

## Faculty, Student, and Practitioner Initial Conceptions of Leadership

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It was during those five years when he realized that supporting young professionals with their leadership development is his life calling. He decided to leave corporate business and accepted a position at Cornell's College of Engineering.

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# **FACULTY, STUDENT, AND PRACTITIONER INITIAL CONCEPTIONS OF LEADERSHIP**

## **Abstract**

Despite being a “paradoxically obscure topic” [1], most people have an inkling of what leadership is, or what knowledge, skills, or attitudes leaders should have. This prior knowledge can help or hinder the deployment of a new leadership program if that new leadership program focuses on leadership principles which build upon, or are dramatically different from, the prior knowledge at the institution. Three universities are in the initial stages of launching engineering leadership programs, and each wishes to build upon the foundational concepts or perceptions of faculty, students, and program stakeholders. This work (still in progress) presents the initial findings of a survey of faculty and students from three separate colleges of engineering: Cal Poly Pomona, San Diego State University, and Harvey Mudd College. Prior to this work, Cal Poly Pomona started with faculty and student engagement using focus groups. We then augmented this initial work with industry focus groups as well as faculty and student surveys. For each school, the faculty and students are sent a link to respond to an online survey. We contacted all of the respective faculty and students via their university email account. The survey consists of two kinds of survey items. The first set of questions is meant to determine the attitude and knowledge the respondent has about leadership. The second set involves providing short answer responses to open-ended questions and statements to observe the keywords used to describe leadership. The results of the survey show students, faculty, and practitioners all see leadership as something that is learned more than born into an individual. That said, faculty and industry have a more nuanced view of leadership than do students as some of them felt that the traits of a leader are very important while students rated ‘born traits’ at merely ‘somewhat’ important. The open-ended responses also help inform the researchers that faculty and students see leadership as a self-development process or a process of learning how to engage others. Very few faculty and students identified leadership as a tool to lead a cause. A similarly small number identified leadership with the ethical dimension. Faculty are already using certain tools to teach leadership without labeling it as such. Faculty stated that they utilize tools to develop student leadership by increasing self-awareness and social-awareness. Very few faculty currently employ lessons to teach leading a cause or leading ethically, but that could be because they consider that part of engineering practice and not leadership development. Students seek opportunities to learn more about developing themselves more and improving working with others. Their demand and the faculty supply of leadership opportunities creates an opportunity to build leadership programs at the three institutions.

## 1. Background

In *The Engineer of 2020* [2], The National Academy of Engineers (NAE) urges academic institutions to prepare engineers to obtain professional skills to remain competitive in a dynamic, global work environment. The National Science Foundation (NSF), noting the challenge of teaching non-technical information in undergraduate engineering programs, suggested that engineering programs teach broad and deep professional skills across the curriculum including design, leadership, communication, understanding social contexts, ethical responsibility, and creativity [3].

This study involves the development of new engineering leadership programs at three schools: Cal Poly Pomona (CPP), San Diego State University (SDSU) and Harvey Mudd College (HMC). CPP and SDSU are both public institutions with relatively large engineering programs (about 5500 and 3500 students respectively). HMC is a smaller, private school of about 550 students. Across the three institutions, there is a wide range of social and economic backgrounds among students as well as diverse faculty that make utilizing the input from these three schools relevant to many other engineering programs in the U.S.

Our three engineering programs have each chosen to implement a leadership program as a way of meeting the challenges identified by the NAE and NSF. Leadership development includes training to improve your communication skills, understanding social contexts, creativity and responsibility, so we feel that a leadership program will holistically address each of the professional skills listed by the NSF.

Most engineering programs with engineering leadership training, have dedicated courses entrusted to only a few instructors to create and deliver the training methods [4], [5], [18]. If we were to embed the leadership training across the curriculum, as the NSF suggests, we would need broad support from faculty, students, and industry. Most engineering faculty already have specialized areas of research and teaching interest and are less inclined to teach outside their specialty area. They are also less likely to have significant formal training in leadership and may not see its importance. We also believe students who participate in leadership training are those who are pre-disposed to see themselves as leaders [6], while most of the rest, may not have interest in non-technical training. Finally, industry advisory boards and alumni may have concerns about leadership training being implemented to displace other technical materials they feel are critical to graduating competent engineers.

