Walking on Water Term Design Project in Fundamentals of Engineering

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Walking on Water Term Design Project in Fundamentals of Engineering Course

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This Complete Evidence-based Practice paper outlines the benefits of incorporating a challenging team design term project in a first-year engineering course for students majoring in electrical, bio, mechanical, and students who have not declared a major. The course provides core engineering knowledge and competencies in a highly interactive course format. Topics include professional skills such as technical writing and presentation, guidelines for professional engineering practice, and career preparation.

In this three credit-hour course, an engineering approach to problem solving is taught with an emphasis on teamwork, communication (oral and written), creativity, ingenuity, coding, and computer-aided design tools. The instructional approach used in this course involves freshman engineering students as active participants in the learning process. Project based learning involves implementing projects with hands-on tasks, well-defined outcomes, multiple solutions to a given problem, and linking science and engineering concepts.

One of the signature assignments in the course is the "Walking on Water" (WOW) team-based design challenge. Students form design teams. They learn the systematic design process and design verification methods. This introductory design experience culminates with a review and presentation of design and a technical report. This project forms a structured introduction to the implementation of principles of design and engineering methodologies, project management, and presentation skills. Teams must design a system that propels a single person (the "operator") across the length of the university's swimming pool with a walking or running motion entirely above water. The project is open ended in the sense that students are allowed to creatively design and fabricate a system that satisfies the requirements. This has encouraged pluralistic thinking wherein students are free to come up with any working design. They are not bound by a commonly encountered right/wrong philosophy.

Teams learned important lessons about the transition from conception to implementation. One of the most important outcomes of the course was learning to work in teams. At the end of the course, each team was assessed on quality of design and team efficacy. The students developed their professional socialization skills while preparing technical reports and PowerPoint and poster oral presentations. On the last day of the program, students presented their group projects.

We report on a 9-year exercise conducted using the WOW project including detailed student feedback from the most recent year.

1. Introduction

Engineering design is defined as the communication of a set of rational decisions obtained with creative problem solving for achieving certain stated objectives within prescribed constraints [1]. The role of design in an engineering curriculum is a key factor contributing to its success [1].

Engineering design projects provide students with a broad view related to the material presented in lectures. Through project-based learning, students are encouraged to assume responsibility for their learning experience and to shift from a passive to an active learning style [2,10,11,12,13].

Multiple active learning projects and hands-on activities are incorporated in our Fundamentals of Engineering course to provide active learning environment to incoming freshman students. This course is required for first-semester engineering students at Fairfield University. A key factor is the heterogeneous nature of the students taking the course, namely, electrical, bioengineering, mechanical and undeclared engineering students.

One of the signature assignments is the "Walking on Water" (WOW) team-based design project challenge. Students form design teams by choosing their teammates and then learn the systematic design process and design verification methods. This introductory design experience culminates with a review and presentation of design and a technical report. This project forms a structured introduction to the implementation of principles of design and engineering methodologies, project management, and presentation skills. Teams must design a system that propels a single person (the "operator") across the entire length of the School's swimming pool with a walking or running motion entirely above water [3].

This Evidence-based Practice paper describes the development and implementation of the "Walking on Water" team-based design challenge and the results of the survey administered at the completion of this project.

2. Course Overview

As the number of first-year engineering students has been increasing, so has the need for experienced faculty. In order to accommodate this trend, the course is team-taught to allow for continuous training of new faculty, as well as to incorporate regular faculty feedback into the ongoing process of improvement. We continuously measure the effectiveness of the course including its annual improvements. The four sections of the course were recently taught by four faculty with the aid of four Teaching Assistants (TA) who previously took the course.

