# Assessing Leadership Development through a Leadership Practice Project: A Work in Progress

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# Assessing Leadership Development through a Leadership Practice Project: A Work in Progress

This work-in-progress practice paper describes the assessment of learning via a leadership practice project for an upper-level engineering leadership course [1] offered at a large public university in the central U.S. The course features a mix of theory and practical application and is designed to teach skills students can use immediately, as well as concepts they may need later in their careers. Learning is assessed through written reflections, a "managing oneself" essay, and a leadership practice project. This paper supports the ASEE Engineering Leadership Development Division's strategic initiatives "Design" and "Assess." We seek to assess students' leadership learning and development as a result of actively engaging in a project requiring application of leadership skills in conjunction with taking the course.

**Research questions.** Specifically, we are interested in the following questions:
Q1: What course concepts did students choose to apply to their projects?
Q2: How did students apply these concepts?
Q3: What lessons did students describe?
Q4: What leadership skills did students develop during the semester?
Q5: How did students' understanding of leadership change over the course of the semester? What happened to produce this change?

**Course description.** "Leadership and Management for Engineers" is a theory-to-practice course focused on the development of functional leadership skills [2] useful in engineering, computing, and science professions. The core emphasis is process-oriented, collectivistic leadership [3], particularly as conceptualized in the team leadership [4], [5] and shared leadership frameworks [6].

Topics covered in the course during the period described in this paper (2017–present) include those listed in Table 1. During this time, some topics have been added (e.g., psychological safety [7], engineering leadership orientations [8], virtue ethics, and building trust), others have been dropped (e.g., judgment and decision-making [9], [10], the People Styles framework [11]), and some have been modified. For example, "teamwork" was updated to focus on "team leadership [12]," since some of the content previously included in the teamwork lesson is now covered in a lower-level course. The course also features 4–6 guest speakers each semester, which helps students make the connection between leadership concepts and professional practice.

At the beginning of the course, we discuss implicit theories of leadership [13]. Students write their own definition of leadership and then create a common definition with students at their table. Taking note of their individual implicit theories supplies a starting point for their leadership development trajectory.

Table 1. Course Topics.

| | |
|---|---|
| What Is Engineering Leadership? | Team Leadership |
| Implicit Leadership Theories | Psychological Safety |
| Project Management for Your Life: SMART Goals and Getting Things Done | Intrinsic and Extrinsic Motivation |
| Ethical Reasoning: Utilitarian, Deontological, and Virtue Ethics in Engineering Leadership | The Incomplete Leader |
| Values and Visioning | Emotional Intelligence |
| Historical Perspectives on Leadership | Leadership and Management: Is There a Difference? |
| Leadership Traits | Tame Problems, Wicked Problems, & Crises |
| Personality and Leadership | Managing Conflict |
| Leadership Behaviors and Skills | Inclusive Leadership |
| Engineering Leadership Orientations | Women in Leadership |
| Power and Influence | Leaders in Action: The Shackleton Expedition and Apollo 13 |
| Building Trust | Judgment and Decision-Making |

**Project overview.** The "Leadership and Management for Engineers" course has no exams, so the project deliverables serve as the midterm and final assessments. For many years, the midterm and final project assignments were conceptual and didactic: students were placed into groups, assigned a topic, and asked to teach the topic to the class. While this structure did allow students to explore the topics in depth, it did not provide an effective way to assess learning of the course material as a whole. It also provided no mechanism for assessing individual learning or leadership development.

In 2017, the original midterm and final projects were replaced with the Leadership Practice Project (LPP). This new project was designed to help students apply their learning in real time. Each student identifies a team-based project on which they are already participating and that requires application of leadership concepts and skills learned in the course. Typical examples include design competitions, capstone projects, and service activities through campus organizations. In an effort to accommodate students with family and professional demands, we also accept other types of projects, such as coaching a child's soccer team or renovating a house for resale. Students must actively participate on the project during the current semester, and their involvement must span a minimum of eight weeks.

The initial version of the project consisted of three assignments: a proposal, a midterm report, and a final report. In 2023, we added a SMART Goals [14] assignment and split the final deliverable into two parts: a three-minute presentation and an extended essay. Each student writes individual reports. For the midterm and final submissions, students assess the project's progress and/or outcomes and describe how they have applied skills and concepts learned through the course. Students are free to discuss any material, technique, or concept covered in the course material. For the midterm report, students also discuss the application of their strengths to the project and identify necessary personal and team-level improvements. On the final report/essay, students also discuss their growth as a leader over the course of the semester through execution of the project.

**Project assignments.** The LPP assignments most relevant to this study include the midterm report and the final deliverables (the final report or, more recently, the final presentation and extended essay). The current final deliverables cover similar content as the previous final report while (1) providing an opportunity for students to practice their presentation skills and (2) reducing the instructors' grading load.

On the midterm report, students summarize their project and its objectives, describe the team's organizational structure, and discuss application of two personal strengths. They then select two course concepts and describe (1) how they have applied each concept to their project and (2) the effects on the project's progress, providing a narrative with supporting details. Finally, they assess their project's progress, identify changes the team needs to make in order to improve the project's outcome, and describe changes they personally need to make in order to be a more effective leader.

