Supporting All Learners:

A Study of Engineering Faculty Professional Development, Values, and Mentorship within a Community of Practice Model

by

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ABSTRACT

One of the primary aims of this action research study was to understand what happens when engineering faculty, staff, and faculty mentors engage in a professional development opportunity focused on improving instructional practices and faculty-student interactions. Since action research is aimed at using innovation to engage with a local problem of practice, for this research a Teaching Community of Practice Virtual Book Study (TCPVBS) innovation was designed, implemented, and studied. This study utilized a qualitatively driven Mixed Methods Action Research (MMAR) approach. Using Communities of Practice and Expectancy Value Theory as the primary guiding theoretical frameworks, the TCPVBS innovation was designed to prioritize a learner-centered approach, fostering collaborative knowledge construction among participants on book study topics through learning materials designed to promote an inclusive lens. Participants in the study included faculty, faculty mentors, and staff at Southwest University, primarily in the College of Engineering. Data was collected in the form of pre- and post-surveys, meeting artifacts, a focus group, semi-structured individual interviews, and reflection journals. A thematic analysis was conducted using codebooks. The study concluded that a faculty book study was a valuable learning opportunity for teaching professional development. Further research is needed to understand how instructional practices and student outcomes are impacted by the TCPVBS innovation. Implications for future research related to engineering faculty culture and embedding an inclusive lens are presented and discussed.

DEDICATION

To Andy, my supportive husband. I literally could not have done this without you. I love you!

To Hunter, I hope you saw how much I loved learning and loved my work during this chapter of your life. I hope you also find work you are passionate about.

To my family, friends, and colleagues, thank you all for your love and unconditional support throughout this journey.

To my Nannie, who saved every penny to create a college fund for my sister and me. I wish you could see the beautiful lives we've built.

To fellow first-generation college students, college is tough - but so are you. You are capable and you belong.

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CHAPTER 1

LEADERSHIP CONTEXT AND PURPOSE OF STUDY

"It's sort of like you *survived* rather than you were *cultivated*."
-Alex, Faculty Mentor

Engineering faculty members juggle numerous responsibilities that demand their time and energy. While some faculty may believe their teaching methods are sufficient to achieve desired learning outcomes, it's essential to recognize that their personal past success within the engineering education system does not necessarily equate to the same method of success for their student body. Faculty serve a pivotal role for every student, regardless of major or circumstance. However, faculty-student interactions vary widely. Engineering faculty members may have experienced a different educational journey compared to their diverse student body, which influences their teaching methods and how they connect with students.

In this chapter, I explore the divide between engineering faculty experiences and the experiences of their students. I delve into the national, local, and situated contexts to illustrate this problem of practice, and then outline the purpose and research questions of my study.

National Context

The United States has witnessed a surge in the number of science and engineering undergraduate bachelor's degrees awarded, increasing from 400,000 in 2000 to 680,000 in 2017 (National Science Board, National Science Foundation, 2019). Engineering emerged as the sixth most popular bachelor's degree conferred nationwide in 2016-2017 (U.S. Department of Education, National Center for Education Statistics, 2019). Below, I detail the demographics of STEM and engineering in the national

context, markers of 'success' in engineering education, and the national landscape of engineering faculty professional development.

Demographics in STEM/Engineering

Despite an increasing demand for science and engineering degrees, there is an anticipated shortage of engineers by 2025 (Squires, 2020). The primary challenge lies in the recruitment and retention of students in engineering programs. Notably, certain demographic groups continue to be historically marginalized in the United States engineering education system, including women, Blacks, Hispanics, and American Indians/Alaska Natives. The underrepresentation of these groups spans all degree levels and engineering disciplines (National Science Board, National Science Foundation, 2019). These groups are often categorized as underrepresented minorities in STEM. However, it's essential to acknowledge the criticism surrounding the 'underrepresented monitories' label, as it tends to oversimplify the diversity within these distinct groups (Bhatti, 2021), it is for this reason in this study I use the term historically marginalized (Bhatti, 2021).

In 2017, women accounted for only 29% of the workforce in science and engineering professions, despite being over half (52%) of the college-educated workforce (National Science Board, National Science Foundation, 2019). Additionally, during the 2015-2016 academic year in the United States, 56% of undergraduates were classified as first-generation college students, meaning their parents did not hold a four-year bachelor's degree (RTI International, 2019). This group of students included many who were not only the first in their families to attend college, but also the first among their siblings. First-generation college students are often characterized as having dependents, being female, and enrolled part-time, making their educational journeys particularly unique (RTI International, 2019).

In the fall of 2018, of the 1.5 million faculty in degree-granting postsecondary institutions, 40% were White males and 35% were White females, with only 25% being all other races/ethnicities (U.S. Department of Education, National Center for Education Statistics, 2020). As of 2017-2018, within engineering faculty nationwide, the female representation of tenure and tenure-track faculty was 33.9% (National Science Foundation, National Center for Science and Engineering Statistics, 2019).

The national data on first-generation faculty members is not easily accessible, as most faculty demographic data focuses on gender, race, and ethnicity. Some universities have initiated programs and campaigns to highlight faculty members who identify as first-generation college students. For instance, the University of California, Los Angeles, runs the First-Gen Faculty Initiative, which features 180 self-identified first-generation faculty members, constituting 2% of UCLA's faculty body (“First-generation Faculty,” n.d.). Duke University has a similar campaign which includes 31 first-generation faculty members (2%) out of 1,650 professors (“Duke Facts,” 2022; Frederick, 2022). It's important to note this type of demographic information is often based on voluntary self-reporting by faculty members as part of news articles or mentorship initiatives.

These demographics highlight several considerations, including the urgency of retaining more historically marginalized students in engineering, especially given the prevalence of first-generation college students and the projected shortage of engineering professionals in 2025. The national data also reveals the majority of engineering faculty are white males, with limited representation of the first-generation college student identity among faculty ranks. This demographic divide between faculty and students profoundly impacts students' success. It can hamper the establishment of meaningful relationships between faculty and students and reduce the instructional and emotional support students receive in the classroom (Osei-Twumasi & Pinetta, 2019). This division

can also give rise to racial microaggressions experienced by STEM students of color (Lee et al., 2020). This highlights the importance for STEM departments to implement intentional strategies aimed at enhancing the academic culture and encouraging faculty to adopt more inclusive practices to support all learners.

'Success' in STEM/Engineering

Educational research often defines student 'success' in terms of traditional measures, like grade point averages, retention, and persistence rates. Examining conventional success metrics, a report by RTI International (2019) found that first-generation students, regardless of their major, exhibited lower rates of persistence to graduation after their first year at four-year institutions. They were also more likely to depart from university and not re-enroll across all degree levels. Failing to graduate with a degree has adverse consequences on a student's employment prospects, as obtaining a bachelor's degree significantly increases employment rates. In 2019, the employment rate for those with a bachelor's degree stood at 87%, compared to a 74% employment rate for individuals with a high school diploma (U.S. Department of Education, National Center for Education Statistics, 2020). Non-traditional definitions of 'success' cast a broader net to include a student's sense of belonging, development of a strong engineering identity, engagement in research opportunities or internships, and overall satisfaction while pursuing an engineering degree. These measures of success cannot be as easily calculated as a GPA. However, belonging, mentorship, and fostering satisfaction through active engagement in the classroom contribute to a student's academic success and overall satisfaction while pursuing an engineering degree (Bernold et al., 2007; Chen et al., 2008).

