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What Makes a Leader? Conceptualizations of Leadership and Implications for Teamwork in First Year Design

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Introduction

Leadership identity development for engineers is more critical than ever to create sustainable and equitable solutions in today's complex world. Despite its importance, leadership remains a challenging competency for students to develop, and engineering educators to teach. A key component of leadership development is understanding what leadership means to an individual [1]. This can be quite challenging for students, as leadership is a complex construct, with a rich history of various leadership theories and no single, common definition. In many ways, the concept of leadership is open to interpretation and each individual may conceptualize and employ it differently. Traditional views of leadership focus on a leader as a "positional authority" [2, p. 111], while contemporary theories view leadership as interdependent within a group (e.g. [3-4]). Significant work has been done to describe the meaning-making process of Leadership Identity Development (LID) in students [1, 5], however less work has focused on how students experience this development in current undergraduate engineering curriculum.

Due to the subjective nature of leadership, it is often left to be developed in undergraduate engineering students *indirectly* through experiential learning opportunities such as in team-based design courses. While this experiential approach can be beneficial, it is unclear if students are actually developing leadership identity and employing beneficial leadership skills within their teams. Differences in conceptualizations of leadership and leadership identity may create disparities in team member expectations [5], ultimately damaging team dynamics. These challenging team dynamics may be particularly difficult for first-year students to navigate, as this is often their first time navigating self-managed teams. Additionally, students within their first year will have various levels of experience with teamwork and leadership, resulting in various LID stages and contrasting views of how leadership can or should be employed within their design team setting. If these challenges are not well managed, students may not develop leadership identities as we hope. This work aims to better understand how students conceptualize leadership within their first-year design teams and the implications of these conceptualizations on team dynamics. With this understanding, engineering educators may be able to better support students within design courses in their leadership identity development.

Background

Adult vs Youth Conceptualizations of Leadership

To understand how students conceptualize leadership, it is important to understand the various conceptualizations that arise from leadership literature, and differences between common adult and youth theories. Komives and Dugan [2] proposed dividing adult leadership theories into two categories of traditional and contemporary. There are many traditional theories of leadership, which broadly separated leaders from followers and viewed leadership as hierarchical, with

leaders placed above followers. The Trait theory of leadership focuses predominantly on the idea that being effective as a leader is dependent on specific qualities and characteristics [6, 7]. Both Traditional and Trait conceptualizations of leadership were highly gendered, with studies being conducted to investigate if there was a positive association between masculinity and leadership, and femininity as its inverse [6]. Behavioral theory is rooted in the idea that leaders perform certain actions [8] such as organizing processes and facilitating collaboration. The Power-Influence theory is characterized by the idea that leaders are those who have power and authority over others and in situations [9]. These theories all seem reminiscent of the "Great Man" theory in which Thomas Carlyle lays out his belief in heroic leadership. In this theory, the world and all of history were created by great men as the rest followed [10], with a clear delineation between those that follow and those that lead.

Contemporary leadership theories, while rapidly evolving, situate leadership as "a relative and relational process, collaborative, grounded in authenticity and deep personal awareness, and directed at enhancing the common good" [2, p.119]. Servant leadership theory characterizes leaders as those who serve others and puts others' needs first, taking on "not only the role…but also the nature of a servant" [3, p. 63] when working within their organizations. This conceptualization views leadership as held by one person, whereas many other contemporary conceptualizations look at leadership as manifesting between people. Shared/Relational theory suggests that leadership is distributed through the group, which is working together to achieve goals [4]. In a similar vein the Social Exchange Model of Leadership Development sees leadership as non-hierarchical, values based, and collaborative [11], while the Complexity theory of leadership conceptualises it as a broader, dynamic, and interactive organizing process [12].

In contrast to the well-established adult theories of leadership, Mortensen et al. [13] worked with youth (between ages 12 to 18) in a leadership-development context and identified five youth conceptualizations of leadership. These were defined as: Anyone having the potential to be a leader; The ultimate goal of leadership is to create change; Leadership is represented by collective effort; Leaders act as guides or mentors instead of giving explicit direction; and Overall good character. Through their research and the elicitation of these themes, they found that "Traditional adult theories of leadership (e.g. Trait and Behavioral) do not align with youths' perspectives on leadership…. Overall, youth perceptions of leadership move past the traditional leadership theories and more closely align with the contemporary theories." [13, p.457]. Interestingly, this does not agree with Komives et al.'s findings [5], which observed that students largely had traditional, hierarchical views of leadership when entering college.

Leadership Identity Development

The process through which students develop their conceptualizations of leadership and leadership identity has been well developed in the literature. Most notably, Komives et al. [1] developed the leadership identity framework, which describes this process. In their Leadership

Identity Development (LID) model, Komives et al. [1] conceptualized the creation of leadership identity into 6 stages; 1. Awareness, 2. Exploration/Engagement, 3. Leader Identified, 4. Leadership Differentiated, 5. Generativity, and 6. Integration/Synthesis. Students in Stages 1 through 3 conceptualize leadership in largely traditional ways (following theories such as Trait and Behavioural), with an emphasis on position and hierarchy. It is in Stage 4 when students begin to transition to seeing leadership in more contemporary ways, moving away from hierarchical views and instead seeing leadership as a process. It is also in this stage that they begin to internalize a leadership identity [1]. Stages 5 and 6 represent higher order understandings including seeing beyond themselves and integrating leadership into their personal identity. Since Komives et al, [1], other scholars have built upon this model by examining how other facets of identity influence students' leadership identity development (e.g. [14]). Studies have also shown that students' leadership identity development was supported when new and more complex experiences were encountered (e.g. [15]).