The final presentations are conducted in the style of a Three Minute Thesis competition [15], but without the competitive aspect. Each student prepares a 3-minute presentation and a single slide. In the presentation, students describe their project, its objective, and the outcome or current state; a significant challenge associated with the project; and the major leadership lesson gained from the project. This lesson should be related to the significant challenge, and the student should refer to specific course concepts during the presentation.

In the final extended essay, students describe how they have grown as a leader over the course of the semester. They are required to address lessons learned through the LPP, but they may discuss lessons learned in other contexts as well. The paper must cover five main topics. The first topic must describe how their ideas about leadership have changed: What did they believe about leadership at the beginning of the semester, what do they believe now, and what happened to cause the change? The other four topics can cover anything else the student believes to be relevant to their leadership development. As with the midterm report, they are expected to tell stories and connect the concepts explicitly to material covered in the course.

**Methodology.** Between 120–180 reports have been submitted each year since 2017. At present, inclusion criteria are simple: Reports from any student who took the course and who consents to participate will be analyzed. If the number of papers in the pool becomes unwieldy, we may narrow the set. Inclusion criteria for a narrower set have not been determined.

Reports will be thematically coded and analyzed using both structured and inductive coding procedures and narrative analysis techniques [16]. In particular, we are interested in the topics chosen for discussion, how students applied the concepts, indicators of understanding, and the leadership skills and identity development trajectories described.

**Theoretical frameworks.** Leadership identity development theory [17], [18], the Integrative Model of Leader Development [19], Engineering Leadership Orientations [8], and the Team Leadership Framework [5] will inform the analysis. The Leadership Identity Development model provides a structure for understanding college students' leadership development over time and has served as the basis for recent work on leadership identity among engineers and engineering students [20], [21], [22], [23], including the identification of three engineering leadership orientations [8]: technical mastery, collaborative optimization, and organizational innovation. The Integrative Model of Leader Development [19] provides a complementary approach to examining adulting leader development. The Team Leadership Framework [5] combines several complementary theories of teamwork and leadership with a functional leadership perspective [2] and is useful for modeling engineering leadership in both professional and academic settings [12], [21], [24].

**Findings.** The informed consent process is underway. Data analysis is scheduled to commence later in 2024.

**Implications.** The Leadership Practice Project provides a context for students to apply leadership concepts they are learning in real time, to assess the results, and to make adjustments over the course of the semester. This practical application with reflection should result in improving their individual capacity for leadership [25], [26] and may enhance their respective teams' capacity as well [4], [27]. The improved leadership capacity may also result in improved outcomes for the focal projects, benefiting not only the students themselves but also their professors, clients, and institutions. Because the LPP incorporates a project on which the students are already engaged, the time demand and coordination issues associated with an additional stand-alone team project are eliminated. Students who are not already engaged in an appropriate project also benefit, as this assignment provides impetus for joining and actively participating with a student organization or other extracurricular group.

Analysis of data from the LPP will also benefit engineering education research. The understanding of the mechanisms of student leadership development in the engineering context, while growing, remains incomplete. This study will advance the young field of engineering leadership development.

## References


[1] K. G. Wolfinbarger and R. C. Pan, "Leadership attitudes and beliefs of students enrolled in an engineering leadership course," presented at the 2016 ASEE Annual Conference & Exposition, New Orleans, Louisiana, 2016.

[2] E. A. Fleishman, M. D. Mumford, S. J. Zaccaro, K. Y. Levin, A. L. Korotkin, and M. B. Hein, "Taxonomic efforts in the description of leader behavior: A synthesis and

functional interpretation," *The Leadership Quarterly,* vol. 2, no. 4, pp. 245-287, 1991, doi: 10.1016/1048-9843(91)90016-U.

[3] F. J. Yammarino, E. Salas, A. Serban, K. Shirreffs, and M. L. Shuffler, "Collectivistic leadership approaches: putting the 'we' in leadership science and practice," *Industrial and Organizational Psychology,* vol. 5, no. 4, pp. 382-402, 2012, doi: 10.1111/j.1754-9434.2012.01467.x.

[4] D. V. Day, P. Gronn, and E. Salas, "Leadership capacity in teams," *The Leadership Quarterly,* vol. 15, no. 6, pp. 857-880, 2004, doi: 10.1016/j.leaqua.2004.09.001.

[5] C. S. Burke, K. C. Stagl, C. Klein, G. F. Goodwin, E. Salas, and S. M. Halpin, "What type of leadership behaviors are functional in teams? A meta-analysis," *The Leadership Quarterly,* vol. 17, no. 3, pp. 288-307, 2006, doi: 10.1016/j.leaqua.2006.02.007.

[6] C. L. Pearce and J. A. Conger, *Shared Leadership: Reframing the Hows and Whys of Leadership*. Thousand Oaks, CA: Sage Publications, 2003.