As our three engineering programs start the process of creating leadership programs we felt it necessary to verify if our faculty, students, and industry partners, fit the typical assumptions stated above, or if there is already a foundation of support for leadership education present at our campuses that have simply gone undocumented. We believe that some faculty is already teaching leadership principles without necessarily associating those skills with leadership learning, or without out doing it very intentionally. We also suppose that other faculty may feel more confident in their understanding of leadership principles if they could identify where are they, or their colleagues, already embedding leadership training experiences in their courses.

They can then leverage that groundwork to embed leadership into more courses or add additional leadership education into their existing courses.

### 1.1 Initial work

CPP held two focus groups moderated by an independent third party: one for students and the other for faculty. Faculty discussed the possibility of teaching leadership to undergraduate engineering students. A few felt that leadership could not be taught, while most did. The discussion about defining leadership varied quite a bit among the faculty present. When the topic of what we should teach came up, the conversation quickly turned to what faculty already teach. Faculty also were very clear that no new required courses could be created because of state requirements to reduce the number of units in the program.

The student focus group yielded a variety of keywords describing leadership. When they talked about where they received most of their leadership training, they mentioned student club roles and other extra-curricular activities. When asked about how we should teach leadership, students suggested general education courses should be employed, and there should be an increase in team/group projects across the curriculum. Some students even suggested requiring more communications classes, debate classes as well as suggesting that engineering programs embed leadership into the curriculum in multiple places.

While only CPP conducted the focus groups, we felt that more focus groups at each institution would not be as effective as sending a brief survey to faculty and students across each institution. The goal of this work is to collect data about faculty and student perceptions of leadership by asking them to answer some frequently asked questions about leadership. From their responses, we hope to identify if they have a well-developed concept of leadership that aligns with literature. We also hope to identify any differences in knowledge or attitudes among students, faculty, and industry.

### 1.2 Leadership domains

Leadership research essentially started as a study to find the specific traits of the leader to be identified in others (i.e., searching for the heroic leader [6]). Recent work by Goleman [7] described knowledge of self, and its companion, self-control, as two of the four domains that make up Emotional Intelligence.

While emotional intelligence also deals with social awareness and relationship management, other researchers have developed approaches specifically focused on how the leader connects to followers and motivates them to do their best. These approaches include leader-member exchange [8], situational leadership [9], resonant leadership [10], servant leadership [11], transformational leadership [12], and path-goal [13].

In leadership literature, *leading a cause* is a process defined by the technical requirements of a project as well as the political (regulatory), social, economic, and environmental constraints. In literature, a cause, or problem, is classified as tame [14] or technical [15] when the inputs, methods, resources, and objectives are all known - the only challenge is to execute the solution given limited budget and schedule. As the problem dimensions become less certain, or

unknown, the work of solving the problem becomes more complex, wicked [14] or adaptive [15]. An American engineer working for a Swiss drilling company boring a tunnel in Uzbekistan needs to understand the social, political, and environmental complexity or it will be a wicked problem for that engineer. Therefore, based on the amount of uncertainty of a cause or problem, a leader employs different approaches to address simpler technical/tame problems versus wicked/adaptive.

Finally, some credit Burns [12] with being the first to philosophically connect ethics to leadership through the concept of 'transformational' leadership. Bass [16] initiated the body of research of ethics in leadership by expanding upon Burns' concepts of transformational v. transactional leadership.

The leadership program at HMC adopted a collection of leadership competencies. They summarize these competencies into the following three domains: (1) Leading yourself, (2) leading others, and (3) leading a cause. Literature shows leadership ethics should also be considered a separate domain, yet it has applications to leading yourself, others and the cause [5]. For this study, we classify leadership education as contributing four learning domains. (1) self, (2) others, (3) cause, and (4) ethics.

## 2.0 Methodology

Identifying initial understanding in Faculty and Students started with focus group meetings with industry professionals. In these focus group meetings, we asked engineering leaders two questions and allowed the conversation to grow from there.

1. What do you wish new engineering employees should learn (apart from the technical training) before coming to your organization?
2. What is leadership to you?

The notes collected from these meetings produced a collection of keywords relating to qualities of good engineering employees, their definitions of leadership, key attributes of leaders, and some ideas on how to teach these skills in an engineering program. The results of the focus group meetings helped refine the survey items for the faculty and student surveys.

We based the faculty survey on comments received from industry leaders as well as by faculty during the focus group meeting mentioned in the Initial Work earlier in this paper. From those notes, we created a survey of eleven items. The first seven items intend to capture the main discussion points of the industry and faculty focus group meetings. The last four items try to collect a small amount of demographic information as well as background information on their exposure to leadership training. The survey responses are anonymous.