Leadership Education in Undergraduate Engineering

Traditionally, many opportunities for leadership identity development for engineering undergraduate students have fallen outside of the core engineering curriculum, relying on co-curricular activities such as design teams, engineering clubs, and profession-based student organizations [16]. Work by Klassen et al. [17] investigated the status of leadership education in engineering and identified three clusters of programs type: Technical Integration programs focused on individual leadership for economic growth and delivered learning through integration with technical content, Social Impact programs emphasized organizational leadership for societal change and delivered learning through workshops, service, and elective courses, and Core Curriculum approaches which integrated teamwork and leadership in the mandatory courses within the curriculum. Knight and Novoselich [18] called for a stronger core curriculum approach, with the inclusion of formal leadership development into the curriculum. Although some programs have developed these explicit leadership development opportunities through seminars, certificates, minors, and even B.Sc. degree programs [19], many leadership development programs are still significantly underdeveloped.

In programs where explicit leadership development opportunities are lacking, it is often assumed that leadership development will occur as an implicit outcome within team-based design courses. Teamwork and leadership are closely related, but distinct constructs. Teamwork has been described as an integral part of leadership [20] however it has been found that leadership skills may not be developed by simply participating in a team [21], [22]. By leaving our students unsupported in the development of leadership identity within their design teams, it is unclear if leadership development is occurring at all. The team environment itself can also affect how students develop leadership identities.

LID Implications for Team Dynamics

Komives et al. [5] identified five categories of influence for a student's leadership identity development. Most applicable to this paper, the "Changing view of self with others" category highlights the dynamic influences of the group on individual development [5], indicating that a small group setting (such as the one present in design teams) may have significant impact on student leadership identity development. Komives et al. [5] also describe that the LID model could be useful for understanding why certain team dynamics may arise based on the LID stage of various team members. For example, if some individuals are within stage four and perceive leadership as a shared construct, while others within stage three identify leadership as positional, there can be a misalignment of expectations, resulting in frustration and poor team dynamics. The various levels of leadership development of students within the team may also affect who each student perceives as a leader, and the expectations of behaviours and attributes associated with leadership. Due to the complex and adaptive nature of teams [23] it is likely that these effects may change over time, as the students interact with each other and develop team norms [24]. Rocco and Priest [25] suggest that instead of a linear model, leadership identity development should be considered as an iterative process, which is constantly under negotiation through internal and external influences. With these considerations in mind, it is critical to determine how leadership identities and conceptualizations of leadership may change over time within design teams.

The First-Year Project-Team Context

First-year undergraduate students typically exist at the boundary between youth and adult. Due to the various conceptualizations of leadership at both the adult and youth levels as well as the transitions of students through the LID process, it is unclear how the students within the first year of an undergraduate engineering program conceptualise leadership. The first-year design course is an opportunity for students to practice leadership skills as they work closely within a team [26], and to develop a leadership identity through these experiences. However, as discussed, merely participating in a team does not guarantee the development of teamwork and leadership skills [21], [22]. It is therefore unclear how our first-year students view leadership within their team (if at all), and what effects certain conceptualizations have on their team dynamics.

Conceptual Framework

While the literature has provided substantial understanding for how student leadership identity is developed in students over time, it is unclear what the impacts of this development are within first-year engineering design project-teams. This work focuses on developing an understanding of the relationships between how students conceptualize leadership, how students see themselves and others as leaders (or not) within the team, and team dynamics over time. The conceptual framework for this work is provided in Figure 1, below.

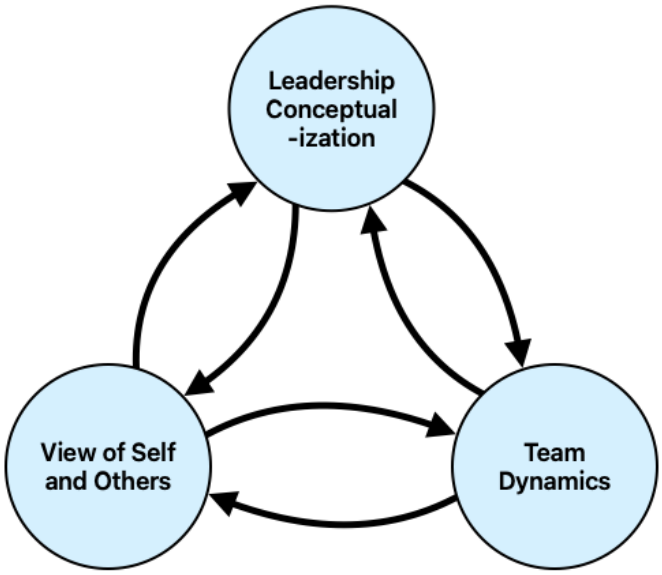

Fig. 1. Conceptual Framework exploring the relationships between leadership conceptualization, view of self and others, and team dynamics over time.

This work aims to answer the following research questions:

(1) How do students conceptualize leadership within their design team over time?

(2) What are the implications of these conceptualizations on team dynamics over time?

Methods

Research Design

This study uses multiple perspective, longitudinal qualitative research (MPLQR) methods to follow the students in one team over a term-long, team-based design project. The term-long, longitudinal approach allows for the investigation of change within individuals, and the team as a whole, over time [27]. All students within the team were interviewed separately, to understand how each student individually views leadership, and the effects that these views have on how they work within the team. In order to allow for significant changes of constructs between interviews, interviews took place at three time points throughout the term: the sixth week, the tenth week, and the fourteenth week. The time points correspond to stages of the design process experienced within the course, as shown in Figure 2, below.

Fig. 2. Timeline of interviews with associated team tasks.