Representation within engineering curricula, programs, and faculty plays a pivotal role in influencing students' engagement and success. A striking example of this

can be observed in the context of women pursuing STEM majors. While there have been notable advancements in recent years, a significant gender disparity persists in engineering textbooks, the presence of female faculty as mentors, and female leadership in the industry (Becker & Nilsson, 2021; Dennehy & Dasgupta, 2017). Research indicates more women tend to switch out of STEM majors compared to their male counterparts (Seymour & Hewitt, 1997). Studies have further demonstrated exposure to experts from one's own historically marginalized group within a field positively impacts students' self-concept, attitudes, effort, and career aspirations (Stout et al., 2011). The absence of visible representation of women and historically marginalized individuals in STEM fields can negatively contribute to a student's sense of belonging and may contribute to the trend of students leaving STEM disciplines.

Faculty members are in a unique position to positively impact a student's success, in both the traditional and non-traditional success definitions. Research consistently demonstrates positive interactions and increased time spent with faculty have a multitude of beneficial effects on students, including enhanced academic achievement, intellectual development, and overall satisfaction (Astin, 1993; Cokley, 2000; Endo & Harpel, 1982; Kuh & Hu, 2001; Volkwein et al., 1986). Additionally, what engineering faculty members do within their courses (i.e., instructional strategies, and pedagogies) and faculty culture (i.e., their attitudes and behaviors related to improvement, assessment, and professional development) influence the nature of students' experiences and learning, both inside and outside the classroom. Chen et al. (2008), in their analysis of the 2007 Academic Pathways of People Learning Engineering Survey (APPLES) data, discovered a positive and substantial impact of faculty-student interactions on engineering students. Chen et al. (2008) noted, "increased contact between faculty and students both inside and outside the classroom results in greater student development,

satisfaction, and degree attainment" (p. 343-344). These increased faculty-student interactions correlated with students reporting higher confidence levels in their professional and interpersonal skills and exhibiting increased confidence in their ability to solve complex problems. These competencies not only contribute to academic student success (i.e., grades), but also bolster student confidence, sense of belonging, and overall satisfaction throughout their educational journey.

The analysis of the APPLES data also highlighted the “increasingly prominent” (Chen et al., 2008, p. 339) concept of college student engagement and its relationship to success in engineering education. Student engagement encompasses several critical components, including the effort and time students invest in their education, as well as the organization of learning opportunities by their university. Notable learning opportunities tailored for engineering students include research initiatives, student organizations, community service opportunities, study abroad experiences, entrepreneurship and venture development, and peer mentor programs. Importantly, when engineering students are exposed to research experiences, they are more likely to engage in other extracurricular activities (Chen et al., 2008). These additional engagements can contribute to a heightened sense of belonging, increased interactions with faculty members, and expanded avenues for career exploration and experiential learning.

Faculty members wield a consistent and significant influence on student success across academic contexts. Faculty-student interactions may vary in nature and depth due to a multitude of factors. However, faculty who utilize research-based instructional strategies, with a particular focus on supporting all learners, including first-generation and historically marginalized students, can serve as catalysts for students' success. Whether measured by academic achievements or a heightened sense of belonging,

faculty members play an essential role in shaping the educational experiences and outcomes of engineering students.

Engineering Faculty Development

The traditional role of a university engineering faculty member includes research, public service, and teaching. Implicitly, faculty serve as role models for students and shape students' perceptions of engineering as a career (Ernst, 1995). While expertise in an engineering discipline and a terminal degree are typical qualifications for faculty positions, formal teaching experience is not consistently required. The prevailing assumption is that subject matter expertise alone equips faculty to effectively educate others. Unfortunately, many faculty members, regardless of discipline, enter their teaching roles without adequate pedagogical training or preparation (Dunlosky et. al., 2013; McShannon et. al., 2006). Although formal faculty development programs have proven effective in enhancing teaching skills and student outcomes (Harris et al., 1994; Lynd-Balta et. al., 2006; McShannon et al., 2006), faculty often face the challenge of balancing numerous responsibilities with limited time for professional development opportunities (Slavich & Zimbardo, 2012).

Colleges and academic programs have increasingly recognized the importance of cultivating effective teaching faculty, aligning with the emphasis placed on teacher effectiveness by external accrediting bodies. The Accreditation Board for Engineering and Technology (ABET), which accredits engineering programs, includes faculty evaluation as one of its criteria. This assessment considers faculty members' education, diverse backgrounds, engineering experience, teaching effectiveness, communication skills, enthusiasm for program improvement, scholarship, participation in professional societies, and licensure as Professional Engineers ("Criteria," 2021). While researchers have explored faculty contributions to curricular excellence (Felder & Brent, 2003), there

remains an opportunity for accrediting bodies like ABET and prominent organizations like the National Academy of Engineering (NAE) to endorse and advocate for professional development programs, signaling to engineering institutions and departments such initiatives are an expected and valued direction for faculty growth (Utschig & Schaefer, 2008). The American Society for Engineering Education (ASEE) does provide instructional professional development (PD) opportunities (e.g., DELTA Junior Faculty Institute), yet these programs often come with substantial costs in terms of time, effort, and fees. Additionally, these opportunities are typically not tailored to the specific needs and contexts of individual institutions and faculty, placing a greater burden on the faculty members to adapt what they have learned.

If the broader higher education systems fail to adequately support faculty in enhancing their teaching skills, the responsibility inevitably falls on individual faculty members. The conventional lecture-based instructional approach remains prevalent in undergraduate engineering courses, despite a growing body of research and support for alternative teaching strategies (Felder & Brent, 2005; Felder & Brent, 2016). Faculty members often continue to teach in the manner they were taught during their own education, especially if it proved effective for them as students. However, it's crucial for faculty to recognize their students may have learning needs and backgrounds that are different than their own. The demographic disparity between engineering faculty and students can impact instructional practices and hinder faculty's ability to engage with all students effectively.

Research has also revealed students who leave engineering programs often possess academic profiles similar to those who remain, and many departing students are highly capable. Dissatisfaction with the quality of teaching they receive has been identified as a significant factor prompting capable students to leave the engineering

field (ASEE, 2009; Felder et al., 2011; Seymour & Hunter, 2019). Furthermore, research indicates a considerable number of students who leave engineering encounter challenges in confidence or abilities in mathematics courses (Belser et al., 2018; Crisp et al., 2009; Honken & Ralston, 2013), which is especially pertinent in the context of large public universities where introductory mathematics courses are typically delivered via lecture-based formats to class sections with a large number of students. To retain students in engineering programs, faculty must evolve traditional teaching methods, like lecturing, and adopt instructional strategies to bridge the demographic gap and support all learners effectively.

The demographic divide between engineering faculty and students, and the gaps in engineering education, demonstrate some of the challenges that exist in the STEM field. The non-traditional markers of 'success' in engineering education partnered with the research on faculty professional development in engineering education highlight the pressing need to empower and prepare engineering faculty to effectively teach a diverse student population. In the following section, I illustrate how these same concepts manifest in my local professional context.

Local Context - Southwest University

Southwest University (SU) is a large, public, research institution in the Southwest region of the United States. The university's charter states its commitment to measuring success by inclusivity and achievement, promoting research and discovery with public value, and assuming a central role in the well-being of the communities it serves. This charter serves as the basis for numerous SU programs and initiatives aimed at enhancing student success, including those focused on the professional development of faculty. In the subsequent sections, I offer insights into the demographics of SU's students and

faculty, outline the various metrics used to gauge student success at the university, and highlight opportunities for faculty professional development at SU.