1. How important are the innate, or 'born,' characteristics to a leader's success?  
(Selected responses: Extremely important, Very important, Somewhat important, Not so important, Not at all important)
2. How important are the knowledge, skills, attitudes developed over time to a leader's success?

(Selected responses: Extremely important, Very important, Somewhat important, Not so important, Not at all important)

3. What is leadership? (Please provide a definition without looking it up)  
(Open-ended response)

4. What are the most important competencies (behaviors, skills, and/or attitudes) for a leader to possess?  
(Open-ended response)

5. If you were asked to teach someone leadership, what are the most important principles to convey? (If there is overlap with question 3 or 4, then you can just refer us to your responses to those questions).  
(Open-ended response)

6. Which activities, tools, or methods do you currently employ to teach Leadership (either in courses or in extra-curricular activities)?  
(Open-ended response)

7. What would you like to learn about teaching leadership to college students?  
(Open-ended response)

8. Please feel free to share anything else about leadership that was not covered already.

9. What is your gender?  
(Selected Responses: Male\Female\Prefer not to say)

10. How would you classify the amount of leadership training you have received in the past 10 years:  
(Selected responses: None\ One or Two Sessions\ A fair amount, but nothing regular (scheduled)\ Regular (scheduled), but not impactful\ Regular and impactful)

11. How many books on leadership have you read in the past 10 years?  
(Selected Responses: 0 \ 1 \ 2 \ 3 \ 4 \ 5 or more).

The student survey is similar to the faculty survey given that the goal is to compare the responses from faculty and students. We restated Question 5 for students as follows:

5. What would you like to learn about engineering leadership?

Question 6 from the faculty survey was removed from the student survey making the final student survey 10 items. The responses to items 3 – 7 on the faculty survey and 3 – 6 on the student survey are open-ended and are evaluated based on the use of keywords.

At the time of this publication, 46 faculty across the three institutions and 31 students from Institution A completed the two surveys.

### 3. Results

#### 3.1 Industry Focus Groups

For a division director at a large water utility, the main quality sought out in new hires is initiative. Initiative, as they defined it, is understanding what needs to be done and then doing it without being told every step. On a related note to initiative, a General Manager of a utility stated that she looks for creativity. This GM even defined leadership as simply *creativity*. The reasoning stated is leaders must use their creativity to see problems differently and find a solution that no one else can see. Creativity allows them to take the initiative and start acting.

A manager at a consulting firm stated that he needed engineers with more humility so that they could be teachable. He went on to explain the importance of learning new things after graduation. He explained how he, as a new engineer, did not appreciate that he needed to continue to learn and adapt to new challenges. To him, that required that he make himself humble enough to learn. He also advocated that any leadership program be based on experiential learning or utilize the case method. Experiential learning is perhaps the most popular pedagogical approach for leadership education [19] among the newer engineering leadership programs surveyed in the US [4], Europe, and Australia [20].

Another group of engineering leaders from two different agencies listed key skills for new engineers as knowing the personality of their teams, understanding how each person prefers to communicate (face-to-face, email, text, phone call), appreciating the differences among generations. The conversation then turned to key attributes for leaders, and this group stated, keywords such as consistent (stable), fair, open-minded, willing to question everything, and to correct errors early (which requires courage & trust), and recognize mistakes. This group suggested that to teach these attributes, the team needs to meet often and debrief after a project – take time to reflect on the process and make suggestions for improvements. Instructors could complete this process through role-playing at the undergraduate level.

A partner at a construction firm quickly mentioned the importance of self-awareness and social awareness as key attributes of new hires as well as seasoned leaders. He shared several stories where, for him, that made all the difference in his approach to leading his various teams. Being self-aware, as well as socially aware helps leaders to show support for those they lead. He also added new engineers must learn to follow effectively by anticipating the needs of the team and taking the initiative and following through (keeping commitments). According to the partner, these skills would allow the engineer to show support for the team even if they are not the leader.

The executive board of a mid-sized consulting firm had a long list of skills that they look for in new candidates. There was also a lot of overlap between what they looked for and what challenges they saw in the latest generation of engineers. Keywords like motivation, initiative, self-awareness, social awareness, and being effective communicators were mentioned here as well. Also, this group mentioned taking ownership of project tasks, being effective listeners, seeking to understand the whole process, being willing to be held accountable and to hold others accountable (having tough conversations), and avoiding making excuses. The concept of holding others accountable came up in the context of the “tough conversations” consultants have

when requesting additional fees from clients as a result of additional work required by the client. Finally, there were many comments about engineers understanding the big picture, the politics, finances (both project-related and firm-specific), marketing, and effective proposal presentation.

