Using Competing Values Framework to map the Development of Leadership skills as Capstone Design students Transition to the Workplace

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Introduction

According to the Engineers of 2020 report, one of the important attributes that will support the success of engineering graduates when entering the workforce will be leadership skills [1]. Engineering students' development of leadership skills is highly acknowledged by industry when looking to hire new talent into the workforce [2]–[5]. Similarly, the Accreditation Board for Engineering and Technology (ABET) revised criteria for student outcomes have specifically mentioned effective team function when students are able to contribute in the team through leadership capabilities [6]. As Universities respond to feedback from industry and accreditation requirements, it is important for engineering programs to better prepare students with leadership skills and incorporate leadership concepts into the engineering curriculum.

To ensure that future engineering graduates are adequately prepared with leadership skills beyond traditional engineering, several universities provide programs in the form of individual courses, workshops, minors, or experiential learning opportunities that educate engineering students about the theory and practice of leadership. Within these undergraduate programs, several types of leadership concepts have been linked to students' educational experiences. Probably one of the most important ones is the senior year capstone design courses which are designed to engage students in various learning opportunities including technical knowledge and professional skills. In these courses, students actively engage in solving ill-structured problems and communicate their understanding effectively in different teams allowing them to develop skills that are essential in building leadership capabilities and confidence among engineering students [7]–[9].

According to a study on self-reported leadership for undergraduate engineering students, students reported strong relationship of curricular emphases including core engineering thinking, professional values, professional skills and broad and systems perspectives with the development of leadership skills [10]. However, there have been few empirical studies that have assessed the leadership behaviors among engineering students and the change in leadership behaviors as they are transitioning to the engineering workplace [11], [12]. Hence, more research is required to investigate how leadership behaviors are developed in universities, and how are transferred and translated into the workplace.

In this study, we used the Competing Values Framework (CVF), a robust framework developed by Quinn and Rohrbaugh [13], to measure the change in students' leadership behaviors as they transition from their capstone course into the workplace. Hence, the purpose of this study is to use the Competing Values Framework (CVF) in the engineering education context to compare leadership behaviors among engineering students at three different points in time. The study will answer the following research question:

RQ: How do leadership behaviors change among engineering students while working in teams at three different points in time: during the capstone course, and at three and six month intervals in their first year in the workplace?

Theoretical Framework

The theoretical framework that framed our study to understand the change in leadership behaviors among students transitioning to the workplace is the Competing Values Framework (CVF). CVF has been extensively used in the area of organizational culture which clarifies leadership roles and expectations and focuses on different leadership behaviors among individuals [14]. According to Cameron [15], the CVF is a robust framework used in several disciplines in a variety of phenomena and describes the "*core approaches to thinking, behaving and organizing associated with human activity*". In terms of leadership, the CVF consists of four different leadership orientations or behaviors: *Collaborate, Create, Control* and *Compete* [15].The *Collaborate* orientation focuses on the "people relationship" aspect of leadership. An individual will act as a mentor and facilitator who acknowledges people's needs, develops people, practices participation in team building, and manages conflict among team members [16]. The *Create* orientation focuses on the "leading change" aspect of leadership. An individual will take the responsibility as an innovator who initiates significant changes with new ideas during problem solving, experiments, etc. [16]. The *Control* orientation focuses on the "managing process" aspect of leadership. An individual will act as a coordinator who would control projects, monitor the progress and develop control and checkpoints [16]. The *Compete* orientation focuses on the "producing results" aspect of leadership. An individual in this aspect will act as a producer who communicates the team goals, emphasizes hard work ethic and clarifies priorities [16].

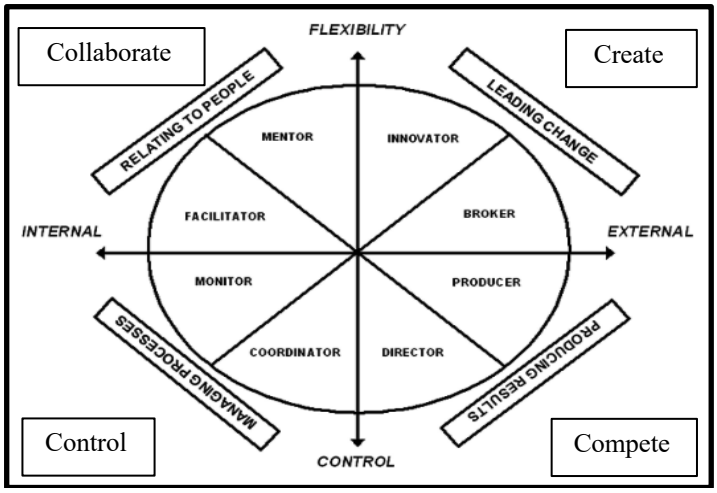

Figure 1. Leadership Orientations and Roles from the CVF [16]

Figure 1 shows four quadrants in which leader types are highlighted for each leadership behavior. The CVF is based on the theoretical foundation of behavioral complexity based on the ability of individuals to exhibit behaviors that align with various leadership orientations [17]. An effective leader is an individual who is able to engage in a wide range of behaviors in given situations in comparison to individuals who rely on one set of behaviors [11], [14]. Hence, one way to find out whether a student possesses effective leadership capabilities is by understanding their behavioral complexity. Therefore, the use of CVF in this study is to understand different

behavioral complexities of students using the leadership profiles of CVF with the goal of continuing to diversify their leadership capabilities in all four profiles.