To encourage participation throughout the entire research project, students were compensated $25 of the school's currency for each interview, with an additional $25 provided if the student participated in all three interviews.

All interviews were recorded and transcribed via Zoom. Following the interviews, the researcher manually edited the automatic transcription to ensure accuracy. At the beginning of each interview, the researcher read through the ethics protocol with the students, reminding them that their interview was entirely voluntary and confidential. Semi-structured, open-ended interview protocols were developed for use in this study. The protocols were aimed at understanding if and how internal and external factors including, but not limited to, leadership and leadership identity development, affected the dynamics of students within the project team. This work is part of a larger research project studying how team dynamics affect student engagement in engineering student project teams. To minimize the effect that our protocol had on data collection, it was designed to provide a structure through the order and wording of key questions, while maintaining flexibility for both the interviewer and interviewee to probe student experiences with further questions or additional details when required [28]. The interviewer was the first author on this paper, who had no current association with the students within the study or with the first-year design course.

Data Analysis

Interviews were analyzed using open, axial, and selective coding [29] and constant comparative analysis [30]. Specifically, an adaptation of the framework presented by Vogl et al. [31], was used, which begins with a cross-sectional thematic analysis of each individual student following their first interview. From there, a cross-sectional analysis was completed, which involved the data from the first interview of each student being compared and contrasted to the other participants, in order to analyze dynamics within and between different accounts [28]. This cross-sectional individual and cross-sectional-team analysis was completed following each time point. Once all interviews at all three time points were completed, longitudinal data analysis

began. First, the data from each individual was analysed longitudinally, to determine if and how conceptualizations for each individual changed from Time 1 through Time 3. Finally, a longitudinal within-team analysis took place, where the longitudinal data from each individual was compared and contrasted to investigate team-level effects. An image of this data analysis process is included in Figure 3. The red boxes within this figure indicate how the data is compared to each other: cross-sectionally or longitudinally, and at the individual or team level. The findings from this work are presented in the longitudinal, team-level form.

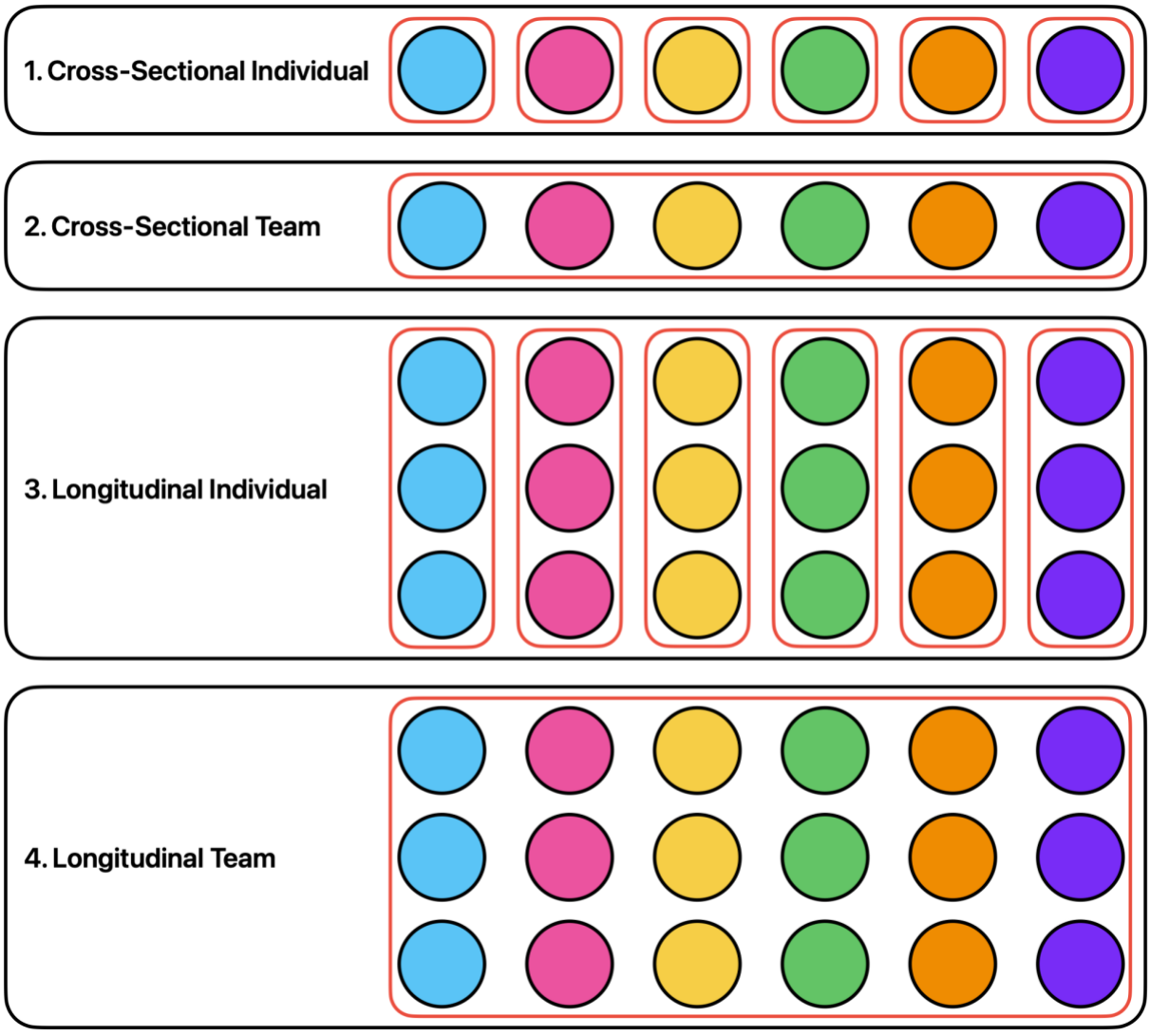

Fig. 3. Multiple Perspective, Longitudinal Qualitative Interview analysis framework, adapted from Vogl et al. [31] showing the stages of coding as cross-sectional/longitudinal and individual/team-level

