in the history of southern Spain in the first

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millennium. The teams were given a base map of the city, and asked to map existing historical sites from the time period they were assigned. They added a hyperlink to each site, where a web page was designed to describe the history, significance, and current status of the site.

TABLE I
TEAM ASSIGNMENTS

Team	Majors of Student	Time Period	Expertise
3	Mechanical Engineering	Early Roman,	Computer
	Political Science	Late Roman,	Research
	Latin American Studies	Visigoth	Language
1	Mathematics	8 TH C	Computer
	Liberal Arts	9 TH C	Language
	Psychology	10 TH C	Research
2	Biology	11 TH	Research
	Mechanical Engineering	12 TH	Computer
	Sociology	13 TH	Language
4	Environmental Studies	14 TH	Research
	Political Science/Economics	15 TH	Computer
	Psychology, Arts	16 TH	Language
5	Electrical Engineering	17 TH	Computer
	Spanish	18 TH	Language

The trip to Spain included several components including lectures at the University of Córdoba, group field trips to historical sites of interest, independent team visits to sites in each team’s assigned time period, trips to other Spanish cities, cultural events, and a final presentation of project results to the University of Córdoba faculty. Each team was provided with a student mentor from the University of Córdoba who acted as a guide to find historical information and to explore the social activities of Córdoba. Students kept journals of their project work, and also personal journals to record their impressions of their experiences with the culture.

Once the students returned from Spain, they finalized their maps and web pages, and submitted them for grading. The 14 map layers that were generated were then integrated into a single map with multiple layers. Using the “Image Mapper” application from ESRI[4], the single map has been converted to a clickable web page[3]. Figure 1 illustrates a typical map for one team.

STATUS AND EVALUATION PLAN

The effort required to plan and implement the initial offering of this experience left little time for an extensive assessment component. The preliminary assessment was promising, however, and we conclude with these results and our plans for evaluation for the next trip.

Students were graded for the course based on their seminar work, journals, project proposal, and project results. The goals of the experience were assessed using the journal results, project results, feedback from the faculty at the University of Córdoba, and a survey form administered to students.

The journals indicated that most students absorbed the main points about the history and culture of southern Spain that we attempted to demonstrate in the experience. A few students admitted that they not take enough initiative to

practice the language and immerse themselves in the culture. The journal was an excellent evaluation method for this aspect of the experience and we will continue to require it in future offerings.

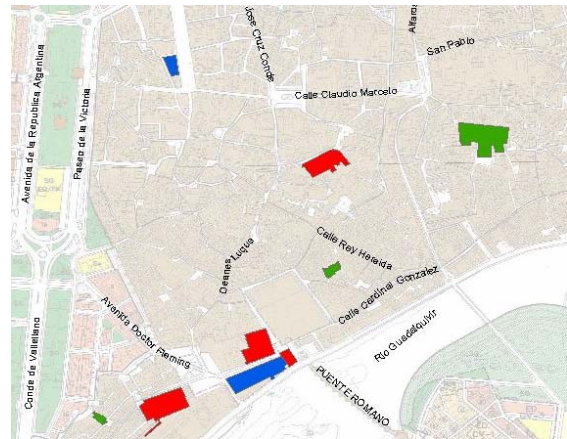


FIGURE 1
TYPICAL MAP IMAGE

The project results themselves were excellent. Each team successfully completed the map layers and databases assigned and submitted complete web pages on all of their sites. Faculty from the University of Córdoba provided very positive feedback on both the content of the web pages and the presentation skills of the students.

The survey form submitted to students asked for feedback on each component of the experience relative to meeting the goals of the mini-term. Unfortunately the return rate was not high and little conclusive data was gathered.

Our evaluation of the next offering (December, 2004) will include a systematic approach with measurement instruments and metrics for each goal. An example is a teamwork evaluation form for peer evaluation of teamwork skills. Another is a complete project evaluation rubric that details expectations and levels of achievement for each project component. Mechanisms will be added to ensure 100% return rates on all assessment instruments.

ACKNOWLEDGMENT

The development of this project has been supported by the Keck Foundation.

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