Literature Review

Leadership is one of the most important attributes that industries look for when hiring engineering graduates into their workplace [2]–[5]. To ensure that future engineering graduates are adequately prepared with leadership skills, several universities provide programs in the form of individual courses, workshops, minors, etc that educate engineering students in the theory and practice of leadership. Georgia Tech, Northeastern University and the Massachusetts Institute of Technology have leadership programs that offer specialized courses which train undergraduate engineering students with leadership skills required by industry [18]–[20]. Pennsylvania State University, The University of Maryland and the University of Central Florida have developed a minor in undergraduate engineering leadership where students develop leadership skills through experiential learning projects [4], [21], [22]. Iowa State University created a 4-year Engineering leadership program with a goal of creating future leaders who can make contributions in the complex engineering world through values-based learning beyond traditional engineering [23].

In spite of the extensive efforts on developing leadership programs at different institutions, few studies have measured leadership behaviors and monitored changes post implementation and investigated the impact of these programs on early career engineers [11], [12], [24]. Specifically, there is no study that explores the change in leadership behaviors among engineering students as they are transitioning from their senior year to workplaces. Even though CVF has not been widely used in identifying leadership behaviors in the engineering education context, through this study CVF offers a valuable way to compare different leadership behaviors among engineering students as they progress into their early careers.

Methodology

The participants in this study are drawn from a larger study of capstone design courses from four different universities across the United States [25]. There were 62 participants recruited from Capstone courses from these universities. Sequential mixed methods analysis was carried out in the larger project. The full data set for the study includes interviews of the participants, conducted at the end of their capstone course, survey responses for the first three months of their employment in engineering workplaces and semi-structured interviews conducted after three, six and twelve months in their workplace. For this particular paper, in order to answer our research question, we took a qualitative approach and focused on the qualitative data. Data were analyzed through the lens of the four leadership profiles offered by the Competing Values Framework.

Sampling

The study involved recruiting participants from 4 different institutions in 3 different regions of the United States including Southwestern, Southeastern and Northeastern region. The 4 institutions studied, while they share similarities in their capstone program design (project-based involving industry sponsors and beyond), differed from each other in more than just geographic location. One institution is private, while the other 3 are public. One of the public institutions is

classified as an HSI. The participants were particularly from 3 mechanical engineering programs and one engineering science program in their senior year of the undergraduate program. The graduating class size ranged from small (20-30 students) to large (350 students) per class. Students worked in small teams or sub-groups of a larger team. There were around 4-6 students per team working in the capstone projects.

Data Collection

The data collection for the project was carried out through surveys, journals, and semi-structured interviews. Study participants were recruited at each of the 4 sites through visits to capstone courses and capstone team meetings. All capstone students received an email inviting them to complete an online screening survey that captured demographic information as well as post-graduation information such as career plans. The dataset for this study includes 62 participants where 33 participants identified themselves as male and 29 females. Of those participants, there were 37 participants who self-identified themselves as White or Caucasian, 12 participants as Asian or Asian American, 6 as underrepresented minorities, 4 as other and 3 of the participants have not disclosed. With respect to the sites, the dataset includes 20, 18 and 14 participants from the three large institutions and 11 participants from the smaller institution.

For the purpose of this study, only semi-structured interviews were considered. The interview protocols were designed to explore students' experiences in both capstone courses and workplaces including the challenges they faced, strategies they used, and several accomplishments they achieved as engineers. The interviews were taken at three different points in time: during their capstone course, 3 and 6 months during their workplace experience.

Participation in this study was voluntary and secured approval from the Institutional Review Board (IRB). The participants were informed on the research nature and complete confidentiality was ensured during all forms of data collection. All the participants provided consent to participate in the study. The interviews in particular were held in enclosed areas to ensure confidentiality among the participants. Interviews were audio recorded and lasted approximately an hour for most of the participants. Process reliability for the data was ensured by cleaning the audio-recorded transcripts using pseudonyms to identify participants and removing identifiable features from the data to maintain participant confidentiality [26].

Data Analysis

To answer our research question, data were analyzed using the qualitative responses from the interview. The first step of the process was to analyze the responses from the participants' interview by using an existing codebook developed as part of a larger study by Ford et al. [27]. The existing codebook was developed using both a priori coding and emergent codes from the qualitative responses of the interview data. Table 1 shows the part of the codebook used for this study, which includes emergent descriptive codes from the qualitative responses and describes the different types of students' experiences during the capstone projects and in the workplace. The full codebook is provided in Ford et al. [27].

Table 1. Coding categories of participants' experience type and description

Activity Type	Description
Workplace/Capstone Experience or Event	The participant is describing an event or experience that happened at work, without suggesting that it was a challenge or an accomplishment.
Accomplishment	The participant is describing the activity as a significant accomplishment.
Challenge	The participant is describing the activity as something they found challenging
Strategy	The participant is describing the activity as a strategy they used to meet a challenge or succeed at a task
Successful Transfer from Capstone	The participant describes the activity in terms that indicate transfer of learning from capstone to the workplace - i.e. the experiences are similar, or the participant used knowledge from capstone in the workplace
Capstone Advice	The participant is providing advice for the capstone course (e.g., to better align it with work)

Figure 2 shows the process of data analysis for this study starting from the interview data to the results. One of the sub-codes from the coding scheme was "leadership" which was defined as an activity where the participant described '*acting as a leader* or *an action that reflected a leadership behavior*' while working in a team. For this study in particular, we used the data excerpts which were coded under 'leadership' and analyzed the data using the four leadership profiles of the Competing Values Framework.