First-year engineering courses are subject to a variety of forces in defining their purpose. Each course goal has been carefully chosen *a priori* and linked to ABET accreditation aligned course outcomes. The goals of the course are: (I) Create a passion for engineering. (II) Develop an engineering mindset, problem-solving skills, and critical thinking. (III) Develop engineering professionalism. Each course outcome links to one of those goals [4]. These outcomes, which are also linked to ABET defined student outcomes, are used to define and measure the success of each activity and learning module of the course [5]. A process of continuous improvement of active learning techniques to achieve each course goal and demonstrate each outcome has resulted in the effective development of our first-year engineering students [6].

While WOW is intended to equip students with skills that are useful in a classroom setting, it is also intended to give students a glimpse into the real world. The project was designed to meet the following learning objectives:

Learning Objective 1: Learn to work in interdisciplinary teams.
Learning Objective 2: Learn about project and time management.
Learning Objective 3: Learn to identify, formulate and solve engineering problems.

Two signature assignments are used as primary performance indicators in course outcome attainment. Those are the short research paper (approximately two pages long) with its oral presentation (approximately five minutes long), and the team-based design challenge with its team presentation. These assignments are significant as they also replace traditional exams in the course. They weigh heavily in determining student grading, as well as outcome attainment.

The main components of the course

- *Discussion of the undergraduate engineering curriculum at Fairfield University:* Faculty guest speakers from each engineering department provided an overview of their engineering disciplines and job opportunities.

- *Individual Technical Writing:* The first major writing project was an individual technical writing (ITW) assignment. Each student selected the topic of his/her choice. This project's main objective was to demonstrate effective technical writing. The specific content was not important. Students were required to use several library resources. They referenced journal articles, technical books, and internet sources, and were required to demonstrate proper technical citation using the IEEE citation style. For most students, this was their first experience with technical writing. They quickly realized that it was different from the writing they had done before in high school English, history, and other non-technical courses. Furthermore, they went through a writing revision process in which their paper went through three iterations of review: self, peer, and instructor review. All reviews were done prior to the final grading of the paper [7].

- *Individual Oral Presentation:* The second project, early in the semester, was an individual oral presentation (IOP) of the ITW paper. This project's objective was to demonstrate effective oral communication of technical content. A lecture focusing on effective oral presentation techniques was presented to demonstrate effective oral presentations. Students presented their IOP in the class [8].

- *Writing Assignments:* Writing assignments (WAs) were chosen as an assessment method to demonstrate students' improvements in technical writing. Individual writing assignments included topics ranging from "Explain how something works" to "Reflect on your speaking skills". Specific content was not as important as demonstrating mastery of writing skills. For example, the first writing assignment was: Understand the roles of engineers in different fields and different industries in a global, economic, environmental, and societal context. Students were asked to interview an engineer and to discuss these topics. It did not matter which field, role, or industry they investigated. [9].

- *Descriptive Statistics Activity:* The topics covered in this lecture include mean, standard deviation, linear regression, significant figures, and measurement techniques. Following this lecture, the teams worked on a mini project in which they experimentally determined the gravitational acceleration using a string, a rock, a cell phone, and a meter stick. This project requires the measurement of time, frequency, and length. Students practiced measurement techniques and applied descriptive statistics (mean, standard deviation, and linear regression).

Team Design Project

The final project was an end-of-semester Team Design Project (TDP).
Students were challenged to design a device with which they can "Walk on Water" (WOW). The design goal was to travel the length of the university swimming pool in a walking or running motion above water. Students were placed in teams of five and were given five weeks to complete the project. At the end of the semester, all four course sections (total of 81 students) participated in the WOW design competition. They competed in first-round heats, semi-finals, and finals to determine the winner. The winning team in the most recent year used parts of a bicycle to create a paddleboat type device. Other devices included beach ball on PVC pipe frames, a human hamster wheel, muffin tin shoes, huge foam shoes, the whale tail design, and foot pump, foot flipper, and ski type propulsion (Figure 1). The event was advertised to Fairfield University students and faculty and the bleachers were packed with fans. The WOW event was a great success and fun for all. While fun and engaging, the project was none-the-less very serious. Students were clearly informed that to pass the assignment, they had to have a device that could traverse the length of the pool and meet all specifications (copy of the assignment and rubric is given in Appendix 1). This forced the students to identify and solve many problems, as well as manage the project wisely.

