

Integrating a Capstone Leadership Project and the S-Triangle Pedagogy to Guide Engineering Leadership Development Education

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Abstract

This paper presents the methodology for teaching leadership development using an overarching capstone project to inform the teaching/learning of the understanding self, style, and situation, also known as the leadership “S-triangle.” In this model, the “needs of instruction” for execution of the capstone leadership project are delivered on a just-in-time basis to reinforce leadership development. While the study of leadership styles and characteristics, understanding of self, and situational strategies is not unique, the integrated approach guided by a capstone project has quantifiably improved student self-reported satisfaction with the class, as well as perceived understanding of leadership concepts.

This paper also presents an overview of the pedagogical approach, so that the reader can assess the potential for using this approach in their leadership development courses or coursework. In addition to reporting and explaining the reasoning for adopting this methods, this paper will present the assessment data indicating this approach has measureable improvement over the previous model used for engineering leadership development education.

The current working theory explaining why this approach has shown improvements in developing engineers as leaders will also be discussed. In addition to the fact that the approach itself allows for a greater “hands-on” learning, the students themselves reflected that the approach presents a more “formulaic” method to leadership compared to similar offerings they had received. They noted that while the approach is not truly algorithmic, it has aspects that are allow more logical thinkers to implement while developing the soft skills needed to be effective leaders. This paper will explore both the reasons for the student’s conclusions and how other programs could adapt this approach in a variety of leadership development situations.

Introduction

The approach described in this paper towards engineering leadership development is a single-semester class experience for selected student leaders, all with significant previous leadership experiences. Therefore, while the information presented here may be useful to any leadership educator, it may not directly apply to other curricular circumstances. Having stated that, there are many aspects of the presented pedagogy that may be translatable, because they are based in similar approaches taken in other leadership development programs.

The leadership “S-triangle,” pedagogy, illustrated in Figure 1, links understanding of self, style, and situation through application of leadership experience. In the model described in this paper, both the student’s previous leadership memories (their leadership inventory) **and** performance of a capstone leadership project are used as the linking experiences (not shown in Figure 1). While the study of leadership styles and characteristics [1], understanding of self [2], and situational

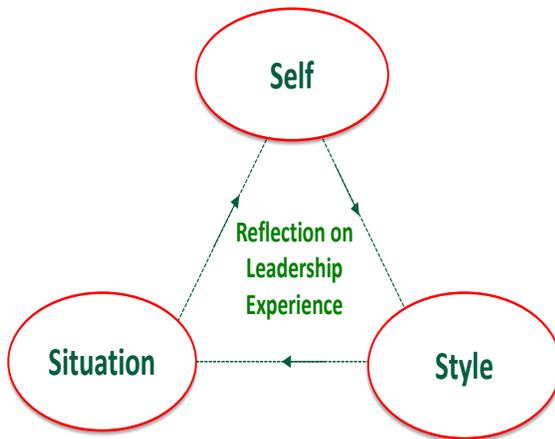


Figure 1. S-Triangle illustration

strategies, logistics, and cases [3], along with personal reflection on experience is not entirely unique, it has been applied, in various forms, for twenty years in engineering leadership development. [4]

A viable and assessable “hands-on” leadership capstone project was recently added to the curricula, but as a separate and late-in-class activity to reinforce concept learning through application. [5] The capstone experience was recently integrated into the S-triangle to guide the learning topic delivery schedule. As a result, there has been a quantifiably improved student self-reported satisfaction with the class, as well as perceived understanding of leadership concepts.

Note that the references provided for each of the key learning outcomes is not meant to be comprehensive, but only instructional.

Methodology and Pedagogy

The S-triangle approach to leadership development consists of three legs (understand self, leadership styles and characteristics, and situational dependence on application of leadership principles), with each leg linked through reflection on personal leadership experience. The learning tools used in developing the S-triangle (before the inclusion of the capstone project) included readings, class discussions, interviews of external experts, and team-building exercises. The four key elements of the S-triangle are discussed in general terms without the application of the capstone leadership project. That application, which we now believe is a very important learning tool, will be discussed later.

