

Enhancing Leadership Capabilities of Engineering Instructional Faculty Through an ICVF-Based Reflection Activity

Dr. Meagan R. Kendall, University of Texas at El Paso

An Associate Professor at The University of Texas at El Paso, Dr. Meagan R. Kendall is a founding member of the Department of Engineering Education and Leadership. With a background in both engineering education and design thinking, her research focuses on how Latinx students develop identities as engineers and navigate moments of identity interference, student and faculty engineering leadership development through the Contextual Engineering Leadership Development framework, and promoting student motivation. Dr. Kendall is the Past Chair of the Engineering Leadership Development Division of ASEE.

Dr. Brett Tallman, Texas Christian University

Brett Tallman is Assistant Professor of Professional Practice at Texas Christian University. He earned his doctorate in Engineering at Montana State University (MSU), with focus on engineering leadership. His previous degrees include a Masters degree in Education from MSU (active learning in quantum mechanics) and a B.S. in Mechanical Engineering from Cornell University. He comes to academia with over two decades of industry experience, including quality engineering with Toyota and managing his own consulting practice in biomedical and product design.

Mr. Henry Salgado, University of Texas at El Paso

Henry Salgado is a Ph.D. student in Computer Science and a graduate researcher at The University of Texas at El Paso. He has earned two Master's degrees, one in Computational Science and another in Engineering. His research interests focus on the intersection of computer science, data science, and engineering education.

Gemma Henderson, University of Miami

Gemma Henderson is a Director of Learning Platforms at the University of Miami, and previously held a position as a Senior Instructional Designer in the Learning Innovation and Faculty Engagement team. Gemma partners and consults with faculty, academic units and other university stakeholders across the University focusing on curriculum development and digital pedagogies. Gemma engages in information technologies and educational initiatives to enrich undergraduate and graduate courses on behalf of Academic Technologies. Gemma currently serves as the Curriculum Development Lead in a collaborative research project, funded by the National Science Foundation, with faculty at the University of Texas El Paso, University of Miami, and Florida International University focused on undergraduate engineering education at Hispanic Serving Institutions.

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Abstract

This practice paper focuses on the design and implementation of a leadership reflection activity used during the AMPLIFY Institute, a semester-long leadership development program for Engineering Instructional Faculty (EIF). EIF (i.e., full-time, largely non-tenure-track educators) are a growing population in higher education. Not only do these educators spend more time in the classroom positively impacting students, but they also play a critical role in leading educational change initiatives, such as adopting curricula that connect with students' cultural identities to bolster their sense of belonging in engineering. However, they, like most faculty, have limited leadership development opportunities tailored to their unique contexts.

To address this opportunity, the AMPLIFY Institute was designed to support EIF's ongoing educational change efforts at their institutions. The institute consists of a two-day kickoff workshop that leverages various individual and group-based participative activities, followed by seven weeks of virtual group coaching. In designing the leadership reflection activity, we leveraged the Integrated Competing Values Framework (ICVF) as a theoretical foundation for understanding the various ways EIF may practice leadership. In short, the activity leverages self-reflection by having participants gauge their leadership capabilities and consider which aspects they want to grow, acquire, or delegate to achieve their proposed change goal.

In hopes that others can adapt this activity to their own faculty leadership development contexts, this paper provides guidance on implementing the activity and the corresponding worksheet, accompanied by preliminary evaluation results. The impact of this activity on participant leadership growth is explored through the analysis of quantitative (i.e., leadership self-assessment survey responses) and qualitative data (i.e., participant worksheets). The preliminary evaluation results suggest the activity effectively facilitates faculty reflection on their current leadership development needs.