Study Context

This work took place in the context of a large, first-year engineering design course "Engineering Strategies and Practice II" (ESPII) at the University of Toronto This design course is split into two separate, term-long design courses, and all first-year engineering students, outside of the Engineering Science program, participate in this course. The course had a total of approximately 950 students enrolled for the Winter term, when the study took place. All students within this course had previously taken the Fall term course where they were placed in teams to complete a four-month design project. In the winter term, students were placed in *different* teams of 4-6 students, working on different projects from their Fall design course. Teams were randomly created by the course coordinator, based on the tutorial section that students were assigned to.

This winter first-year design course is designed for teams to progress through a complete design cycle and produce a workable solution for their client. This course aims for students to develop skills including professional communication, problem solving, independent thinking, systems thinking, and team dynamics. Leadership development is *not* an explicit learning outcome for this course.

The course structure required that students determine roles within the team to assist in team organization. It was up to the students to decide who would have which role, and what the responsibilities of that role would entail. The following roles were required by the course structure: Team Leader, Project Manager, and Communications Manager. Other roles were defined by the team, until all students had a role. Although there is a "Team Leader" role, the course teaching team explicitly instructed students that leadership was not to be conceptualized as positional, but as influence which can be done by all students within the team, regardless of their role. While there was team education provided in the course, outside of this discussion regarding roles within the team, there was no explicit leadership education provided.

Participants

All teams within the Engineering Strategies and Practice II course were invited to sign up for the opportunity to participate in the study. Participation was entirely voluntary and was not connected to any grades or advantages within the course. In total, 18 teams signed up to participate. Due to the data-intensive study methodology used in this research, one team of six students was randomly selected to participate. All students within the team were enrolled in civil engineering. The demographics of these students are included in Table 1, below.

Table 1. Participant Demographics and Roles

Pseudonym	Gender	Discipline	Role within the Team
Ahmed	Man	Civil	Team Leader
Benjamin	Man	Civil	Communications Manager
Carol	Woman	Civil	Editor
Dennis	Man	Civil	Editor
Eloise	Woman	Civil	Project Manager
Frank	Man	Civil	Transcriber

Findings

(1) How do students conceptualise leadership within their design team over time?

Our findings show that there were various conceptualizations of leadership within the team, and these conceptualizations seemed to change over time. While initial conceptualizations seem to indicate more traditional understandings of leadership, as the term progressed the students began to express more contemporary understandings. Despite these varying conceptualizations, all students independently recognized that two students, Ahmed and Eloise, were considered as leaders within the team.

Interestingly, the role of "Team Leader" did not seem to be desirable to any of the students when they were initially selecting their roles at the beginning of the term. Ahmed, who eventually took the Team Leader role, did so only after no one else volunteered. While describing how role distribution occurred, Benjamin stated that when they began discussing who would be the Team Leader: "Immediately, the kind of feeling [in the group] was like, no one wants to be Team Leader" (Time 1). Dennis mentioned that he "didn't want to be a Team Leader or Team Manager" (Time 1). In fact, Ahmed suggested that Eloise take the Team Leader role because she had an outgoing personality and was the "leadership type", but according to Ahmed, "Eloise dumped [the role] on me" (Time 1). One reason for the disinterest in the Team Leader role within the team may be that this role is associated with higher workload and more responsibility. When asked why Eloise wanted the Project Manager role, she stated that she "wanted to have a bit more control over things, yet not [have] too much responsibility. So I… didn't want to be a Team Leader" (Time 1). When asked about if he wanted to have the Team Leader role, Ahmed responded "Not really. But what can you do? Someone's gotta do it" (Time 1). Regardless of their "official" roles, all students within the team seemed to agree that Ahmed and Eloise were leaders within the team. The reasons that Ahmed and Eloise were described as leaders varied between students and along points in time.

There were four common themes for the conceptualizations of leadership described by the students within the team. Students described that initial perceptions of leaders within the team were based on their personality characteristics, coded as 'Leadership as a Personality'. Once the team began working together to accomplish tasks, students shifted to describe the leaders in their team based on their management behaviours, coded as 'Leadership as Management', their willingness to help others, coded as 'Leadership as Helping', and their ability to bring the team together, coded as 'Leadership as Connecting'. It appears that the students' leadership conceptualizations did change as the team developed. Figure 4 shows this change of conceptualizations over time.

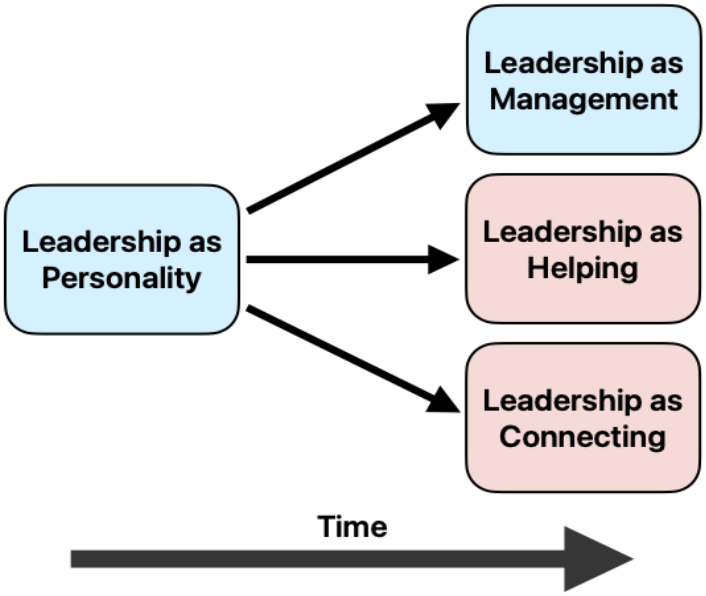

Fig. 4. Evolution of leadership conceptualizations over time, with traditional theory alignment in blue and contemporary theory alignment in pink.