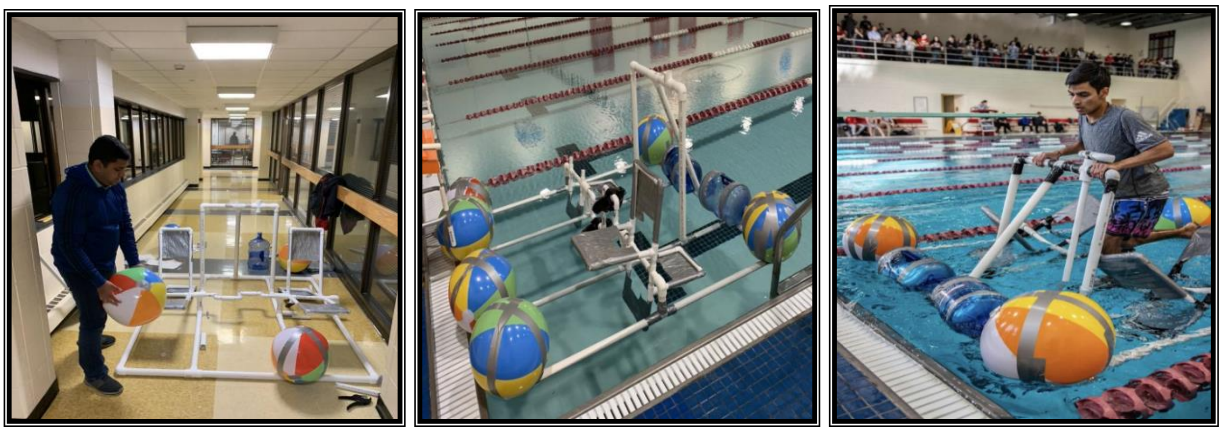

Figure1: Walking on Water - A design project from construction to competition

Assessing Design Practices

Evaluation of student performance in the TDP challenge is difficult, and somewhat subjective. Student feedback in the first years indicated a need for a more transparent evaluation method. Early iterations involved instructors meeting to holistically evaluate all teams at once, and assign grades based on reaching common consent.

Through continuous improvement, we built on student feedback to develop a transparent method of evaluating the design challenge. We decided, for consistency, to implement a simple check sheet style rubric for evaluation of demonstrated design thinking and project management skills in the team-based design challenge. Skills are either demonstrated, or they are not.

The same design challenge and criteria are given to each team in the course, and all are asked to design a solution that will be competitive against the other teams. Our chosen challenge is the TDP. This challenge presents the team with a specific scope, design criteria defining success, a budget, and a strict deadline that must be met, all which are key components of a project.

We again met as a team of instructors to decide which categories were most important in both the design and the team presentation. Within each of those categories, more factors were identified for those categories deemed most important, to increase the respective weight. The categories were chosen to define the aspects of the design process that we were looking to assess: creativity, performance in competition, engineering design cycle, project management, and presentation. This rubric resulted in 25 factors, plus up to 5 points for actual objective performance in the competition event, for a total of 30 points. Some elements of the TDP rubric were assessed on the day of competition, such as novelty of the design, and following competition rules (design criteria).

However, other aspects were assessed during the team presentation. For example, project management had to be demonstrated with photos in the presentation, by documenting the design, the build and the test phase. Project management roles that team member assumed, such as the budget manager, and communications manager were described. The TDP rubric was given to students as part of the TDP assignment, so they were well aware in advance of all grading criteria. This rubric allowed us to clearly define, why a particular grade was earned, instead of the previous subjective, holistic approach.