Overall, these conversations demonstrated that the keywords and phrases used by industry map easily to the four leadership domains. These conversations helped shape how we not only refined the survey items for faculty and students but also how we mapped the survey responses to one of the four domains. Figure 1 is a list of the key words used by the participants in the focus groups.

SELF		OTHERS	
Motivated	Life-long Learner	Empathetic	Open-Minded
Initiative	Reflective	Fair	Effective Communicators
Questions Everything	Time Management	Courage	Effective Listener
Humble	Self-Awareness	Social Awareness	Keeping Commitments
Taking Responsibility		Holding Others Accountable	Trust
CAUSE		ETHICS	
Decisive	See Big Picture	Recognize Mistakes	Stewardship
Adaptable	Creative	Being Trusted	Honesty
	Vision	Accountable	Integrity
			Humble

Figure 1. List of the unique keywords used by industry leaders participating in focus group meetings. Normal cells are attitudes, while highlighted cells are skills/competencies.

The industry focus groups used key words such as humble, life-long learner, creative, initiative taker, listener, and self-aware. The keywords that pertained to the attributes of the leader (as an individual) were counted as that respondent thinking of the ‘self’ domain.

The keywords that apply to the ‘others’ domain included words and phrases such as accountability, social awareness, correcting the errors in others, trust, keeping commitments, having tough conversations, knowing communication preferences of others, and anticipating needs. We attributed these to the ‘others’ domain.

The cause domain focuses on the problem that needs to be solved by the team, so we sorted words and phrases about the cause into that domain. Examples include being adaptive, competent (which is relative to the problem being solved or cause being led), understanding the whole process, vision, big-picture, creativity, and problem-solving.

Finally, we categorized words and phrases that identify the importance of moral character, positive interactions, or ethical dilemmas into the ethics domain. Accountability, trust, integrity, honesty, and stewardship are examples of words that were considered to be about leadership ethics.



Many of the words or phrases can fit into different categories or into more than one category at the same time depending upon the context of the word or phrase. Therefore, the context was examined to determine if a word such as "listener," was referring to a characteristic of the leader (self) or an attribute that the leader encourages in the team (others). Similarly, the word "trust" can refer to one's character (self) or one's competency [21]. As competency is a function of the task (or cause), trust could be interpreted as either self or cause domains. Accountability could be how a leader interacts with their followers, or it could be a commentary on the leaders' ethics. In the cases where the context does not fit the keyword or phrase into a single domain, then the word or phrase was counted as both categories. We found that these key words typically touched the ethics domain as well as one of the other domains (e.g. humble – self/ethics; accountable – others/ethics)

### 3.2 How important are the innate, or 'born,' characteristics to a leader's success?

The results of the first question show faculty mostly believe that inborn traits are 'somewhat' or 'not so' important (18 and 16 or 46 respectively). Figure 1 shows that the student responses are similar: most students feel that inborn traits are 'somewhat,' 'not so,' or 'not at all' important (25 of 31).

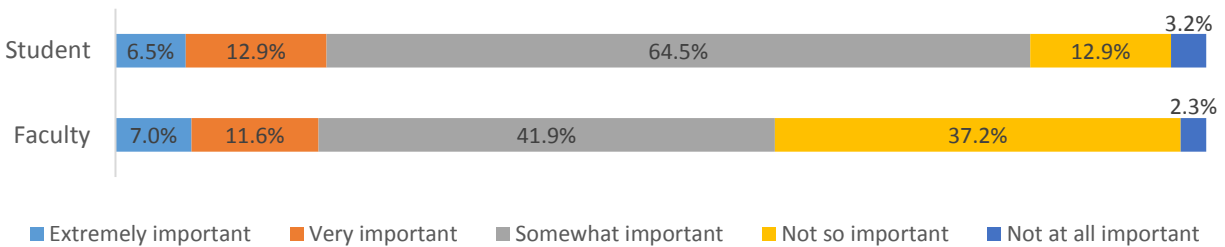


Figure 1. Results of question no. 1 for faculty and students.  
*How important are the innate, or 'born,' characteristics to a leader's success?*

### 3.3 How important are the knowledge, skills, and attitudes developed over time to a leader's success?

Figure 2 shows that the responses to Question 2 are noticeably similar between faculty and students. There seems to be agreement between faculty and students that what we learn and how we develop ourselves as leaders is 'extremely' or 'very' important to the success of the leader.

