

Leading Diverse Engineering Organizations

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Abstract

Many positions within the engineering field continue to call for leadership skills as academic institutions still struggle to find ways for engineering and engineering technology students to develop these types of skills. In addition, today's engineering organizations are becoming more culturally and organizationally diverse; and therefore, all employees are expected to be competent in their discipline and function within a diverse multidisciplinary team environment. While some older leadership styles such as trait based leadership and contingency theory are still reliable, the evolution of some engineering work environments demand a different approach to leadership. Organizations today need a flexible, a more egalitarian structure that allows employees to learn their role as a process, emphasizing communication with leadership. Situational leadership can provide these parameters, allowing for extensive personnel growth within an organization. This pilot study examines how the lack of leadership development in both engineering and engineering technology university curriculums as well as organizations can effect both leaders and followers growth within organizations.

Keywords

Engineering, Engineering Technology, Engineering leadership, Situational leadership, Leadership,

Introduction

Progressive and successful engineering organizations require an exceptional amount of flexibility to adapt to scenarios that are always evolving and changing in needs. In order to adjust to these changes, leadership should be ready and able to adapt as well. These types of work environments can cause stress, miscommunication, along with many other possibly counterproductive scenarios.¹⁴ Using situational leadership; a leader can lessen the impact of significant stress-producing changes. Situational leadership functions in the ideology that leaders change and adapt their style to the competencies and commitment of each respective team member.¹⁸ This gives the leader a role of facilitator, as opposed to an autocratic role. Because of this, a leader must develop a functional working relationship with subordinates, promoting free communication in the organization. Allowing a leader to use personal skills and natural ability gives situational leadership a distinct advantage in the development of the leader-follower relationship, making change less traumatic, while allowing both leader and follower to grow. Because the communication is open and on an egalitarian foundation, levels of self-regard and self-respect among employees are generally high, leading to confidence and self-reliance, which is critical in progressive engineering environments.

In the field of engineering education there have been three formative publications: The Grinter Report;⁸ The Green Report;² and Educating the Engineer of 2020.¹⁷ While the Grinter Report

called for increasing the theory and basic sciences in engineering,⁸ the Green Report emphasized educational reform to include skills such as leadership.² However, many of the non-technical skills mentioned in the Green Report such as: team work; “communication; leadership; systems perspective; ethics; understanding of societal; economic and environmental impacts of engineering decisions; commitment to quality; timeliness and continuous improvement; a multidisciplinary perspective; appreciation for different cultures and business practices; and understanding diversity”² are usually all crammed in the senior design course.⁷ Colleges and universities have been cautioned for many years by practicing professionals for producing engineers that are technically and intellectually capable, however they are not trained for the real world.³

Research Problem

A gap exists between demand and supply, where leadership in industry is not developed and possibly neglected. Leadership skills are generally not taught in engineering and engineering technology degree programs and industry inadequately supplements this aspect of education to its engineers.^{7,10} Generally leadership skills are only taught in large organizations and to top leaders.⁷ “Leadership development in industry can best be described as ad hoc with on the job training being the primary mechanism. Engineers at all levels must be more adept at market forces and business realities, developing large scale systems, and working with people from other disciplines and cultures”.⁷ Engineering management in many organizations generally look at employees that could be potentially management in the wrong context. The majority of the time management will look at who excels at the technical aspect of the job, with the logic that if the engineer is exceptional in that technical area, they will have no problem leading a team.⁵ This is not an accurate way of evaluating leadership talent, mainly because technical expertise is just a small percentage of an engineer’s leadership role. Other times, in companies that deal with the public sector, the team member with the most extraversion and sociability will be promoted. This is another invalid way of leader selection because neither of these traits necessarily reflects the ability to demonstrate effective interpersonal communication or integrate teams, two of the most important aspects of engineering leadership.^{5,11,13}

A leader promoted on superior technical skill or their tendency to be an extrovert can open the door to a host of leader-follower issues. The dynamic of employees being promoted like this simply neglects the aspect of employee development and from a research standpoint; there is no link between the traits or skills of the individual with the success of a team or group.¹⁸ These systems of promotion also hinder communication on many levels. Lending to a more autocratic style of leadership, these situations make communication with team members more linear, discouraging needed feedback and healthy interaction. In an innovative type environment like engineering, this can prohibit both employee and product growth. Proper communication in a team environment is complex and involves every aspect of the individual.⁹

