The Making of Sustainability: A Case Study of an Undergraduate Technology Course Project

Jeanine M. Scaramozzino, College of Science and Mathematics Librarian, California Polytechnic State University
Yi-Hsiang Isaac Chang, Assistant Professor of Industrial Technology, California Polytechnic State University

Abstract

21st century engineers need skills not just to develop technologies but also to assess broad implications of those technologies. We present a faculty-librarian collaborative project designed to enable students to acquire both technical knowledge and information literacy skills to assess needs, research and evaluate emerging technologies, identify social, economical, and environmental issues, synthesize findings, and make sound decisions in a global economy.

Background

Academic inquiry requires critical thinking and is based on the ability to determine the information you need, locate, evaluate, synthesize, and utilize that information. This ability is known as information literacy. As many students arrive at college without such a skill set, equipping them with the ability to utilize diverse sources of information properly has become an important goal of higher education and provides a basis for lifelong learning. This collaboration was designed for undergraduate industrial technology students to bridge the information literacy gap between high school and university and gain the skills necessary for the future.

Introduction

The collaboration between the instructor and librarian was primarily focused on teaching the students how to utilize library and online resources to collect and evaluate information, analyze and synthesize data, and determine the feasibility of deploying a particular technology:

- Assignments were created to guide the students through the resources in a stepwise progression
- Web based research guides were developed to focus students and teach about information resources, how to evaluate sources, search techniques and hints, etc.
- The 2.5 hour library training session included an information literacy pre-test
- Presentations and assignments were graded independently by the instructor and librarian and grades were discussed in the context of learning outcomes and perspectives

Course Learning Objectives

Industrial Technology 150: Industrial Power Systems

Course learning outcomes were mapped to Industrial Technology Learning Goals:

- Recall the forms of energy and common methods for energy production and conversion.
- Recognize the impact of energy consumption and power system usage on humans and the environment.
- Identify the capacity and limitations of common methods of energy production in terms of availability, efficiency, and sustainability.
- Demonstrate the basic skills needed in designing and handling power systems.
- Design and build a solar truck for competition and subject to multiple constraints, e.g., task requirement, competition rules, budget, resource availability.
- Utilize library and online resources to collect and evaluate information, analyze and synthesize data, and determine the feasibility of technology deployment.

Preliminary Findings

The pre-test result revealed that students' information retrieval and evaluation skills ranged from adequate to poor. Students' initial feedback on the library training session was positive, especially regarding the introduction of citation management software. This finding is interesting, as most instructors only provide students the "how to find information" lecture. In evaluating the first assignment and presentation it was evident that the students did identify relevant and reliable resources and were able to articulate the additional information that they needed to discover. It appears that giving the students a tool to organize information via tagging, notes fields, linking to related articles, etc., provided a value vehicle for the synthesis of information. However, while specific instructions and grading rubrics were provided to the students ahead of time, it was not reflected their assignments. For the remaining assignments it is clear that the instructions and rubrics will need additional explanation.

Research Guide Screenshots

Fig. 1. IT150 Research Guide Home Page

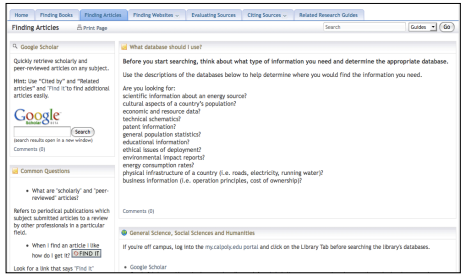

Fig. 2. Finding Articles Tab

Research Assignment Components

Research Project: Teams of two students were required to determine the feasibility of energy-related technology deployment in a foreign country by considering not just the technical complexity of the project but also the country's current needs, resources, infrastructure, educational systems, and so on. Assignments were designed to help students progress in stepwise fashion and build on what was discovered:

Research Proposal Essay and Presentation

- Rationale for selecting the country of interest and justification for selecting the power system technology for potential adoption.
- Clearly specified research questions that cover various aspects of deployment in order to determine whether the implementation of such a technology would be successful.