Demographics at SU

SU is a large, public research institution with multiple campuses in a metropolitan area of the Southwest United States. It offers a wide range of on-campus and online programs. As of fall 2022, the university had an enrollment of over 140,000 students, with more than 100,000 of them pursuing undergraduate degrees. According to SU's official website and institutional analysis reports, approximately one-third of its current attendees are first-generation college students, a figure that has quadrupled over the past two decades. Nearly half (46%) of SU's students come from minority backgrounds, and one-third of undergraduates receive Pell Grants for financial assistance. In contrast to the diverse student body, the faculty at SU, which includes professors, instructors, lecturers, and faculty associates, is predominantly White (66.2%). Despite SU's designation as a Hispanic Serving Institution, the Hispanic/Latino faculty representation stands at a mere 7.5% of the total faculty body. In fall 2021, 26% of undergraduate students in on-campus programs identified as Hispanic or Latinx. This demographic mismatch underscores the long-term need for greater faculty diversity and the interim need for support systems to prepare the existing faculty to effectively instruct a diverse student population. State law prohibits public education entities from offering preferential programs (i.e., affirmative action) based on race, sex, ethnicity, skin color, or national origin in the state where SU is located. The ban on affirmative action has not negatively impacted the diversity of the student body according to the state's public university leaders, but it is important to note it in the local context landscape as it has implications for student recruitment, student support, and faculty hiring.

‘Success’ at SU

The success of students at SU can be described in several ways. In terms of traditional success and persistence to graduation, 31,880 total degrees were awarded in 2020-2021 at SU. These degrees include 20% awarded to students who identified as Hispanic/Latino, 4.7% to Black or African American students, 1.2% to American Indian/Alaska Native, and 56% awarded to women. SU welcomed 4,601 new campus transfer students in the fall of 2021, with one-third of them being historically marginalized students. These demographics highlight the remarkable diversity within the SU student body, encompassing aspects such as race, ethnicity, instructional modality, and different student profiles (e.g., transfer students, first-generation).

The university boasts a significant online student population, with more than 60,000 online students categorized under the online campus in fall 2022. Among online students, the majority (62-65%) are women and most attend part-time. Of the total degrees awarded by SU during this period, one-third (12,263) were online degrees, including over half (7,273) that were undergraduate online degrees. While many students and faculty at SU remain on-ground, there is a growing shift towards online learning to meet and sustain the rising demand for education. Consequently, it is of growing significance for SU to persist in evaluating how new online programs meet the needs of these learners.

To support the academic success of its diverse student population, SU offers a wide array of student academic and support services, including tutoring centers, academic advising, mentorship programs tailored to various student groups, and co-curricular and extracurricular initiatives. Unfortunately, research shows first-generation students are less likely than their peers to opt-in to these student support services, apart

from financial aid services (RTI International, 2019). Thus, relying solely on students to opt-in to out of class programs may not be sufficient to address students' needs.

Data from SU's Academic Program Profile for the 2019-2020 academic year provides valuable insights into the classroom interactions between students and faculty. Among the SU seniors who participated in the Graduating Senior Report Card, most students reported they received timely feedback on their academic performance from their faculty members. Moreover, the majority of these students expressed satisfaction, either being 'Satisfied' or 'Very Satisfied,' with the 'quality of instruction' they received in their 300-400 level courses. However, it's essential to recognize this dataset offers a limited perspective on student experiences, only focusing on a specific group of students who have succeeded and are at the culmination of their undergraduate journey and preparing to graduate. This subset of students might not represent the full spectrum of experiences and challenges students encounter during their academic careers. It is also clear from the data that a substantial proportion of students are not engaging in discussions with faculty members on topics beyond coursework, such as career planning or aspirations for graduate school. Only one-third of students report having these conversations.

Faculty Development

SU offers a range of professional development opportunities, primarily accessible online, to enhance faculty members' instructional practices. For those interested in online training and development, SU provides access to a comprehensive selection of training modules and LinkedIn Learning courses, enabling self-paced learning and skill-building in a virtual environment. Faculty members involved in teaching in online course programs also have access to specialized resources tailored to teaching in the online modality. These resources include modules designed to improve online teaching, along

with toolkits and webinars that offer guidance and support for effective online instruction. In addition, faculty members have the option to participate in in-person or hybrid workshops conducted in various schools or departments, although these workshops are not as readily accessible and can be more challenging to find.

To gain a deeper understanding of the specific challenges and opportunities faced by faculty in the College of Engineering (CoE) at SU, I now delve into the situated context. This exploration highlights the unique characteristics and dynamics within SU's engineering faculty culture and the potential for solutions tailored to this context.

Situated Context - College of Engineering

The CoE at SU markets itself as a dynamic and innovative college committed to fostering an environment that prioritizes continuous improvement, student achievement, faculty excellence, and diversity, equity, and inclusion. This dedication to progressive engineering education has made CoE an attractive destination for a large and diverse student population. To gain a deeper insight into the cultural intricacies and the specific challenges within this context, the following sections provide background information for the examination of the experiences and practices of engineering faculty at SU, along with their influence on student success.

Demographics at the CoE

As one of the largest engineering programs in the United States, the CoE at SU includes eight schools of engineering, collectively offering a comprehensive array of 72 undergraduate and graduate degree programs. This expansive academic portfolio serves a vast student population, with over 31,000 students enrolled in CoE programs during the fall of 2023. Facilitating the learning of this large study body are more than 600 dedicated full-time faculty members. Within this faculty body, approximately 60% hold teaching-track positions, encompassing roles such as assistant teaching professors,

associate teaching professors, lecturers, and professors of practice. As of the fall semester in 2022, there were over 200 engineering faculty associates and graduate teaching assistants fulfilling part-time roles as instructors of record, contributing significantly to the instructional activities within the CoE.

Additionally, 40% of faculty members in the CoE are tenured or tenure-eligible and these faculty have responsibilities and contributions beyond teaching. Tenured or tenure-eligible faculty also mentor graduate students, actively engage in research and entrepreneurial endeavors, author scholarly publications, pursue external grants and funding opportunities, and fulfill critical roles in professional services, including committee memberships. These responsibilities take up the majority of the tenure/tenure-track workload, leaving little time for teaching professional development.

The most recent Engineering & Engineering Technology: By the Numbers (2022) report by the American Society for Engineering Education highlights an ongoing demographic imbalance within faculty and student populations. While the CoE has witnessed increasing diversity among its students, consistently ranking among the top 50 institutions to award engineering bachelor's degrees to women (21% of degrees awarded) and historically marginalized students (23% of degrees awarded), faculty remain predominantly white males. It's worth noting that CoE also ranks highly for female tenured/tenure-track faculty and Hispanic tenured/tenure-track faculty. However, these rankings still underscore significant demographic imbalances. While SU ranked among the top 20 institutions with Hispanic tenured/tenure-track engineering faculty, this category comprises only 3% of the tenured/tenure-track faculty body in CoE.

‘Success’ in the CoE

The CoE administers a range of extracurricular and co-curricular programs collectively known as the Engineering Enrichment Initiatives (EEIs), a pseudonym. EEIs are dedicated to enhancing student outcomes beyond traditional coursework by offering an array of out-of-class learning experiences. While academic achievement is certainly a vital aspect of success, the CoE recognizes true student success also includes ensuring students have access to and are engaged in rich learning experiences through co-curricular and extracurricular programs. EEIs include faculty-directed opportunities such as undergraduate research programs, social entrepreneurship and community service projects, scholar programs, engineering student organizations, venture development, peer mentoring, engineering-specific tutoring resources, and support from engineering career services. These initiatives not only foster a sense of belonging among CoE students, but also ensure their readiness for successful careers in industry.

Crucially, these co-curricular and extracurricular experiences are faculty-directed. Faculty play a pivotal role in referring students to and mentoring students in these programs. Recognizing faculty serve as essential connectors between students and these valuable opportunities, the faculty-student interactions that occur within the classroom become a vital initial step in directing students toward these opt-in programs.