Introduction

Within engineering education, multiple constituents – from our accreditation boards to students, alumni, and industry partners – call for change and innovation to better prepare a diverse population of engineers capable of addressing the sociotechnical opportunities and challenges of the future [1]. Much of this conversation has traditionally centered on preparing engineering students with both the technical and professional skills needed to tackle these sociotechnical challenges, particularly engineering leadership. However, this goal depends not only on how and what we teach students but also on the perceptions engineering faculty have of leadership and leadership development. In their roles, faculty shape curricular change, model professional behaviors, and influence department and institutional cultures. Yet, many faculty do not receive formal leadership training and frequently learn through observation or trial-and-error – processes that, although valuable, may have limited impact without structured opportunities for reflection that yield agentic strategic actions [2], [3]. Moreover, in our faculty development work, we have found that many faculty do not identify as leaders, despite their continued efforts to impact

engineering education. Therefore, if we want to have faculty who are better equipped to lead change in engineering education broadly and integrate professional skills development in the classroom specifically, higher education institutions and faculty developers need to provide leadership development opportunities tailored to engineering faculty.

To address these gaps, this practice paper shares a pilot-tested leadership development activity, informed by the Integrated Competing Values Framework (ICVF; [4]) and designed to foster structured reflection for engineering faculty. Developed within the AMPLIFY Institute, our approach emphasizes the importance of introspection and self-assessment as an opportunity to reflect on leadership growth opportunities. Therefore, we provide here a brief overview of the importance of reflection, the ICVF framework, suggestions for implementation based on our development and piloting efforts, and the handout for others to adapt to their own faculty development contexts.

Role of Reflection in Bolstering Faculty Leadership Development

Understanding why reflection is a powerful mechanism for faculty leadership development requires examining its theoretical foundations. This foundation helps explain not only why our approach emphasizes reflective practice but also how structured reflection can transform faculty's perception of themselves as educational leaders. At its core, faculty leadership development is an exercise in adult learning and development, which, from a Social Cognitive Theory perspective, is an agentic process based on intentional individual action [5]. The central tenet of this model is a triadic reciprocity between interpersonal, behavioral, and environmental determinants that effect human development, adaptation, and change. This model contrasts with environmental determinist perspectives by highlighting the autonomous and interactive nature of human agency. It also contrasts with personal determinisms by highlighting the internal determination of behavior, while still acknowledging human behavioral complexity and inconsistency [6]. Agency has been explored by researchers in the context of professional life (e.g., [7], [8]), including academic contexts (e.g., [9], [10], [11]).

From a Social Cognitive Theory perspective, self-reflection is arguably the most important of the four core properties of agency, the others being intention, foresight, and self-reaction [5]. Self-reflection enables individuals to analyze their experiences and thoughts, thereby increasing their knowledge of the world around them; moreover, it empowers individuals to monitor and even change their internal perspectives and beliefs. This reflection facilitates several intrapersonal mechanisms: it engages self-efficacy as a determinant of action; it provides guidance on energy expenditures; it illuminates perseverance thresholds; and it even guides emotional disposition in potential challenges [6]. In sum, “[a]mong the types of thoughts that affect action, none is more central or pervasive than people’s judgments of their capabilities to deal effectively with different realities,” [6]. Specifically, “[t]he metacognitive capability to reflect upon oneself and the adequacy of one’s thoughts and actions is the most distinctly human core property of agency” that we seek to leverage in this faculty leadership development program’s design [5].

The importance of reflection extends beyond theoretical frameworks into practical applications for educational leadership. Reflection is well-established in the literature as a critical practice for teacher leadership development [12], [13]. Through reflective processes, educators deepen their

self-awareness, clarify their values, and identify practical strategies for improvement [14]. Building on this established connection between reflection and leadership, this project seeks to develop an exercise that leverages reflection to enhance the agency of engineering faculty to lead educational change.

Program and Population Overview

The faculty leadership development program we focus on in this study is part of a larger multi-year project funded by the National Science Foundation (NSF). The AMPLIFY project aims to foster educational change and innovation within engineering education at Hispanic-serving institutions (HSIs), promoting multicultural and student-centered approaches that empower and celebrate the diversity of its educators and students [15], [16]. The primary activity at the center of this larger project is the AMPLIFY Institute.