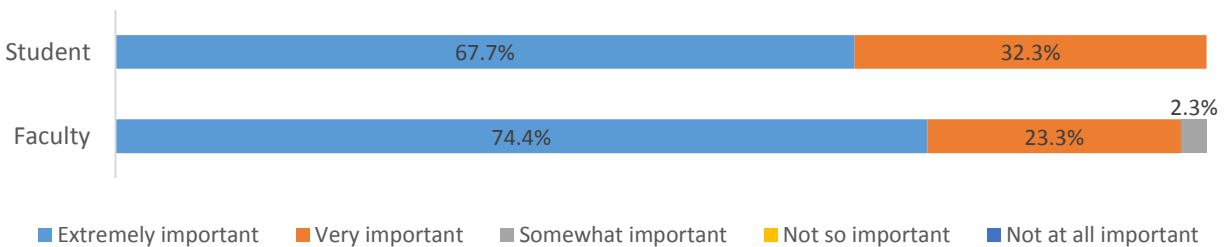


Figure 2. Results of question no. 2 for (a) faculty and (b) student survey.

*How important are the knowledge, skills, attitudes developed over time to a leader's success?*

### 3.4 What is leadership?

We identified keywords or phrases from each of the open-ended responses as described in the methodology section. For each response using a keyword or phrase associated with one of the four domains, we categorized the definition as being part of that domain or domains. Example responses from faculty and students that sorted into the 'self' domain include words such as able (or ability) or knowing 'what you want' as a leader. We classified words and phrases such as motivating, inspiring, directing, guiding, and organizing others as 'others.' Any mention of goals, vision, mission, objectives, direction, or just 'things,' denoted a definition sorted as leading a cause. Finally, example statements in the ethics domain included words and phrases such as ethical, 'individual growth,' 'positive change,' 'meaningful change,' 'strive for their best', or 'without exploitation.'

The responses to this question show that faculty definitions of leadership most frequently align with the others (93%) and leading a cause (86%) domains (see Figure 3). There is less emphasis on leading yourself (63%) though still a majority which included this domain in their definitions. For students, there was a similar emphasis on leadership being about leading others (87.5%) and slightly less emphasis on leading a cause or 'self' domains (both at 69%).

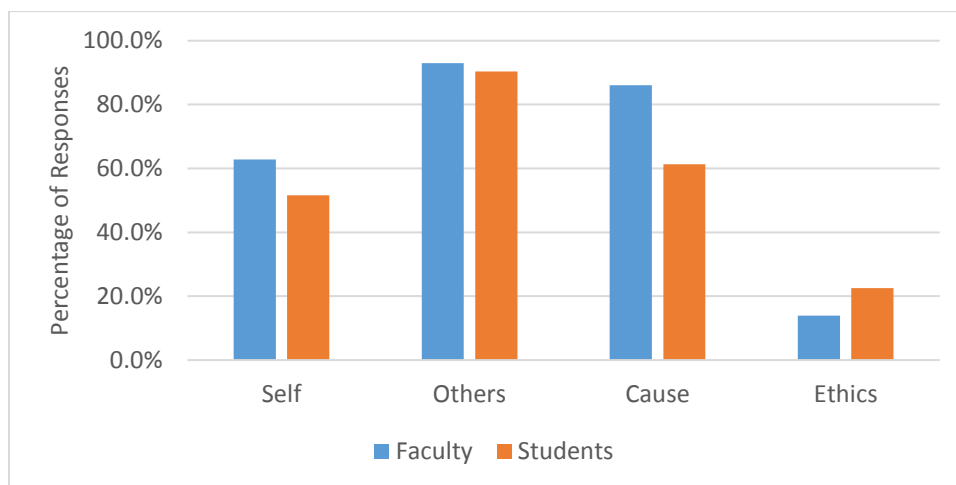


Figure 3. Summary of responses to question no. 3 categorized by the four leadership domains.

*What is leadership? (Please provide a definition without looking it up)*

Almost unidentified is the importance of ethics in the definitions of leadership by faculty (14%). Student responses identified 'ethics' in their keywords at a slightly higher rate (22%).

