

Full Paper: Re-imagining a first year design course to incorporate service-learning while minimizing traditional challenges

First Year Engineering Experience

Rowan University

July 25th, 2018

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Outline

- Introduction
- Original structure of Foundations Lab
- New structure of Foundations Lab
- Design process for “New Foundations”
 - Phase 1: Individual ideation and planning phase
 - Phase 2: Group action phase and design decisions
 - Phase 3: Fabrication and evaluation phase
- Example project: minimization of challenges
- Course evaluation (Gelmon, 2001)
- Conclusion

Re-imagining “Foundations Lab”

Foundations of Engineering Lab (EGN3000L): First year, interdisciplinary course for introduction to the profession and engineering design.

- 12 sections of 45 students each. Each department teaches 2 sections.
- 1 credit hour course meeting once per week for a 75 minute period

Service-Learning: The incorporation of collaborative community relationships to accomplish objectives. Students should reflect on their experiences and the value of reciprocity should be emphasized. A symbiotic relationship should exist between the community or community partner and the students towards the mutual benefit of all

Course Evaluation: What is the effectiveness of the newly created service-learning first year engineering design course at the University of South Florida?

- Previously, this course taught 4-5 unrelated projects with no real-world tie-in
- The new service-learning course provides a choice between five service-learning projects. Students choose one project for the term.

Re-imagining “Foundations Lab”

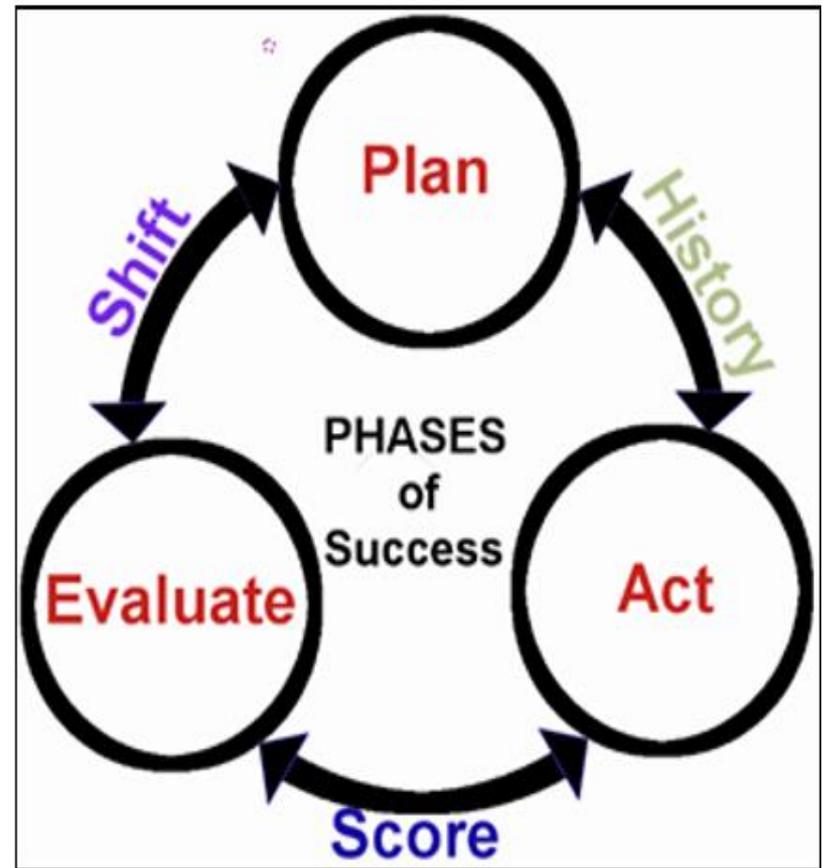
Service-Learning: The incorporation of **collaborative** community relationships to accomplish objectives. Students should **reflect** on their experiences and the value of **reciprocity** should be emphasized. A symbiotic relationship should exist between the community or community partner and the students towards the **mutual benefit of all** (Lima, Oakes, & Gruender, 2006)



Service-Learning: The incorporation of collaborative community relationships to accomplish objectives. Students should reflect on their experiences and the value of reciprocity should be emphasized. A symbiotic relationship should exist between the community or community partner and the students towards the mutual benefit of all.



Design Process Clustering



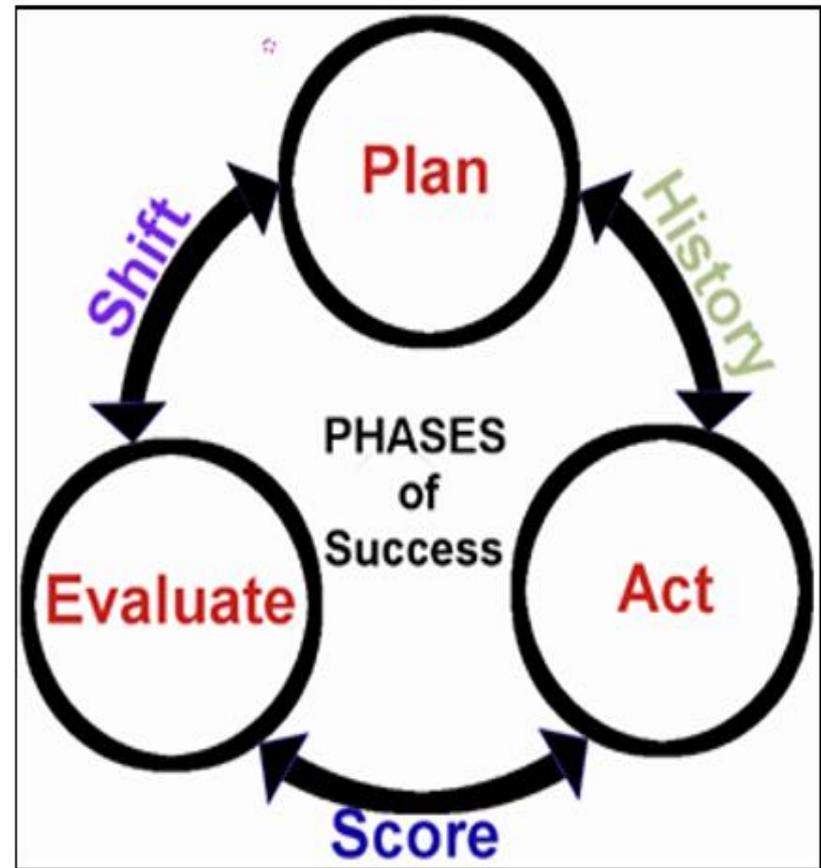
Design Process Simplified

Phase 1. Individual Ideation phase and group assignment:

- Students pick a project choice and use CAD to flesh out potential solutions
- Student groups are assigned based on project choice and what their ideas are
- Both as an individual and a group, students complete steps 1-3
- **Design Review 1:** hosted on USF campus for partner collaboration in design



Design Process Clustering



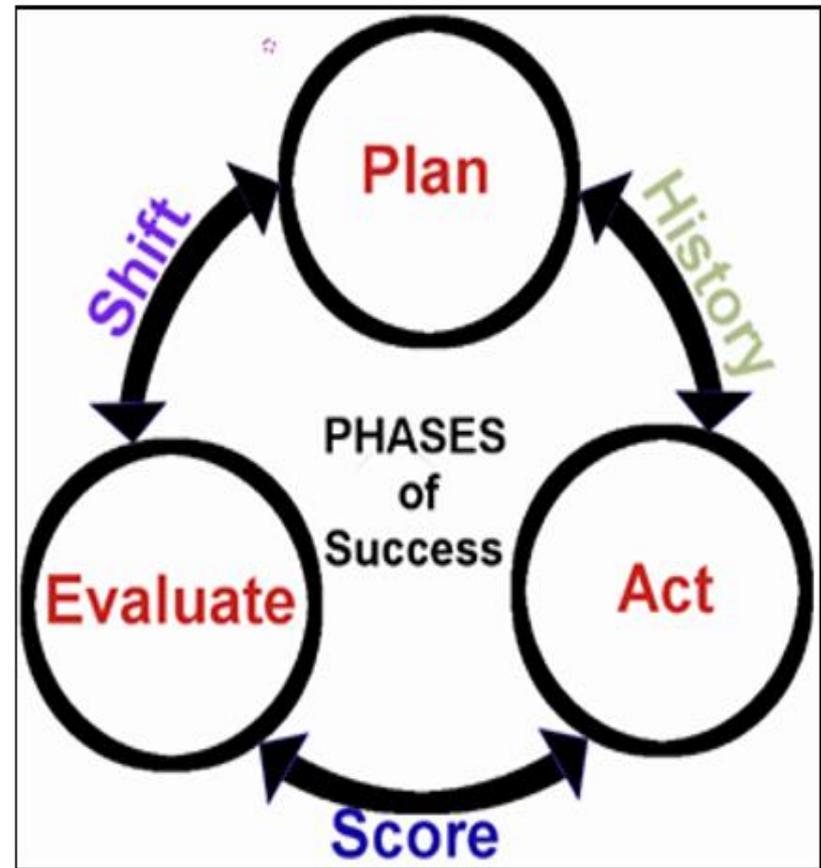
Design Process Simplified

Phase 2. Group action phase and design decisions:

- Groups combine their individual ideas into two candidate designs
- Group members adapt individual roles as they prepare for fabrication
- **Design Review 2:** Groups work with community partner to finalize plans
- Using tools such as a Pugh diagram, groups choose a design to fabricate



Design Process Clustering



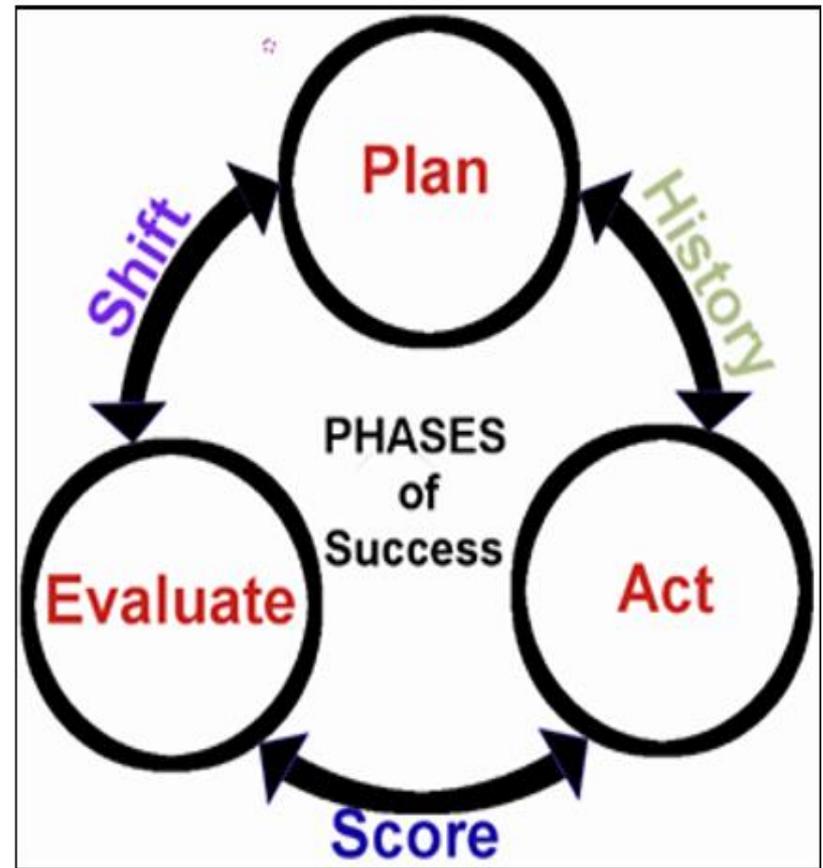
Design Process Simplified

Phase 3. Final project fabrication, testing, and showcase for community partner:

- The final product ideas are developed to prepare for fabrication
- The product is fabricated using rapid prototyping tools such as 3D printers
- Educational materials are created showing how to make and use the product
- **Showcase:** The final product and educational materials are presented