This AMPLIFY Institute was designed for a specific engineering faculty population at HSIs: full-time faculty who are primarily evaluated on their instruction, regardless of tenure status (e.g., professors of practice, professors of instruction, and lecturers). At four-year institutions, these individuals are typically in non-tenure-line roles, while at two-year colleges, they may have tenure-line roles. A growing population across higher education, engineering instructional faculty (EIF) have an outsized impact in terms of time spent with students, especially for lower-division students [17], [18]. These faculty see themselves as professional educators, many of whom are returning to academia from industry to help impact the next generation of engineers [19], [20]. They are also more likely to engage in instructional professional development than their tenure-track peers [21]. EIF are, therefore, optimally positioned to understand student needs and potential changes to existing education practices that would support these students. Hence, supporting this faculty subpopulation as change agents may be an especially efficient use of resources in implementing effective educational innovations.

The Institute's facilitators, also authors of this paper, leveraged a design thinking approach to curriculum development to tailor the curriculum to the unique context of EIF at HSIs [22]. Based on the project team's initial work exploring the experiences of these EIF [19], [23], [24], [25], [26], a leadership development program was designed based on the emerging model of EIF leadership development and their professional development needs [15], [16], [27], [28]. Overall, the Institute leverages a leadership development model that integrates *assessments* of their need for and progress in developing as leaders, *challenges* or opportunities to practice and apply their skills, and directed *support* through coaching, similar to that of the Center for Creative Leadership [29].

The Institute consists of a two-day kickoff workshop that leverages various individual- and group-based participative activities, followed by six virtual group coaching sessions that support EIF's ongoing educational change efforts at their institutions [28]. The institute closes with a final virtual celebration where participants share their perceived leadership growth, project outcomes, and future goals. The kickoff workshop, which includes the activity we focus on in this paper, includes intentional community building and peer mentoring around theory-informed topics of understanding faculty and student assets (e.g., community cultural wealth [30]), their leadership roles via the Integrated Competing Values Framework (ICVF; [4]), and faculty

agency toward educational impact [11]. Ultimately, the facilitators guide EIF through defining their change initiative's goals and implementation strategies, which are revisited during the coaching sessions. In this paper, we share one of the activities designed to support EIF reflection on their roles as leaders and opportunities for development based on the ICVF.

Theoretical Foundations

Given the importance of reflection in leadership development [31], one goal of the program was for faculty to reflect on their definition of leadership, explore how they enact leadership in their role, and identify areas where they would like to grow as leaders. To facilitate this reflection, we leveraged the Integrated Competing Values Framework [4].

The ICVF was derived from Quinn et al.'s competing values framework, which explains the various managerial roles required for personal effectiveness in complex organizational environments [32], [33]. This framework recognizes the tensions that exist within organizations due to the individual and organizational values that are embraced along two axes. On one axis, they note the tension between valuing individual flexibility and adaptability of *people* versus ensuring stability and control of processes and *task* execution. On the other axis is the tension between the maintenance of *internal* processes and information versus ensuring *external* competitiveness, positioning, and innovation. Together, these axes form quadrants representing the dominant role and values of the organization and its units as those that Create, Compete, Control, or Collaborate (Fig. 1). Though each organization may have a dominant quadrant, all are essential in the effective operation of organizations. For example, most academic organizations could be classified overall in the Collaborate quadrant since they tend to value an internal focus on people and their development/education. However, academic institutions may also have units focused on marketing and communication or the commercialization of research innovations, which are Create-focused. Similarly, to complete that research, academic institutions have units focused on the health, safety, and welfare of researchers and participants (e.g., offices of environmental health and safety or institutional review boards), which are Control-focused.

Within each quadrant are leaders and managers who take on roles congruent with the values of the quadrant. Quinn et al. initially defined a set of eight leadership roles evenly distributed across the quadrants. However, much like organizations, leaders rarely exhibit only one leadership style. In fact, Quinn's early work found that the most effective managers could switch roles based on their environment; correspondingly, Hoojiberg found that the effectiveness of leaders is reduced when they do not move between the operational roles when necessary [34]. Vilkinas et al. applied the CVF to university contexts [35] and the relationship between PhD students and their supervisors [36]. Within engineering education specifically, [37] studied leadership behaviors of engineers in their school-to-work transition and [38] examined how leadership is distributed in self-managed teams.