The leadership conceptualizations of note were not discussed in equal proportions. "Leadership as Management" was most commonly referenced (48%), while "Leadership as Personality" was least commonly referenced (6%). A detailed account of coding frequencies and theoretical alignments are included in Table 2.

Table 2. Coding Frequency and Theoretical Alignment of Conceptualizations

Conceptualization	*n* of participants contributing (N=6)	*n* of transcript excerpts assigned	Percentage of Total Excerpts	Traditional or Contemporary Alignment
Leadership as a Personality	2	3	6%	Traditional
Leadership as Management	6	27	48%	Traditional
Leadership as Helping	5	13	23%	Contemporary
Leadership as Connecting	5	13	23%	Contemporary

Leadership as a Personality

The students described that due to the initial reluctance of all students to take on leadership roles within the team, those who emerged as "leaders" did so initially based on their strong personalities. This largely aligns with traditional trait-based leadership theories. Dennis explained that "Ahmed and Eloise are kind of right off the bat… taking more of a leadership [role] generally… [because] they are pretty outgoing" (Time 1). Benjamin explained that he thought Ahmed and Eloise had "personalities that are more driven towards leadership… more than anyone else in the group" (Time 2). He added that the leaders were "pretty assertive in [the way they were] talking" (Time 2). Benjamin also commented that Eloise "seemed confident", which he associated with leadership. In another interview, Benjamin mentioned that Ahmed and Eloise were "more naturally keen to leadership" (Time 3) because of their outgoing personalities.

Leadership as Management

As the team began working together, the students described leadership in ways which largely aligned with behavioural conceptualizations of leadership. Specifically, the team heavily associated leadership with management tasks. When asked if certain students within the team were showing leadership, Benjamin described: "For sure … in terms of checking in on everybody and … making sure that they're on task and even assigning tasks… just taking more initiative in that… Two people in my group, the Ahmed and Eloise… they've been leading [and] it's been less on everyone else" (Time 1). Eloise mentioned that she wanted to make sure other team members completed their tasks by the deadlines, explaining: "At the end of meetings, I have been repeating myself multiple times, and I make sure I make eye contact with all of [the other team members], and make sure we get affirmative feedback from them all about the internal deadline guidelines to follow" (Time 3). This role of management reinforced the students' perception of Eloise as a leader in the team. The behaviours of task distribution and

task management in association with leadership were discussed by five of the six students on the team.

We additionally see some descriptions of leadership that align with Power-Influence theories of leadership, despite the fact that there is no actual authority for the leaders within the team over their peers. Dennis said, “I feel like having a group member that just tells us what to do, having a leader to direct us in the right direction, will definitely help us succeed.” Benjamin appreciated that the leaders within the team took on the responsibilities for task distribution and management because “it does make it easier for everyone else … it's kind of easy to know what to do, if you're told what to do” (Time 1).

Many students also mentioned that the leaders within the team took initiative in ways that other team members did not. Benjamin described that Eloise has “a lot of initiative” and would “assign things… then ask if they were done” (Time 1). Ahmed commented that he was “doing most of the checkups” (Time 1) to see if tasks were completed. Ahmed also commented that he and Eloise seemed to take more initiative than the other team members, explaining: “I guess I would say [we] volunteer more than others… I feel like whenever there's a task that nobody knows who's accountable for the task, [the rest of the team] is just like, I think the team leaders should be accountable” (Time 1). In a similar vein, Dennis commented that for tasks that did not fall squarely under someone’s role, “the team leader did most of that stuff” (Time 1).

Students would also look to the leaders of the team for approval or feedback on their work. Benjamin stated “I think we'll look to Ahmed for approval, at least me. Like I finished my section. I'm like ‘Can you read this and tell me if it's up to your standards or what you think it should be?’ And then if he says ‘Yes’, I'm done. That's my mental cue to be like, it's good” (Time 2). This approval seeking is another way that the mental load is transferred from the individual student to the leaders within the team.

Leadership as Helping

Students also described contemporary views of leadership. Many students discussed Ahmed's commitment to the team and willingness to help others as a factor that differentiated Ahmed as a leader within the team. This aligns with the contemporary servant leadership theory where the leader is called to put other team members above themself. Benjamin described: “Ahmed is very willing to help. He takes a lot of initiative. It's like, when he's done his part, he's always looking for something else to do. Which I wouldn't say is really the case for anyone else, including me. Everyone else is kind of just doing their part” (Time 3). When asked if Benjamin was also helping with other sections of the project, he replied “Oh, no. If I finish a part, I rarely attempt to understand or jump onto another part” (Time 3).

Carol described that Ahmed is a leader because he is "very helpful, and wants to help everything and he knows what to do … if someone has a problem or a question with a certain section, then he'll give advice to that person. And I think it's really good" (Time 1). Interestingly, while Ahmed falls into this category of leadership, Eloise does not. Carol described "Eloise, she does her part really well, but she doesn't exactly help with other parts" (Time 1).

