

2006-1094: INTEGRATION OF FRESHMAN ENGINEERING PROGRAM INTO THE ALL UNIVERSITY FRESHMAN READING INITIATIVE

Charles Dolan, University of Wyoming

H. T. Person Professor of Engineering, University of Wyoming, Laramie, WY 82071
cdolan@uwyo.edu

Larry Schmidt, University of Wyoming

Assistant Librarian, University of Wyoming, Laramie, WY 82071
lschmidt@uwyo.edu

Integration of Freshman Engineering Program into the All University Freshman Reading Initiative

Abstract

In the fall of 2005, the University of Wyoming initiated a Freshman READ program for all incoming freshmen. The book selected for the inaugural READ program was Dava Sobel's *Longitude*. The University objective was to explore how the book could be used across the curriculum in all colleges and to provide the first year students with a common reading experience. This paper explores how the College of Engineering incorporated the University READ program into the freshman introduction to engineering course. Included in the paper is a discussion of how the annual design challenge was adapted to a *Longitude* theme, how information literacy questions were structured around the theme, and how the university library system supported the student research and assessment papers required for the course. A critical component of the project was assessing the student papers and the student's ability to evaluate and comment on their research papers. A summary of this assessment is included. The paper concludes with a summary of the overall assessment of the integrated program including suggestions on how other engineering colleges might be able to capitalize on first year reading programs.

Introduction

The College of Engineering, like many other engineering programs, is impacted by the general education requirements of the University. In 2003, the University of Wyoming established a new University Studies Program (USP). The program requires students to not only satisfy general education requirements in humanities, social sciences and the arts, but also students must develop oral communications skills, fundamentals of information literacy and learn to work in team environments identified as "intellectual communities." These objectives are similar to the continuing ABET a-k requirements as adopted by the departments within the College of Engineering. Therefore, to avoid additional pressure on the number of credit hours required to satisfy the University Studies Program, the College of Engineering adopted the University Studies Requirements into an integrated first year program. This allowed an opportunity to introduce global problem solving skills and introduce design early in the curriculum while meeting the university requirements.

In the fall of 2005, the university introduced the Freshman READ (Read, Evaluate, Analyze, and Discuss) program. The freshman READ program was intended to engage a common topic across campus; however, participation in the program was optional by instructor. The selection committee had a short list of three books: Barbara Ehrenreich's *Nickel and Dimed*¹, H. G. Bissinger's *Friday Night Lights*² and Dava Sobel's *Longitude*³. *Longitude*³ was eventually selected. Over 800 copies of the book were sold during the summer orientation with the expectation that students would read the book prior to arriving on campus.

Each fall the College of Engineering offers 12 to 14 sections of ES 1000, *Introduction to Engineering*. Each section has 20-22 students and is taught by faculty members that are selected for superior teaching skills and an interest in first year students. The course is required of all

incoming first year engineering students. In addition, approximately 25 non-engineering majors take the course to satisfy the USP requirements and these students are randomly enrolled within the sections. Classes are multi-disciplinary in that Architectural, Civil, Electrical, Computer, Mechanical, Chemical and Undecided engineering students are intermixed with Computer Science students. Thus, a wide spectrum of intellectual interest is present in each section.

As a one credit course, the amount of material that can be introduced is limited. Therefore, incorporation of the UW read program required adjustment to the normal curriculum.⁴ Specifically, the curriculum was altered in two areas. First, the requirement for the students to self select a research question for their term papers was modified to select from a list of research questions generated from *Longitude*³. Second, the Design Challenge was developed using a theme related to *Longitude*³. In addition, each fall the College of Engineering sponsors a homecoming lecture. In conjunction with the UW READ program, we were able to select a speaker with complementary thematic content. The following sections examine the impact of each activity on the freshman engineering program and assess that impact.

Longitude³

Dava Sobel's *Longitude*³ is the historical development of John Harrison's quest to design and build the world's chronometer to allow navigators to know their longitudinal position on earth. From an engineering perspective, the book had multiple benefits for inclusion in the freshman program. First, it follows product development from initial inception to completion, including development of numerous intermediate steps. Second, it can properly be classified as one of the world's first design competitions. Third, it is a classical comparison of a scientific solution, in this case an astronomical method of calculating longitude, and an engineering solution, the chronometer. These themes could be woven into the fabric of the course with both intellectual and visual clarity.

Information Literacy and the Freshman Research Paper

A critical element in the development of lifelong learning is the ability to posit and answer research related questions. To initiate this learning skill, freshman engineering students in ES 1000 "Introduction to Engineering" self select a "research question" for further investigation. They then prepare a three page "answer" to their question. As a minimum, the students must use three references; one from a peer reviewed journal, one from the popular press and one from an internet source. Instructors are careful to point out that journals found on internet sites may be different than a "Google" search and the students must be able to differentiate the sources they are using. Supplementing the research paper is a three page assessment of the sources they used to resolve their question. The assessment paper is the critical activity as the faculty members examine the response to determine if a student understands the value and merit of the source material.

The faculty assessment of the self selected questions has generally been favorable. Self selection of a research question generally motivates the student's interest in the topic. Faculty members are able to communicate concerns about the quality of their source material and students usually learn that they need more in depth research than they initially thought. Faculty assessment of the

papers did raise concerns about the students assigning themselves “softball” research questions or questions that they had a high personal interest but little engineering content. Thus, questions were screened by the instructors. The questions must be approved by the course instructor prior to initiating research, thus assuring some level of competence in the process.

