

STUDENTS INSTRUCT STUDENTS WITH THE WEST POINT BRIDGE DESIGNER

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1. INTRODUCTION

A nationally recognized, award winning, and free software package, the West Point Bridge Designer, is used as the basis for an assignment in a structural analysis class for engineering technology students. A Print Screen image of the software is shown in Figure 1. The assignment has college students work with a younger student in high school or middle school to complete the assignment. College students simulate structural analysis and bridge design with the software, adapting subject matter learned with pencil and paper in the classroom by using the computer program. The college students then teach the younger students how to use the software and design a bridge. The high school students compete for prizes with their designs when they enter both local and national contests. The college students are challenged to learn the subject matter and the software program more thoroughly since they have to teach someone else how to use it. Furthermore, the college students gain confidence in relating what they know to someone else. The high school students get a glimpse of what is done in a college class as well as the chance to win prizes. Additionally, the computer software and contests serve as outreach programs to generate younger student interest in science, engineering, and technology. All students benefit by using computer software technology much like an engineer would do in the work world. The interactive nature of the software program simulation drives the user to want to continue working with the program. The software program has many levels of difficulty from not only just the point & click of using a program, to simulating bridge design and creating a bridge that satisfies the design criteria, but also to the very challenging aspect of design optimization. It is incredibly challenging to design a bridge at a low cost. Students compare their efforts to anyone entered in the contest all over the world by viewing the contest scoreboards. College students write a report for the assignment. The assignment is termed a service learning assignment because the college students are required to serve some younger student in learning the software and entering the contest.



Figure 1.
Print Screen image of software

The essence of the assignment is for college students to collaborate with younger students. The assignment has been used during the past three course offerings. Undoubtedly there are ways the assignment can be improved. Reaction from colleagues has been positive. Student response to the assignment has been mixed. The learning achieved from the assignment has not yet been quantified. Outcomes from the assignment are characterized in qualitative manners. The intention is to continue to develop and use the assignment and eventually institute metrics to assess student learning.

2. ASSIGNMENT DETAILS

The assignment is a part of the class CET 283, Applied Structures II at Indiana University Purdue University Fort Wayne. This class involves subject matter usually associated with a course in strength of materials. There is a prerequisite course in statics. The course is required for students in the associate of science degree programs of architectural engineering technology and civil engineering technology. The assignment was developed by the author following participation in the ExCEED Teaching Workshop at the United States Military Academy at West Point in the summer of 2003. ExCEED is an acronym for Excellence in Civil Engineering Education.

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An assignment sheet is given to the students to explain the assignment requirements. The assignment sheet is included as Appendix A. The software is demonstrated to the college students during class. The assignment coincides with both a Local Contest event and the regular West Point Bridge Design Contest. The assignment is termed as a service learning assignment. The service aspect of the assignment is the college students working with the younger students.

3. OUTCOMES

Student submissions include the assignment sheet as a cover page and written responses to various questions. Each student makes an individual submission that includes total cost of the bridge they design and the bridge designed by the student team that they help. Some college students express frustration at having to work with someone outside of the class and some students have not completed the assignment. Student responses have been varied from very positive to very negative. The grading of the assignment is largely based on the lower cost bridge resulting in a higher grade. Additionally points are earned for teaching the younger student how to design a bridge at a lower cost than the college student's bridge. The cost of the bridges is recorded on an electronic scoreboard maintained at West Point. Students can view their bridge design and its standing in terms of all other entries in the local contest by viewing the local contest scoreboard. Thus, a student can put in extra effort to design a bridge at lower cost until that student sees their entry relatively high on the local contest scoreboard. An image of a contest scoreboard is shown in Figure 2.

Rank	Team Name	Members	School/Org	Location	Submitted...
1	The Numanorian	David	Iowa State University	Ames, IA	Wed, Jan 25, 2006, 9:12 PM
2	Brahma Physics	Matt	Douglas MacArthur H.S.	San Antonio, TX	Wed, Jan 25, 2006, 9:11 PM
3	viperline2002	David	—	Tampa, FL	Wed, Jan 25, 2006, 9:10 PM
4	OBSt_LaO	Edgar Robert	MO's Competition (former Mac Student)	San Antonio, TX	Wed, Jan 25, 2006, 9:22 PM
5	Edgewater	Michael	Edgewater High School	Orlando, Florida	Wed, Jan 25, 2006, 7:29 PM
6	Zephyros	Robert Kathryn	ASU (formerly MacArthur) Angelo State University	San Angelo, TX	Wed, Jan 25, 2006, 9:21 PM
7	WC Physics	Ginger	Winden Choctaw High School	San Antonio, Texas	Wed, Jan 25, 2006, 9:08 PM
8	Greyhoundx	Felix	Wilmington Area School District	New Wilmington, Pennsylvania	Wed, Jan 25, 2006, 9:13 PM
9	Strapped Out	Adam	Rochester Institute of Technology	Rochester, New York	Wed, Jan 25, 2006, 2:28 PM
10	PrairieMath	Daniel	Prairie High School	Prairie, Idaho	Wed, Jan 25, 2006, 5:52 PM
11	ididistix	Rebecca Justin	— Home Educated	—	Wed, Jan 25, 2006, 5:33 PM

