Introduction

Background: The “Scholars of Excellence in Engineering and Computer Sciences” (SEECS) program was established in 2008 at Gannon University, funded by the National Science Foundation (NSF) Scholarships in Sciences, Technology, Engineering and Mathematics (S-STEM) program. SEECS has been funded through three consecutive awards. The current award period started in 2017 and will run until 2021.

Motivation: All students must participate in a community-based design project, nominally a two-year effort. Some projects have experienced significant setbacks:
1. original project sponsor de-committed at the end of the first year due to funding concerns
2. project location changed multiple times due to uncertain sponsor requirement and city regulations
3. design itself has required substantial alteration several times due to external factors

Goal: This work examines the evolution of student perceptions of the validity of the project, compares that evolution to historic data obtained from previous design groups, and speculates about the cause/effect relationship between externally-imposed design changes and student perceptions. In particular, the effect of design changes on student enthusiasm and sense of purpose is to be examined.

Projects Descriptions and Change of Scope

Project 1 – Green Power Generation and Distribution Center Design
Cohort: sophomore class
Goal: engineer a device that will harness mechanical energy produced by exercise machines to store, convert and distribute electrical energy to an external source
Location: Gannon University Recreation and Wellness Center

Project 2 – Renewable Energy Power Station
Cohort: junior class
Goal: set up a renewable energy station to harvest wind and solar energy into electricity and store it for later use
Location: changed multiple times
Note: scope of the project has also been changed along with the evolving of the location

Project 3 – Pennsylvania Soldiers’ and Sailors’ Home Artifact Display Unit
Cohort: senior class
Goal: design and build a case to protect and display historical military artifacts
Note: minimal evolution in the requirements

Methods

- Survey all the students active in the program
- The survey was developed based on the goals of the study, with several rounds of review and revision to ensure that the questions would be interpreted as intended
- Paper copies of the survey were distributed to all students for different phases of the projects
- Survey data was analyzed using standard methods while written comments were analyzed using open coding in order to identify common themes

Results and Discussions

- Project 1: Change of scope has affected students negatively in all parameters.
- Project 2: Initially very positive perceptions. By second year, all parameters were negatively affected. This group experienced the greatest change in scope and location.
- Project 3: This group experienced the least change in scope and customer requirement and displayed the steady increase of all parameters as might be expected due to project progress.

Qualitative students’ comments
- Project 1: Lack of interest and direction from the stakeholder has contributed negatively to the perception of the value of the project
- Project 2: 71% mentioned the changes of scope as the reason to the decrease in enthusiasm. 57% stated that the project started with a high value to the community but the current usage will be limited
- Project 3: 80% stated “…it got more exciting and we could see the project coming together.”

Conclusions and Future Directions

The preliminary results provide evidence that large-scale changes in the scope of a design project may affect student motivation, enthusiasm, group dynamics, and the perception of value. A longitudinal study will be continued to obtain data to support this hypothesis. The end goal is to identify ways to mitigate these effects to ensure a better student experience.

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