The main purpose of this pilot study is to first recognize, through lack of leadership education and development, that the field of engineering and engineering technology has retained older leadership styles, leaving many organizations utilizing outdated, hierarchy-type theories to lead the organization. As engineering organizations have dramatically changed toward a more flat

structure over the past few decades, an effort has been made to develop additional leadership education in the industry.¹⁰ Situational Leadership Theory, being sequential on paper, yet very flexible in nature, could be the right combination for engineering minds to grasp. This particular leadership theory could also open the door for less extraverted leadership, which is common in engineering, to be more open with co-workers, allowing them to grow as people as well as employees. Situational leadership's main focus is continuous communication, which is an intriguing choice to study in terms of its effectiveness in engineering organizational settings. Even in a cultural context, with Americans being highly mobile, future oriented and low in commitment, the U.S. arguably have the most diverse levels of experience in any given organization.¹

This pilot study should also show the effect followers could have on leadership and how their performance affects the next step in organizational growth.⁶ Reaching out to people, making them understand the importance of what they are doing, is critical to the success of the team and in the bigger picture, the organization itself.^{5,13} The followers of large organizations form a framework and their behaviors can dictate the capability of leadership. Because situational leadership is a never-ending cycle, the communication with subordinates is continuous, giving continuity in the leader-member exchange. This is critical to organizational growth, as leaders, followers and the organizational success are all directly affected by each other.⁴ This pilot study helps grant further understanding of the leadership aspect of engineering, with the goal ultimately being to identify if a sequential, evolved leadership style (situational leadership) could be implemented and used to the advantage of such organizations.

Literature Review

Technology advances at a faster pace now more than ever; engineering leadership's importance has risen to an unprecedented level. Since the beginning of the 1990's, time-to-market has established itself as one of the key components of having a competitive advantage.¹⁵ The changes in workplace environment and job redesign have caused excessive stressors in the form of contradictory work demands, challenging social conditions and wavering organizational support.¹⁴ Along with all this comes a more spatial work environment, reducing the opportunities for face-to-face leadership. Within many organizations, a hierarchical leadership system is implemented, causing constraints and possible conflicts between leadership and team members.

Followership

When dealing with any style of leadership study, it is important to bring up the significance of followers and their needs. Followers make up the bulk of most engineering organizations and the role they play is vital toward being competitive in the market and is also closely intertwined with effective leadership.^{4,6} Effective followers can help enhance leaders; just as effective leaders keep followers engaged and developing.⁴ Understanding how followers think and react is key in keeping them committed and engaged, as well as continuing development in employees and individuals. Followers perform better with a leader who builds a relationship and shows mutual respect. The only way to do that is to be authentic.^{4,16,18}

Situational Leadership Theory

Paul Hersey and Kenneth Blanchard first developed situational leadership in 1969.¹⁸ Developed from an earlier theory from Bill Reddin, the situational approach has been revised several times since its inception and has been used frequently in leadership training and development.¹⁸ Two behavior dimensions ultimately predict leadership effectiveness: task-oriented and relationship-oriented behavior.⁴ Situational leadership focuses on both of these behaviors simultaneously. This allows leadership to be more task or relationship directed based on the need of the follower.

Situational vs. Trait Approach

Trait based leadership was one of the first approaches to be studied. Trait leadership focuses on the leader and the traits they exhibit. Ralph Stogdill created the best overview of trait-based leadership. Stogdill found through his own research that individuals in leadership roles were above average in one or more of eight basic traits: self-confidence, initiative, sociability, persistence, responsibility, insight, alertness, and intelligence.^{4,18} This type of leadership was effective in the past due to the fact that it was thought that leaders were born and not made. A good example of trait leadership in engineering would be when an individual is promoted based on their superior technical skills. This happens frequently because it generally yields consistent results. However, promoting someone based on technical skills that are constantly changing in modern organizations can cause issues. These types of leaders may lack situational awareness, resulting in communication difficulties. Situation tends to be more of a factor in the success of a trait based leader, as certain traits excel in some scenarios, while others do elsewhere. This goes against most leadership roles in engineering since change is a constant in the work environment. This also makes leadership training and development difficult because there is no definitive set of traits that make a leader good for all possible situations.

Situational vs. Contingency

Contingency approaches to leadership are actually a form of situational leadership, sharing similarities and possessing some of the same basic principles. Contingency approaches take the parameters of specific workplace leadership situations and roles and decide which leadership style is appropriate.⁴ Contingency approaches revolve around styles and situations, where leadership styles are considered task or relationship motivated. These two factors provide the framework for matching the right leader to the situation.¹⁸ Considered situational in theory, but more serving to the leader as opposed to the follower. This approach is used in industry and can be effective, particularly in larger organizations, where the leadership talent pool is large. Currently in engineering there is a fixation on leadership when thinking in terms of organizational success, however, it is the followers and the relationship with leadership that truly dictates this way of thinking.⁶ With contingency theory, the style of leadership is built upon the relationship between the leader and follower. This relationship will determine how task or relationship oriented the leader will be handled. If the contingency approach to leadership is executed well, it will fit in a more production-oriented, management type of role. However, it is leadership focused and does not give employees the freedom and personal growth that situational leadership might offer, due to the fact that it leaves the focus on leadership. If an organization wishes to grow and become more diverse, it must be focused on employee development as much, if not more, than leadership development.^{4,6}

