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Understanding Academics Motivation to Engage in a Voluntary Research Program

Homero Murzi (Assistant Professor)

Dr. Homero Murzi (he/él/his) is an Assistant Professor in the Department of Engineering Education at Virginia Tech with honorary appointments at the University of Queensland (Australia) and University of Los Andes (Venezuela). Homero is the leader of the Engineering Competencies, Learning, and Inclusive Practices for Success (ECLIPS) Lab where he leads a team focused on doing research on contemporary, culturally relevant, and inclusive pedagogical practices, emotions in engineering, competency development, and understanding the experiences of traditionally marginalized people (e.g., Latinx, international students, Indigenous students) in engineering from an asset-based perspective. Homero is interested in understanding how to develop effective and culturally relevant learning environments that can promote the sustainable competencies engineering students require to succeed in the contemporary workforce. His goal is to develop engineering education practices that value the capital that traditionally marginalized students, bring into the field. Homero aspires to change discourses around broadening participation in engineering and promoting action to change. Homero has been recognized as a Diggs Teaching Scholar, a Graduate Academy for Teaching Excellence Fellow, a Global Perspectives Fellow, a Diversity Scholar, a Fulbright Scholar, an inductee into the Bouchet Honor Society, and received the prestigious NSF CAREER award. Homero serves as the VT Engineering Education Chair for Equity and Inclusion, and the American Society for Engineering Education (ASEE) Incoming Chair for the Commission on Diversity, Equity, and Inclusion (CDEI). He holds degrees in Industrial Engineering (BS, MS) from the National Experimental University of Táchira, Master of Business Administration (MBA) from Temple University, and Engineering Education (PhD) from Virginia Tech.

Tahsin Chowdhury

Tahsin Chowdhury is an Engineering Education Doctoral candidate who focuses on engineering in the 21st century. He is passionate about enhancing professional competencies for engineering workforce development in academia and beyond. He is trained in Industrial and Systems Engineering and has a combined 6 years experience spanning both academia as well as lean manufacturing at Fortune 500 companies. Tahsin’s long term goal is to bridge the engineering competency gap between industry demand and academic fulfillment. A global engineer and researcher, Tahsin is an advocate and ally for better inclusion in STEM and beyond.

Lloyd Herbert Morris (PhD Management Sciences)

Lloyd Morris is a professor in the Department of Industrial Engineering at the Catholic University of Pereira - Colombia. He has engineering and master's degrees from the National Experimental University of Táchira in Venezuela, a master's degree from the University of Alcala, and a doctorate in Management Sciences from the University of the Armed Forces. Before coming to Colombia, he was a professor of industrial engineering at the National Experimental University of Táchira in Venezuela, where he taught production courses. In addition, he held different administrative positions such as Head of the Treasury and Director of the Master in Business Management, and President of the UNET savings bank. Morris has 22 years of experience in higher education in Colombia and Venezuela. In addition, Dr. Morris has several years of experience in the manufacturing engineering industry, for example at LAFARGE as a chief manufacturing officer. Dr. Morris's goal is to improve processes in engineering operations by incorporating techniques or mathematical tools into decision-making processes to increase manufacturing productivity.

Understanding Academics' Motivation to Engage in a Voluntary Research Program

Abstract

The School of Civil Engineering at The University of Queensland in Australia developed a voluntary research program to engage students with experiential learning opportunities and increase motivation and engagement. Projects were developed by academics (research faculty members or doctoral students) in their research laboratories. The purpose of this exploratory study is to understand the motivation the academics had to engage with students and invest time and resources in creating research projects not attached to students' grades or credits. We conducted interviews with academics to understand why they decided to engage with the research projects. Our results suggest that the most important thing was to develop student-teacher engagement, which had an implication later on in their classrooms. Similarly, they saw it as a mentoring opportunity and as a way to improve their time-management skills.

Introduction

Student motivation and engagement have been proven to positively impact learning and improve students' academic experiences [1], [2]. Accordingly, the field of engineering education has worked on ways to promote students' motivation, engagement and ultimately promote sense of belonging in engineering students [3], [4]. Furthermore, sense of belonging has been directly linked to successful academic outcomes, including persistence, self-efficacy, and perceptions of technical competence [5]–[7]. Therefore, engineering students need to have different systems in place to support and complement their formal education in engineering classrooms to promote belonging.