Vilkinas et al. expanded on this work, seeking to better explain how leaders navigate taking on different leadership styles (Fig. 1, [4]). Their work collapsed the original eight roles into five and introduced a new role of the Integrator. They describe the Integrator as the reflective skillset that

helps leaders navigate between and execute different leadership roles based on contextual needs. Therefore, in addition to explaining the tensions within organizations, the ICVF highlights the varied types of roles and expertise that individuals may be require in the execution of a project. As we see in the evaluation section of this paper, this framework proved useful in supporting EIF as they reflected on the diverse roles and expertise necessary for completing their engineering education change project during the Institute.

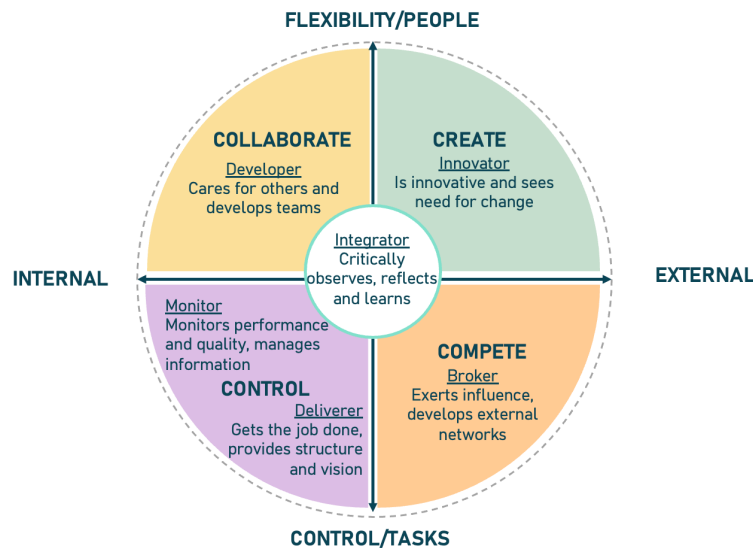


Fig. 1 The Integrated Competing Values Framework (adapted from [4])

ICVF Reflection Activity

Though the whole program is intended to facilitate leadership development, the ICVF reflection activity is embedded in the second day of the institute to make explicit the leadership concepts woven throughout the program. The ICVF reflection activity consists of small group discussions with affinity mapping to activate prior knowledge, a leadership self-assessment, a brief leadership theory presentation from facilitators, and completion of the ICVF reflection handout. Here, we describe the final form of the reflection activity in hopes that others can adapt it to their own context. We share the activity's evolution and evaluation in the subsequent sections.

Participants are first asked to *form small groups and discuss* the prompt: “What does it mean to be a leader in academia?” Each group is instructed to capture their responses on sticky notes and create an affinity map of their group’s exploration of typical ways participants perceive power dynamics in academia. Before explicitly introducing leadership concepts via a formal presentation, a *self-assessment survey* is administered to participants via QuestionPro, which assesses their leadership style according to ICVF [4]. Participants are given time to complete the survey during the workshop to ensure everyone has their scores available for subsequent reflection activities. Scores for the related concepts are automatically calculated and sent to participants via email. To provide additional language and a framework for continued discussion, a facilitator provides a *brief presentation on ICVF*. A key aspect of this presentation is providing examples of how typical roles in academia could be categorized. This allows participants to explore various leadership styles regarding their own experience while still exploring potentially

divergent perspectives of their peers. In addition, the ICVF recognizes the value of multiple ways of engaging in leadership, thereby providing participants a framework for positively making meaning of their own way of being. This gives participants the opportunity to revisit earlier discussions using clearly defined vocabulary and ICVF concepts. In addition, it provides participants with an interactive forum through which they can further elucidate their own leadership role preferences, as well as explore the relevance of these leadership roles in their projects.

Next, participants reflect on their results from the ICVF survey by completing a *handout* and engaging in discussion with colleagues (Fig. 2). This activity encouraged participants to first gauge their current capabilities in the ICVF roles by recording their scores from the leadership self-assessment on the spider chart (Fig. 2Step 1). Then, participants reflect on the leadership capabilities required for the success of their respective change projects, noting in a second color where they felt that leadership role should be (Step 2). This results in a spider graph that compares current capabilities (Step/color 1) with project demands (Step/color 2), as illustrated in Fig. 3. Finally, participants reflect on three areas where they feel particular roles are needed for their project, two that they did not already feel strong in and would like to grow, and one that they did not prefer to embody for their project and would like to delegate (Step 3). These three areas became a focus area for the faculty during the coaching sessions.