[7] A. C. Edmondson, "Psychological safety, trust, and learning in organizations: a group-level lens," in *Trust and Distrust in Organizations: Dilemmas and Approaches*, R. M. Kramer and K. S. Cook, Eds., New York, NY: Russell Sage Foundation, 2004, pp. 239-272.

[8] C. Rottmann, R. Sacks, and D. Reeve, "Engineering leadership: grounding leadership theory in engineers' professional identities," *Leadership,* vol. 11, no. 3, pp. 351-373, 2015, doi: 10.1177/1742715014543581.

[9] D. T. Willingham, *Cognition: The Thinking Animal,* 3rd ed., Upper Saddle River, NJ: Pearson/Prentice Hall, 2007.

[10] D. Kahneman, P. Slovic, and A. Tversky, *Judgment Under Uncertainty: Heuristics and Biases*, New York, NY: Cambridge University Press, 1982.

[11] R. Bolton and D. G. Bolton, *People Styles at Work… And Beyond: Making Bad Relationships Good and Good Relationships Better*, 2nd ed., New York, NY: Amacom, 2009.

[12] K. G. Wolfinbarger, "Team leadership in engineering education," in *New Directions for Student Leadership: No. 173, Student Leadership Development in Engineering,* pp. 53–61, M. R. Kendall and C. Rottmann, Eds., Wiley, 2022, https://doi.org/10.1002/yd.20479.

[13] R. G. Lord, O. Epitropaki, R. J. Foti, and T. K. Hansbrough, "Implicit leadership theories, implicit followership theories, and dynamic processing of leadership information," *Annual Review of Organizational Psychology and Organizational Behavior,* vol. 7, no. 1, pp. 49-74, 2020/01/21 2020, doi: 10.1146/annurev-orgpsych-012119-045434.

[14] L. J. Zachary, *The Mentee's Guide: Making Mentoring Work for You*. Hoboken, NJ: Jossey-Bass, 2009.

[15] U. of Queensland, "Three Minute Thesis," https://threeminutethesis.uq.edu.au/higher-degrees-researchstart-your-3mt-journey-here (accessed 2024).

[16] K. Klenke, *Qualitative Research in the Study of Leadership,* Bingley, UK: Emerald Group, 2008.

[17] S. R. Komives, J. E. Owen, S. D. Longerbeam, F. C. Mainella, and L. Osteen, "Developing a leadership identity: a grounded theory," *Journal of College Student Development,* vol. 46, no. 6, pp. 593-611, 2005, doi: 10.1353/csd.2005.0061.

[18] S. R. Komives, S. D. Longerbeam, J. E. Owen, F. C. Mainella, and L. Osteen, "A leadership identity development model: applications from a grounded theory," *Journal of*

*College Student Development,* vol. 47, no. 4, pp. 401-418, 2006, doi: 10.1353/csd.2006.0048.

[19] D. V. Day, M. M. Harrison, and S. M. Halpin, *An Integrative Approach to Leader Development: Connecting Adult Development, Identity, and Expertise*. New York, NY: Routledge, 2009.

[20] B. Tallman, B. E. Hughes, and W. J. Schell, "Identity-based engineering leadership instruction: a reflexive instruction model and its impact," presented at the ASEE Annual Conference & Exposition, Baltimore, MD, 2023.

[21] K. G. Wolfinbarger, R. L. Shehab, D. A. Trytten, and S. E. Walden, "The influence of engineering competition team participation on students' leadership identity development," *Journal of Engineering Education,* vol. 110, no. 4, pp. 925-948, 2021, doi: https://doi.org/10.1002/jee.20418.

[22] B. Tallman, W. J. Schell, T. A. Sybesma, M. B. Kwapisz, B. E. Hughes, C. Bozic, and D. Kotys-Schwartz, "How do engineering undergraduates define engineering identity?" presented at the International Annual Conference of the American Society for Engineering Management, Philadelphia, PA, 2019.

[23] W. J. Schell and B. E. Hughes, "An approach to understand the role of identity in engineering leadership," presented at the ASEE Annual Conference & Exposition, Columbus, OH, 2017.

[24] K. G. Wolfinbarger and R. L. Shehab, "What behaviors and characteristics do engineering competition team members associate with leadership?" presented at the ASEE Annual Conference, Seattle, WA, 2015.

[25] D. Miscenko, H. Guenter, and D. V. Day, "Am I a leader? Examining leader identity development over time," *The Leadership Quarterly,* vol. 28, no. 5, pp. 605-620, 2017, doi: https://doi.org/10.1016/j.leaqua.2017.01.004.

[26] D. S. DeRue, J. D. Nahrgang, J. R. Hollenbeck, and K. Workman, "A quasi-experimental study of after-event reviews and leadership development," *Journal of Applied Psychology,* vol. 97, no. 5, pp. 997-1015, 2012, doi: http://dx.doi.org/10.1037/a0028244.

[27] J. R. Hackman and R. Wageman, "A theory of team coaching," *The Academy of Management Review,* vol. 30, no. 2, pp. 269-287, 2005, doi: 10.5465/AMR.2005.16387885.