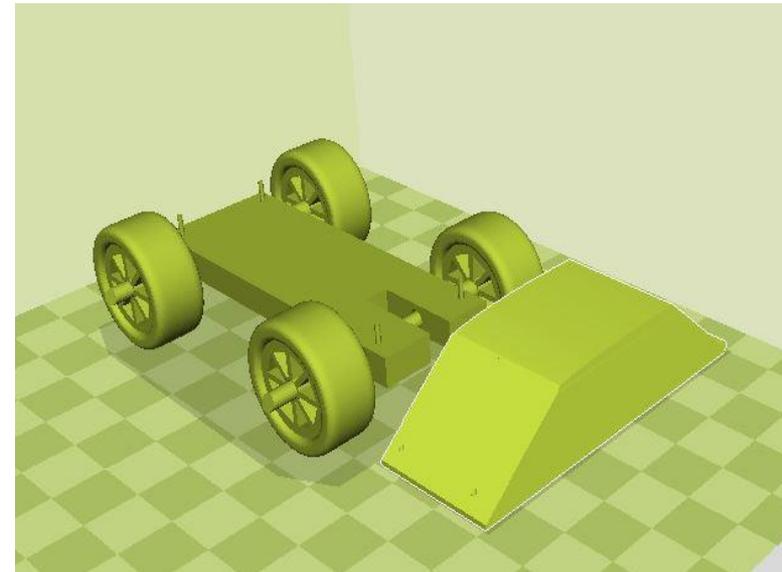
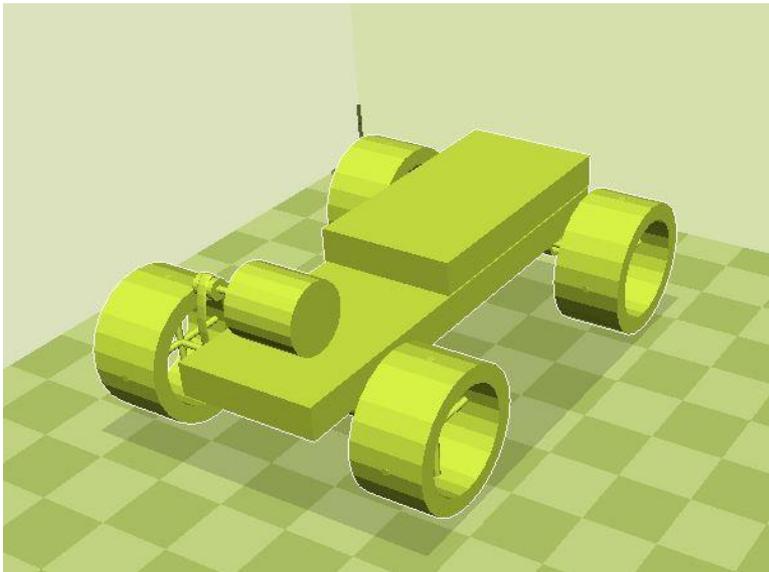
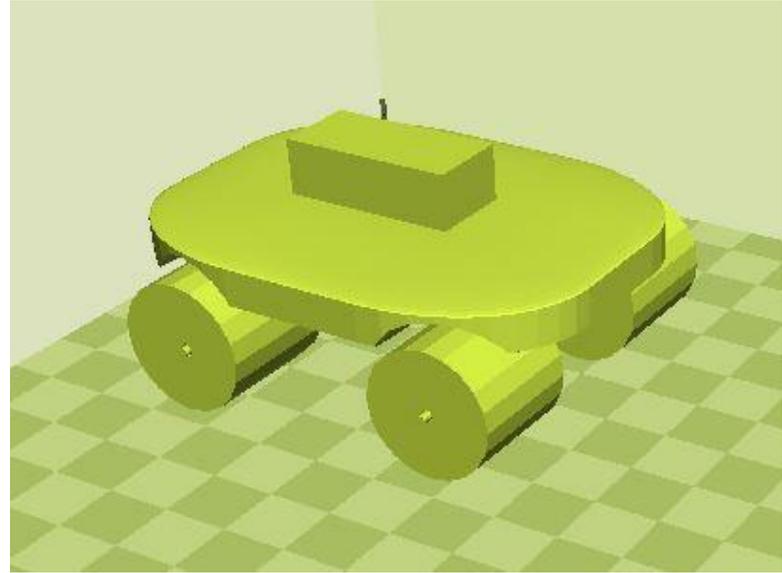
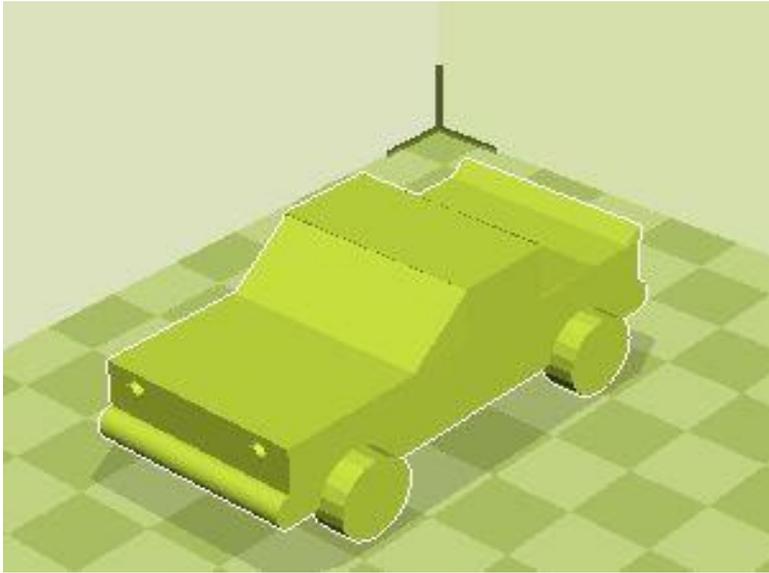