Though it is not significant, it is interesting to note that only one responded out of all faculty and students had a definition that touched on all four domains – and it came from a student:

*“Leadership is **the ability to motivate others to become their best versions while trying to accomplish a common goal.**”*

These results seem to point toward an understanding that leadership is mostly about interacting with others, toward a common goal (cause). It also utilizes a significant amount of individual traits, skills, behaviors possessed by the leader. However, the group was less specific about what the individual leadership characteristics were. Most mentioned that the leader had to have some ability to motivate or inspire which is a step in the right direction.

It seems as though both faculty and students could do better to understand that leadership requires intentional ethics, as well as problem solving and creativity. Faculty and students likely see critical thinking and problem solving as just engineering education and not part of leadership development. Further work will be needed to conclude if this is a correct statement.

A question that nearly always comes up among students when discussing leadership is how to address the effective leaders in history whose actions were objectively negative (for example Hitler, Stalin, and Pinochet). According to Burns [14], they may have wielded power, but that was not leadership. More recent research classifies dictators by their ethics: they have negative leadership ethics. The results tend to show that respondents (both faculty and students) tend not to think of leadership as ethical, which provides a clear opportunity for future training.

3.5 What are the most important competencies (behaviors, skills, and/or attitudes) for a leader to possess?

Similar to the response to Question 3, we categorized responses to Question 4 into the four leadership domains. Examples of competencies, mentioned by faculty and students, sorted into the ‘self’ category included persistent, confident, positive, and organized to name a few. Empathy, fairness, openness, motivating, communicator, listener, and delegator are all words categorized as leading others. The most common words or phrases for ‘cause’ included being decisive, adaptable, having a vision, and seeing the big picture. Finally categorized under ethics are humility, integrity, ethical, honest, recognizing mistakes, and being trusted. There were a total of 71 unique keywords or phrases mentioned by the respondents. Figure 4 provides a complete list of keywords and phrases used by faculty and students sorted by domains.

SELF		OTHERS	
Persistent	Self-Reliance	Empathetic	Holding Others
Confident	Consistency	Fair	Accountable
Positive	Patience	Openness	Coaching
Focus	Gratitude	Assertive	Negotiation
Taking Responsibility	Introspective	Respectful	Persuasion
Optimism	Selflessness	Approachable	Identify Strengths
Imagination	Time Management	Aggressive	Feedback
Resilience	Organized	Communicate effectively	Team Player
Enthusiasm	Prioritize	Good listener	Diplomacy
Great Attitude	Knowing Myself	Motivate	Encourage
Self-Directed	Well Read	Inspire	Direct Others
Courage	Self-Awareness	Delegating	
Being Accountable	Memorizing	Building a Team	
Conviction	Recognize Mistakes	Influencing	

Reflective	See multiple points of view	Comfort Working in Groups	
CAUSE		ETHICS	
Decisive	Prioritize	Recognize Mistakes	Ethical
Adaptable	Venturing into unknown	Being Trusted	Honesty
Having a Vision	Sets Goals	Compassionate	Integrity
See Big Picture	Decision Making	Humble	
Clear Purpose			

Figure 4. List of the unique keywords from faculty and students from question 4. Normal cells are attitudes, while highlighted cells are skills/competencies.

Figure 5 summarizes the keywords from question no. 4. The first two bars represent the fraction of keywords faculty and students mention distributed by domain. Both faculty and students listed a greater proportion of keywords/phrases in the self and other domains, but students think of the ‘self’ and ‘ethics’ domain at a higher rate than faculty.