According to Allendoerfer et al. [8], those systems come together when students have formal incoming cohorts in classrooms and labs, and living/learning communities -such as engineering residences, where they can interact and develop peer relationships. Therefore, those spaces have proven effective as part of an integral college experience. However, in addition to these spaces, it is also essential to provide informal spaces to gather with professors and tutors for non-academic reasons to develop mentorship and role model relationships; and provide informal learning opportunities [8]. Many universities in the United States (U.S.) have intentionally developed several of these systems to support students during college. However, the reality in Australia is very different.

According to the Australian Higher Education Report [9], students enrolled in large universities' engineering programs have different challenges. These include large class sizes, low student attendance, and a higher education system structured to limit student-academic and peer-to-peer interactions, limiting student engagement development [10]. Similarly, students are mainly commuters living at home. Thus, attendance to class is conditioned by external variables such as transport, schedules, etc. Large class sizes present a barrier for students to develop relationships with their peers. In addition, in Australia, digital recording and streaming of lectures have become a standard component of the resources provided to students through learning management sites [11], impacting the decrease in student attendance in class, and interaction

with their peers. There were serious issues regarding students' low motivation to interact with academics in our particular context, which impacted their morale. Furthermore, student/staff ratios were very high; hence there was limited capacity for mentorship interactions. Some academics felt that undergraduate students were unmotivated and that there was no value to engaging with them outside the classroom environment. To find ways to address these problems, we developed the Icarus program.

Context: The Icarus Program

Icarus is a voluntary, project-based research program where students engage with peers in small projects, directed by academic mentors, with the goal of establishing a small class atmosphere that promotes peer-to-peer interactions, applying some knowledge in real research settings - expanding learning beyond the classroom, and providing with mentoring and role modeling relationships. The program's initial goal was to generate intrinsic motivation in engineering students regarding their civil engineering education. The Icarus Program was developed with three primary goals: (i) to boost undergraduate student interest and experience in diverse and interdisciplinary projects; (ii) to foster close collaboration between academic mentors and small groups of students, and (iii) to leverage this engagement to elevate student learning pathways, student career outcomes, and the program national and international reputation for producing the leaders of tomorrow.

The program officially started in the first semester of 2015 with four projects across structural, environmental, and transport civil engineering streams. For the initial semester, 60 students were enrolled in the program. Students were in the second year of civil engineering. However, it was their first year in the civil major since all students undergo a general first-year engineering program. Students committed 2 to 4 hours per week of work. They were expected to actively contribute to a real research project supervised by an academic mentor. However, the project was intentionally non-structured such that students had to decide and direct how to engage and learn from it.

Students had 24/7 access to a student-run design studio space during the first semester and the opportunity to work closely with project mentors in small settings and collaborate with motivated peers. In addition, mentors tried to make students apply the knowledge they were acquiring in the second-year classes (structure engineering, environmental engineering, and transport). Hence, there was an intentional overlap of learning outcomes. Students were complementing the learning acquired in their courses through the research projects.

The program also motivated academics to create projects that were not limited to the core civil topics but could include exposure to other civil engineering topics and even some issues outside the field. This also included being intentional about developing some professional skills (e.g., communication, leadership, teamwork). By the end of semester 1, 2016, the program had grown considerably three semesters after its initial pilot, having 144 students working on 39 different projects. In addition, from having six mentors in the initial semester, Icarus has 24 academics serving as mentors for the students in the following areas: environmental, geotechnical, computational mechanics, hydraulics, fire safety, structures, transport, wind, construction management, entrepreneurship, and architecture. Each academic had different student teams;

some were small (i.e., four students), and some academics had larger teams (i.e., 12 students) and a balance in between. There are also several industry-sponsored projects where students have had the chance to conduct research, interact with academics, and participate in real-world research solving problems for these companies. Floyd-Smith et al. [12] argued that developing a sense of belonging leads to students' engagement; however, creating a community where students can participate and interact with others is imperative. The authors explain that when students feel they belong, they will also demonstrate intrinsic motivation. This engagement will lead to short-term and long-term positive academic outcomes. The program was structured with this framework in mind.