Design Process Clustering



Design Process Simplified

Phase 1: Individual Exploration



Phase 2: Group Action

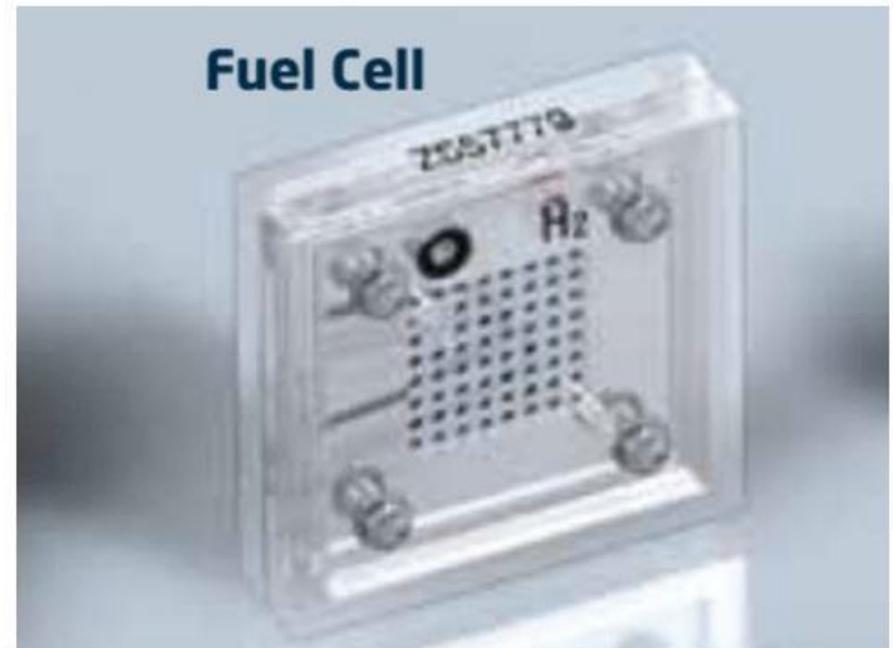
Introduction to the Project

How a Fuel Cell Works

- Splits water into Hydrogen and Oxygen
- Fuel cell recombines gases to make fuel

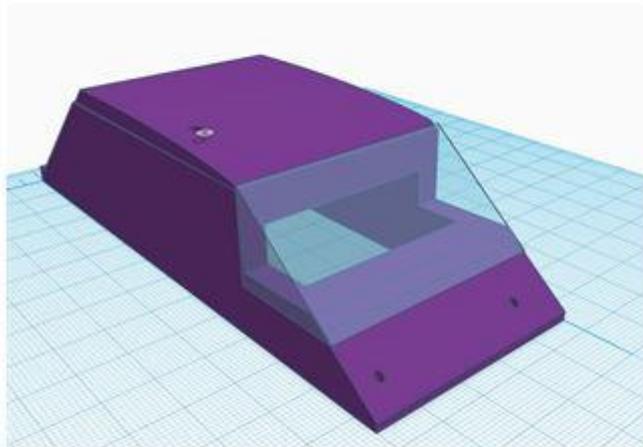
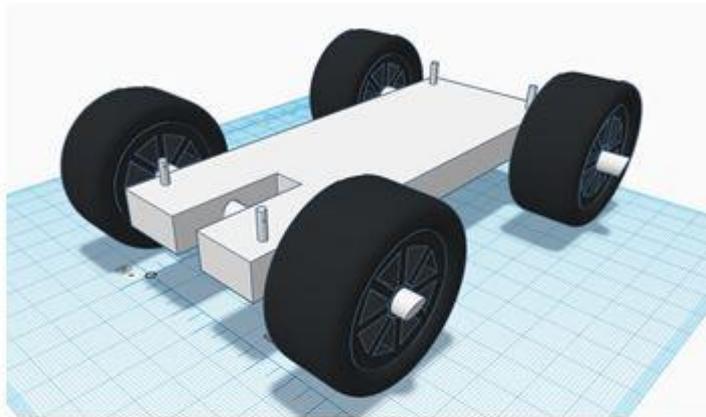
Limitations of Our Project

- Distilled water
- Requires outside power source
- Size
- Knowledge of 3D printing/
TinkerCad



Phase 2: Group Action

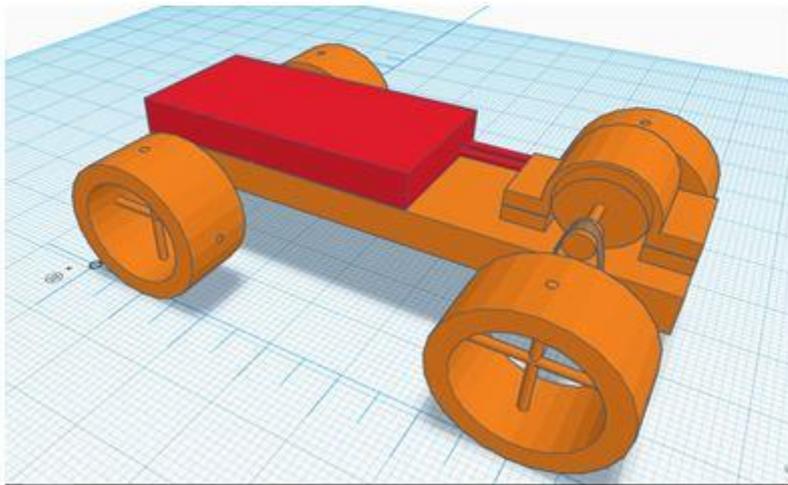
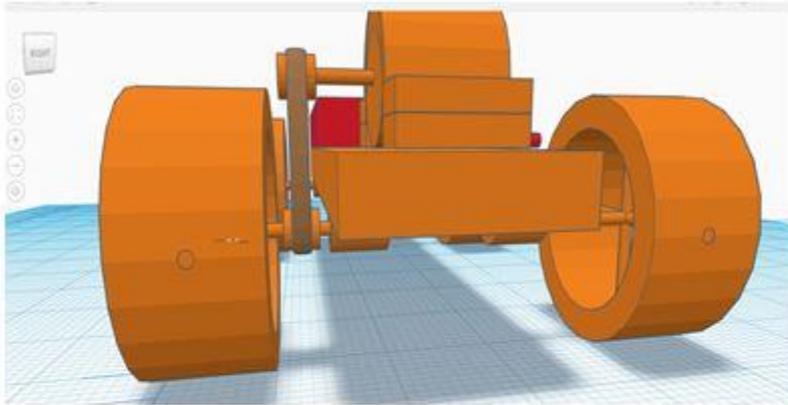
Candidate Design 1