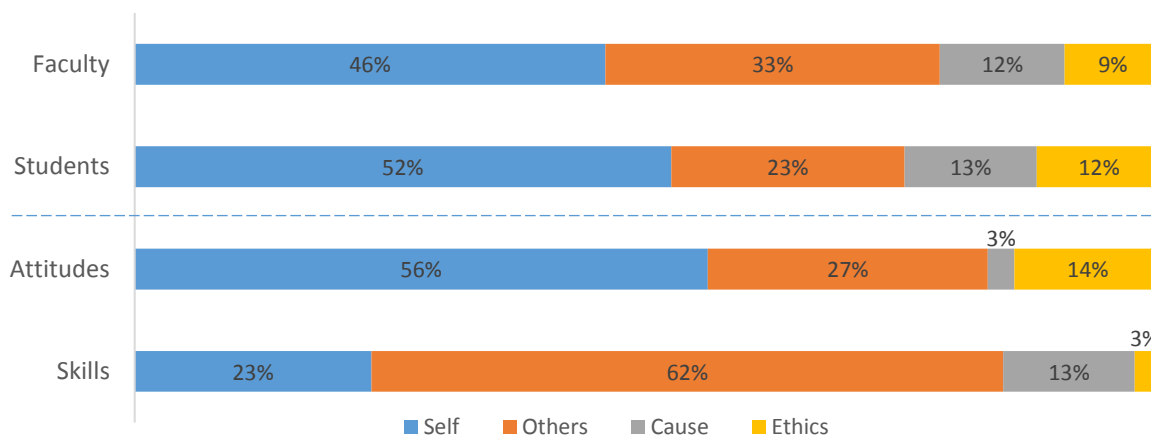


Figure 5. Summary of results for question no. 4. The results are displayed for both faculty v. students and attitudes v. skills/competencies.

*What are the most important competencies for a leader to possess?*

After reading the responses, we noticed that many of them provided a list of important competencies as well as a list of important attitudes. We grouped all responses from faculty and students into representing either attitudes or competencies, and those data are represented in Figure 5 as well. Figure 5 helps us see that faculty and students see leadership skills as being applied to leading others, while leadership attitudes apply mainly to the leader themselves.

Based on the most frequently reported “must have” competencies (mentioned in more than three instances) we can envision the kind of leader faculty and students collectively describe. They describe a leader who is (‘self’ domain) persistent, positive, confident, manages time well and is organized. They are (others domain) empathetic listeners, who are fair and open, who are effective communicators who motivate and inspire others. They (cause domain) have a vision, can see the big picture, make decisions effectively and prioritize their work well. Finally, (ethics domain) they are humble and have integrity. While this view of leadership is not

comprehensive, it does provide an initial goal around which we can start to form a leadership training program (See Figure 6).

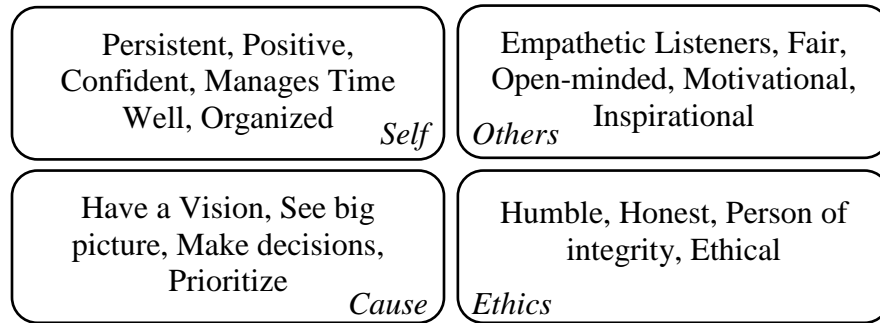


Figure 6. Most common skills and attitudes listed by faculty and students categorized by the four domains.

3.6 If you were asked to teach someone leadership, what are the most important principles to convey?

We surveyed faculty about what leadership principles they would teach as a third way to encourage thoughts about leadership as well as give insight into what they might feel comfortable teaching.

Interestingly, 12% (5 of 43) of the faculty responses to this questions were left blank, or they simply referred us to their previous responses (23% or 10 of 43). For those who responded to the question, they seemed to focus more on teaching skills and attitudes that students can use to better themselves and improve team interactions. Similar to previous questions there are fewer references to the cause and ethics domains as can be seen in Figure 7.