The expectation was that the students who participated in Icarus positively engaged with their engineering program and their peers, but not at the expense of their academic coursework. The Icarus program emphasized the value of the alignment between the research project offered and the coursework students were enrolled in. The program has been reportedly successful from a student perspective; however, we also wanted to understand the academics' motivations to participate and their perceptions of the program.

Methods

In this paper, we present preliminary findings of a study conducted with academic leaders (faculty members) directing some of the Icarus program research projects. Following qualitative methods best practices [13], we developed and piloted an interview protocol based on Eccles' [2] theory around motivational beliefs and values. We had the goal to understand the reasons for academics to engage part of the already busy time to create and supervise research projects for undergraduate students that were not attached to any academic credit or part of any formal structure in the school of civil engineering.

We conducted seven interviews. Our participants were academics in the School of Civil Engineering. Regarding academic rank, 3 were lecturers (Australian equivalent to Research Assistant Professor), 2 were senior lecturers, and 1 was a full Professor. Five participants identify as men, and 2 participants identify as women. All participants had active research laboratories and provided research projects in their technical area of expertise related to the courses they teach in the program. Interviews lasted about 1 hour and were audio-recorded. Recordings were transcribed using a professional service provider. Transcripts were coded using an open coding analysis influenced by thematic analysis [14], [15]. Two researchers were involved in the coding, and a third researcher provided support for agreement about codes when needed. The study secured ethical clearance.

Results

Results yielded several key patterns across the participants' responses, which primarily discussed the reasons academics had to engage with the research projects, and their experiences while being involved with the program. Table 1 shows the codebook developed, which includes different themes and the corresponding description of each. Figure 1 shows the counts for each theme that emerged from the data. In the following sub-section, we will present a more detailed look at the qualitative responses from the themes.

Table 1
Codebook and description from the thematic analysis

Category	Description
Workplace preparation	Recognizing and teaching skills necessary to transition to real-world engineering, including industry, academia, etc., where research projects are involved.
Value of the program	Describing benefits, improvement opportunities, budgeting, and outcomes of the project
Feeling competent	Feeling confident and motivated toward the project
Sense of belonging	Feeling of security and support when there is a sense of acceptance within the program
Student-teacher engagement	Interaction, information, and formal communication, and maintaining interpersonal relations between students and teachers
Time management	Additional time, workload, the extra effort taken by instructors/students toward the project
Mentoring	Supporting students' learning and encouraging them to maximize their potential in the project