- Looks Nice
- No Functionality
- Has Protective Covering

Phase 2: Group Action

Candidate Design 2



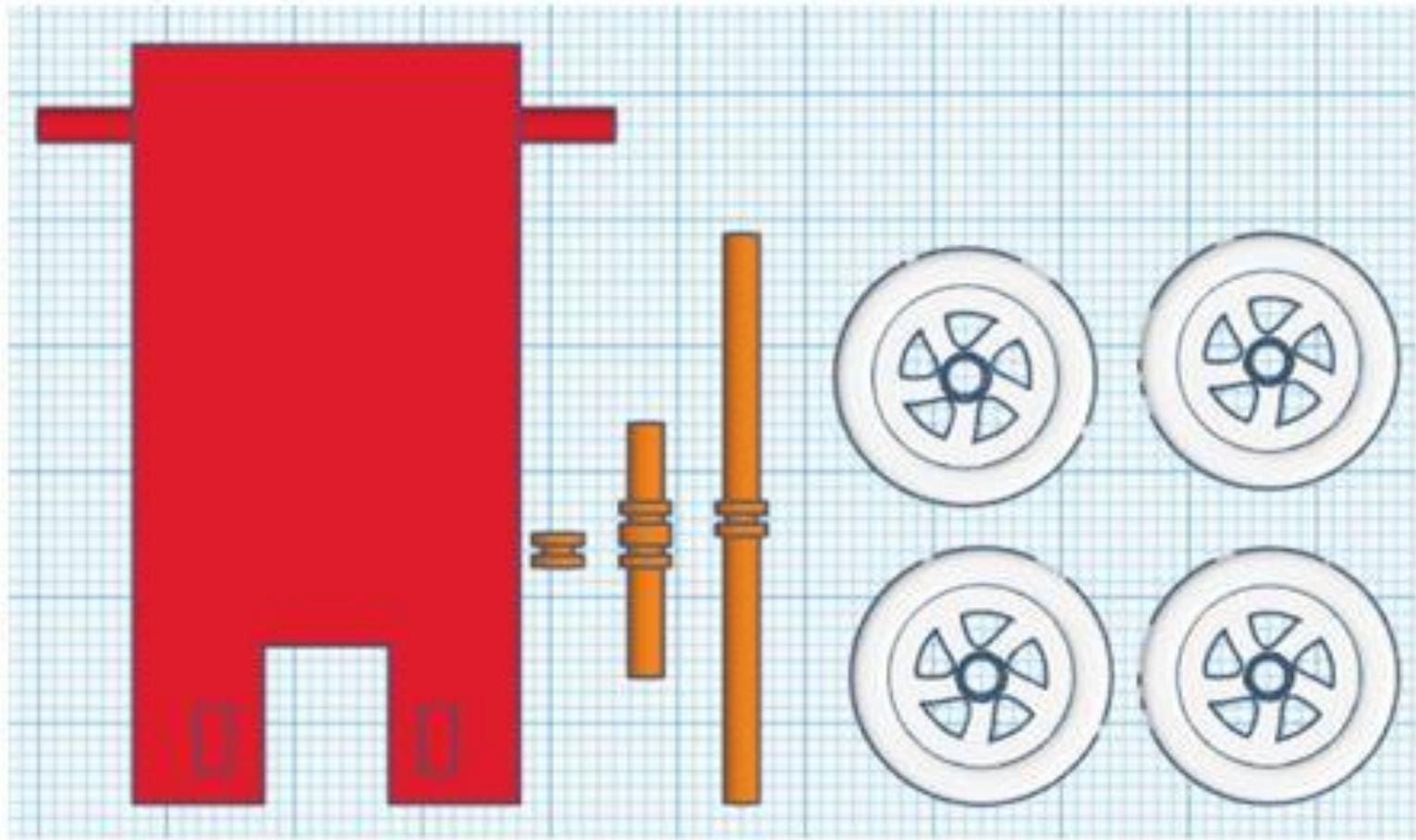
- Rear wheel driven
- Belt driven
- Mount for motor

Phase 2: Group Action

Weighted Benefit Analysis

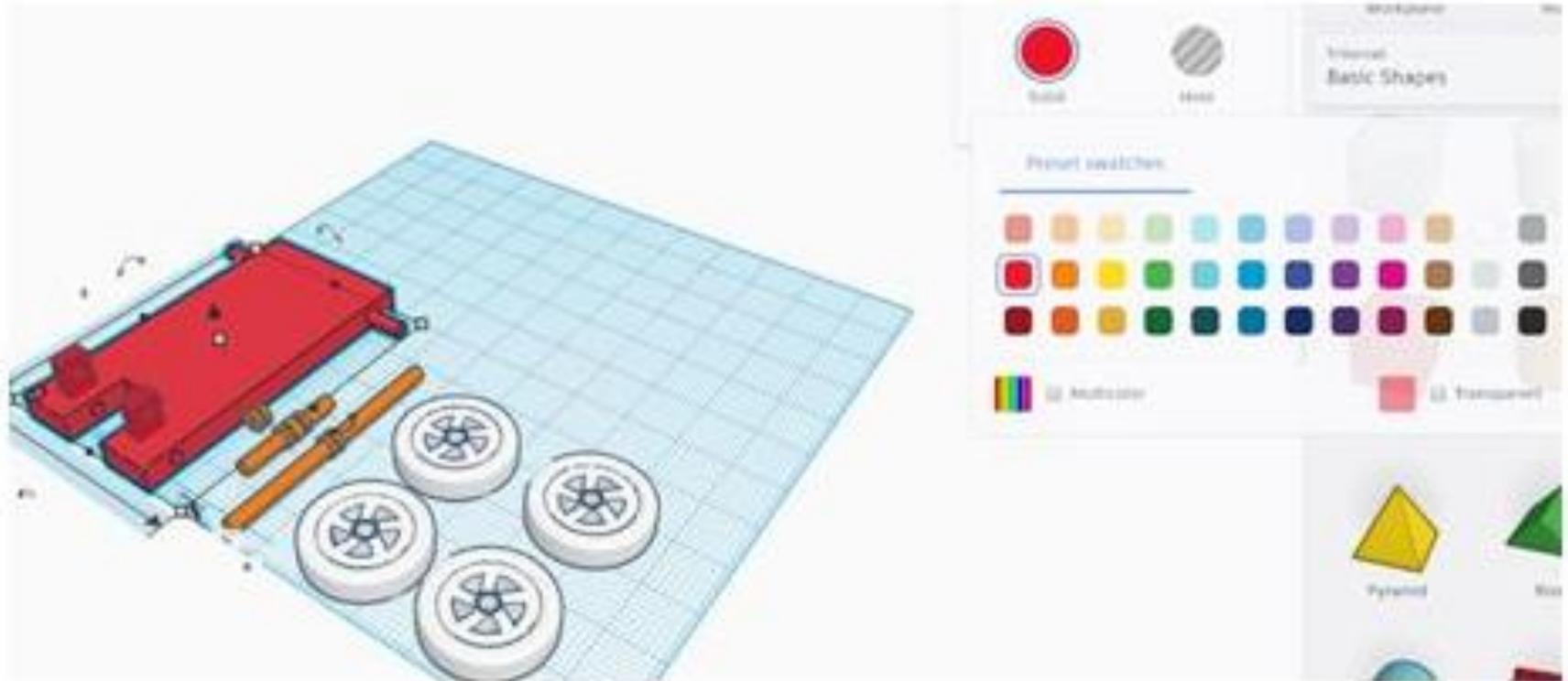
Customer Need	Reliable	Simple	Time Efficient	Safe	Constructive Learning	Affordable	Portable	Total
Weight	10	9	7	10	6	9	5	
Design 1	0	10	10	10	5	9	8	411
Design 2	9	7	6	5	9	6	7	388
Design 3 (Combined)	9	6	7	9	10	7	9	451