Although the student poll of rubric effectiveness (see appendix 2) indicates that only 52% of respondents Agreed or Strongly Agreed that they found the TDP rubric effective at assessing the engineering design process. Only 53% of respondents Agreed or Strongly Agreed that they

found the TDP rubric to be an accurate method of grading their project and presentation. We, however, found this new TDP rubric to be effective in helping students meet the desired outcome. Of the 16 teams, 95% exceeded the minimum threshold of 70% for satisfactory performance. In fact, the lowest grade was an 80%. The faculty was satisfied with the achievement of all teams, with no major weaknesses in any of the desired skills. Student feedback regarding the rubric will be considered for implementation in next year's course.

Course Outcomes

Data were collected at the end of the Fall 2019 semester using Blackboard. All students from the four sections of the Fundamentals of Engineering course participated.

Achievement of course outcomes has been tracked through quantitative assessment for continuous improvement and accreditation purposes. In previous years students consistently met the performance threshold of 70% for these assessments. In the Fall 2018 semester, student averages were 84% on ITW, 86% on the IOP, and 87% on the TDP. Well above the desired threshold, with 93% or more of students meeting the desired threshold on all three assessments. With implementation of the new rubrics, student outcome attainment increased. In fall 2019, Students averaged 87% on the ITW, 84% on the IOP, and 92% on the TDP. These scores were well above the 70% minimum performance indicator for ABET assessment, with 95% of students meeting or exceeding the threshold. Outcome attainment has been better than satisfactory, while student satisfaction with the course has at the same time improved.

These attainments can be compared with the first-year assessment of these items. At that time average score on the ITW was 88%, IOP was 90%, and TDP was 80%, with 5% of students not meeting the threshold for the ITW and IOP, but with nearly 20% of students not meeting the threshold for the TDP. Acceptable levels of attainment have improved since the first year, especially considering that the expected cognitive level of the ITW and IOP have increased by demonstrating critical thinking.

Achievement of WOW outcomes has been tracked through quantitative assessment for continuous improvement and accreditation purposes (Appendix 2). The results are summarized as follows:

- 78.66% of the students agreed that the WOW project has increased their interest in engineering.
- 68.00% of the students agreed that the WOW project has increased their motivation to study engineering.
- 81.33% of students agreed that the hands-on experience with the WOW project has caused their interest in engineering to increase.
- 57.33% indicated that the hands-on experience with the WOW has caused their confidence in their ability to succeed in engineering to increase.
- 84.00% indicated that the WOW project has caused their understanding of engineering design to increase.
- 78.66% of students agreed that the WOW project has caused their appreciation of teamwork to increase.

- 52.00% agreed that the TDP rubric was effective at assessing the engineering design process that their team followed.
- 68.00% agreed that they are more likely to continue to pursue a degree in engineering, due to their experience with the WOW project.

Student Feedback

In addition to quantitative feedback, we also collated anecdotal comments. Students were asked to discuss the WOW project and other course assignments with the instructor in a classroom feedback session and to provide suggestions for change. The instructors will subsequently consider this feedback for change in the next iteration of the course. One of the survey questions was: "What is the best aspect of WOW – What is your most memorable aspect of the WOW project?"

A few of the responses are shown below (students' words):

> *Watching something I built make it across the length of the pool.*
>
> *The racing part since it shows the creativity of everyone.*
>
> *Working with teammates to design and build the machine.*
>
> *Having the opportunity to build and design a device. I have always loved to build things, so I was very excited to do the Walk on Water project.*
>
> *The most memorable aspect was the test trials and learning from the mistakes on our design*

It is noteworthy that 81.33% of the participants agreed that the hands-on experience with WOW has increased their interest in engineering. The student comments further suggest that the WOW project met the learning objectives for students exploring engineering and thus gaining interest in engineering.

It is interesting to note that several students requested in their feedback additional technical specifications for WOW. Another important suggestion was to provide students with more tools (power drills, saw, glue guns, hammers, screw drivers) for implementing the final design project.