Background Essay and Presentation

- Rationale for selecting a particular technology application and comparison with current technology for the same application.
- Current information on topic, works consulted, initial analysis of information collected, and analysis of what issues still need to be explored.

Technology Deployment Essay and Final Presentation

- Overview of the research project: country (location, population, economics, culture, education), technology (operation principles, cost of ownership), and application.
- Proposed solution. Note whether or not the technology has the potential to be adopted, propose a plan for implementing it or finding an alternative solution.

Example Research Project and Information Needs

Deployment of Fuel-cell Based Electrical Transit Buses in Argentina

Background information: A transit company in Buenos Aires is considering bringing fuel-cell electric transit busses to service. In order to evaluate the situation carefully, and identify potential benefits and problems, the following types of questions need to be asked:

- What is the initial cost? What is the operational cost? What is the total cost compared with the current solution (e.g. busses using gas)?
- What sort of infrastructure or utility is needed in order to operate the electrical bus? For example, where and how can the busses be fueled?
- Who can drive the electrical bus? Is special training needed? How about bus maintenance? Can existing staff handle that, or will someone else need to be hired? If so, does the surrounding area provide such a workforce (education and skill set)?
- Who will benefit from such an action? Will the government partially sponsor the purchase or operation? Is there any impact toward the company's revenue?
- Does the consumer care? Will a clean bus attract more riders? Will the driver come from a union?
- What is the carbon footprint of electrical busses?
- Which route should be used as a pilot?

Next Steps

- Examine student team progress
- Administer information literacy post-test and evaluate individual student progress
- Evaluate website feedback and comments
- Map student assignment/critical thinking development
- Analyze student evaluations of instructor, librarian, and the course

Advice

- In order to reinforce student learning outcomes it is not sufficient to hold formal training on literature search techniques or provide necessary search tools. Evaluation and synthesis need to be addressed.
- The instructor must work closely with the librarian to forge a learning experience through carefully designed assignments that will engage students' research skills.
- Given the fact that research often appears overwhelming, one-to-one discussions between the students and instructor/librarian and feedback at each stage of research are crucial.
- Providing 3 milestones during the course of the project appears to retain student focus and interest.

Further Reading

- Association of College and Research Libraries (ACRL) Standards Committee (2000). Information Literacy Competency Standards for Higher Education. Retrieved April 21, 2009, from http://www.ala.org/ala/mgrps/divs/acrl/standards/informationliteracycompetency.cfm
- American Library Association (ALA) /Association of College and Research Libraries (ACRL)/Science and Technology Section (STS) Task Force on Information Literacy for Science and Technology (n.a.). Information Literacy Standards for Science and Engineering/ Technology. Retrieved April 21, 2009, from http://www.ala.org/ala/acrl/acrlstandards/infolitscitech.cfm
- Judy, R. W. & D'amico, C. (1997). *Workforce 2020: Work and Workers in the 21st century*. Hudson Institute, Washington, D.C.
- Kritt, D. W. & Winegar, L. T. (2007). *Education and Technology: Critical Perspectives, Possible Futures*. Lexington Books, Lanham, M.D.
- McRae, A. R. (2005). *Industrial Technology Education Teachers' Perceptions of National Standards for Technological Literacy in the State of Arizona*. Master Thesis, Brigham Young University, December 2005.
- National Academy of Engineering. (2005). *Educating the Engineer of 2020: Adapting Engineering Education to the New Century*. National Academies, Washington, D.C.
- Saunders, L. & Vreeland, C. (2004). *Maximizing Value: Creating an Online Tutorial That Will Also Serve as a Reference Tool*. Virtual Reference Desk (VRD) 6th Annual Conference, Retrieved January 29, 2009, from http://data.webjunction.org/wj/documents/12494.pdf
- Scott, T. J. & O'Sullivan, M. (2000). The Internet and information literacy: taking the first step toward technology education in the social studies. *Social Studies*, *91*, 121-125.

Acknowledgements

This work was supported by Cal Poly State University Kennedy Library and Industrial Technology Department. We would like to thank Brian Greenwood, Joe Grimes, and the Junior Faculty Learning Community for their ideas and support.