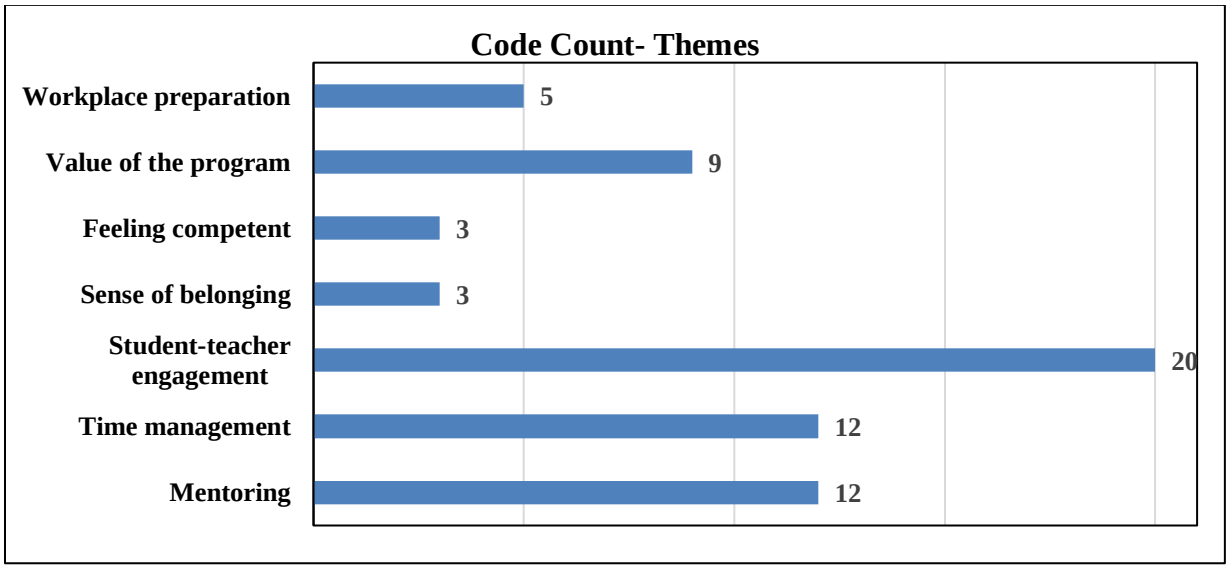

Figure 1. *Code counts from the thematic analysis*

Workplace preparation

Academics reflected on why they decided to get involved in the projects, and preparing students for the transition into the workforce after graduation was one of them. They mentioned recognizing the necessary skills required for their students to transition to real-world experiences in industry or graduate school. One academic described the high-quality research skills students acquired for their final thesis project, which might help them when they transition to graduate school to pursue a doctoral degree:

> …also, by the time they get to their later years, they have a set of skills which can deliver them, you know, a good sort of final thesis project, and allow them then to approach a really good and high-quality research. And that will happen potentially to further, um, you know, pursue a PhD

Another academic mentions the necessity of students to learn engineering skills like collecting, interpreting, and presenting data to various stakeholders, which would help them when they transition to the engineering workplace:

> …that would be nice to have graduates that are confident when they say like, presenting their results …and measure stuff in the field or interpret data that comes from these reports, or, you know, when you're an undergrad or graduate engineer moving into a consultancy, you pretty much have to do everything.

Value of the program

Academics discussed different aspects of being involved in the projects, including research benefits (getting things done that were not possible otherwise), improvement of their students' grades in their courses, and research outcomes with low budget investment. Some academics discussed how the program helped them improve their teaching, research, and mentorship skills and how being involved in the development of projects and the program represented a faculty development opportunity. As discussed by an academic in these two quotes:

> I think it has probably benefited both my teaching and research. We get to know what the students actually think of courses and how they run and all the irritations that they have with lecturing styles or, you get to know people at a much more personal level.

> The benefit to me is, the ability is, as a young and inexperienced academic to try out, in a low-risk way, different mentorship strategies with students in that there's no consequence of it doesn't go well, but there's not a formal consequence in terms of their grades for a project

Academics also discussed challenges while being involved in the program and provided recommendations to enhance the overall experience of the future projects. For example, one of the challenges mentioned was not having enough facilities and space for students' well-being during their projects:

> From the school's perspective, they should push a bit more. And that's something that I miss; I have to say, facilities are very poor. Yeah, if you want students to really get comfortable, you need to give them a bit more confidence. I would come there, and you see a student, uh, you know, resting a bit for half an hour. So, by doing that, you would really see that it's a really a non-intimidating environment.

Another academic recommended the team size for future projects, which would help in enhancing their learning experience. The excerpt exemplifies the ideal team size:

> A project should be a minimum of two people. For me, this ability to work with another person is essential. And that's where I think a minimum of two students per project should be required with the project that I have worked on. I think for some activities like fieldwork, having ten people is beneficial for one as a whole, and for some activities where the work takes best in the laboratory, I would say three to four would be a maximum for some modular project. Five to six will be appropriate. I think in terms of a semester work, if we want to facilitate the communication or interaction between the matter on the student, the size of the group, us to remain small, I think more than six students is probably too much

Feeling competent and Belonging

This theme reflects the experiences in the program that made instructors feel more confident and motivated as faculty members. For example, they explained how working and engaging with students in projects allowed them to learn new aspects of research and improve their current practices. However, it is also important to discuss that some academics felt they were not included as part of the team and were removed. The excerpt below exemplifies this theme:

> I'm brainstorming with them and I'm explaining some of the things and while doing that, I'm expanding my view of research. And it actually helped me a lot because when you talk to the industry, you have to sometimes explain it in a more common way. And by talking to students, it actually allowed me to do better at these things. So, from my experience, I see a big value because it just helps me deliver the idea. And the more often you talk about the project, the clearer it becomes and the more objectives of the research standard are met.