Referring to the Academic Program Profile once more, this time focusing on engineering students, reveals valuable insights. In the 2019-2020 academic year, similarly to SU, a majority of engineering seniors expressed their satisfaction with the 'quality of instruction' in their upper division engineering courses. However, this figure is lower (by 10%) than the SU-wide average on this survey question, indicating a difference in student experiences at large across SU and student experiences within the CoE. Fewer engineering students reported receiving timely feedback on their academic performance

from engineering faculty members (compared to the SU-wide average). Comparable to their peers across SU, only one-third of engineering seniors reported having discussions with faculty members on topics outside of coursework. These types of conversations are instrumental in shaping students' success beyond the classroom, fostering mentorship, and opening doors to additional learning opportunities. Faculty-student interactions outside of the coursework context appear to be underutilized, including recruitment into EEIs.

Engineering Faculty Development at the CoE

There have been a number of faculty PD opportunities at the CoE. Many of these initiatives have been made possible through grant-funded projects, with just-in-time teaching programs serving as the cornerstone of the college's faculty PD initiatives. An overarching goal within the CoE is to encourage engineering faculty members to actively engage in PD activities and subsequently adjust their instructional strategies to align with research-based best practices. The intended outcome is an increase in meaningful interactions between faculty and students, a change that has been shown to significantly benefit first-generation and historically marginalized students (Aruguete, 2017; Glass et al., 2017; Rattan et al., 2018).

In 2021, the CoE established the Center for Teaching and Learning (CTL), a significant milestone aimed at institutionalizing PD efforts and fostering a culture of teaching and learning in the engineering college. The CTL's mission includes a range of initiatives, including PD opportunities, instructional consultation, collaborative course development, and the utilization of learning analytics. Emphasizing the importance of empowering faculty members to employ creative teaching strategies to enhance student retention and outcomes, while simultaneously promoting access and inclusivity across all programs, the CoE Dean positioned student success at the center of CTL. Unlike CTLs

in other universities or even other colleges at SU, the CoE CTL is distinct in that it provides highly specialized and tailored support to the unique needs and challenges of *engineering* faculty members. Research suggests that engineering faculty tend to benefit more from discipline-specific professional development (Brawner et al., 2002) and by focusing exclusively on engineering, the CoE CTL maximizes impact, ensuring faculty members receive targeted guidance and resources.

The CTL offered an array of teaching PD and learning opportunities for faculty members at the time of this study. These included regular monthly meetings with guest speakers that delve into engineering education topics, monthly workshops exploring educational technology tools, and a year-long cohort series designed to equip new engineering faculty with foundational teaching knowledge and research-based instructional methods. Most of these offerings were organized as discrete opportunities and did not require continuous engagement or commitment over time. In addition to these structured opportunities, the CTL provides supplementary resources for ongoing learning. On the CTL's website, readily accessible Teaching Reference Guides serve as valuable resources, offering insights and strategies for implementing effective teaching methods tailored to specific teaching tasks and challenges (e.g., active learning, academic integrity).

Why Me?

I have worked in the CoE since I was hired at SU 6 years ago. In my first role with the CoE in September 2017, I focused on supporting entrepreneurially minded student programs, many of which were faculty-directed. In this capacity, I had the privilege of collaborating with exceptional faculty on extracurricular initiatives designed to nurture students' curiosity, problem-solving abilities, and their pursuit of engineering solutions that create value for society. Through these experiences, I witnessed firsthand the

profound impact of faculty-student interactions in out-of-classroom programs and events on CoE students. These interactions empowered students to develop their technical and professional skills, connect with peers and mentors, and strengthen their sense of belonging and engineer identity.

In September 2021, I transitioned to a role within the newly established CTL. In this capacity, I have been actively involved in facilitating a diverse range of faculty PD opportunities, including workshops and events. Additionally, I oversee our Faculty Mentors program, which supports CoE faculty serving as valuable peer mentors. I also manage the development and curation of Teaching Reference Guides.

Throughout my tenure in the CoE, I have worked closely with students (both undergraduate and graduate) and faculty members (including tenured/tenure-track and teaching-track faculty) from across the engineering schools. These experiences have allowed me to lead a diverse array of programs and create a wealth of resources aimed at enhancing the educational experiences within the CoE. Across these experiences, I have heard faculty struggling with their workload, but wanting to improve. I have heard of the obstacles they have to overcome to try new things in their classroom. I have also heard of the barriers students face when asking for help. While faculty and students experience different struggles, I have seen how these various challenges affect motivation for all.

I am a first-generation college student. I uniquely understand the mindset of 'just getting a degree.' For me, this mindset meant not attending faculty office hours and not identifying and participating in learning opportunities outside the classroom. Out of financial necessity, I worked during my undergraduate career. In my senior year, I worked on campus as a student worker in an international education office. This was my first job in higher education. I recall the first time I heard the term first-generation college student; it was not until I was a professional staff member at SU with a Master's

degree under my belt. While I knew both my parents had never completed a four-year degree, it did not resonate that there was a label out there for this part of my identity. The struggle of belonging resonates with me to this day. I see the missed opportunities in my educational experience that could have been impacted by cultivating better relationships with faculty members. I see the missed opportunities of being mentored. The missed research opportunities. I do not want our current students to miss out. Not when we have excellent, talented faculty members who can make an incredible difference in their success.

Problem of Practice

This study centers on a problem of practice in the CoE, which is faculty members' experiences differ from the diverse students they teach. While many of our CoE students are first-generation college students and come from diverse social and cultural backgrounds, most of the engineering faculty are represented by white males with an unknown first-generation college student status. Research shows the educational backgrounds and experiences of engineering faculty can significantly influence their instructional practices. Unfortunately, how faculty teach may not always align with the needs of the diverse student population they serve. This mismatch can hinder meaningful faculty-student interactions. This problem of practice is further complicated by teaching PD being undervalued in higher educational settings. While the CoE has taken steps to promote the value of teaching PD (e.g., establishing the CTL), there is still more work to be done to foster faculty members' motivation to engage in PD activities. Simultaneously, there must be recognition of the utility value of PD opportunities in the context of faculty promotion and tenure. Defining student 'success' as more than just GPA or retention rates is also essential. As a college we need to see success as encompassing a sense of belonging, the development of a strong engineering identity,

and overall satisfaction in pursuing an engineering degree. Research consistently underscores the positive impact of faculty-student interactions on student outcomes, including academic achievement, intellectual growth, and overall satisfaction. Faculty members who value improving their teaching practices and implement research-based instructional strategies to support all learners play a pivotal role in enhancing the 'success' of every student.

Innovation Overview

Considering the national, local, and situated context of engineering education, student demographics, and engineering PD, I designed, implemented, and researched the Teaching Community of Practice Virtual Book Study (TCPVBS) innovation. The innovation provided faculty with a space to discuss their teaching experiences, fostered peer collaboration and knowledge sharing, facilitated access to faculty mentors, and, most importantly, encouraged faculty to reflect on how their practices support all learners in their classrooms. I offer more details about the innovation in Chapter 3.

Purpose and Research Questions

The purpose of this qualitatively driven, concurrent, mixed methods action research (MMAR) study was to understand what happens when engineering faculty, staff, and faculty mentors engage in a professional development (PD) opportunity, the TCPVBS, focused on improving instructional practices and faculty-student interactions. The research questions guiding the study were:

1. How and to what extent does the participation in the TCPVBS impact a faculty member's:
    1. Knowledge of how students learn, metacognition, motivation/emotions, and growth mindset?
    2. Perceptions of first-generation college students in engineering?

    3. Plans to implement inclusive instructional practices in their course?
2. What happens when participants engage in the TCPVBS innovation?
    1. What do they learn about their own educational journey?
    2. What are their reflections on their practice?
    3. What from the innovation do they find valuable?
3. What are the reflections of Faculty Mentors who participated in the TCPVBS?
    1. What are their reflections on their role and integration into the book study?
    2. What are their reflections on mentoring faculty through a community of practice model?

CHAPTER 2

THEORETICAL PERSPECTIVES AND REVIEW OF SUPPORTING LITERATURE

"They say in theory, theory and practice *are the same*. But in practice, they're *different*."