Phase 3: Fabrication and Evaluation

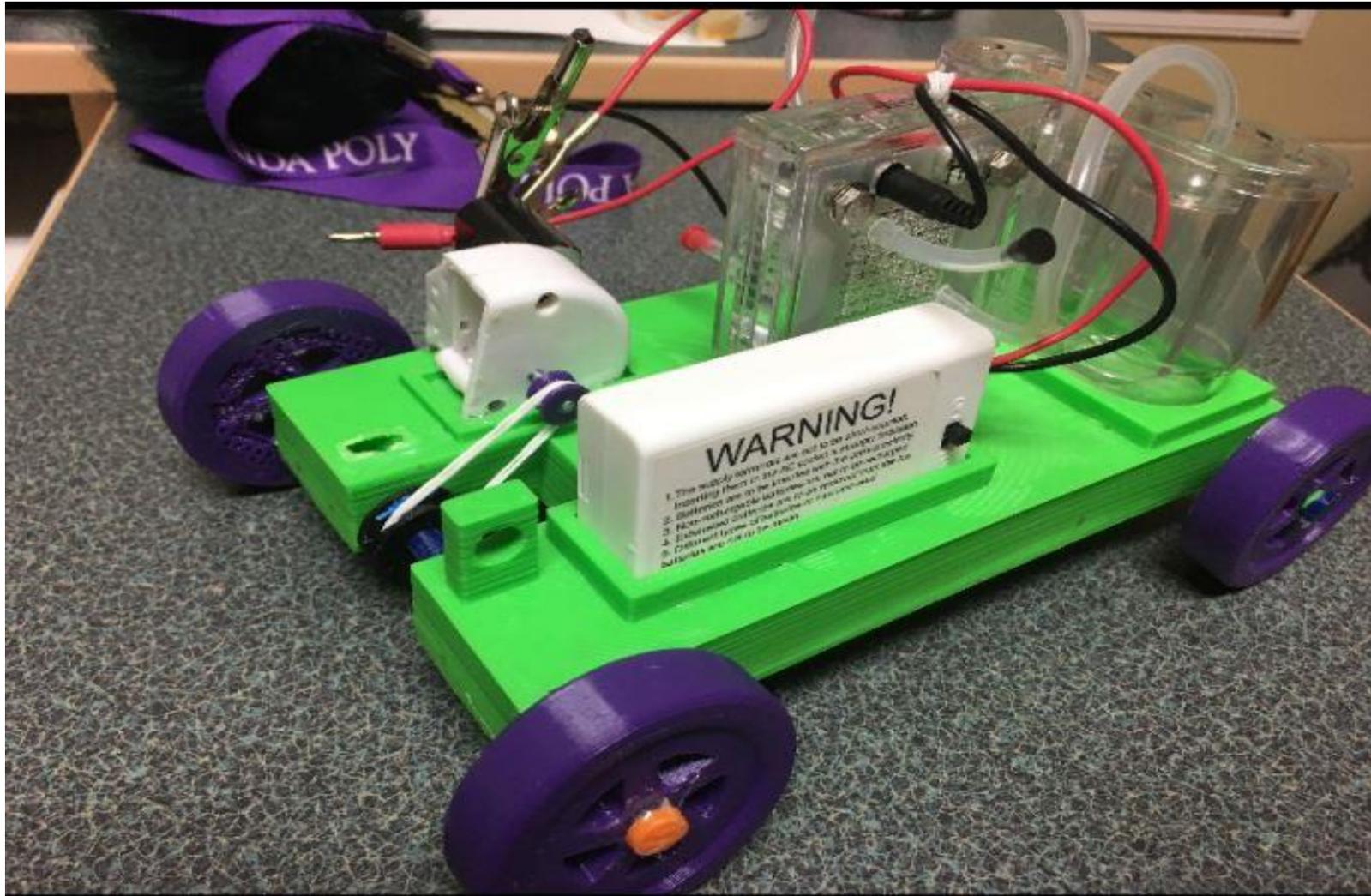


Phase 3: Fabrication and Evaluation

To change the colors of any piece of the car, simply right click the piece in mind, and in the upper right-hand corner a box will appear with two circles. Click on the one that says solid and choose the color. Be sure not to click on the circle that says hole, as it will essentially make the piece disappear. If you wish to upgrade the design or change it in any way, go to the learn tab and get some practice with the software.



Phase 3: Fabrication and Evaluation



Service-learning survey results

- To evaluate the course effectiveness, students were given Gelmon (2001) service-learning pre- and post- surveys
 - Survey was 23 questions and scored based on a 5 point Likert scale (SA, A, N, D, SD)
 - 60 students completed the pre- and post- surveys.
 - The pre- and post- survey results were analyzed using an Anova single factor analysis with Alpha = 0.05 to check for statistical significance
- Subsets of questions are presented by theme

Service-learning survey results

I have a responsibility to serve my community.

Most people can make a difference in their community.

I can make a difference in my community.