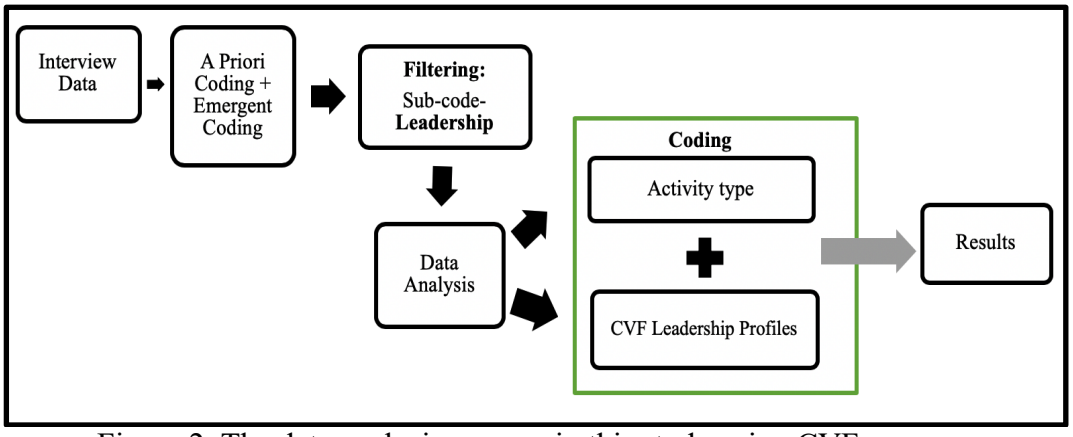

Figure 2. The data analysis process in this study using CVF

Research Quality

To ensure inter-rater reliability, the 'leadership' and 'activity type' coding from the interview data were implemented by a team of coders from the project who were initially trained and normed on the codebook. The final coding on leadership profiles were reviewed by the project leaders to ensure consistency in the results. Any discrepancies in the coding process, were discussed by the team until agreement was reached.

This study had several limitations. Even though the data collection resulted in rich description of participants' experiences in both their senior year and workplace, the data in this study were limited to participants' who mentioned their experiences on 'leadership behaviors' only, which could have biases in the results. Second of all, since the participants' come from the mechanical engineering and engineering science programs, it is difficult to transfer the findings in this study to other engineering disciplines. Thirdly, some participants of this study already had leadership experience from co-curricular activities, coursework or other experiences beyond school which could unintentionally influence their responses in the interviews. Hence, we suggest the findings of this study to be taken with caution when making generalizations.

Results

From the qualitative responses of the participants, initial data analysis shows that more participants referred to taking a leadership role or acting as a leader during their capstone experience than in reference to their workplace. Specifically, 33% of participants have mentioned being in a leadership role or showing leadership behaviors at least once during their reflective interview conducted at the end of their capstone experience and prior to beginning work. In comparison, only 11% of participants have mentioned leadership roles or showing leadership behaviors in the workplace during their 3 months interview and 12% during their 6 months interview. Figure 3 shows the comparison of number of participants mentioning leadership behaviors at three different points in time.

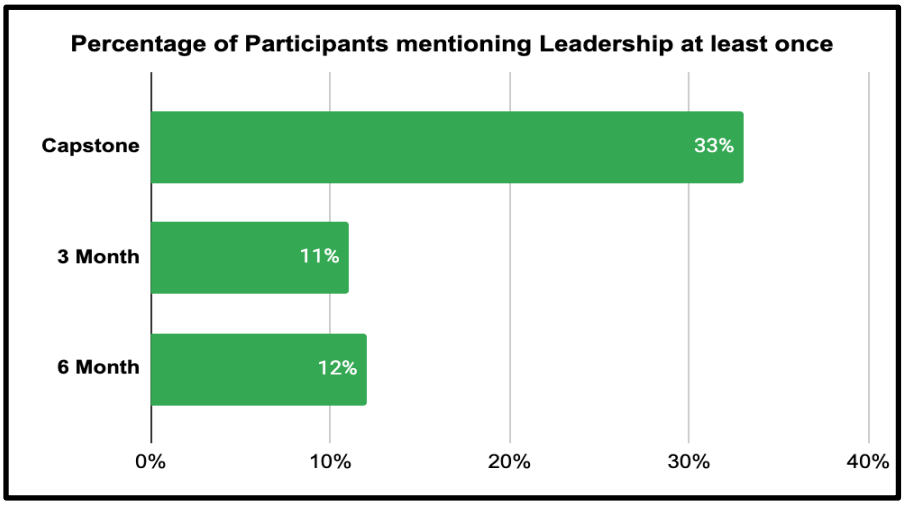

Figure 3. Percentage of participants who mentioned '*acting as a leader or showing leadership behavior*' at least once during their interview

From our process of data analysis as shown in Figure 2, several key patterns emerged from the section that consisted of coding 'Activity type' and 'CVF Leadership Profiles'. The participants' experience in capstone, 3 months and 6 months were mapped into the leadership profiles as shown in Figure 4, 5 and 6. Each of the figure represents the participants' experience type mapped into all the 4 leadership profiles which emerged from our data analysis. The legend in the figure shows the type of leadership profile and the corresponding color representation. The size of the bubbles from the figures represent the code counts for each of the profile. Hence a larger bubble size represents a higher number of code counts for that particular profile in the figure. No presence of bubble in a particular profile means zero code count. In order to compare the leadership profiles at three different points in time, we ensured normalization of the coding data. From Figure 4, it is seen that participants during capstone experienced leadership behaviors mostly in the 'create' and 'collaborate' profiles with mostly larger bubble sizes under all the activity types.

