

Board 294: HSI Implementation and Evaluation Project: The Freshman Year Innovator Experience (FYIE): Bridging the URM Gap in STEM

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HSI Implementation and Evaluation Project: THE FRESHMAN YEAR INNOVATOR EXPERIENCE (FYIE): BRIDGING THE URM GAP in STEM

The Freshman Year Innovator Experience (FYIE) program at The University of Texas Rio Grande Valley, a Minority Serving Institution (MSI), aims to enhance the freshman experience for incoming students by developing key academic success skills. The program is developing self-transformation skills in freshman mechanical engineering students to help them overcome academic and professional challenges exacerbated by the COVID-19 pandemic. FYIE participants are taking two courses simultaneously: Introduction to Engineering (Course A) and Learning Frameworks (Course B). In Course A, students will complete a 6-week engineering design project, and in Course B, they are completing a 6-week academic career path project. During these parallel projects, timed interventions demonstrate the analogies between the engineering design process and the academic career pathways project. The objective is for students to realize that they can apply the design thinking skills they learn in the engineering design process to solve their academic career challenges. A pilot of the FYIE program began in the 2023 Spring semester, with instructors from Course A and B introducing the parallel projects. The pilot continues in the 2023 Fall semester, with refinements to the parallel projects and the definition of analogy intervention points for self-transformation. The authors of the paper will present the results from the pilot implementations, as well as discuss the challenges and future work. This proposed initiative is designed with the intention of adhering to the ongoing mission of the College of Engineering and Computer Science (CECS) at the UTRGV to 1) increase the number of STEM degrees awarded to Hispanics, 2) broadening participation of females in STEM related fields, and 3) increase the persistence and self-efficacy in STEM fields amid COVID-19. This project is funded by NSF award 2225247.

Introduction

One of the difficulties for freshman engineering students is transitioning to college. According to past studies, the first year of college represents the most critical students' academic success, particularly because it is where the support networks with their colleagues, faculty, and academic resources are developed that will help them be successful during the undergraduate curriculum [16]. However, a lot of students do not know how to start building these networks, who to look for, or how to proceed to experience academic success. In order to ease this transition, we propose that incoming students are exposed to the engineering design innovation process, which can be applied, by analogy, to the design of their academic and career pathway. For example, a good comparison is that engineers, considered as designers and innovators, use multiple techniques, tools, and approaches to develop new technologies. This idea allows a parallelism to be established to the "design" of the students' academic career pathways.

The objective of this pilot study is to: 1) present the progress on the project supported by NSF award 2225247, and 2) assist freshman engineering students to realize they can apply the design thinking skills they learn in the engineering design process to solve their academic career challenges. In addition, a pilot study of the FYIE program began in the 2023 Spring semester, with instructors from the courses Introduction to Engineering (Course A) and Learning Frameworks

(Course B) introducing the parallel projects. The pilot continued in the 2023 Fall semester, with refinements to the parallel projects and the definition of analogy intervention points for self-transformation. The authors of the paper will present the results from the pilot implementations, as well as discuss the challenges and future work.

From the student data at UTRGV, it is observed that the academic success of incoming students particularly in the College of Engineering and Computer Science (CECS) needs to be addressed. Such data, shown in Table 1, illustrates that retention rates within CECS and within the University were tending to increase prior to COVID-19, however, the pandemic affected the outcome [4], [8], [12], [13], [14].

Table 1. UTRGV College of Engineering and Computer Science First Year Full Time Freshman 1st Year Retention Rate.

Cohort	Retention Within College	Retention Within University
Fall 2015	62.3%	78.2%
Fall 2016	66.6%	77.0%
Fall 2017	64.7%	74.9%
Fall 2018	69.4%	78.5%
Fall 2019	67.2%	79.0%
Fall 2020	53.3%	60.9%

According to the literature, there are at least three major factors that have resulted in such low statistical measures: (1) socioeconomic factors of the Rio Grande Valley (RGV) region, (2) most freshman students are first-generation college students, and (3) the effects associated with COVID-19. Due to these factors, several student tendencies were observed by faculty members in the classroom. For example, students are not aware when they face academic challenges; study habits are not well developed; students avoid asking questions early in the semester; only a limited number of students create a support network, study group, or learning circle; and students are not aware of the value of extracurricular activities until their senior year.