Figure 2
Contest Scoreboard

Students have expressed mixed sentiments about the assignment. A majority of students seem to accept the assignment much like any other assignment. Some students get very interested in the assignment, devote much time to it, and actively seek to optimize their design. A few students have expressed great discontentment with the assignment even to the point of refusing to complete the assignment or the part of the assignment that requires them to work with a younger student.

Other faculty have generally commented that the assignment is a good assignment. In particular, Colonel Steven Ressler, Professor at the United States Military Academy at West Point and the creator of the West Point Bridge Designer software, has stated, through e-mail communication with the author, that the assignment is a good assignment and has invited this author to share the assignment with others. It is not yet apparent that any other instructor has adopted this assignment though. The assignment is not practical at the United States Military Academy because the student cadets do not have contact with younger age students. The major frustration expressed by CET 283 students is the difficulty in finding a younger student to work with. At times an open computer lab on campus has been arranged and the general public invited to attend a training session on how to use the software. CET 283 students who had difficulty finding a younger student staffed the computer lab during this time. Although more student interest in the assignment was initially anticipated, that has not yet occurred.

4. CONCLUSION

Continued use of this assignment is planned by the author when teaching CET 283. Improvements to the assignment are being investigated. Consideration is being made to help CET 283 students find younger students by arranging visits to high school classes or youth groups. The author would like to encourage other instructors to use such an assignment and report the outcomes in an e-mail or through a similar publication or presentation. A formal quantitative assessment of the learning achieved by the assignment is a desired future improvement to the assignment.

REFERENCES

West Point Bridge Design Contest, website, <http://bridgecontest.usma.edu/>, last accessed the 25th January 2006.

Appendix A Assignment Sheet

CET 283, Spring 2004
Service Learning Assignment

Write your name on the back of this sheet

- Access the WWW, navigate to <http://www.ipfw.edu/bridgecontest/>, and read the information on this web page.
- From the above URL, click on the link to the West Point Bridge Design Contest and become familiar with the resources of the West Point Bridge Design Contest website.
- Download the West Point Bridge Design software and design a bridge.
- Register yourself as a team (a 1-person team with a name-CET 283, for example Bridge-CET 283) in the West Point Bridge Design Contest. Enter the Local Contest Code of "IPFW" during the registration process. You are not eligible for awards but will be entered in the open competition for both the national contest and the local contest. You may work with other students in creating your design. However, each student must register as an individual. Do this before 3 April 2004.
- Write the team name you selected in the registration process: _____-CET 283_____
- Write the cost of the bridge you designed: _____
- Find one or two persons, at least 13 years old and not yet graduated from high school.
- Assist this person/these people in designing their own bridge using the software and assist them in entering the local contest. Do this before 3 April 2004.
- Write the team name of those who you assisted: _____
- Write the cost of the bridge this team designs: _____
- Write responses to these questions:
 - How useful was the information on the WWW?
 - How did you design your bridge? (be specific to matters pertaining to structures)
 - How did you assist others in their bridge design? (again be specific to structures)
 - Did you improve your understanding of any subject matter of structures, if so what subject or subjects, how, in what manner and to what degree?
 - What new information did you learn from this assignment?
 - What comments did those who you assisted make?
 - What do you think those who you assisted learned from this experience?
 - Was this assignment interesting or fun for you and for those who you assisted?
- Hand in this sheet and your responses to the questions in class on Wednesday 7 April 2004. Late assignments will not be accepted.

Your grade for this assignment is based on:

- | | |
|-----------|--|
| 10 points | your design in the bridge design contest (lower cost, more points) |
| 10 points | your efforts in assisting others with design (lower cost than your bridge) |
| 10 points | a complete and well written response to the questions |