-Jesse, Faculty Member

In Chapter 1, I introduced the national and local contexts, emphasizing the impact of the demographic divide between students and faculty on instructional practices and highlighting the undervalued nature of teaching professional development (PD). I also outlined the purpose of my study and research questions. In this chapter, I present the theoretical frameworks I relied on when designing the innovation and this study: Communities of Practice and Expectancy-Value Theory. Additionally, I introduce relevant studies that informed my research, originating from the fields of engineering, STEM education, and higher education in general. I also delve into concepts related to my disciplinary knowledge in engineering education, which are pertinent to my innovation. Finally, I conclude the chapter by providing insights gained from my previous cycles of action research (AR) and how I have applied all these ideas (i.e., theoretical frameworks, disciplinary knowledge, and previous AR cycles) to the design of my study.

Theoretical Frameworks

I utilized two major theoretical frameworks in this study: Communities of Practice (CoP) and Expectancy-Value Theory (EVT). CoP is a social learning theory that centers social interactions in the construction of knowledge (Wenger, 1998). EVT is a motivation theory that asserts persistence and performance on a task can be explained

by a person's beliefs on how well they will do and how much they value the activity (Eccles et al., 1983; Wigfield & Eccles, 2000). These frameworks, which complement one another to support aspects of both social and motivational learning, informed my innovation design, the book study community structure, and the focus on creating a low-cost, high-value learning opportunity. Applying these theories in my study allowed me to design an innovation that would be relevant and supportive for faculty members.

Communities of Practice (CoP)

I used CoP as a learning theory to highlight the crucial role of social interactions in knowledge construction. Wenger's (1998) CoP conceptual framework posited that "engagement in social practice constituted the fundamental process through which we learned and shaped our identities" (text inside the cover). This theory shifts the focus from individual learning to the role of social interactions in knowledge construction and the learning journey.

The term CoP was coined by Wenger and Lave in 1991 during their study of apprenticeships, where they observed how social relationships intricately shaped the learning process (Wenger-Trayner & Wenger-Trayner, 2015). Though this theory underwent adaptation and refinement over the years (Lave & Wenger, 1991; Wenger, 1998; Wenger, McDermott & Snyder, 2002), its essence remains consistent: "Communities of practice consist of groups of individuals who share a concern or passion for a specific domain and collaboratively enhance their expertise through regular interactions" (Wenger-Trayner & Wenger-Trayner, 2015, p. 2). This statement embodies the three defining attributes of CoPs, as shown in Figure 1: domain, community, and practice. CoPs derive their identity through a shared interest and enthusiasm for a core issue within their domain of expertise. Through pursuing knowledge and improvement of this shared interest (i.e., domain), members of the community build relationships

through shared discussion, activities, and learning (i.e., community) to create a body of knowledge and tools (i.e., practice). Through engaging in this process of collectively constructing knowledge, CoP members actively apply the insights gained from one another, initiating the development of a shared repertoire encompassing best practices, experiences, methodologies, and narratives.

Figure 1

Community of Practice Attributes

Note: Adapted from Wenger-Trayner, E. and Wenger-Trayner, B. (2015) *An introduction to communities of practice: a brief overview of the concept and its uses.* Available from authors at https://www.wenger-trayner.com/introduction-to-communities-of-practice.

Membership in a CoP is voluntary and optional, with leadership coming from both formal and informal leaders in and outside of the community (Blankenship & Ruona, 2007). Members do not necessarily work together on a daily basis but come together regularly to build community and relationships, allowing them to learn from

one another to improve practice (Wenger-Trayner & Wenger-Trayner, 2015). The organizational culture of a CoP values innovation, collaboration, and knowledge sharing (Blankenship & Ruona, 2007). Members of a CoP are invested in the community because the topics are perceived as relevant, the CoP connects to their identity, and they see the personal or professional value that can be gained from participation.

Mentorship in CoPs

CoP also serves as a framework for understanding group mentorship in PD. Within a CoP, mentorship takes on various forms, occurring as members actively engage in shared practices of the domain, thus facilitating the development and deepening of knowledge (Smith et al., 2013). While members may not explicitly label these interactions as mentoring, they experience it as a natural element of the practice while collectively pursuing the CoP's shared vision (Smith et al., 2016).

A CoP perspective situates mentoring within the broader social context, enabling researchers to view mentoring as a developmental process intricately connected to the CoP's activities and interactions (Bottoms et al., 2020). This approach provides a deeper understanding of mentoring relationships within the embedded context, as it recognizes the dynamic and interconnected nature of mentoring within the CoP environment. Instead of viewing mentoring as a standalone activity, CoP acknowledges mentoring is influenced by and, in turn, influences the collective activities, goals, and interactions of the CoP.

Typically, traditional mentoring relationships involve a dyadic structure, featuring a one-on-one mentoring connection between a mentor and a mentee (National Academies of Sciences, Engineering, and Medicine, 2019). Dyadic mentorship models are commonly employed in formal mentorship programs but can also occur naturally and informally. Dyadic mentorship offers several advantages, including the cultivation of

a close and personalized bond between the mentor and mentee, allowing for a tailored approach to address the mentee's unique needs. Informal mentoring relationships within a CoP differ from dyadic models of faculty mentorship in higher education, where the mentor typically serves as an advisor, supervisor, or occupies an evaluative role in relation to the mentee (e.g., faculty advisor and graduate student, postdoctoral scholar, and supervisor). In contrast, in a CoP, informal mentors have “no specified responsibilities, and involve no evaluative or supervisory function” (National Academies of Sciences, Engineering, and Medicine, 2019, p. 76).

Collective mentoring, often in the form of group mentorship, entails a gathering of mentors and mentees who convene regularly to offer mutual support and guidance (National Academies of Sciences, Engineering, and Medicine, 2019). This model can prove more efficient than dyadic mentorship, as it facilitates the exchange of knowledge and expertise among multiple mentors and mentees. Furthermore, the group dynamic fosters a sense of community and belonging among mentees (Li et al., 2009). Additionally, collective mentorship naturally creates opportunities for reciprocal mentoring between mentors and mentees. Reciprocal mentoring is a mentorship model in which both mentor and mentee actively contribute to each other's growth and development (National Academies of Sciences, Engineering, and Medicine, 2019). This model benefits mentors and mentees, allowing both to learn from each other's unique experiences and perspectives.

CoP Supporting Studies

CoPs can take many forms in organizations and in higher education and are commonly referenced in PD initiatives for faculty. Faculty members' involvement in CoPs can enhance their professional effectiveness and teaching practices, impacting instruction (Sherer et al., 2003). A review of the literature by Gómez & Suárez (2021)

found CoPs to be valuable sources of learning new information, as well as promoting professional networking for faculty members. Through CoP engagement, faculty acquire instructional methodology and feel empowered to develop their pedagogy and knowledge around assessment strategies (van As, 2018). The interactive nature of CoPs can support faculty collective learning and individual understanding of concepts (van As, 2018).

Beyond promoting changes to instruction, CoPs have broader impacts within an institution. An analysis of cross-institutional STEM faculty CoPs found changes not only in teaching practices, but also in departments, curricula, and educational values (Gehrke & Kezar, 2017). Design variables of CoPs that were found to be positively and significantly associated with department-wide changes include "community culture, community leaders, and innovative and new ideas of the community" (Gehrke & Kezar, 2017, p. 819). Furthermore, the adoption of a distributed leadership model within a CoP has shown promise in increasing the likelihood of STEM faculty members incorporating research-based instructional practices into their teaching (Ma et al., 2019). This highlights the importance of community members participating across engagement and leadership levels in a CoP. Recent literature on mentoring relationships has emphasized collaboration, with both mentees and mentors actively engaging in reciprocal and dynamic activities, such as planning, taking action, reflecting, asking questions, and solving problems (National Academies of Sciences, Engineering, and Medicine, 2019). The CoP model supports this level of collaboration among community members, including mentors and mentees.