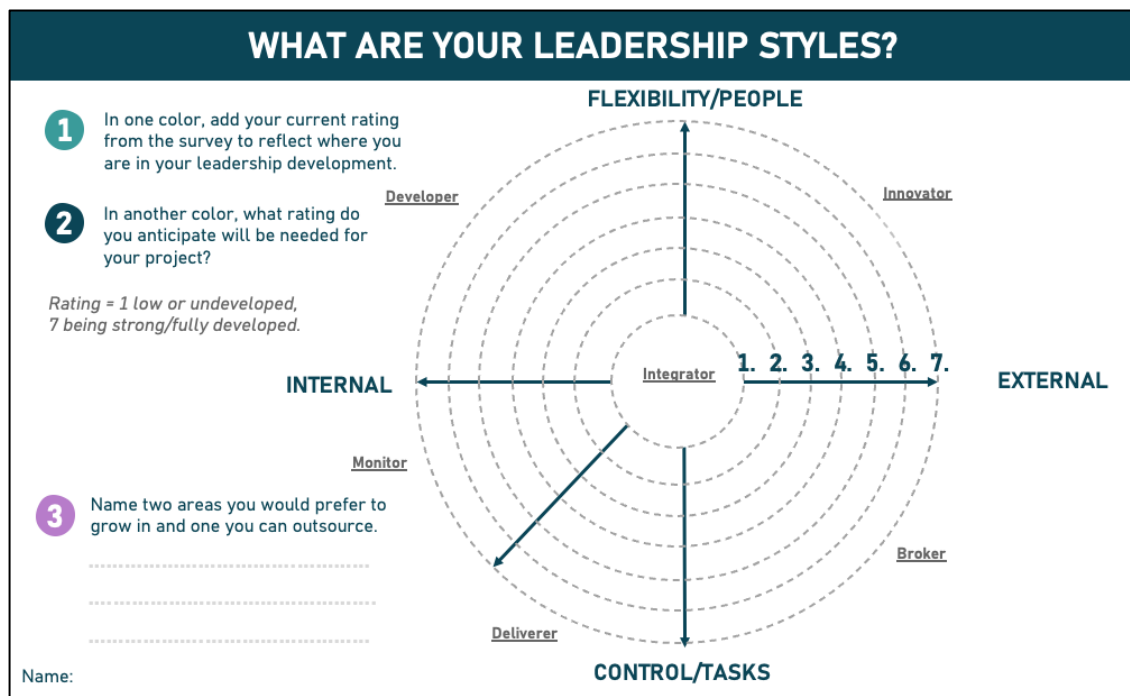


Fig. 2 ICVF-Based Handout Designed for the AMPLIFY Institute

Pilot Implementation and Evaluation

This activity has been refined over three offerings of the AMPLIFY Institute during the fall terms of 2022, 2023, and 2024. To date, 66 EIF from 32 HSIs across the USA have completed the ICVF reflection activity. It evolved from a broad exploration of leadership in the 2022 cohort to a more targeted, project-focused approach to leadership in the 2023 and 2024 offerings. The

initial 2022 Institute explored three leadership frameworks centered around beliefs [39], [40], identity [40], and styles [4]. In practice, time constraints and participant feedback led to the omission of several planned activities associated with the leadership frameworks, shifting from a multifaceted approach to focusing solely on ICVF by 2024. Therefore, we reduced the number of leadership frameworks in the subsequent offerings, allowing more time for individual and group reflection. We retained the affinity mapping and discussion of academic leadership strengths across all offerings, which participants appreciated. The self-assessment survey was simplified, and score calculations were automated by the second iteration in 2023.

By the 2023 and 2024 offerings, the focus of the activity was centered around participants connecting their individual leadership styles to their project needs, recognizing the practical shifts needed to achieve project outcomes. For instance, dedicating time to reflect on potential outsourcing opportunities to leverage the strengths of others helped introduce the collaborative nature of leadership. The iterative process of the program allowed us to refine the activity, prioritizing reflection, participant engagement, and practical application of the ICVF in the scope of their project.