From Pre-Post- Survey; Gelmon (2001)

The idea of combining service in the community with university coursework should be practiced in more classes at this university.

I would like to enroll in additional service-learning courses at USF.

The community service aspect of this course helped me to see how the subject matter I learned can be used in everyday life.

The community service aspect of this course helped me to develop my problem-solving skills.

This service-learning course helped me become more comfortable working with people different from myself.

The community service I performed in this course helped me learn how to plan and complete a project.

Participating in the community helped me enhance my leadership skills.

I feel I would have learned more from this course if more time was spent in the classroom instead of in the community.

I feel that the community service I did through this course benefited the community.

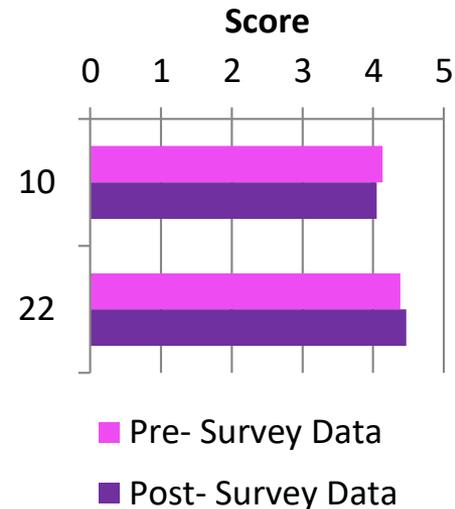
The community service involved in this course helped me to become more aware of the needs in my community.

The community service involved in this course made me more aware of my own biases and prejudices.

Service-learning survey results

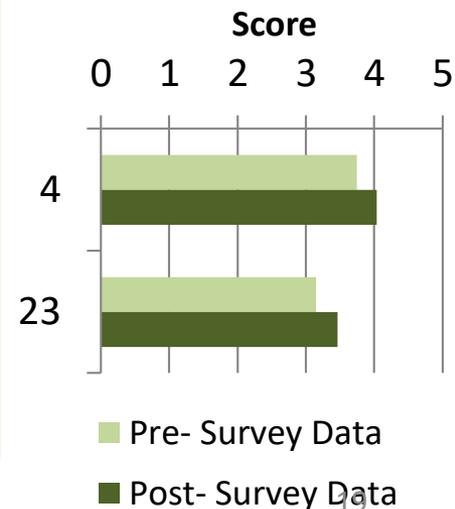
I have a responsibility to serve my community.
Most people can make a difference in their
community. (10)

I can make a difference in my community. (22)



The idea of combining service in the (4)
community with university coursework should
be practiced in more classes at this university.

I would like to enroll in additional service-
learning courses at USF. (3)



Service-learning survey results

I have a responsibility to serve my community.
Most people can make a difference in their
community. (10)

I can make a difference in my community. (22)

High

Agree Pre &
Agree Post

The idea of combining service in the (4)
community with university coursework should
be practiced in more classes at this university.

I would like to enroll in additional service-
learning courses at USF. (3)

Statistically
Significant

Increase

Paired t-test

Service-learning survey results

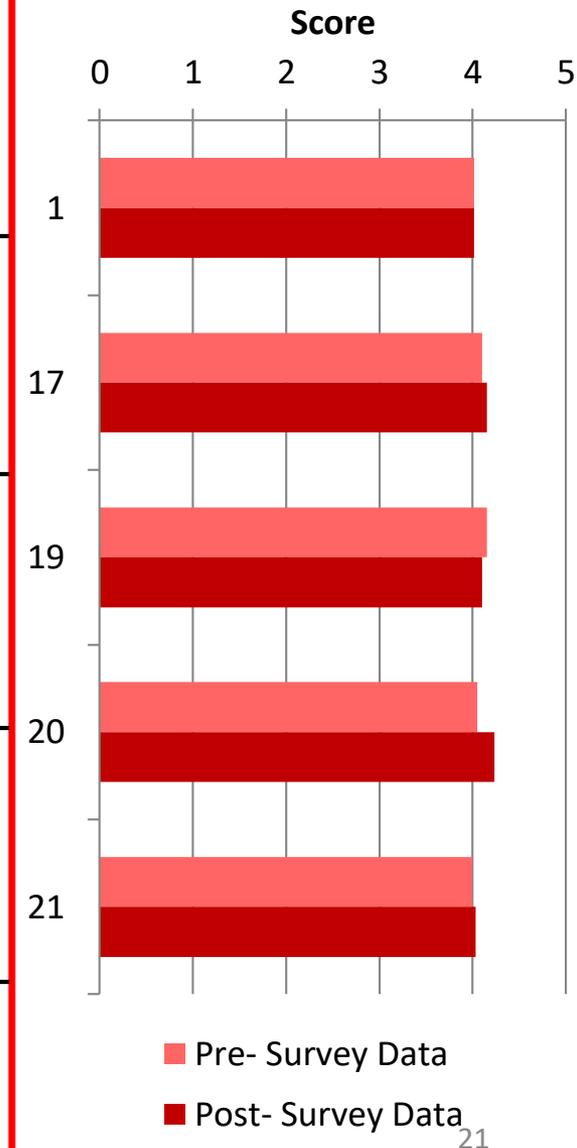
The community service aspect of this course helped me to see how the subject matter I learned can be used in everyday life. (1)

The community service aspect of this course helped me to develop my problem-solving skills. (17)

This service-learning course helped me become more comfortable working with people different from myself. (19)

The community service I performed in this course helped me learn how to plan and complete a project. (20)

Participating in the community helped me enhance my leadership skills. (21)



Service-learning survey results

The community service aspect of this course helped me to see how the subject matter I learned can be used in everyday life. (1)

The community service aspect of this course helped me to develop my problem-solving skills. (17)

This service-learning course helped me become more comfortable working with people different from myself. (19)

The community service I performed in this course helped me learn how to plan and complete a project. (20)

Participating in the community helped me enhance my leadership skills. (21)