This approach has been particularly useful when the students focus on areas of their major. It is additionally useful for undeclared engineering to explore research in one of the disciplines they are considering for a major. Assessment papers vary widely and allow positive feedback to students. As a minimum, the students become aware of resources on both the internet and the library and develop an embryonic comprehension of when additional research is needed.

Research Papers Based on *Longitude*³

With the selection of *Longitude*³, the College of Engineering had an opportunity to refocus the research question to complement both the READ program and the research objectives. Consequently, a list of approximately twenty questions were developed and provided to the students. The students could select a question from the list or submit a question based on *Longitude*³ for approval. Sample questions included:

The 1714 Longitude Act was a successful “Design Competition.” Identify a modern successful design competition and compare it to the trials described in *Longitude*.

Harrison and Maskelyne had a long ongoing battle on scientific merit. Identify another classical scientific battle, the protagonists and the outcome.

Adoption of the UW READ program into the Introduction to Engineering program produced alternative research questions and a slight variation in the approach to the project. The preselected research questions were developed by three of the ES 1000 instructors so the full assessment of the impact by all instructors was not undertaken.

One outcome of this change was that the students were far less comfortable with the topic, which necessitated additional research to develop an answer. There is anecdotal evidence that this approach develops a deeper understanding of research initiative than answering self selected questions. The evidence comes from library inquiries where one author (Schmidt) assists the students in finding critical information and from the paper evaluation and assessment by the second author (Dolan). Since the information is primarily anecdotal, the authors are developing a control study in the fall of 2006 where students in one section retain the opportunity for self selected questions and a second section receives prepared questions. This will allow direct comparison of the student effort.

Freshman Design Challenge

The annual design challenge was modified to incorporate the *Longitude*³ theme. Instead of having the students prepare a design project, the class participated in a GPS based “scavenger hunt.” The GPS challenge involved dividing each section into teams of up to four students.

Each team was given a handheld GPS unit and a set of initial longitudes and latitudes. The team had to locate the coordinates on campus, where they found a problem to be solved. Problems ranged from determining areas, and volumes, to finding titles of books in the library. The latter task gave the students the coordinates of the library (which at the University of Wyoming is underground). At those coordinates, a peer assistant gave the team a call number and the team had to find the title of the reference.

Results of the challenge were compiled and the students were given the statistical results of their findings. The actual areas and volumes, as determined by upper class students with surveying equipment, were compared to the mean and standard deviation of the GPS solutions. The exercise initiated a discussion of precision, repeatability and accuracy.

Overall this adaptation of the UW READ program was judged unsuccessful. While the students enjoyed the challenge and found the results interesting, they were not involved with any preplanning exercises. Thus, the challenge became a one shot – hit or miss – activity. This did not meet the global requirements of problem solving. Additionally, the challenge lent itself to one student with some GPS experience, controlling the group. Thus objectives of teamwork were compromised.

Homecoming Speaker

Complementing these activities, the college was able to recruit Mr. Joseph Anselmi of the Aerospace Corporation as a homecoming speaker. Mr. Anselmi has had the responsibility of positioning the GPS satellite system since the late 1970s. He has been involved in over 70 GPS satellite launches. He provided the students with a personal perspective of the launch, orbital maneuvers and final positioning of the GPS satellite system. The incorporation of an external speaker with noted expertise in the subject was well received.

Assessment and Conclusions

The introduction of the University of Wyoming freshman READ program offered an opportunity to adjust the information literacy component of the Introduction to Engineering course. The course was altered to integrate the reading, the design challenge and the fall homecoming speaker into a common theme. Selection of *Longitude*³ was particularly beneficial for the College of Engineering because it could be incorporated into existing curricula models. Initial assessment of the combined program suggests that the students benefited from the combined activities. More importantly, the authors noted a possible improvement in the level of critical analysis and content in the students writing assignment. This leads to our revised thinking of the assessment of freshman information literacy papers.

The selection of predefined questions as the topic of research papers allows the College to adapt the freshman READ program into the College of Engineering courses and assists in integrating the students into the entire intellectual community. Adapting the design challenge to the READ program proved to be less successful due to the inability to quickly adjust the program to meet the teamwork and problem solving objectives of the course. Addition of an expert speaker was beneficial.

In the fall of 2006 the authors intend to establish control two groups to compare the writing based on self direct research questions versus prescribed research questions. The prescribed questions will come from either the fall freshman reading program or from a set of control questions developed by the authors.

Poster Session

This paper is to be presented in a poster session. The poster session will vary from the paper in the following areas. First, the poster will include the full list of directed questions available to the freshman students. A shorter list of papers for an individual section is included to indicate how the program was reduced to allow oral team presentations. Second, the poster includes a description of the GPS course and the GPS problems that the students had to solve. Results of the GPS challenge will be provided. This is informational as the control of the competition was not sufficient to bring statistically valid conclusions but it does show how contradicting errors can provide correct answers. Lastly, photographic material from the student challenges will be included.

References

1. Ehrenreich, Barbara, *Nickel and Dimed*, Henry Holt, NY, NY, 2001, 256 pgs.
2. Bissinger, H. G., *Friday Night Lights*, De Capo Press, Cambridge, MA, 1990, 367 pgs.
3. Sobel, Dava, *Longitude, the True Story of a lone genius who Solved the Greatest Scientific Problem of His Time*, Penguin Books, NY, NY 1995, 184 pgs.
4. Dolan, Charles W., David L. Whitman, Thomas V. Edgar "Introduction to Engineering Program at the University of Wyoming" *Proceedings of the 2005 American Society of Engineering Education Annual Conference & Exposition*, American Society of Engineering Education, June, 2005