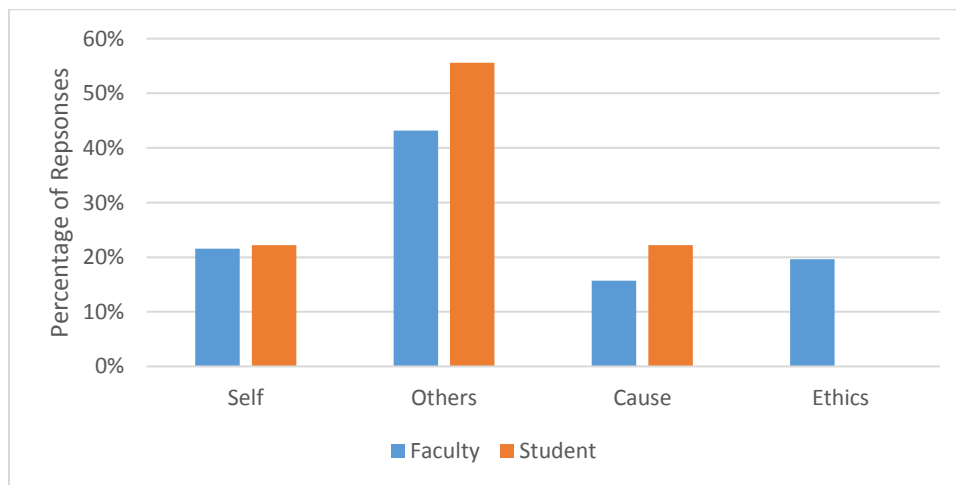


Figure 7. Summary of data from question no. 5 categorized by the four leadership domains

*Faculty Question: If you were asked to teach someone leadership, what are the most important principles to convey?*

*Student Question: What would you like to learn about leadership in engineering?*

Perhaps the reason why 1/3 of the respondents did not respond can be summed up in this one comment from the faculty responses: “I am not sure I can teach leadership myself, at least not yet!”

The student version of this question was similar but framed for their perspective: “What would you like to learn about engineering leadership?” Only 1 of the 16 students did not respond to this question. As can be seen in Figure 7 their responses mirrored the faculty responses except for none of the students listed a desire to learn any principles of the ethics domain.

It seems faculty are most comfortable teaching about leading others and most students also happened to desire more training in those areas. Teaching how to lead others seems like a good place to build a leadership program – focusing on where the demand and supply are strongest.

### 3.7 Which activities, tools, or methods do you currently employ to teach Leadership?

The responses to this question varied between pedagogical approaches to specific leadership lessons that touched on one of the four leadership domains. Team activities and group work seem to be at the intersection of pedagogy and leadership principles. Teamwork and group activities are considered high impact teaching practices [17], and they also happen to be a great tool for teaching and assessing student performance in leading others.

Despite the use of team activities by faculty, only 8 out of 42 faculty respondents specifically called out principles such as “work[ing] well in teams” or dealing with “conflict management” and other aspects of teamwork as “important principles to convey.” These observations show that faculty want to use teamwork in their classes, but they do not often teach principles of teamwork. This observation aligns with the work of Lingard & Barkataki [18]. This disconnect between team activities that many faculty already employ, and the awareness that such team activities need intentional instruction represents an important opportunity for faculty training.

## 4. Conclusion

The results of the survey helped us draw several conclusions that can be used to identify a starting point for our leadership programs and shape the programs for the future. These conclusions are listed below:

- Faculty and students share the view that while leaders have ‘born’ traits, the developed skills and attitudes are more important. We should not need to spend time much time convincing faculty and students that a leadership program is beneficial to the learner.
- Faculty and students have a strong sense that leadership training involves both leader development and improving the engagement with others.
- Based on their definitions of leadership they both saw that ‘leading a cause’ is an important part of leadership, but from the other questions, the ‘cause’ domain was less important. For both faculty and students, their definitions of leadership include keywords

related to 'leading a cause,' but when it comes to teaching and learning leadership faculty and students, both think of the self and others domains as more important.

- Many faculty state they teach leadership principles from the 'self' and 'others' domains, while students are most interested in learning from the 'self' and 'others' domains. Faculty are strongest where students demand more, so there is an opportunity to build around these domains to ease the transition to teaching leadership in an engineering classroom.
- Faculty did not list teaching teamwork as an important principle as much as they listed it as an important tool they currently use to teach leadership. We need more training for faculty to teach and assess teamwork (in other words development in the 'others' domain) who already have team or group assignments in their respective courses.
- We conclude that simply doing this survey, at least anecdotally, has improved interest and as well as buy-in from faculty regarding the new leadership programs at our respective institutions. Colleagues have been asking questions about the effort and making comments about what they can do specifically. They have also shared resources that they are already using to help teach and assess leadership principles.

## 5. Future Work

We continue to add more survey results to the current study. The next wave of responses will come from students from HMC and SDSU, as the timing of the work at each campus has limited student responses until this time. Industry surveys may also be needed to add to the notes from the industry focus groups.

Based on the results of the survey it seems the most logical place to start building our leadership programs will be through the existing teamwork, or group, assignments that many faculty already implement in their courses. It is important that these learning opportunities be intentional and provide some instruction as well as assessment for student improvement [15]. We also believe that faculty will need the training to implement leadership into existing courses, so we also plan to start working on training materials for faculty.

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