The elements for implementing successful CoPs include environment, peer, and community support (i.e., both informal and formal collaborations), and a welcoming culture that makes community members feel they belong (Terry et al., 2020). STEM-

faculty CoPs that support regular discussions and connections related to teaching have been found to be an effective PD strategy for improving instruction (Ma et al., 2019). For faculty CoPs in particular, it is important to share the goals and value of the CoP in order to create a sense of belonging around a shared goal and mutual support (de Carvalho-Filho et al., 2019).

One application of a CoP as a form of faculty PD is a professional book study. Book studies are recognized as a "low-commitment, low-expense, yet high-impact approach" (Landry et al., 2022, p. 170) to fostering community and addressing individual faculty members' instructional needs and goals. In the realm of education research, professional book studies have been more extensively examined within the context of pre-service and in-service K-12 teachers (Blanton et al., 2020; Burbank et al., 2010; Kooy, 2006), where participants often expressed greater satisfaction with book studies compared to traditional PD approaches. Moreover, participants in book studies frequently found significant utility in reflecting on their current practices through discussions with fellow teachers (Burbank et al., 2010).

In the realm of engineering education, book studies have demonstrated their potential for personal and professional development for students, including benefits such as fostering connections among female engineering students (Gulati, 2021) and serving as an additional element of Research Experience for Undergraduates learning community models (Martin et al., 2008). Moreover, the Institute for Engineering Education and Innovation at Texas A&M University evolved traditional book study formats into virtual watch parties for documentary films. These watch parties served as an effective platform for engineering faculty to collectively engage with and discuss topics related to diversity and inclusivity within the community (Natarajarathinam et al., 2022). Finally, curriculum changes have emerged as a direct outcome of faculty book

studies. As a result of participating in a book study centered on *Teach Students How to Learn* (McGuire, 2015), Hirst et al. (2020) found that faculty members identified the need for a science-specific course utilizing learning theories to assist first-year students. The theoretical framework of CoP, the structure of mentorship within a CoP, and supporting studies of CoP for engineering faculty, including those in the form of book studies, emphasize the crucial role of social interactions in knowledge construction.

Expectancy-Value Theory (EVT)

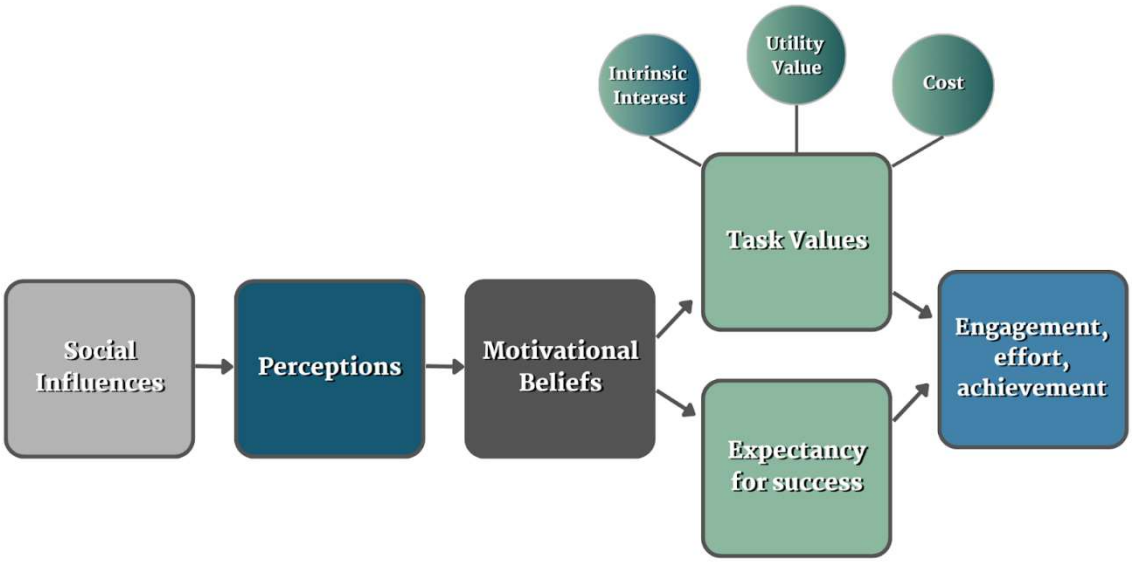
Expectancy-Value Theory (EVT) served as a motivational framework to understand faculty participation in PD and their willingness to experiment with new instructional approaches in the classroom. EVT asserts that an individual's choices, perseverance, and performance on a task can be explained by their beliefs about how well they will do on the activity and how much they value the activity (Atkinson, 1957; Eccles et al., 1983; Wigfield, 1994; Wigfield & Eccles, 1992, 2000). A simplified EVT graphic is shown in Figure 2.

EVT theory emphasizes two critical task values: intrinsic value and utility value. Intrinsic value denotes "the enjoyment derived from task engagement" (Wigfield & Eccles, 2000, p. 72) and has been demonstrated as a robust predictor of engagement and effort (Guo et al., 2015). Utility value refers to the task's relevance to an individual's future plans, such as taking a mathematics course to meet a requirement for a science degree (Wigfield & Eccles, 2000). Utility value is perceived as the most extrinsic among the task values in EVT because it links to external factors, groups, and objectives (Harackiewicz et al., 2016). This implies that utility value may be the aspect most influenced by external interventions. Additionally, utility value may be intertwined with an individual's sense of identity or intrinsic core values, particularly if the future plans pertain to career advancement (Eccles & Wigfield, 2020). Faculty members already hold

teaching positions, but utility value in this context was related to factors such as promotion, career progression, and improved course evaluations.

Figure 2

Simplified Expectancy Value Theory



Note: Adapted from Cook, D. A., & Artino Jr, A. R. (2016). Motivation to learn: an overview of contemporary theories. *Medical education*, *50*(10), 997-1014.

EVT Supporting Studies

EVT has been used to explain the impact of PD programs in education on changes to instructional practices (Andersson & Palm, 2018; Boström & Palm, 2020). It has also been applied to understand the higher participation of early-career faculty in PD activities, as they exhibited greater expectancy and value beliefs along with lower perceived costs compared to faculty with more experience (Boström & Palm, 2020). In engineering education, faculty members have discovered intrinsic value in designing project-based courses, solving real-world problems, enhancing course relevance, and fostering a fun classroom environment (Hixson et al., 2012). Furthermore, their motivation to enhance instruction extended beyond personal utility value (e.g.,

promotion, course evaluations) to include the utility value for their students, such as building teamwork and communication skills and establishing connections to real-world applications.

EVT can also be applied to specific course strategies in engineering education, considering faculty's value-based obstacles (e.g., planning time, preferences) to implementing new instructional approaches (Bouchard et al., 2022). Understanding these potential barriers becomes crucial when designing PD, especially in structuring learning opportunities. Ideally, PD initiatives should mitigate or eliminate barriers, bolster faculty expectancy in their ability to implement new instructional practices and reduce perceived costs.

Researchers have also found that EVT can provide insights into faculty motivation for engaging in research-practice cycles of innovation in engineering education (Matusovich et al., 2014). Faculty motivation to participate in educational practices as research, or scholarship of teaching and learning, was influenced by their expectancy of success (e.g., confidence in their ability to succeed), utility value (e.g., funding, support from administration or peers), and cost value (e.g., time commitment, tenure implications). Therefore, a university's teaching and learning culture should support classroom innovation through research-practice cycles, address barriers to trying new instructional methods, and cultivate teaching PD opportunities that deliver value to faculty members.