High

Agree Pre &
Agree Post

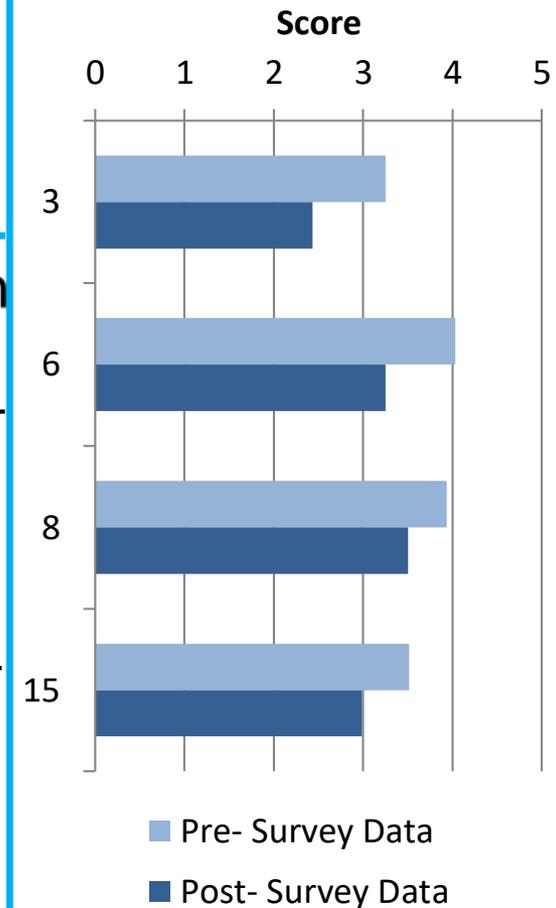
Service-learning survey results

I feel I would have learned more from this course if more time was spent in the classroom instead of in the community. (3)

I feel that the community service I did through this course benefited the community. (6)

The community service involved in this course helped me to become more aware of the needs in my community. (8)

The community service involved in this course made me more aware of my own biases and prejudices. (15)



Service-learning survey results

I feel I would have learned more from this course if more time was spent in the classroom instead of in the community. (3)

I feel that the community service I did through this course benefited the community. (6)

The community service involved in this course helped me to become more aware of the needs in my community. (8)

The community service involved in this course made me more aware of my own biases and prejudices. (15)

Statistically
Significant
Decrease
Paired t-test

Service-learning survey results

The service I performed in the community enhanced my ability to communicate in a “real world” setting. (16)

The work I accomplished in this course has made me more marketable in my chosen profession when I graduate. (14)

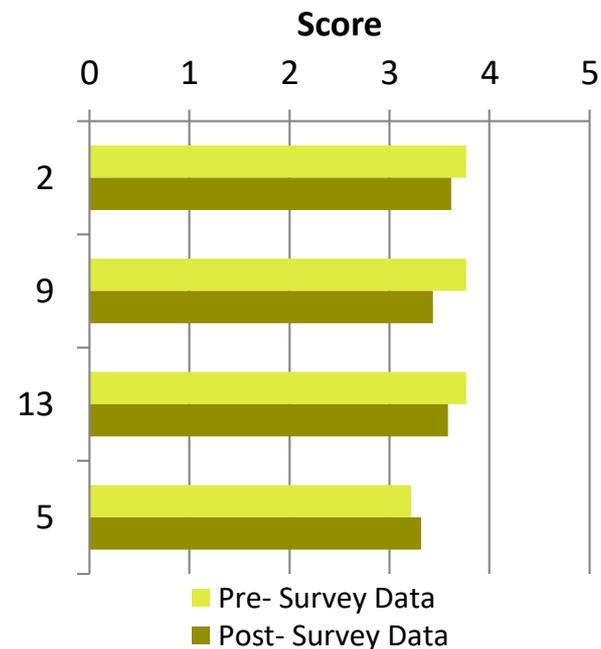
I probably will volunteer or participate in the community after this course. (7)

The community service I did through this course helped me to better understand the lectures and readings in this course. (2)

My interactions with the community partner enhanced my learning in this course. (9)

The community service I performed in this class enhanced my relationship with my professor. (13)

I was already volunteering in my community before taking this service-learning course. (5)



Service-learning survey results

The service I performed in the community enhanced my ability to communicate in a “real world” setting. (16)

High for Pre-
Slimly under High for Post

The work I accomplished in this course has made me more marketable in my chosen profession when I graduate. (14)

Slimly under High for Pre
Slimly under High for Post

I probably will volunteer or participate in the community after this course. (7)

The community service I did through this course helped me to better understand the lectures and readings in this course. (2)

My interactions with the community partner enhanced my learning in this course. (9)

Not sure for Pre
Not sure for Post

The community service I performed in this class enhanced my relationship with my professor. (13)

I was already volunteering in my community before taking this service-learning course. (5)

Next Step/Unresolved Questions

How could service learning be done so Freshman students confidently believe it enhances their communication in “real world” settings, makes them more marketable upon graduation, and more willing to volunteer in the future?

The service I performed in the community enhanced my ability to communicate in a “real world” setting.

High for Pre-
Slimly under High for Post

The work I accomplished in this course has made me more marketable in my chosen profession when I graduate.

Slimly under High for Pre
Slimly under High for Post

I probably will volunteer or participate in the community after this course.

Next Step/Unresolved Questions

How important is it for service-learning to convince students that it can be used to understand course content, increase relationship with professor, or improve likelihood for future civic engagement?

The community service I did through this course helped me to better understand the lectures and readings in this course.

My interactions with the community partner enhanced my learning in this course.

The community service I performed in this class enhanced my relationship with my professor.

I was already volunteering in my community before taking this service-learning course.

Not sure for Pre
Not sure for Post

Next Step/Unresolved Questions

Should the approach to service learning be adjusted to give students more of a feeling that they benefited the community/ made more aware of community needs, personal bias and/or prejudice?

I feel I would have learned more from this course if more time was spent in the classroom instead of in the community.

I feel that the community service I did through this course benefited the community.

The community service involved in this course helped me to become more aware of the needs in my community.

The community service involved in this course made me more aware of my own biases and prejudices.

Statistically
Significant
Decrease

Conclusion

- A service-learning first year course was designed
- The course was implemented in three phases
 - “Individual Planning” phase
 - “Group Action” phase
 - “Fabrication and Evaluation” phase
- 60 of 90 students participated in a course evaluation using Gelmon (2001) pre- post- test
 - Students expected and “received” project skills
 - Students were not convinced that they helped others
- Community partner role may be revisited in the future

Questions?