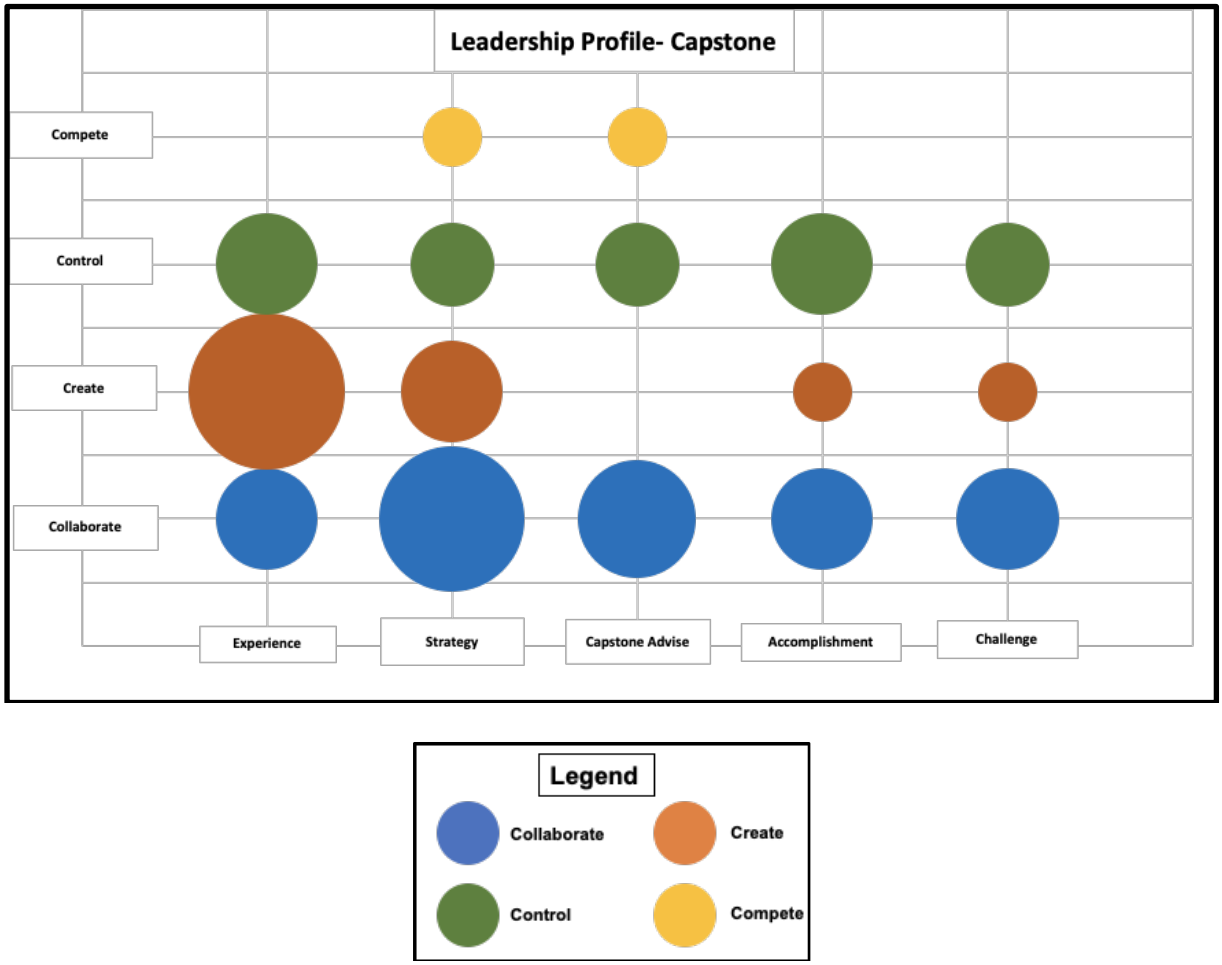

Figure 4. Mapping participants' experiences in Capstone with the four leadership **profiles**

In comparison to capstone, participants in 3rd and 6th months as practicing engineers reported to have leadership behaviors mostly under the ‘control’ and “collaborate” profiles. Figure 5 represents the participants experiences during their 3 months into their jobs which shows presence of larger bubbles mostly in the ‘control’ and ‘collaborate’ profiles. However, the most prominent bubble is seen in ‘control’ profile under the ‘challenge’ activity type.