A few other suggestions stood out (students' words):

> *More time to work on the WOW project.*
>
> *The instructor should start the project a little earlier. Also, funds for supplies should be provided by the University.*

Student feedback, in addition to faculty observations, will be considered for implementation in next year's course.

Conclusion

This paper presented a detailed description of the design component of the Fundamentals of Engineering course. The Team Design Project and several mini projects were developed in order to teach the design component of the course. The projects introduced students to basic concepts of engineering design and project management. Completion of the team-based design project is an essential requirement.

Survey results demonstrated positive student support of the design project and also highlighted areas for additional consideration related to the activities of the course. The results of this study show continued success in achieving course and TDP outcomes.

We believe that the experiments reported here would help our colleagues who work on course development at different universities. Further details may be provided upon request.

References

[1] Sohail Anwar, Todd Batzel, Ed Sell. Integration of Project-Based Learning into A Freshman Engineering Design Course. Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition.

[2] Fabien, Brian and Vereen, Keona. Implementing a Freshman Engineering Design Experience at the University of Washington. 3rd International Conference on Higher Education Advances, HEAd'17, Valencia, 2017.

[3] Daniel Raviv. Hands-on Activities for Innovative Problem Solving. Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition.

[4] ABET student outcomes. http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2017-2018/#outcomes

[5] Engineering Accreditation Commission. (2011). Criteria for Accrediting Engineering Programs. Baltimore, MD: ABET

[6] Siegel, C. Putting the Pieces Together: Linking Learning Outcomes, Assessment, and Curriculum. Center for Academic Excellence: Summer Institute on Integrative Learning. Fairfield University.

[7] D. Belfadel, R. Munden, M. Arambulo, M. Zabinksi, and James Cavallo. Use of the Arduino Platform in Fundamentals of Engineering. ASEE: Annual Conference and Exposition, Tampa, Florida. June 2019.

[8] R. Munden, M. Arambulo, D. Belfadel, and M. Zabinksi. Assessment of Critical Thinking and Design practices in Fundamentals of Engineering. ASEE Annual Conference and Exposition, Salt Lake City, Utah. June 2018.

[9] M. Eodice, A.E. Geller, and N. Lerner, The Meaningful Writing Project. Logan, UT: Utah State Univ. Press, 2017.

[10] J. Kellar, W. Hovey, M. Langerman, S. Howard, L. Simonson, L. Kjerengtroen, L. Sttler, H. Heilhecker, L. Ameson-Meyer, and S. Kellogg, “A problem-based learning approach for freshman engineering,” in 30th Annual Frontiers in Education Conference (FIE), Feb. 2000.

[11] H. Lei, F. Ganjeizadeh, D. Nordmeyer, and J. Phung, “Student learning trends in a freshman-level introductory engineering course,” in 2017 IEEE Global Engineering Education Conference (EDUCON), April 2017, pp. 152–156.

[12] L. A. Meadows, R. Fowler, and E. S. Hildinger, “Empowering students with choice in the first year,” in 2012 ASEE Annual Conference & Exposition, San Antonio, Texas, Jun. 2012.

[13] L. L. Wu, R. M. Cassidy, J. M. McCarthy, J. C. LaRue, and G. N. Washington, “Implementation and impact of a first-year project-based learning course,” in 2016 ASEE Annual Conference & Exposition, New Orleans, LA, Jun. 2016.

Appendix 1: Team Design Project

Walking on Water (WOW) Competition

Design Criteria/Goal:

Teams must design a system that propels a single person (the "operator") across the entire length of the University swimming pool with a walking or running motion above water.