Learning about Self

The ability to understand one’s self (self-awareness) has been long recognized as a key to leadership development from Goleman’s *Emotional Intelligence* to best sellers on entrepreneurialism [4, 6]. Several personality inventories are used, include the Myers-Briggs Temperament Indicator, True Colors personality spectrum, and the Bolton personality test [7, 8, 9]. One Piece of Paper [10] maxims are also used to help the students articulate their core beliefs in the areas related to leadership. Teambuilding exercises are also used to help the students understand how they relate to others.

Students develop a five-minute video autobiography to present to the other students in the class, and have several assigned readings that require the student to understand the importance of self-understanding in order to be authentic with others, knowing what hill to die on [11], and the importance of self-awareness in developing personal integrity.

Learning about Style and Characteristics of Effective Leaders

Learning activities in this leg of the triangle start with a discussion of the explicit leadership styles defined by Goleman [1]. The styles of commanding/coercive, visionary/authoritative, pacesetter, democratic, affiliative, and coaching are compared and contrasted both among the Goleman styles and with styles identified in other leadership literature. Further, the students are asked to assess themselves and rate what they think is their baseline style, which links this leg to the “understanding of self” leg.

After reviewing several other leadership texts [10-13], the students, working in smaller teams, develop lists of leadership characteristics that they perceived necessary for sustained and effective leadership. This list is refined for more than a week as the students present and hear arguments supporting the characteristics. The students consistently arrive at some version of the following list of characteristics of sustained and effective leaders: including character/integrity, vision, passion, understanding of self/emotional intelligence, communication or storytelling, ability to listening/ask questions, persistence, risk-taking, and competence.

Additionally, the students are asked to define the roles of successful leaders as a thought exercise. With some direction, the facilitator and students usually agree that a leader connects people to people, connect people to the vision for the organization, changing or setting the culture, making decisions, motivating and affirming followers, listening, and asking questions.

Finally, the students spend significant time discussing, comparing, and contrasting the concepts of “leadership” and “management.” In addition to differentiation, students are asked to envision how to use management tools to augment leadership styles, including assessment and resource management in achieving a specific goal.

Learning about Situation

The S-triangle is based on the concept that all leadership is discrete and depends on the situation, but preparation for leadership should be continuous. This leg of the triangle (understanding the situation) is anecdotally perceived as more practical and less academic. However, because mastery of situational leadership requires application of the two other legs, cross-referencing is critical to the studies of this leg.

The pedagogical approach taken in helping the student learn about the importance of the situation in leadership is interviews (not lectures) of alumni leaders by the students in the presentation of “real life” leadership cases. The case studies, explicitly presented as cases or revealed through the interviews of successful alumni leaders, provide the students with a chance to integrate some of the skills learned in the other legs and speculate on how application of those skills and ideas could have influenced the “leadership outcome” of the case situation.

While the main purpose of the leader interviews is for the students to assess how situation affected the leadership employed in the situation, it also allows for several other key outcomes. Because the interviews are not speeches by the visiting alumni leaders – they are interviews where the students must ask questions to gain the desired knowledge – separate learning

activities are used to help the students develop skills to interview, listen, and ask good questions, culminating in a mock interview of the class instructor.

The other desired outcome for the leader interviews is for the students to test the assumptions and conclusions reached in the study of the other two legs of the triangle. Through the interview, experienced leaders can reflect on specific characteristics of sustained and effective leadership, as identified previously by the students. The students can also get personal reflections from experienced leaders on their roles, the importance of understanding themselves and others, as well as any other topic they chose to explore.

In addition to the leader interviews, another tool in understanding the role of situation is a leadership biography. Students are asked to identify a leader of interest, describe why that leader has value to them (personally), and then explore their leadership through their historical actions. The students are asked to identify the leader's key styles and characteristics within the context of the leadership event, describing how the outcome of the situation was likely influenced by the leader's actions and styles. This activity allows the students to identify how all three legs of the "S-Triangle" influenced the eventual outcome.