Disciplinary Knowledge

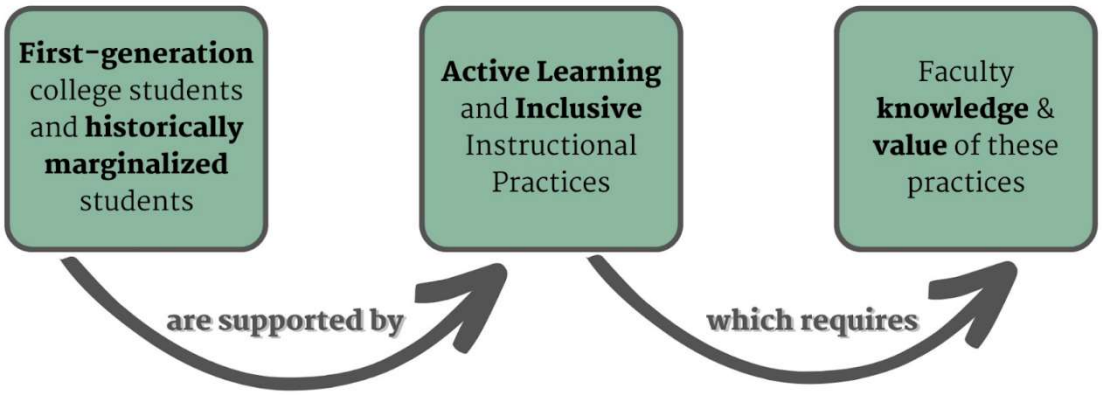
Disciplinary knowledge is content knowledge and experiences I draw on in my professional roles in higher education to better understand how to support students and faculty in the CoE. I have organized this section into two parts: firstly, knowledge pertaining to students, and secondly, knowledge pertaining to instructional practices in

engineering education. These two dimensions significantly informed my innovation's design for the book study, my facilitation approach, and ultimately played a pivotal role in shaping my research design, which is showcased by the connection of these ideas in Figure 3.

I am aware, as the literature recognizes, of the necessity to improve diversity within the engineering workforce through proactive efforts to recruit and retain first-generation college students, women, and historically marginalized students (Hunt et al., 2015). This deliberate diversification stimulates innovation, creativity, and global competitiveness within the engineering field. An inclusive workforce actively enhances the quality of scientific and technological products, services, and solutions and ensures that engineering solutions are designed to meet the diverse needs of all users (Ganesh et al., 2018).

Figure 3

Disciplinary Knowledge Connections



Ultimately, the instructional practices that support first-generation college students and historically marginalized students simultaneously enhance the learning of

all students in the classroom, effectively narrowing the gap and providing support to all learners in the engineering classroom.

Knowledge about Students

Understanding the unique experiences, challenges, and opportunities students encounter is instrumental in creating effective PD opportunities for faculty. In this section, I explore the literature on first-generation and historically marginalized students, the critical role of faculty-student interactions in the 'success' of students, and how these interactions cultivate cultural and social capital and the formation of engineering identity.

First-generation College Students and Historically Marginalized Students

First-generation college students often face challenges their continuing-generation counterparts do not experience (Peteet et al., 2015). These challenges include financial constraints, a lack of role models or mentors, the demanding nature of engineering coursework, and the delicate balance between academic commitments and personal responsibilities (Fernandez et al., 2008). Additionally, first-generation students contend with feelings of self-doubt, compounded by a lack of emotional support from family members unfamiliar with the college experience (Terenzini et al., 1996). Research indicates early experiences and academic performance significantly influence persistence in the fields of physical sciences, engineering, mathematics, and computer sciences (Dika & D'Amico, 2016). Understanding and addressing these challenges are essential in fostering an inclusive and supportive learning environment for first-generation students in engineering education.

Historically marginalized students in STEM are more likely than white students to experience stereotype threat, or anxiety caused by the expectation of being judged negatively due to a stereotype about their group (Steele, 1997). Research suggests

stereotype threat contributes to attrition rates in STEM disciplines, particularly among minority and female students (Beasley & Fisher, 2012). To mitigate this threat, Beasley and Fisher (2012) emphasize the importance of providing students with relatable role models. Although minority and female faculty representation remains notably low (Beasley & Fisher, 2012), all faculty members can support their historically marginalized students. This support can be manifested through mentoring techniques that offer constructive feedback and instill confidence in students' abilities to meet the rigorous demands of engineering education. Faculty can also utilize research-based and inclusive teaching strategies, such as incorporating diverse examples and case studies, modeling inclusive language, and reducing anonymity in their classrooms (*DIA Checklist Strategies*, 2023). In essence, faculty members play a crucial role in fostering a welcoming and inclusive environment for historically marginalized and first-generation college students.

Faculty-Student Interactions

Positive interactions and time spent with faculty members have been consistently linked to a range of favorable outcomes for students. These positive outcomes include higher retention rates, increased graduation rates, enhanced self-esteem, improved leadership skills, and overall holistic student development (Astin, 1993; Cokley, 2000). Research indicates that faculty-student relationships are more influential in predicting academic success than students' background characteristics, particularly among minority students (Lundberg & Schreiner, 2004). Faculty-student interactions encompass both formal classroom experiences, such as class discussions and activities, as well as interactions outside the classroom, such as faculty office hours. However, faculty-student interactions are not limited to formal settings. Informal avenues like extracurricular

activities that involve faculty-student mentorship positively influence students' perceptions of the value of their courses and their academic efforts (Thompson, 2001).

Faculty-student interaction has a significant influence on the attitudes, interests, and values of college students (Chickering, 1987; Terenzini et al., 1984; Terenzini & Wright,1987; Thompson, 2001). Engineering faculty members influence the nature of students' learning experiences in several ways. As mentioned previously, Chen et al. (2008) identified a substantial and positive correlation between the frequency of faculty-student interactions and various aspects of engineering students' academic and professional development. However, an increase in faculty interactions does not necessarily mean a positive experience for a student. The quality and nature of these interactions, along with the classroom environment, significantly depend on the role, influence, and power dynamic of faculty with their students in their classroom. Hong and Shull (2010) interviewed engineering students to gauge their perceptions of faculty members and how they interpreted faculty interactions and behaviors. Their case study revealed instances where students felt respected, inspired, and engaged by faculty members, but it also revealed instances where students believed professors hindered their progress, undermined their self-concept, or thwarted their plans (Hong & Shull, 2010). In essence, the sheer quantity of faculty-student interactions alone is insufficient. What truly matters is how faculty actively shape and nurture learning environments to facilitate positive interactions with students. This goal is further complicated by the increase in student diversity in engineering learning contexts. Much of the foundational research on faculty-student interactions has not considered the differences of gender and race (Kim & Sax, 2009). To establish conducive environments for positive interactions, faculty must take steps toward understanding the diverse backgrounds and needs of their students.

Cultural and Social Capital

Cultural capital, originally introduced by Pierre Bourdieu in the 1970s, encompasses the cumulative knowledge, behaviors, and skills individuals can employ to demonstrate their competence and social status (Davies & Rizk, 2018). According to Bourdieu (1986), there are three types of cultural capital: objectified cultural capital (e.g., cultural goods like books and technology), embodied cultural capital (e.g., mannerisms, preferences, language, and dispositions), and institutionalized cultural capital (e.g., education, academic credentials, or professional qualifications). To refine Bourdieu's theory, Lamont and Lareau (1988) offered a more precise definition, characterizing cultural capital as being "institutionalized" (p. 156) denoting its widespread acceptance and high social status. Within the Lamont and Lareau (1988) framework, cultural capital encompasses cultural signals such as attitudes, preferences, formal knowledge, behaviors, material possessions, and credentials, all of which are employed for the purposes of social and cultural exclusion.