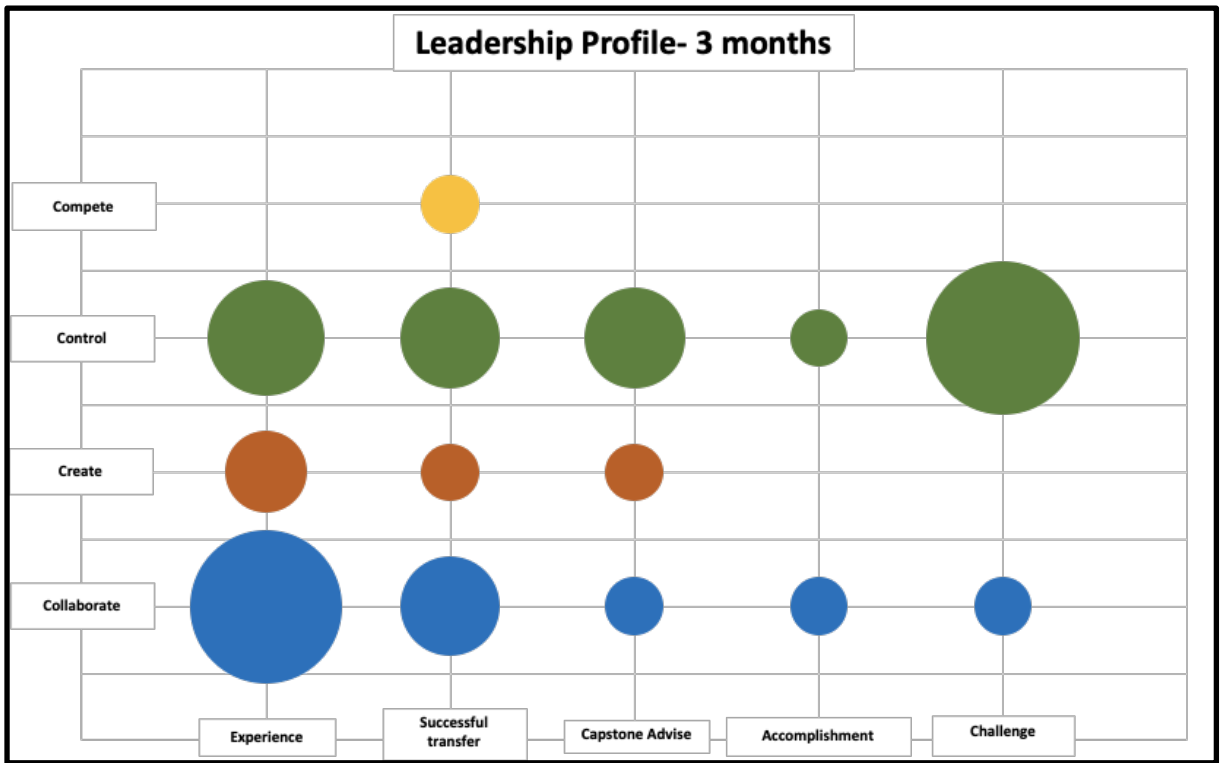

Figure 5. Mapping participants’ experiences during their 3rd month in the workplace with the four leadership profiles

Figure 6 represents the participants experiences during their 6th month as a practicing engineer in the workplace mapped into the four leadership profiles. Similar to their 3-month experience, the figure shows presence of larger sized bubbles in the ‘collaborate’ and ‘control’ profile. However, the bubbles in this figure are more evenly distributed among the activity types.

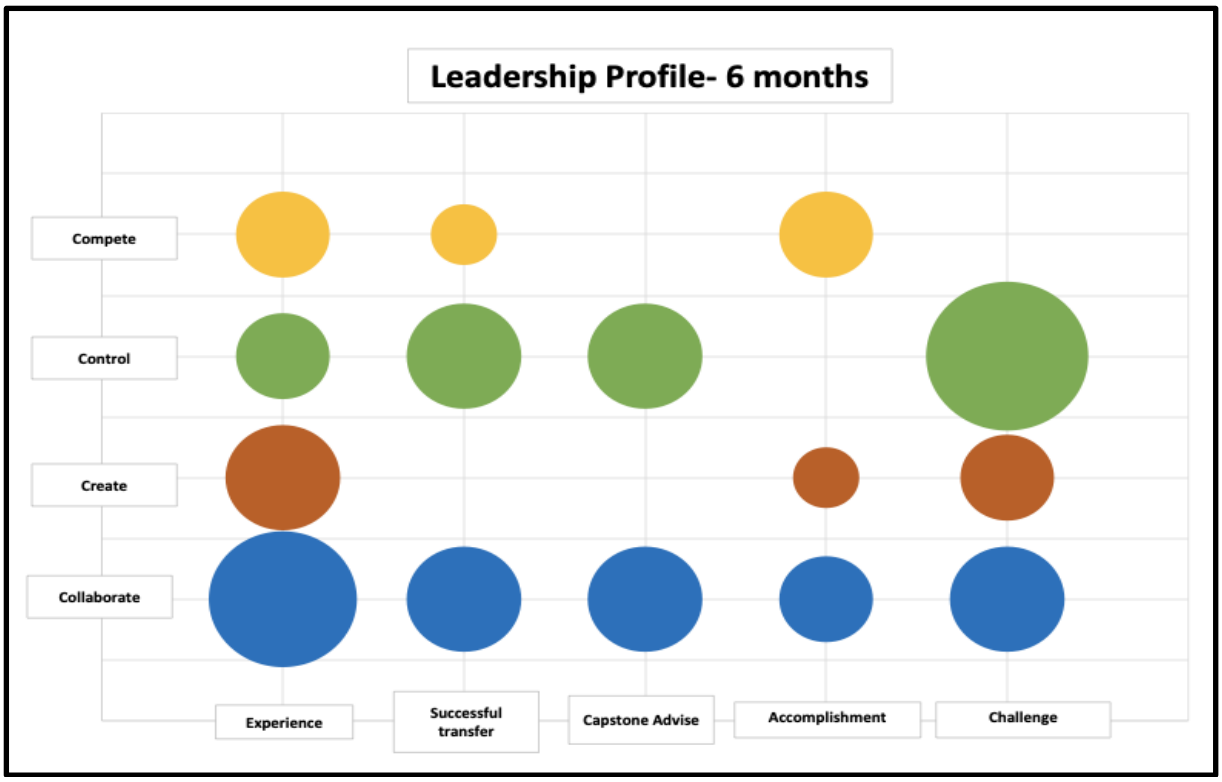

Figure 6. Mapping participants' experiences during their 6th month in the workplace with the four leadership profiles