Reflection

The final part of the original S-triangle pedagogy was reflection on leadership experiences held by the students as each segment of the triangle was developed. Students were instructed on how to identify key leadership concepts learned in the leadership study and then to reflect on a leadership memory they held that was related to the concept. The student then identified how their experience was either enhanced by correct application of the concept or could have been addressed differently using their new-found knowledge. This approach was used weekly throughout the semester to link the leadership concepts to existing student memories.

Integrating the S-triangle with a Capstone Leadership Project

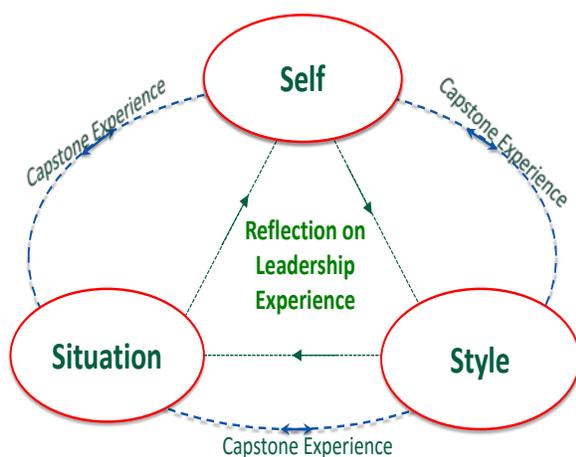


Figure 2. S-Triangle with capstone project

A capstone leadership experience was added to the class as described in [5]. It was previously implemented in addition to and not integrated with the S-triangle. This approach was modified, so that the capstone project became concurrent, linking the legs of the triangle, as shown in Figure 2. Instruction of S-triangle elements were given on a just-in-time basis to support elements and milestones required for the capstone project. This section describes how the project was executed and the resulting linkage with the S-triangle.

The approach to integrating a capstone project with the S-triangle methodology has been applied to two different educational models – an

“in-person” class with students selected by application and interview and an on-line class of professionals seeking an M.S. degree in Engineering Management. Because the pedagogical approach is the same, differentiation between the applications is not discussed.

Implementation

After the students are placed into a small cadre of 3-5 students using the CATME team creation tool [14], they develop lists of leadership characteristics and leadership roles previously discussed in the S-triangle methodology. They also collaboratively discuss their personality inventories and describe how they would work with the other personalities in their cadre for given situations. In fact, throughout the semester, they do team building and sharing of their journeys in their quest to better understanding “self.” This included the sharing or video autobiographies, engaging in the Ohio University Challenge Course as a cadre, and various remote video teambuilding exercises designed by the cadres themselves.

The actual leadership project is launched in the first week of class by asking the students to choose a leadership opportunity in an organization that of personal interest to that student. The student must be active in that organization and have sufficient background to influence potential changes. The students are also required to describe their passion for that organization in explaining why this opportunity is significant to them (personally). Further, they are also asked to describe the leadership opportunity (define the problem) and articulate the vision for the organization in their ideal outcome.

As the rest of the S-triangle is discussed, especially the role of situation in leadership, the students submit specific objectives for their vision, create a strategic plan for achieving their vision including a communication strategy for key stakeholders and followers. They develop a plan for delegation and empowerment of the followers, including a timeline for completion of the objectives, and list explicit metrics or targets that must be quantified in order to demonstrate that the leadership objectives are met (merging leadership and management). The overall flow of the activities is shown in Figure 3.

		Week in Semester													
Activity	Deliverable for Applied Leadership Project	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Selection of potential applied leadership project	Written submission to instructor	x													
Cadre formation															
Personality inventories															
Cadre team-building															
Identification of leadership characteristics															
Identification of leadership roles															
Leadership biographical case study					x		x		x		x		x	x	
Identification of applied leadership activity and motivation	Written submission to instructor and cadre					x									
Structured case studies and interviews															
- Integrity, storytelling, empowerment, mentoring															
- Building a culture, decision making, risk taking															
- Listening, trust, difficult conversations															
Cadre feedback on the activities and motivations	Discussion board posting among cadre (only)						x								
One Piece of Paper personal maxims															
Detailed work plan for executing project including milestones	Written details and Gantt chart							x							
Understanding motivation and "Drive"															
Cadre feedback on work plan	Discussion board posting among cadre/instructor								x						
"Executive coaching" by instructor to cadres															
Progress report and updating of Gantt chart	Written submission to instructor and cadre										x				
Cadre feedback on work plan revisions and updates	Discussion board posting among cadre/instructor											x	x	x	x
Reflections on leadership lessons learned	Written submission of reflections	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Final Progress Report with assessment	Exit Interview with Instructor														x