Engineering Leadership Application

Effective leadership begins with the implementation of an effective program within an organization. Although situational leadership may look like a long, lengthy concept to grasp, it is actually very straightforward.¹⁸ It is very practical, easy to understand, and can be applied across a variety of settings. This could make situational leadership a very comfortable transition for an organization looking for more from their leadership development. At the same time, it is also very prescriptive and directed, showing leaders how to approach different scenarios effectively. These attributes are all critical to success in modern industry, as technology and demand are changing faster than ever. Due to the continuous communication style used in situational leadership, the follower has time to develop their own ideas and concepts about their role and tasks. This allows a leader's ideas to converge naturally with their followers. This makes for better collaboration and improved processes doing similar projects or tasks in the future.

Research Design and Data Collection Method

The field of engineering is broad in scope with many disciplines and areas; to conduct the pilot study most effectively interviews were conducted. The interviews were formulated to gather data regarding these areas: organizational structure/size; communication quantity/quality; employee/leadership development; and leadership/followership flexibility. The interviewees were chosen from a different area or discipline in the field of engineering with actual job function in mind. A number of the interviewees are from areas that require strictly engineering, while another group of the interviewees work in a multidisciplinary team in various engineering roles. Only one of the interviewees is in a defined leadership role that is directly responsible for their team's training and development.

The interview consisted of nine questions. Most questions were open ended and all subjects were encouraged to elaborate as much as possible. All interviewees were notified beforehand on interview's intent and purpose. To keep the communication open in regards to each interviewee's organization, the method chosen for the interview process was a semi structured approach, in a casual setting. This combination allowed interviewees to relax and speak openly, while adhering to a preplanned order of questioning, building on the concept of situational leadership implementation within their organizations.¹² While a larger number of individuals were originally selected for interviews, for a variety of reasons, only five actually participated.

Pilot Study Results

Interviewees were asked what they thought are qualities that leadership in their organizations are looking for in terms of potential leaders. While answers varied, the common message in the majority of the answers was that experience was the main attribute that was needed in leadership. The data reflects that most engineering organizations look for technical expertise first and foremost in their search for leaders. One of the interviewees indicated that in the field of engineering, roughly 70% of people get promoted to management because they perform the technical skills that comprise their job at an exceptional level. Other interviewees indicated the following for the answers to this question: experience is the leading factor within their organization when being considered for leadership; accountability is important; composure under

pressure is important for their organization; employees that bring in the most business get promoted; and work ethic and efficiency are considered for leadership roles.

The second question posed to interviewees was how much time (*in hours, roughly*) do you spend a week in a leadership role? When asked about leadership time, most interviewees answered that substantial amounts of their workweek are spent in the leadership role. Only one interviewee is not in a leadership role, however, there is some administrative work involved in the position. The range of time spent on leadership was between 20 to 40 hours a week for all.

Interviewees were also asked, do you feel your subordinates or team members learn at the same pace, or are they essentially different in their learning curve? This question allowed interviewees to discuss how they view followers and their development. The information from this question could be used to state a case for a more follower-based ideology of leadership. The answers for this question were quite interesting. Two interviewees both felt that within their organizations team members learn at roughly the same pace. This is notable because both of their organizations feature many different work titles with very different roles. Their organizations had the highest number of employees. Two other interviewees both felt that most subordinates learn at a different pace, with one adding that there are certain individuals that take years to develop into an effective engineer. Working in a highly specialized area of technology, one interviewee felt that skill level coming into the organization plays a large factor, along with the aptitude of the individual.

Interviewees were asked, do you feel that in your organization there is extra time allowed to show a team member or individual a task or role, if needed? Along with gauging follower development importance, this is a question geared toward determining if an organization has the capability to utilize situational leadership and if the organization values allowing extra time, if needed, for someone to become comfortable in their role. With the exception of one, all interviewees agreed that their organizations offered extra time to learn a task or role.

Interviewees were asked do you feel the employees who learn their role the quickest end up being the most productive? This question was used to gauge, and possibly verify, the leadership style that is most frequently utilized in their positions, as well as to help verify that situational leadership can be applicable. The responses varied. Two of the interviewees answered favorably to employees who are quick learners. Another answered that he felt it was not always the case, adding that, at times, organizational barriers hindered employee development. Including that at times, he felt wavering work ethic and personality constraints play a factor in overall employee production. Another interviewee felt there was no correlation at all between quickness of learning and productivity, as he has seen slow learners have a better overall sense of the job, as opposed to a team member who learns quickly. Another answered similarly reflected that many times a quick learner is more productive early on, but not necessarily the most productive or developed employee long-term.