The difference in the leadership profiles during the transition was because participants responded to having been more involved in bringing new ideas to the projects in their senior design teams, making changes proactively while working alongside industry clients and advisors and were actively involved in negotiations with clients and advisors during their project phase which falls within the 'create' and 'collaborate' leadership profiles. The following subsections draw on the interview data to provide rich descriptions of participants' experience using the leadership profiles at three different points in time.

Capstone Experience

As discussed in the previous section, participants demonstrated leadership behaviors mostly in the 'create' and 'collaborate' profiles, based on our data. Specifically, participants have discussed mostly facing challenging experiences while acting as a leader in the capstone team. Team leaders in capstone faced challenges while managing teams, especially when handling large team sizes. The most challenging experience was in the "collaborate" profile as shown in Figure 4. Participants discussed their challenging experiences mostly in terms of poor communication and facilitation within the team. This particular communication challenge is exemplified by one of the participants.

> *In terms of management, it became more difficult in the spring to make sure that* [sub-group leaders] *were including the people underneath them and communicating when they were working. Stuff like that that was a little bit harder to deal with. We had talked about*

it with the team after it was kind of like, some people were complaining that the workload wasn't managed very well, they didn't get enough stuff to do, it wasn't communicated to them. [2161]

However, to overcome the challenges faced in the team projects, strategies were carried out among the leaders mostly through the "collaboration" and "create" profiles to make the senior design projects successful for the team. With respect to strategizing through effective communication using multiple tools to make sure the team members were on the same page in the project, one of the participants in the team explained,

...about managing groups, I would message my friend, and I would be like, "Hey, do you know how these Google groups work?", and just reaching out to any connections for those simple survey and Doodle Poll type tools. Those types of tools I could reach out to other people…I would send out the email, and then I would ask my friend, "Did you get an email from me? Did it go through?" We were able to bounce off each other ... Some of it was reaching out to friends, and some did it and we hoped it worked. You're like, "Okay. It went through. That worked. [1109]

In terms of the create profile, one of the participants' discussed taking over the project design while handling ambiguity and initiating changes in the design to ensure success in the project. The following response exemplifies the leadership strategy taken by the participant.

...we were having to come up with how we're going to implement a joystick, how we were going add a trackball. All these random things that we had never had ... we don't have expertise in those fields. We were having to reach out to computer programmers and all kinds of different people... So one of my team members came up with the initial design, we got that in, and then I came up with all ... from the point where we got it in and got the parts, I basically took over from there. [1116]

Leaders stepped up in the capstone projects using several strategies that reflected leadership behaviors and helped make the project experience a success. Figure 4 shows that Accomplishments were made mostly in the 'collaborate' and 'control' profiles. This particular accomplishment of the tasks during the project is exemplified by the quote below.

...I still tried to maintain a leadership role, so when we'd get to meetings, I would try to say, "Okay, this is what we need to talk about," or, "Here are some of the upcoming events," but to be honest I think it took leadership from everyone because I think, normally, I would say the boss doesn't have any work to do, but the boss is even more of the role of trying to keep everyone together and less of the on-the-line-with-his-hands work. Having to do both could be difficult at times, so I was glad when people would step up and say, "Hey, guys, we also have this coming up," so I wasn't the only one that had to be relied on. [1108]

I would visually see timing of everything, if something took longer than we previously had anticipated or if something was a lot shorter, I would try to rearrange time

differently and tasks differently, based on how well people are following the timeline… [3155]

3 Month Experience

In comparison to capstone, participants in 3 and 6 months were given leadership responsibilities and mostly under the 'control' and "collaborate" profiles. Similarly, participants responded on having difficult and challenging experiences while leading teams and projects under these profiles, but the main difference with capstone experience was that they were neither able to use any strategy nor were guided by mentors or their supervisors with leadership strategies to overcome these challenges.

Figure 5 highlights the leadership profiles which had significantly higher challenging experiences in the 'control' profile and very low accomplishment experiences. One of the participants' emphasized on being given the responsibility of a project leader within 3 months into work and having difficulty in monitoring project tasks and coordinating with team members. The challenge is exemplified in the quote below.

> *I feel that because I'm really new and I just graduated from college, working with people who are more senior than me is ... I find it more challenging. I'm a project manager and sometimes I have to get people to do things on time, or I need to follow up with people. Some people will give me a shorter answer. Sometimes it's harder to get information out of people. Others are not so open to talk about it, or why they're stuck, or you know what I mean?* [3146]

The participant also highlighted the difficulties coordinating a group of team members working in different roles trying to unify them as a single team. The participant emphasized on the culture of working individually in the workplace for which coordinating amongst all the members made it more difficult. This challenge is exemplified in the quote below.