Fig. 3 Example Handout Completed at Institute in 2023

Given that this activity is embedded within a larger development program, it is challenging to isolate its impact on EIF leadership development. Therefore, in this paper, we focus on evaluating responses on handouts collected from participants in the fall 2023 institute, looking for indicators of whether we successfully encouraged participants to reflect on their leadership because of the activity. In our continuing research, we hope to evaluate whether the faculty have followed through with their proposed leadership development and change projects, and therefore the impact of the overall Institute.

To examine whether the activity enabled participants to identify areas they wished to focus on for their leadership development, we analyzed the self-assessment survey and written responses on the ICVF reflection handout from the fall 2023 institute (see example response in Fig. 3). All nineteen attendees from the 2023 cohort completed the reflection handout and added their ICVF self-assessment survey scores (see Table 1), noting what roles they felt were necessary for their projects (Steps 1 and 2).

The self-assessment leveraged an adapted version of Vilkinas et al.'s ICVF survey instrument [4]. This instrument consisted of Vilkinas et al.'s 19 Likert-style items, where 1 is almost never and 7 is almost always. The instrument was adapted by duplicating items for new constituencies (e.g., “comes up with innovative ideas” was adapted into “Come up with inventive ideas for your classroom” and “Come up with inventive ideas with colleagues”), given the diverse nature of faculty roles in this population [19]. Other items were adapted by adding specificity to the context (e.g., “Maintains tight logistical control” became “Maintain tight logistical control in your classroom”). We also created entirely new items in some roles based on prior interviews with faculty about their responsibilities as EIF (e.g., “Regularly measure students’ performance to gauge progress”). The final instrument, consisting of 31 items, will be shared elsewhere.

Table 1. ICVF sample items and average scores from Fall 2023 participants (n =19)

ICVF Role	Items (<i>new</i>)	Sample Item (bold denotes adaptations)	Mean	SD
<i>Innovator</i>	5 (3)	Experiment with new concepts and ideas in your classroom	4.00	1.11
<i>Broker</i>	4 (2)	Influence decisions made by collegial groups (e.g., committees).	3.16	0.92
<i>Deliverer</i>	4 (1)	Clarify your (collegial) team’s priorities and directions?	4.21	0.68
<i>Monitor</i>	5 (4)	Maintain tight logistical control in your classroom.	3.98	0.58
<i>Developer</i>	6 (3)	Show empathy and concern in your classroom.	4.52	0.54
<i>Integrator</i>	7 (1)	Learn after reflecting on past behaviors with students, staff, and colleagues	4.55	0.58

Based on an ANOVA ($F(5,108) = 8.395, p = <.001$) and Tukey post hoc analysis (HSD = 0.690) of the 19 participants’ responses, only the Broker role ($M = 3.16, SD = 0.92$) was statistically significantly different from mean scores for other roles for these faculty. Given the small sample size, we validated these findings using a non-parametric Kruskal-Wallis H test, which also indicated a significant difference among the groups ($H = 29.37, p < .001$). To identify specific differences, we performed a Conover post-hoc test with Bonferroni correction, which confirmed that the Broker role differed significantly from other groups. The box plot in Fig. 4 illustrates the lower median score of participants’ Broker role compared to other roles.

In Step 3 of the handout, twelve participants identified one to three areas where they would like to develop their leadership, while eleven identified one area to delegate. The participants at our workshop were nearly evenly distributed in their desire to grow as Innovators ($n=6$), Deliverers ($n=5$), Monitors ($n=5$), and Developers ($n=4$). Interestingly, eight out of the eleven who identified an area to delegate noted Broker, which was also the only statistically significantly lower mean score for this group. These results differ in which role scored lowest from those of

heads of schools, for whom the Developer, Innovator, Broker, and Deliverer were displayed the same, but Monitor was least displayed [35]. This may reflect the professional vulnerability experienced by faculty not on the tenure track, who might feel less comfortable exerting influence in collegial decision-making processes without the job security tenure provides [20]. Though receiving the highest mean score within the group, none selected Integrator as the role they wished to strengthen or delegate, which may be due to reasons we discuss further below.