Design Constraints/Rules:

1. All systems must fit in single regulation sized swimming lane.
2. Total project cost must not exceed $100 (each student is responsible on her/his share). However, no materials or funds are provided so it is encouraged that you find spare, unused, and recycled materials to work with (include their fair market value in the budget).
3. If the operator falls into the water, they must either: (a) get back up in that location unassisted or (b) return to the start and have their team help them remount.
4. Absolutely no cardboard or paper can be used in the design of the WOW system. Be considerate and do not use any materials that could potentially cause damage to pool drains.
5. The operator must be able to swim, and we highly recommend that you wear a helmet.
6. You may not use any detached accessory to steer, propel or balance. No pushing off the side. Do not hold on to anything other than your system for balance. Any violation will result in starting over (your time will not be restarted). Do not use the lap ropes for any reason.
7. You must be in the standing position (walking or running position). You can use your arms for balance.
8. You must propel yourself with your feet and legs only. You may not use your arms to propel yourself.
9. Time will be calculated from when the buzzer sounds until the front of your system touches the opposite wall. Mounting and dismounting do not count as part of your time.
10. Bicycle frames are restricted in the interest of creativity this year! No whole bicycle frames can be used, though parts may be scavenged.

Any student judge or instructor can determine if your team is violating a rule or Design Goal at any time.

Designing/Building/Testing:

- Pool times for testing during the week prior to the event will posted on Blackboard.
- Visit the pool to survey the area for obstacles like starting blocks (starting position), diving boards (finishing end), narrow hallways, doorways, etc. before designing. Get any measurements you need.
- We can provide you space to build your WOW systems, but space is limited. You may want to use common areas in your dorms, but please get permission first.
- You may want to take advantage of trips home to find and gather materials and supplies that you might need.
- Please be in good communication with instructor about your needs as far as tools are concerned. We have some available and there is also a Machine Lab that you can use under

supervision.
- Materials can be procured from any location, but you are responsible for transportation. There is a Campus Shuttle Fairfield Home Depot on Saturdays. Campus vans are also available. Contact the instructors to schedule a day.

Project Deliverables:

1. WOW System

On the day of the competition:

- You will take a photo of your WOW system and your entire team (before the start) and include the photo in your presentation
- We will check and evaluate your system before, during, and after the competition.
- Your team must abide by all rules of the project and the competition. To get a passing grade on this project, you must satisfy the Design Goal.
- Your team MUST return your WOW system to your work area for breakdown and recycling/disposal.

Due: Saturday, November 16, 2019 by 1:00pm

2. Team Design Project Presentation

During the class following competition:

- 15 minutes team presentation of your project to the class
- In your presentation please include graded WOW system criteria above, photos of all aspects of the process, explain your design process, technical explanations of why things worked, and try to incorporate all topics that were covered in class.

PowerPoint Slides Uploaded on Bb by: 11/24/19 at 11:30am

Presentation given: 11/25/2019 in regular class time

TDP Grading Rubric

Creativity

- Novelty of design
- Used materials in a new way

Performance

- Followed all competition rules
- High Quality Craftsmanship
- Performance in Competition (0 – Did not meet design goal, 1-5 based on best time)
    - 5 pts + Bonus 1 pt– less than 1 min [0,1)
    - 4pts – 1 - 2.5 min [1,2.5)
    - 3pts – 2.5 – 4.5 min [2.5, 4.5)
    - 2pts – 4.5 – 6 min [4.5, 7.5)
    - 1pts – 6+ min [7.5, 15]

Engineering Design Cycle

- Demonstrated Problem Solving approach
- Showed consideration of multiple concepts or ideas
- Described the Engineering Design Cycle by showing iterations, drawings, calculations, etc.
- Showed evidence of material testing, component testing, and final design testing prior to competition day

Project Management –

- Stated project goal
- Articulated series of steps or processes to achieve goals
- Determined, procured, and optimized all resources needed
- Created and maintained budget
- Demonstrated that the project goal was met
- Each Team member held a project management role

Presentation Skills

Organization

- There is a logical sequence to the topics
- Lessons-learned are clear

Visuals/Slides

- Slides clearly convey the message
- There were no technical errors in the slides
- Images/Figures/Text were clear