> *The biggest challenge in unifying the team is because the data team comprises of the people doing data engineering work which is building the infrastructure using cloud services and writing code to deploy those things. Then you have the people who are on the data analysis side, who come up with models or do predictive analysis to get meaning behind the data. Everyone here, even though they're in different roles, should be able to talk freely with one another because you can't have the data analysis people not talking to the data infrastructure or data engineering people. I think right now, this team is not used to that because they've been always working separately…* [3146]

6 Month Experience

There has been more "compete" reported in 6 months in comparison to 3 months and capstone experience. Figure 6 shows more presence of 'compete' profile among respondents in comparison to Figure 4 and 5. This is due to the increase in responsibilities of the participants in their workplaces as they moved 6 months into their work. One of the participants' emphasized on starting to produce results as the project manager with increased productivity and hence being

given more projects to lead in 6 months' time. This accomplishment is exemplified by the quote below.

> *...if I'm getting more reports done, I'm probably getting to them quicker. And this needs less revision from people above me. Which means they'll have to spend less time revising my reports. And that that way the projects can get out faster. Hence, I can start a new project. And that means we can take on even more new projects. So, looking at the numbers, I think, the best way to say I'm improving is to put out more reports. And do things more autonomously. So, do more surveys and more meetings by myself.* [1108]

Participants' had been given more leadership responsibilities in 6 months of their work experience, however, they responded to have faced multiple challenges during this time. Figure 5 shows significant number of challenges in both the 'control' and 'collaborate' profiles. One of the participants discussed on lacking confidence and feeling less prepared to lead and facilitate team meetings. The following response highlights this particular challenge.

> *So right now, I still wouldn't say that I'm the most prepared for it. Still a little bit, get a little bit nervous during the meetings. Like, how do I figure everything out in this one meeting? How can I pull everybody together, get everybody to cooperate and work together well? So, it's really, I would say over time I build that confidence, but as of now it's still does make me a little bit anxious in ways.* [1123]

Another participant discussed on being overwhelmed after being assigned to lead a project and facing difficulty in monitoring tasks and coordinating with other team members. The following response highlights this particular challenge.

> *I did do a little bit of project managing before, but this was just a headache, because you have to keep track of your own schedule, make sure you don't go over the given budget, which is very small, so there wasn't a lot of ... You can't spend a lot of time on it, so you have to keep pushing other people, and pinging everyone, and I don't know what kind of person it'll be taking in the team*. [4123]

Comparison between 3 Month and 6 Month Experience

Figure 7 integrates the 3- and 6-months profiles and shows differences in the leadership profiles in these two points. The darker colors represent 3 months and the lighter colors represent 6 months. The shift in profile demonstrate that leadership behaviors change over time and guidance from mentors, advisors and supervisors on leadership skills is essential for learning and applying the leadership behaviors in all environments. During the 3 months, 'collaborate' and 'control' profiles were more prominent and as we shift to 6 months, 'create' and 'compete' profiles become more significant.

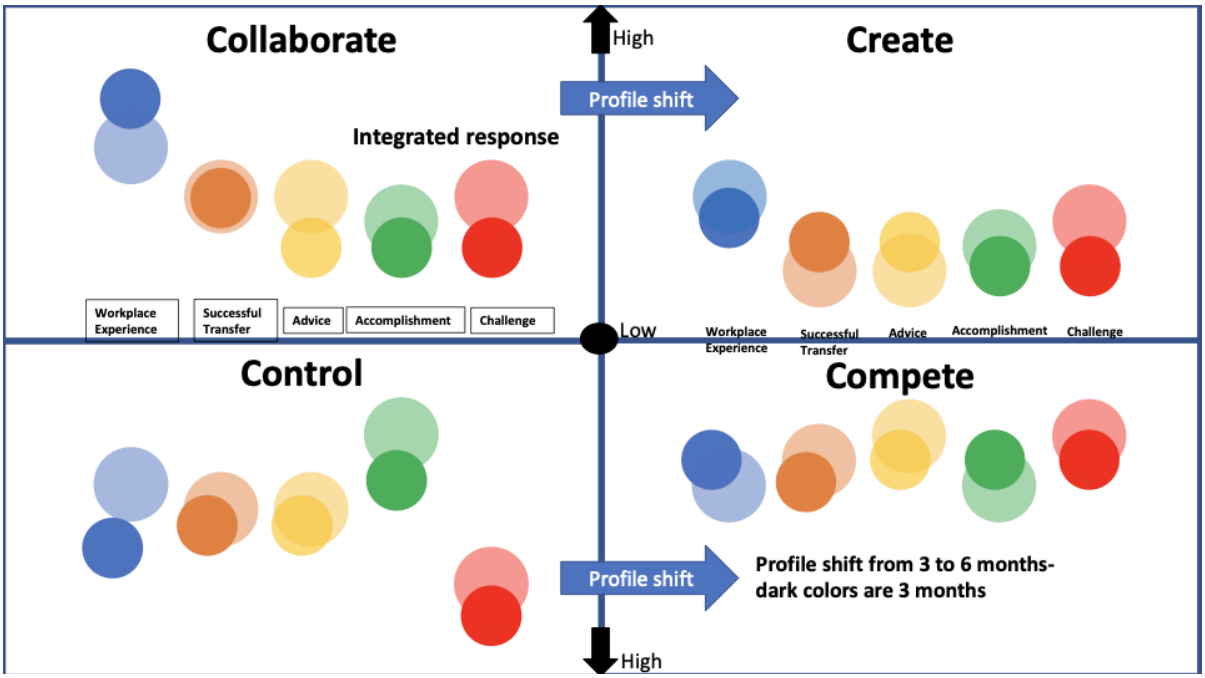

Figure 7. Comparison of 3 month and 6 month leadership profiles from participants' responses using the CVF

Transfer of Learning from Capstone to Workplace

Several participants discussed about activities that involved leadership behaviors in the workplace which were similar to their experiences in capstone and indicated transfer of learning from capstone. These responses are exemplified in the following quotes below.