During his second interview, Ahmed described that "now [the Team Leader role] has become an all-inclusive role… I kind of touch on every single other role. I do some project management, some editing, I do a little bit of everything" (Time 2). Benjamin also acknowledged the extra work of Ahmed, stating "I think my team leader is kinda like the Swiss Army knife of our team. He's definitely doing the most" (Time 3). Frank also stated that Ahmed is "putting in that extra effort, [more] than maybe other people are." Benjamin summed up his thoughts on what a leader is quite concisely: "The team leader will help out with a lot of people, which is the thing that you would kind of expect the leader to do; to bring everyone together" (Time 3).

Leadership as Connecting

In that vein, students also described the leaders within their teams as the ones who tie the team together and maintain their connections to one another. Carol said "I think Ahmed and Eloise, they take a lot of leadership [within the team, while] other group members… focus on their own sections" (Time 2). Similarly, Benjamin described the team's leaders as being the ones who oversaw all parts of the project, while the other team members focused solely on their own parts. He said "Some people have a better understanding of what's happening [in] the project as a whole, right? Like Ahmed and Eloise, they probably have more of a tick list of this is done, this is done, this is done. And that would equate to the whole thing being done, versus maybe everyone else does more just like, individually what you're supposed to do. Yeah, like your section is done, you don't need to care about the rest" (Time 3).

(2) What are the implications of these conceptualizations on team dynamics?

Effects of 'Leadership as a Personality" Conceptualizations

We see that initial conceptualizations of "Leadership as a Personality" created a team environment where students quickly sorted themselves into "leaders" and "non-leaders" based on the personality traits apparent in the first meetings. This reinforced the positional hierarchy within the team, with Ahmed and Eloise being placed above other students. This segregation created a sense of responsibility for the leaders within the team, where they consistently were the ones to ensure that the work was completed to a high level, while other students were able to shy away from these responsibilities.

Effects of "Leadership as Management" Conceptualizations

Due to the separation of leaders and non-leaders created through the initial conceptualization, the leaders within the team were largely left responsible for managing all aspects of the team. This resulted in a massive shift of both cognitive and emotional workload onto the leaders of the

team, despite the leaders not necessarily wanting to take on these responsibilities. When asked if Ahmed minded keeping other students on track, he responded "It's kind of a pain, but I mean, I do it… we gotta get it done" (Time 2), insinuating that if he did not perform these 'check ups' for the team, the work would not be completed on time. Ahmed also talked about the difficulties in trying to enforce rules and deadlines, because "I don't really have authority over [the other team members]" (Time 1). This is one of the problems with the hierarchical conceptions that the students held regarding leadership; although they position the team leaders in a hierarchy, there is no actual authority, such as what would exist in a workplace. This creates stress for the students in leadership positions as they try to navigate these unclear hierarchical positions, while other students can relax and be taken care of.

This conceptualization may also contribute to the reluctance on behalf of the students to be in the Team Leader role at the beginning of the term. This may be because the students expected, from previous experiences, that the Team Leader role would be more effort and responsibility than the other roles within the team, with little to no reward. Despite all of the other team members appreciating the way that he led the team, Ahmed was left overworked and overburdened. In his last interview, Ahmed described "At the beginning, I was very motivated. I portray myself as always motivated to my team. But internally, I feel like I'm kind of dying… I spent the most time on this project… They definitely ask me for help the most out of anyone else. It's … tiring" (Time 3). While his teammates appreciated the leadership that he provided for the team, Ahmed did not enjoy being in this leadership position. He stated "I don't like being this person [who people always rely on]. I definitely would try my best not to become this [again]" (Time 3). In this case, his leadership experience has alienated Ahmed away from leadership and will likely affect whether or not he pursues future leadership opportunities.

Effects of "Leadership as Helping" Conceptualizations

Because Ahmed was eager to help others, an expectation for his behaviour as a leader within the team was created. Eloise described that by the end of the term, "We're all relying on our Team Leader more and more. [During] every single assignment, I felt like the Team Leader is just taking on a lot of work that wasn't originally assigned to them. And he did a great job doing the editing and proofreading [last time]... We're just feeling like, oh, maybe he'll do the same thing again" (Time 3). Because Ahmed was helping others as they needed, the other students began to do less and less work, assuming that Ahmed would take care of it for them. Eloise stated: "We kind of just don't like [doing] the smaller things like editing or checking the grammar and the formatting stuff… Ahmed can do it" (Time 3). Carol described that "we always expect the Team Leader to sort of help us out" (Time 3). Ahmed agreed with this sentiment, commenting that "Yes, [when] they can just reach out [for help], why wouldn't they? Why would they try really hard when they can just ask me" (Time 3). This inequity in workload was damaging to Ahmed, but was celebrated by the other students within the team, as they could do less work but still receive an excellent grade. Due to the over-contribution of Ahmed to make up for the under-

contribution of other members, from the outside the team appeared to be working well, with assessments being submitted on time and achieving high grades. Eloise even commented that “I feel like to [the teaching team] we're considered the happy group” (Time 3), despite Ahmed feeling “like I'm kind of dying” (Time 3) in response to the workload and expectations placed upon him within the team. If the instructors do not see the internal team dynamics, they are unlikely to intervene, and the team will continue to work in these damaging ways.

Despite these negative effects, there are also some positive aspects of the “Leadership as Helping” conceptualization. This conceptualization allowed the students to give and receive help which contributed to stronger relationships between Ahmed and other team members. Because of Ahmed’s willingness to help, in many ways this team turned into a “hub and spoke” dynamics, where Ahmed was central to the team processes and the other students were on the periphery. Feedback was freely asked for by these other team members and given by Ahmed. This facilitation of feedback is particularly helpful for first-year students, as they navigate feelings of psychological safety, conflict, and vulnerability which can often be barriers to requesting feedback from others [32]. Figure 5 shows the interdependence of the members of the team, with Eloise largely assigning and managing tasks, while Ahmed provides feedback and assistance to all team members.