In addition, academics discussed their challenges regarding them not feeling accepted and included with the project team members. Not many participants shared this; however, we consider this an important outcome as it is something to pay attention to when developing these programs. Some of the students worked very independently and interacted primarily with their peers without seeking help from academics; they also had a lot of autonomy. Independence was expected but could have an impact on how the academic felt. One example is exemplified below:

> …you find out a lot of people that didn't want to necessarily do the cost kind of sensing network type things, then moved over to the erosion control. That's all. Yeah, it's a little weird, but yeah, you definitely get this group of really driven, interested, sort of ones that interact a lot outside of friends with each other and that sort of thing. So, they always kind of just carry on and do the work and then some others don't fit into that. And so, it made me feel a little bit excluded or something.

Student-teacher engagement

This theme discusses the interaction between students and academics during the project through formal and informal communication. Academics shared their experiences while interacting with

students, which led them to build interpersonal relationships which were mostly engaging, fun, and positive. The excerpts from two participants exemplify their experiences:

> ...that was fun, and I think they kind of lose their fear in other like say if you go and lecture, in a course and some students already know you kind of at a more personal level than they are more inclined to, to respond back or at least not be petrified of talking and that sort of thing.

> I definitely still have those relationships. Yeah. It's ten years on, and I really struggle to understand how in a class of 20 or whatever we had at the end of all professional, probably friends.

As shown in Figure 1, this was the theme that was more mentioned by academics in the interviews. Most of them discussed student-teacher interactions, which has been one of the biggest motivators to participate in the Icarus program.

Time Management

One of the most important themes that emerged from the data was 'time management,' which describes instructors' additional time, workload, and effort towards the program. For example, academics mention fieldwork activities during projects, coordinating with teams, teaching different aspects of the project, which required additional time investment. These efforts were sometimes challenging for the academics while managing their responsibilities. Some excerpts as examples of this theme:

> If you want to properly supervise a group, you need to meet them weekly. I do a one-hour meeting with them and I spend more than probably two to three hours a week going to discuss the students when they have some questions. In addition, during formal meetings with them, you have to do some preparation work to prepare some documents for them ahead

> I'm in this extra work associated with them, particularly with field-based activities because you have to go through this whole health and safety… Right. And so yes, there's drawbacks and I guess more load on your schedule, but I don't think that that's a legitimate reason if you are, you must know that when you started, it's not, it's not a surprise. Right. Um, and so it was fully aware of what I was getting myself into

Mentoring

This theme discusses the process of how academics mentored their students in the project to achieve their goals. The process involves asking questions, helping to solve problems, task responsibilities, etc. the example below exemplifies this theme,

> I took five students and I got them to be involved with five different projects...And, so I sat down with the concerns and I just basically asked them

before deciding on the projects, like, what do they want to achieve for the semester? And based on that, I assign them to projects and workload so that they could try to achieve what they want.

Conclusions

This paper described the experiences of academics investing extra time in developing and supervising research projects for the Icarus Program. Our results suggest that the time investment in providing students with a hands-on experience where they could voluntarily engage with real projects had a positive impact on the faculty development of the faculty members. They described how participating in the program improved their teaching practices by being able to interact closely with students and better understand what they thought was important. This also led to more engagement from the students in their courses by developing some out-of-the-classroom interactions with their professors. Similarly, this allowed for an opportunity to improve their mentoring and research practices. Finally, they mentioned how exploring projects in a controlled, low-risk environment allowed them to explore areas of research that otherwise they would not have been able to explore.

The Icarus Program was created with the goal of improving sense of belonging, students' engagement and providing students with an opportunity to have out of the classroom experiences to apply some of the technical knowledge they were learning in their courses while also developing a cohort and closely interact with their peers and professors. We consider that this goal was fulfilled based on the faculty members' perceptions.

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