Do you feel there is a “one size fits all” style of leadership for most groups or teams, or is there a definite need to articulate to each individual? Since situational leadership is fundamentally the opposite of a “one size fits all” style of leadership, this question helps answer whether the organization’s followers respond well to situational leadership? All interviewees answered

favorably in that they unanimously felt the need to articulate individually when training team members. One implied that a lot of the need for articulation depended on team size, along with experience levels within the group. Another acknowledged that it should vary from person to person, and another added that no two employees are the same. Two interviewees felt another reason to articulate to each individual is the fact that, in engineering and technology, there is often more than one way to get a task done. Another aspect brought up was the validity of articulating to employees individually is that different learning techniques should be utilized based on the training need.

When training a new employee or new team member, how much time is needed before they work independently with little direction from leadership? By using the full training time as a metric, the possible implementation of situational leadership can be gauged. Most of the employee's roles within their organization are fairly specific, so training time answers for most of the interviewees were relatively short. The range was from a couple of weeks to one year depending on the job and different types of customized equipment used within his organization.

Another questions posed to the interviewees, are all employees the same in regards to how much direction is needed once they have learned their job or position, or do some need more direction and coaching to get certain things done? This question was designed to prove, regardless of being fully trained, some employees still require a different style of leadership, offering more validity to situational leadership implementation. Most answers heavily favored the fact that even seasoned employees need direction and coaching at times in their tasks or role within the organization.

Interviewees were asked, how long do you think it would take to implement a new style of training and leadership, one that allows time to train individuals in other areas and focus on continuous communication in your organization? Having told all the interviewees the purpose and intent of the interview up front this question was a simple way to find out the limitations in regards to the timeframe needed to implement situational leadership theory smoothly. Most interviewees were quick to say that a new style of leadership and training would take some time. All of the interviewees of the larger organizations estimated it would take around a year to make such a change. One of the interviewee's organizations recently went through a leadership style change and it took several months. Most of the others felt that it would take a month to several months to implement. One felt that due to the fact that his or her department's roles are always evolving, a full leadership style transition would take a considerable amount of time. Another felt that due to the nature of the work and several different areas of expertise that a dramatic change in leadership style would cause considerable turnover making implementation a long, difficult process. Being in a small office with very similar roles, another interviewee felt that with an extensive training session, his organization could change leadership styles smoothly in as little as a few weeks.

Interpretation of Results

Based on the data collected from interviews and literary sources, the research study yielded parameters and insight on how situational leadership could effectively be implemented. The data collected from the leadership qualities question reflect that most organizations in engineering are utilizing a trait approach to leadership. Data from the question regarding whoever learns the

quickest is the most productive indicates that many engineering organizations that use the trait approach fail to see potential leaders in the majority of their employees. A majority of the interviewees answered positively to the question regarding learning curves, showing the need for flexibility in training time. The answer to the “one size fits all” leadership question provides strong evidence that followership in engineering is vital to an organization and each employee must be valued as an individual. Most interviewees also answered positively to the question regarding the need for extra time allowed for learning tasks or roles. This reflects that most organizations do offer extra time for employee development, a parameter of situational leadership. The data also reflects the capability to implement situational leadership in all interviewees’ areas of specialization. However, certain organizations seemed to have limitations in regards to situational leadership’s implementation. Organizational size is definitely a factor in ease of implementation of situational leadership with more employees to train with different roles.

Conclusion

One of the important aspects gathered from this pilot study is that there still is a large need for skills such as leadership to be taught in engineering and engineering technology programs. Faculty should work with industry to make sure engineering and engineering technology graduates are prepared with skills like those mentioned in the Green Report, “team work; communication; leadership; systems perspective; ethics; understanding of societal; economic and environmental impacts of engineering decisions; commitment to quality; timeliness and continuous improvement; a multidisciplinary perspective; appreciation for different cultures and business practices; and understanding diversity”.² As engineering and engineering technology educators, we need to recognize that these types of skills are an essential part of our students’ educational tool set needed to prepare them for their place in industry.

For the pilot study, the interviewees helped provide essential data to state a case for both the need and applicability of situational leadership in engineering organizations and a need for leadership education for engineering and engineering technology students.

Given the small number of participants in this pilot study, it is recommended that the study be expanded to include more participants, including some who have already incorporated situational leadership in their engineering organizations. It is anticipated that the results of the follow up study will provide some practical methods to provide a process for implementing leadership development process for engineering organizations. In addition, it is recommended that the new study look at engineering leaders that studied at institutions that provided leadership education and some that did not to determine what type of leadership organizations are using.

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