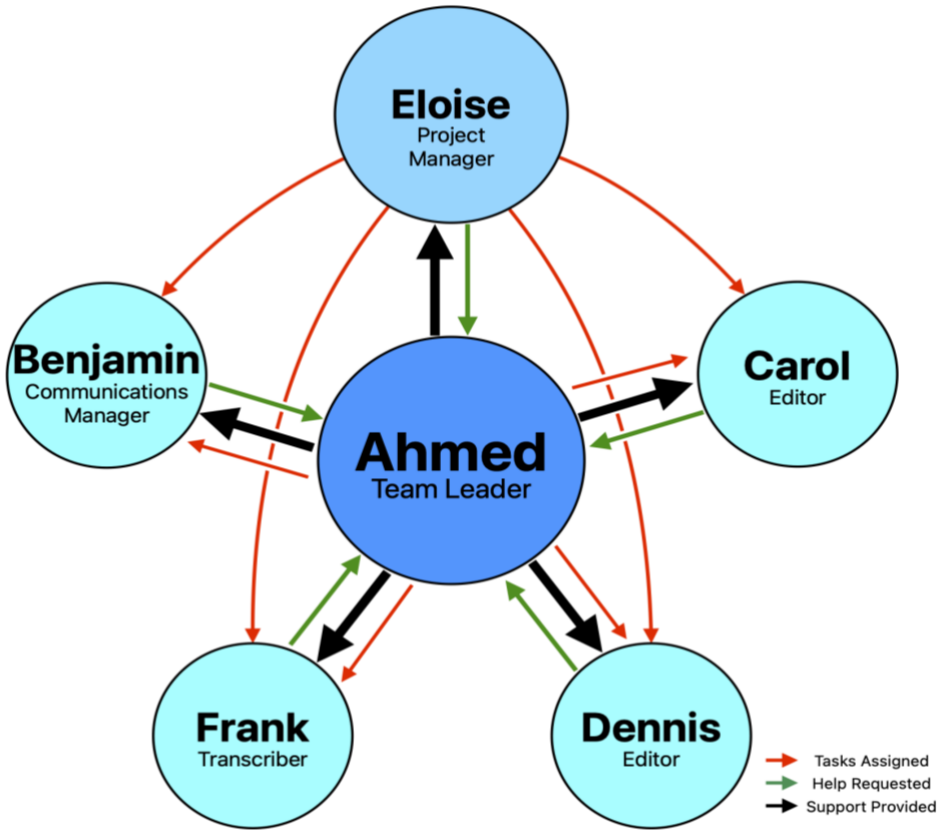

Fig. 5. Predominant leadership interactions as described by students within the team. Tasks Assigned reflecting "Leadership as Management", Help Requested and Support Provided reflecting "Leadership as Helping", and all three actions reflecting "Leadership as Connecting".

Effects of "Leadership as Connecting" Conceptualizations

The "Leadership as Connecting" conceptualization resulted in an increased connection of the team members to Ahmed, and to each other through Ahmed. This is a critical piece of team dynamics, as higher levels of interdependence is important for the development of healthy teams [33]. This conceptualization shows that students do understand the importance of connectedness within the team, even if Ahmed is the only student actually providing this connection.

Despite these positive effects, the fact that Ahmed was the only student providing this connection did place a significant burden on him. Ahmed described that "I have my parts, but then I'm also like, reaching out to the other parts to like, help them out when they are struggling… I'm the only one that knows about every aspect of the project. Our team is too individually focused, everyone works by themselves too much. Whereas I [am] always trying to work with everyone else". He added that "I feel like I have [had to do extra work] the entire semester to make sure the team doesn't fall apart. I cannot imagine this team being held together if I wasn't there." When asked if Ahmed was taking on these extra responsibilities because his official role in the team was the Team Leader, he explained that "Even if I wasn't team leader, I

would still be doing the same thing. Okay. So I don't think it's the role. I think it's just how I am, helpful." This shows that for Ahmed, leadership is not just available to those in the official 'Team Leader' role but exists on a more personal level.

Discussion

Clearly there are many conceptualizations of "what makes a leader" in this first-year design team. Initial perceptions of leadership tended to follow more traditional views (such as trait-based, behavioural, and power-influence), while as the team developed more contemporary views (such as servant leadership) were expressed. While the students did not provide a clear definition of what leadership is, they were all able to come to the same conclusion that there were two "leaders" within the team. Although the reasons why they described these students as leaders varied, this agreement shows that leadership in some form is present within the team, beyond just the title of "Team Leader". While Ahmed was clearly represented as a leader in all conceptualizations, Eloise was only present in "Leadership as Personality" and "Leadership as Management". Eloise's initial avoidance of the Team-Leader leader role to avoid feeling overly responsible for the team, while still seeking a management role to maintain control within the team, may indicate that Eloise may have purposefully avoided the social-emotional components of leadership that Ahmed displayed.

With respect to the LID model, we see alignment with previous research of students entering college with hierarchical and traditional views of leadership [5]. Throughout the term, we see some transition towards contemporary views of leadership, however behavioural views are also present. This may be indicative that throughout the first-year design course students are beginning to transition through Stage 3 into Stage 4. Interestingly, while both Ahmed and Eloise were pinpointed as leaders at the beginning of the term and recognized within "Leadership as a Personality" and "Leadership as Management", we then see only Ahmed recognized in more contemporary leadership ways through "Leadership as Helping" and "Leadership as Connecting". This may be indicative that Ahmed is at a more developed LID stage than Eloise.