Figure 3. Flowchart of the Applied Leadership Project Activities

The specific combination of leadership approaches (styles and characteristics) applied to the leadership project (situation) is reviewed by each member of the cadre. Reflection and feedback (coaching) is provided by the cadre members and course instructor. Fortunately (for the instructor), the cadre feedback has been exceptional and total instructor coaching time has been less than two hours per cadre. Additionally, each cadre member must develop a plan for how they will hold their teammates (other leaders) accountable for progress. This is done through weekly postings of progress by students to their cadre and weekly feedback as to how the teammate can be helped by the cadres. Finally, students are then engaged to use the tools they learn from the leadership biography and from the multiple leadership interviews to test their plans and assumptions and to review their progress.

Results

Student Exit Surveys

At the end of the in-person class, exit surveys of the students have been used to quantify student satisfaction with the class, as well as perceived increased understanding of leadership concepts. The survey tool has been taken relative to an entry survey after several readings have been completed. The two survey groups were the class right before (Group 1) and the class right after (Group 2) the integration of the S-triangle pedagogy with the capstone leadership project. The results, shown in Table 1, for the question “Rate your overall satisfaction with the class on a scale of 1-5” indicate that the students were much more satisfied with the course after integration. The results, while not conclusive, are statistically significant to a one-tailed p value of 0.025.

Table 2 shows the results for the student survey question “Rate your increased understanding of leadership concepts on a scale of (1-5). Again, the results are not conclusive, the second group also indicated that they felt they understood the leadership concepts more fully. The data shown in Table 2 are not to the same significance level as from Table 1, but are statistically significant to a one-tailed p value of 0.05.

Student Comments

Along with the numerical assessment, student reflections were used to evaluate the worth of the integration effort. Student commented that the approach presents a more “formulaic” method to leadership compared to similar offerings they had received. They noted that while the approach is not truly algorithmic, it has aspects that allow more logical thinkers to implement while developing the soft skills needed to be effective leaders. To quote one student “Having a way to efficiently organize what I need to do to be a more effective leader has made my job much easier.” While merely speculation at this point, it is surmised that the student impression of the class is a result of the more practical ties between the execution of “leadership” with the study of complex and fuzzy concepts involved in leading others.

Table 1. Results of Overall Class Satisfaction Survey before and after capstone integration

\bar{x} Group 1	4.21
\bar{x} Group 2	4.61
s ₁	0.66
s ₂	0.47
n ₁	17
n ₂	18
t	2.07
P (one tail)	0.024

Table 2. Results of understanding of leadership concepts survey before and after capstone integration

\bar{x} Group 1	4.06
\bar{x} Group 2	4.47
s ₁	0.75
s ₂	0.61
n ₁	17
n ₂	18
t	1.79
P (one tail)	0.046

Conclusions and Future Direction

While there is only a small sampling of data to back this, it seems preliminary results for the integration of a capstone leadership project to the teaching of the S-triangle for leadership development has had some success. Students have indicated they appreciated the tangible linkage of leadership concepts to practice through their projects helped them learn. However, many things could be improved in future years.

Specifically, there are few articulated expectations for cadre behavior other than to support each other and provide thoughtful feedback to each other. While this has worked in the limited context of this class (so far), clearer definition of roles and responsibilities should be developed. Further, the time demands for successful implementation of the leadership project will require scaling back of other class assignments for the students. However, it may be possible to integrate some assignments with the project reports and reflections. Finally, additional assessment and refining of the overall course based on student and stakeholder feedback will be necessary for continued improvement. This will be easier now that the general methodology has been established.

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