One of the participants in his six months, discussed leading the project as a team facilitator which helped him in his workplace.

> *I was the project team facilitator in capstone. I was the team facilitator for my group and that was a lot of project management, keeping things organized that really translates to my job a lot since it's a lot of dealing with the projects and keeping it organized, reviewing the plans and then once it's going to construction, tracking that they have all their paperwork and they have their permits issued and they do all their required meetings, pay all their fees. So, there's a lot of project management that's involved in it. So, that's been a big one for me.* [1109]

Another participant discussed being a project manager and emphasizing on monitoring team tasks which helped her transfer the learning 3 months into her work.

> *...a lot of the skills I've learned through the project management aspect in our senior design are skills that I'm still using. So for example, when I was a project manager for my team, we used mark sheets as an instrument to make Gantt charts and schedule our project, and I still use that, and that's the only thing I use in order to create schedules...I've been able to implement that and make sure that everything is well*

documented within the process, and that seems to be very helpful especially when people within the company are asking what is it that we did, I have everything already documented in something. So that's been very helpful. [3147]

Discussion

Results suggest that the leadership behaviors of the participants do change during the transition from Capstone to the workplace. We used code counting as part of our analysis to understand the difference in participants' responses on leadership across the different points in time. The percentage of participants mentioning 'leadership' from the code counts were more in the capstone phase in comparison to the workplace. Most of the leadership experiences from the participants in both capstone and the workplace were in the 'collaborate' and 'control' profiles which involve leadership behaviors including acting as facilitators, mentors and managing processes. However, participants during the capstone course described more experience related to the 'create' profile describing more leadership behaviors including acting as innovators and negotiators in comparison to workplace. For example, participants in capstone course were involved as innovators bringing new ideas to the projects in their senior design team, led several changes in the project while working alongside industry clients and advisors, and were also actively involved in negotiations with clients and advisors during their project phase.
As participants had more workplace experience in 6 months, they reported to have been given a broader range of leadership responsibilities by their supervisors that map to all of the CVF quadrants. In addition, participants indicated that their leadership experiences from capstone helped them overcome challenges while leading projects during the 3 and 6 months in the workplace. One possible explanation is that the capstone experience provides a safe place for students to take risks with implementation of innovative ideas and assuming leadership roles in their times.

The data from our study demonstrate that leadership behaviors change over time and the profile shifts according to the leadership responsibilities carried out in the team. The create profile is more dominant in the capstone course while collaborate and control profiles are common in all phases and compete profile arises after six months on the job.
These results highlight the differences in the nature of the Capstone experience and the entry-level demands of the first six months in the workplace. Capstone design, as the culmination of an undergraduate program is one of the key places for creative leadership in the curriculum. The results of the study support the Capstone course as one of the major design experiences in the curriculum.

Once Capstone students graduate, the entry-level roles they have in the first six months' transition and the type of entry-level leadership that is required shifts even more heavily to the Control quadrant than in Capstone. Here, new employees are less likely to be asked to make major management contributions and are more likely to be expected to learn to act as new professionals, who monitor and coordinate the individual tasks they have been given effectively and efficiently in anticipation of larger roles. The results of this study appear to confirm this transition as an emphasis on shifting from one type of leadership behaviors to another.
It is also important to consider the lack of prevalence in the Compete quadrant all the way through the Capstone and out to six months of employment. Capstone traditionally has more of

an emphasis on the design process than the results and entry-level employees are also learning their company's processes. It is interesting to see the increase at the six-month level in the compete quadrant as employees are given additional responsibilities that have more of an impact on their company's performance.

One other interesting result is the presence of leadership behavior in the Collaborate quadrant throughout every phase of Capstone and the first six months on the job. This result highlights the importance of teamwork skills for the successful transition through Capstone as well as the first six months of the job [28]. Across the larger study teamwork has emerged as the activity most frequently engaged in by new engineers in their first six months of work which validates the strong emphasis placed on teamwork outcomes in most Capstone programs.
One limitation of the study is that determining leadership behaviors for participants from the data was an entirely qualitative effort. Future studies could incorporate available survey assessments of the Competing Values Framework [29]. Knowing a participant's quantitative CVF profile which highlights participants relative strengths in the quadrants could help researchers and Capstone instructors better understand the qualitative experiences that engineers report as they are transitioning from Capstone to the workplace.

Conclusion

According to Feiner [30], universities have put in extensive efforts to teach professional skills which can be easily communicated, identified and quantified, but leadership is a skill which is difficult to get right. Feiner [30] elaborates that is difficult to agree on different leadership skills to teach students for which the leadership skills among students are lacking. The application of the Competing Values Framework in this study brings some clarity to the debate of which leadership skills to teach by emphasizing the contextual nature of leadership behavior. The results suggest that successful Capstone leaders would more frequently call on behaviors associated with the innovative Create quadrant than those associated with entry level engineering work with its emphasis on learning the tasks of a new job through coordination and control. This suggests the need to balance the curriculum in Capstone design to encourage the creative leadership associated with a major undergraduate design experience that integrates all previous curriculum while nurturing the coordination and monitoring tasks new graduates will encounter when starting out as an engineering professional.

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