Interestingly, the conceptualizations discussed by the students within this paper fall squarely into the adult theories of leadership (e.g. positional or attribute based, servant leadership), with little to no mention of any youth conceptualizations (e.g. that anyone could be a leader at any time). Because the students fall on the boundary between youth and adult, we expected that some youth conceptualizations may be mentioned. The lack of youth conceptualization representation is concerning as the youth conceptualizations centralize empowerment and change-making [13], which we would hope that our engineering students also prioritize. If our objective is for engineering students to understand the connection and impact of their work with society, we would hope to see these change-based, youth conceptualizations of leadership being reflected in the engineering students.

As engineering educators, initial perceptions of the leaders as those students with outgoing personalities is concerning. If students with outgoing personalities are selectively chosen or are the only ones to volunteer to be in leadership roles within the team, introverted students may not receive the opportunity to try to lead in their own way. The reluctance to be a leader within the team is another cause for concern. If leadership development is a desired outcome from team-based engineering design courses, it should be something that students strive for, not elude. When the students are left to develop their own understandings of leadership and implement it however they like, it appears that these students use the people who are taking up leadership roles as a "catch-all" for anything that students may view as extraneous or not a strict requirement of them within the course. This may be due to the heavy stress [34] and workload [35] that place significant cognitive and emotional loads on first-year engineering students. This is particularly concerning because poor leadership experiences (such as Ahmed's, presented in this paper) may lead to students, who at one time may have wanted to develop leadership skills, to avoid future leadership opportunities.

Although many conceptualizations of leadership were discussed by the students, one theory is notably absent; the team did not mention any aspects of shared leadership theory. Conceptualizations of shared leadership are seen in Stages 4 and up within the LID model [5] and the absence of these conceptualizations indicate that most of the students have not reached this level of leadership identity development. In a peer-based project team, where no one student has significant power over another, it would be ideal for students to utilize a shared leadership understanding, so that they can divide tasks evenly and all feel empowered to lead the team in certain ways. Due to the students' more traditional understanding of leadership, many roles and responsibilities (such as management, and uniting the team together) were only taken on by Ahmed and Eloise, while all other students avoided those responsibilities. This asymmetry in leadership and workload is particularly alarming because it occurred in the first-year course, and may have significant consequences for subsequent courses and real-world team experiences. The students who were not leaders within the team coasted off of the leaders' efforts and enjoyed the rewards, and may be likely to continue dumping their work onto leaders in future team scenarios. The leaders within the team may realize that they do not want to take on future leadership roles as they result in heavier workload and more responsibility, all to get the same grades as their non-leading peers.

Limitations and Future Work

The major limitation of this work is that this study only included one team in one first-year design course at the University of Toronto. Results are expected to somewhat vary across different teams and different levels of study (e.g. Capstone). This is a limitation of the methods used, which are incredibly resource and time intensive. Future work should expand to other

teams within the first-year design course at the University of Toronto to develop generalizability for the first-year context.

Another limitation of this work is the engrained course structure, which utilizes official roles for each student within the team for organisational purposes. The use of these roles may bias results, because students within what they consider "Leadership Roles" such as the Team Leader and Project Manager, may be more inclined to perform actions that they associate with leadership, while students in "Non-Leadership Roles" may be less inclined to act in ways that align with their conceptions of leadership. This was addressed in the interviews and students expressed that their official role did not affect how they performed within the team, however it is still a consideration for the study. Future work should include conducting the same study within a team where no official roles are required, to determine if similar phenomena occur.

Additionally, future work investigating leadership identity development of students from first through fourth year would provide a comprehensive understanding of if and how the current curriculum supports leadership development, and in which ways it can be improved to create engineering graduates with strong leadership identities.

Recommendations

The findings of this work show that without explicit leadership instruction or support throughout the course, the students had various conceptions of leadership which had a significant impact on team dynamics. This leads to several recommendations for engineering educators, as follows.

1. The first-year design course holds promise for leadership development, however this development should be scaffolded through instruction and support for students throughout their design team process.
2. Students should be supported in discussing with their team what leadership means to them, and how it should be implemented within the team. This may help create a shared understanding of leadership, reducing the potential for harmful team dynamics arising out of incongruent leadership conceptualizations.
3. Explicit leadership instruction is required to help students develop more contemporary/advanced understandings of leadership within their design team. Merely indicating that leadership is not positional, while requiring a student to hold a "Team Leader" position, is inadequate for supporting leadership identity development.
4. If roles are used within a course, particularly if certain roles have leadership connotations (e.g. Team Leader) while others do not (e.g. Editor), there should be a rotation of these roles on a regular basis. This will help prevent the "leaders" of the team holding leadership positions throughout and may encourage other students to develop their own leadership identities while in the "leader" role.

Conclusion

The results of this study indicate that leadership is present within the first-year design team, and the students conceptualize leadership in a variety of ways including some traditional views such as trait, behavioural, and power-influence, as well as more contemporary views such as servant leadership. Despite the variety of conceptualizations present, any mention of shared leadership is notably absent. The leanings of the students towards more traditional views of leadership resulted in an imbalance of workload and responsibility, with the burden being placed on the leaders within the team, ultimately causing them to be overworked and resentful. This also leads to a reluctance to take on leadership roles, as they are associated with heavier workload and more responsibility. It is critical that first-year students are explicitly taught not only what leadership can look like, but how it should be implemented within their project-teams to ensure equity in workload, accountability, and the development of leadership skills.

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