Based on these observations by faculty members, it motivated the creation of a one-week onboarding intervention for freshmen engineering students. (Boost-camp) [17]. In this one-week intense experience, the agenda was established with the intention for students to participate on a variety of activities including: 1) faculty research talks, 2) engineering student organization's introductions, 3) hands-on engineering projects, 4) lab visits, and 5) networking opportunities.

Given the success of the first bootcamp, which initiated in the summer of 2021, it was expanded to include students from other engineering departments in CECS. For the second time around, faculty members from each engineering department were trained on the bootcamp activities, and how to conduct the weekly program.

Proposed Approach

The FYIE participants will be taking two courses simultaneously: Introduction to Engineering (Course A) and Learning Frameworks (Course B). These selected courses are focused on assorted topics and include project elements of technical innovation (MECE 1101) and career path planning

(UNIV 1301). As such, the Challenge Based Instruction (CBI) approach was selected as the pedagogical method for these courses (Figure 1) [2], [5], [9]. In this regard, CBI is focused on student engagement when properly implemented.

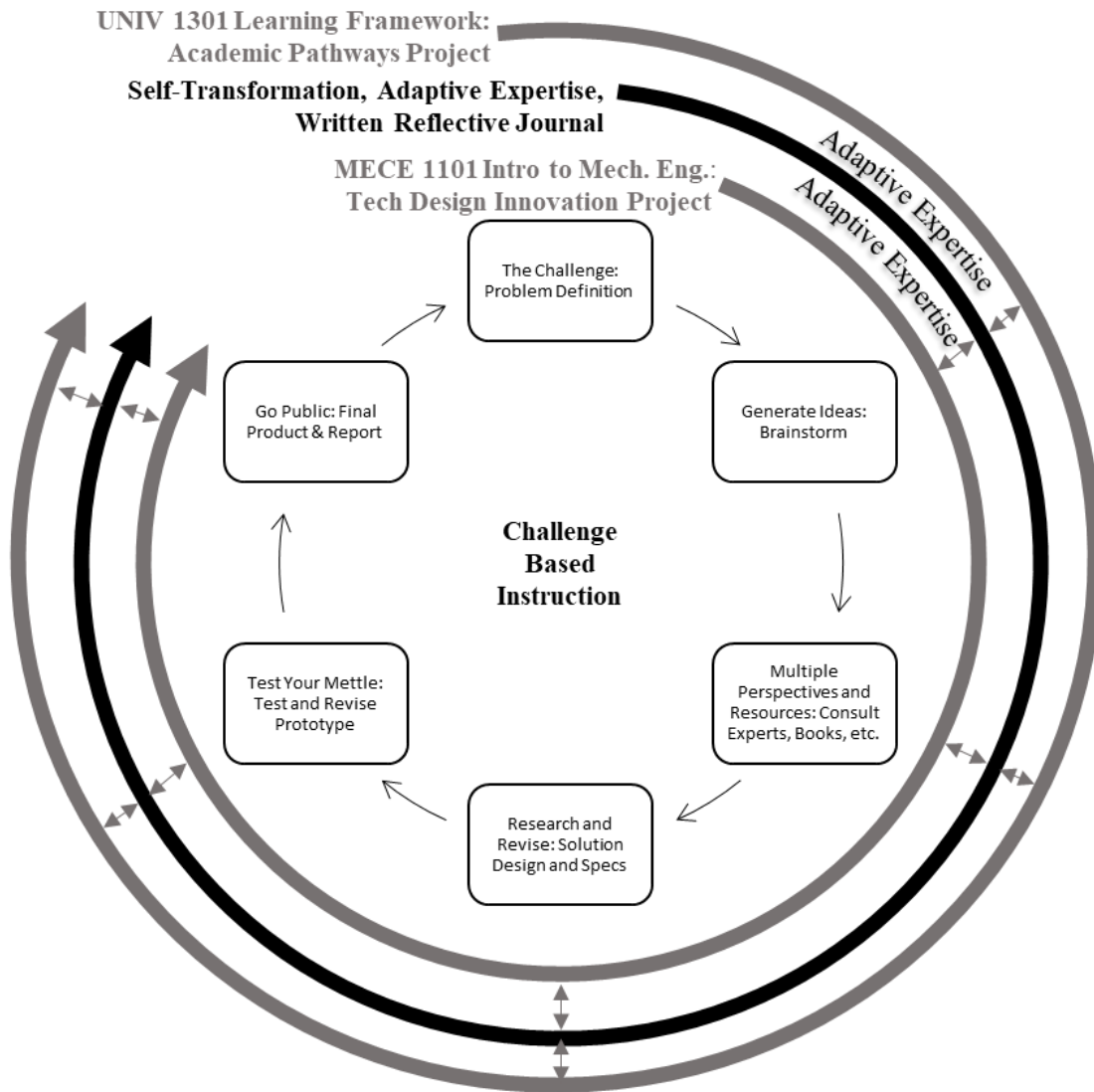


Figure 1. Overview of the FYIE Approach.

In Course A, students will complete a 6-week engineering design project, and in Course B, they are completing a 6-week academic career path project. During these parallel projects, timed interventions demonstrate the analogies between the engineering design process and the academic career pathways project. The objective is for students to realize that they can apply the design thinking skills they learn in the engineering design process to solve their academic career challenges [3], [6], [7], [10], [11], [15]. A pilot of the FYIE program began in the 2023 Spring semester, with instructors from Course A and B introducing the parallel projects. The pilot continues in the 2023 Fall semester, with refinements to the parallel projects and the definition of analogy intervention points for self-transformation.

2023 Spring Pilot Implementation

During the 2023 Spring semester, two sections UNIV 1301 and MECE 1101 were selected to participate in the pilot study, in which a total of 8 instructors were involved. In the first implementation, each instructor followed the subsequent project guidelines: 1) MECE 1101 sections used Arduino controllers for projects, 2) MANE 1101 section utilized a catapult kit and 3D printing, 3) CIVE 1101 section used a paper tower project, and 4) UNIV 1301 sections used journaling, reflection, and guest talks. In this initial implementation, the faculty learned valuable lessons to improve