Timing

- Stayed within total allotted time
- Each presenter contributes equally to the presentation

Speaking

- The students did not read from notes excessively while speaking
- Spoke fluently, without hesitation, excessive interruption, or fillers

Nonverbal Communication

- Maintained eye contact with the audience
- Used gestures or laser appropriately

Appendix 2 – WOW Student Survey Fall 2019

WOW Fall 2019		
True/False	**I understand that my choice to complete this survey will not affect my grade.**	
	Answers	*Percent Answered*
	TRUE	97.26%
	FALSE	1.37%
	Unanswered	1.37%
True/False	**I am voluntarily participating in this survey.**	
	Answers	*Percent Answered*
	True	94.666%
	False	2.666%
	Unanswered	2.666%
Multiple Choice	**Overall, the WOW project has increased my interest in engineering.**	
		Percent Answered
	Strongly agree	26.666%
	Agree	52.00%
	Neither agree nor disagree	14.666%
	Disagree	2.666%
	Strongly disagree	4.00%
	Unanswered	0.00%
	Sum of Agree and Strongly Agree	**78.66%**
Multiple Choice	**Because of my experience with the WOW project, I am more likely to continue taking courses toward a degree in engineering.**	
		Percent Answered
	Strongly agree	34.666%
	Agree	33.333%
	Neither agree nor disagree	24.00%
	Disagree	6.666%
	Strongly disagree	1.333%
	Sum of Agree and Strongly Agree	**68.00%**
Multiple Choice	**The hands-on experience with the WOW project has caused my interest in engineering to**	
		Percent Answered
	Increase a lot	28.00%
	Increase	53.333%
	No change	16.00%
	Decrease	1.333%
	Decrease a lot	1.333%
	Unanswered	0.00%
	Sum of Agree and Strongly Agree	**81.33%**
Multiple Choice	**The hands-on experience with the WOW project has caused my confidence in my ability to succeed in Engineering**	
		Percent Answered
	Increase a lot	21.333%
	Increase	36.00%
	No change	32.00%
	Decrease	8.00%
	Decrease a lot	2.666%
	Unanswered	0.00%
	Sum of Agree and Strongly Agree	**57.33%**

Multiple Choice	**The WOW project has caused my understanding of engineering design to**	
		Percent Answered
	Increase a lot	25.333%
	Increase	58.666%
	No change	13.333%
	Decrease	1.333%
	Decrease a lot	0.00%
	Unanswered	1.333%
	Sum of Increase and Increase a lot	**84.00%**
Multiple Choice	**The WOW project has caused my motivation to study engineering to**	
		Percent Answered
	Increase a lot	20.00%
	Increase	48.00%
	No change	24.00%
	Decrease	6.666%
	Decrease a lot	1.333%
	Unanswered	0.00%
	Sum of Increase and Increase a lot	**68.00%**
Multiple Choice	**The WOW project has caused my appreciation of teamwork to**	
		Percent Answered
	Increase a lot	34.666%
	Increase	44.00%
	No Change	10.666%
	Decrease	9.333%
	Decrease a lot	1.333%
	Unanswered	0.00%
	Sum of Increase and Increase a lot	**78.66%**
Opinion Scale/Likert	**Was the TDP rubric effective at assessing the engineering design process that my team followed**	
		Percent Answered
	Strongly Agree	18.666%
	Agree	33.333%
	Neither Agree nor Disagree	18.666%
	Disagree	24.00%
	Strongly Disagree	4.00%
	Unanswered	1.333%
	Sum of Increase and Increase a lot	**52.00%**
Opinion Scale/Likert	**Was the TDP rubric an accurate method of grading my TDP project and presentation**	
		Percent Answered
	Strongly Agree	17.333%
	Agree	36.00%
	Neither Agree nor Disagree	26.666%
	Disagree	16.00%
	Strongly Disagree	4.00%
	Unanswered	0.00%
	Sum of Increase and Increase a lot	**53.33%**