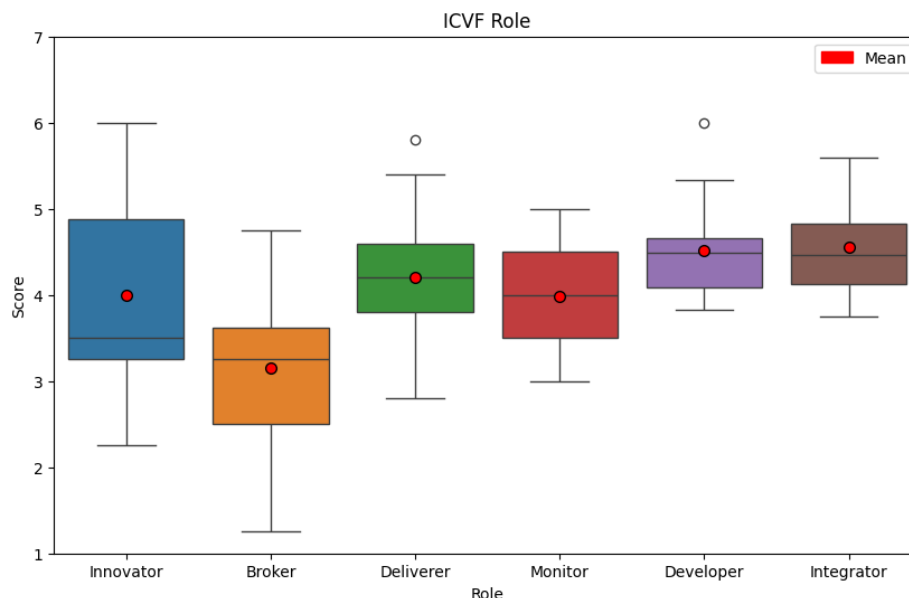


Fig. 4 Boxplot illustrating ICVF scores of Institute Participants

Insights for Future Use

In reflecting on our facilitation of this activity, we note a few potential limitations and insights that we and others should consider when implementing this activity in future leadership development programs. First, participants rarely noted scores for their project's leadership demands below their current perceived abilities, as scored by the ICVF survey. This may indicate how the activity was introduced to participants and, therefore, may be worth explicitly pointing out as an option and area for participants to reflect on. Second, it is unclear whether people selected their top growth and delegation areas purely based on the needs of their projects, where they felt weakest, where they scored lowest on the self-assessment, or some combination. Future handout versions could include more explicit guidance and ask them to note how they decided on their growth and delegation items. Third, since none of our participants identified the Integrator as a role for growth or delegation, facilitators may need to remind participants to consider their Integrator role during reflection explicitly. It was unclear during our piloting of the handout whether participants included it in their reflections or if they were considering it but were genuinely satisfied with their competence in the Integrator role. Though the Integrator role did have the highest mean score, it was only statistically significantly different from the mean scores for the Broker. Further, initial versions of the handout did not have an explicit location for participants to note their Integrator scores (see sample handout Fig. 3), which has been corrected in the version shared above (Fig. 2) but likely impacted participant responses. Finally, we also informally observed participants' immediate reactions to their self-assessment results, with many

expressing how closely their scores match their perceived leadership styles. Future iterations of this activity could create more structured opportunities for these conversations, perhaps by adding a small-group reflection on specific discrepancies between perceived and reported leadership orientations.

Conclusion

To better equip faculty to lead change in engineering education broadly and integrate professional skills development in the classroom specifically, this paper shares a reflection activity used in a program tailored to engineering instructional faculty leadership development. In designing the activity, we leveraged the Integrated Competing Values Framework as a theoretical foundation to encourage instructional faculty in engineering to reflect on the various ways they practice leadership. A preliminary evaluation of this activity suggests that it effectively prompts faculty to reflect on their leadership development needs. Therefore, we hope others can adapt this activity to their own faculty leadership development contexts.

Acknowledgement

This paper is based upon work supported by the National Science Foundation under Grant Numbers 1953560 and 1953586. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. The team would also like to acknowledge the invaluable insights, enthusiasm, and contributions of the HSI engineering instructional faculty participating in this study.

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