their implementation. This effort to implement dual projects in UNIV and MECE has valuable contributions since both units, the College of Engineering and Computer Science and the Office of Student Success wanted to homogenize and standardize the learning experiences for freshmen students. Most UNIV instructors had some sort of career pathways project implemented, each with a different approach that reflected their understanding and expertise. Similarly, most INTRO instructors included some sort of hands-on project that engaged students but was not formalized. This project accelerated this much needed process of homogenization (formalizing the projects and providing similar learning experiences to all participating students).

Fall 2023 Implementation

For the 2023 Fall semester, the UNIV and INTRO instructors received stipends to improve their respective project implementations. The UNIV instructors were asked specifically to communicate and converge into a similar project format. Similarly, INTRO instructors were asked to collaborate to arrive at similar project formats, while maintaining freedom to change the actual project (i.e., Rube Goldberg machine, Arduino mechanism, etc.). The faculty subgroups delivered much more aligned project formats that reflected the best practices. The authors observed a good level of agreement and concurrence on the projects, based on this, the priorities were defined for the Spring 2023 implementation.

Future Work

The main goal for the current implementation is to generate a deployment package for UNIV and for INTRO instructors at other institutions. The objective is to thoroughly document the respective projects so an instructor can replicate them in their respective courses. The authors see a triple benefit in this deployment package, ready for dissemination, 1) the INTRO project is a valuable addition by itself, 2) the UNIV project is also valuable, and these two projects can be deployed independently with clear benefits, and 3) the self-transformation interventions can be attached to the INTRO only or UNIV only projects for student reflection or to both if launched simultaneously. Further, the objective is to expand the interventions to include other departments in CECS and possibly to other colleges such as the College of Science or College of Business. Our vision is to have a sequence of interventions that continue this Freshman Year experience with Sophomore, Junior, and Senior Year Innovator Experiences, with an increasing portfolio of skills each year.

Acknowledgements

The authors express their gratitude to the participating instructors: Sandra Morrow, Erika Perez, and Michelle Alvarado, as well as the students involved in this project. Funding for this project was provided by NSF award 2225247.

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