Tan and colleagues' (2019) meta-analysis of 105 studies revealed that certain forms of cultural capital can influence learners at various stages of their academic journey. These forms included a range of items, such as access to educational resources at home, parental education levels, parental expectations, participation in cultural activities, and engagement in school-related activities. When considering the experiences and access to forms of cultural capital of first-generation and historically marginalized students in STEM fields, these forms of cultural capital are particularly important.

Thompson and Jensen-Ryan (2018) discovered that students who embodied forms of capital and science dispositions familiar to their faculty are more readily recognized and rewarded by faculty with increased opportunities to cultivate additional cultural capital in the field of science. Importantly, their research also evidenced faculty

can have a substantial impact on students by expanding their recognition of who a 'science person' is to students who differ from them. This expansion of their recognition enables faculty to validate a diverse body of students' interest in science and mentor them in understanding the implicit 'rules of the game' (Bourdieu, 2004; Thompson & Jensen-Ryan, 2018), which students with existing cultural capital often already possess. Thus, I believe providing PD opportunities for engineering faculty members to recognize and acknowledge their own cultural capital, understand the forms of capital their diverse students bring, and broaden their mindset on supporting the diverse engineering student body can be highly valuable and impactful in my context.

Social capital, a concept closely related to cultural capital, refers to the resources individuals acquire through group membership and social relationships. Bourdieu (1986) defines social capital as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships" (p. 21). Alternatively, it has been characterized as "resources embedded in a social structure that are accessed and/or mobilized in purposive actions" (Lin, 2001, p. 29). Historically marginalized students often rely on peers and faculty members of the same racial or ethnic background for support, which can manifest as information-related social capital (e.g., exam preparation, institutional navigation) as well as social support (Mishra, 2020). However, few faculty members share the same racial or ethnic background with their students, and as such, are unable to provide this type of support.

To enhance perceived social support and students' intent to persist in college, it is essential to ensure all students, regardless of their backgrounds, have the opportunity to ask questions and actively participate in discussions (Mishra, 2020). Faculty members, by acknowledging and valuing the diverse forms of capital their students bring to the learning environment, can create a more inclusive and equitable classroom. Moreover,

faculty-student interactions that foster social capital can serve as a conduit for students to access valuable networks and resources. In essence, these interactions go beyond traditional teaching and learning; they become mechanisms for bridging cultural and social divides, promoting greater equity, and nurturing an inclusive learning community. Faculty who understand the significance of cultural and social capital in their students' lives can better cultivate an environment where all students can thrive.

Engineering Identity

Identity, as Gee (2000) defines it, is the recognition of a person as a particular "kind of person" (p. 99) within a given context. Expanding on identity research, Stryker and Burke (2000) outline diverse traditions, emphasizing identity can stem from both social structures and internal cognitive processes. It can manifest as category-based identities, like those grounded in race, gender, or first-generation college status, or role-based identities, such as student, teacher, or engineer.

In the context of engineering, the concept of engineering identity is "the ways in which students describe themselves and are positioned by others in the role of being an engineer" (Godwin & Kirn, 2020, p. 364). This identity is nurtured when students see themselves as engineers, when they encounter engineering peers with similar identities, and when they are acknowledged by the engineering community (e.g., faculty members) as belonging in engineering (Tonso, 2014).

Over the past decade, there has been a notable increase in research on engineering identity in the higher education context (Rodriguez et al., 2018). Faculty at Seattle University, for instance, identified key elements like "vision, reflective faculty, relevant curriculum and pedagogy, and supportive policies" (Han et al., 2021, p. 10) as important in shaping their department's culture and nurturing students' engineering identity. Another study revealed the persistence of effort among first-generation

students, marked by their ability to overcome setbacks and exhibit diligence, is positively impacted by their engineering identity and sense of belonging (Verdín et al., 2018). Identity is connected to social and cultural capital, as well as faculty-student interactions, as these factors collectively contribute to the development and affirmation of students' identities as engineers.

Knowledge about Instructional Practices

In addition to understanding the literature related to students, it is equally important to explore knowledge about instructional practices. In this section, I explore a spectrum of strategies and approaches, including active learning, asset-based pedagogy, metacognition, and the fostering of a growth mindset. These practices serve as avenues through which faculty can ensure learning experiences are relevant, engaging, and designed for student success, which is a mission of the CTL in our college. Creating learning materials for the book study required me to understand these instructional practices and approaches.

Active Learning in Engineering Education

Active learning includes a range of instructional practices designed to boost student engagement and involvement in the learning process. In contrast to traditional instructor-centered teaching, where information is transmitted in a passive lecture format, active learning shifts the focus towards a more student-centered approach, emphasizing what students will actively 'do' during their learning experience. Felder and Brent (2009) provide a practical definition of active learning as "short course-related individual or small-group activities that all students in a class are called upon to do, alternating with instructor-led intervals in which student responses are processed and new information is presented" (p. 2). Beneath this practical explanation lies the theoretical foundation of active learning, which centers on the idea that students should

be at the center of learning and actively engaged in the process. This philosophy aligns with the constructivist view of learning, a concept I delve into further in Chapter 3, where knowledge is understood as being constructed by the learner.

Writing, discussions, problem-solving, hands-on experiences, and reflective exercises are all examples of active learning. These diverse strategies collectively aim to engage students in higher-order thinking, leading to improved retention and a deeper grasp of the subject matter. Many active learning strategies have proven highly effective in engineering education, such as problem-based learning, project-based learning, and just-in-time teaching (Prince & Felder, 2006). These strategies represent complex forms of active learning that significantly enhance student engagement and responsibility. Nevertheless, even small active learning strategies, such as posing questions or implementing think-pair-share exercises, can greatly benefit students comprehension of content and improve their attitudes toward STEM (Freeman et al., 2014).

Research consistently affirms the effectiveness of active learning as a valuable instructional strategy in engineering. In a comprehensive meta-analysis that incorporated 225 studies, Freeman et al. (2014) concluded, when comparing student performance and failure rates, active learning stands out as the most empirically validated and effective teaching practice for STEM classrooms. Freeman et al. (2014) also recommended that future research delve into the specific aspects of instructor behavior that exert the greatest influence in maximizing the benefits of active learning. Furthermore, the authors advocated for further exploration of recent findings indicating these active methods offer the most substantial advantages to underprepared and historically marginalized students.

Asset-based Pedagogy and Inclusive Teaching

The diversity of learners and the unique experiences they bring into their education should be viewed as an asset and strength, rather than a deficit. Asset-Based Pedagogies view the diversity students bring to the classroom, including culture, language, disability, socio-economic status, and other characteristics, as valuable strengths to classrooms and communities ("Asset-based pedagogies," n.d.). These pedagogical frameworks have evolved over time, drawing from critical theories such as Culturally Relevant Pedagogy (Ladson-Billings, 1995), Culturally Responsive Teaching (Gay, 2002; Hammond, 2015), and more recently, Culturally Sustaining Pedagogies (Ladson-Billings, 2014; Paris, 2012; Paris & Alim, 2014;). The goal of these pedagogies is to cultivate and nurture learners from diverse backgrounds through their coursework, rather than weeding them out or excluding them.

Inclusive teaching is a pedagogy that strives to serve the needs of all students and support their engagement with subject material, regardless of their background or identity. Inclusive teaching checklists and guides show it as an approach to teaching that mindfully acknowledges the diversity of students in the classroom and aims to create a learning environment where all students feel valued and supported (Dewsbury & Brame, 2019; "DIA Checklist Strategies," 2023). Inclusive teaching can be implemented in a variety of ways, including the use of inclusive language and avoidance of stereotypes, the creation of a welcoming and supportive classroom environment, the utilization of diverse teaching methods to engage all learners, the facilitation of opportunities for students to share their own experiences, and the provision of accommodations for students with disabilities.

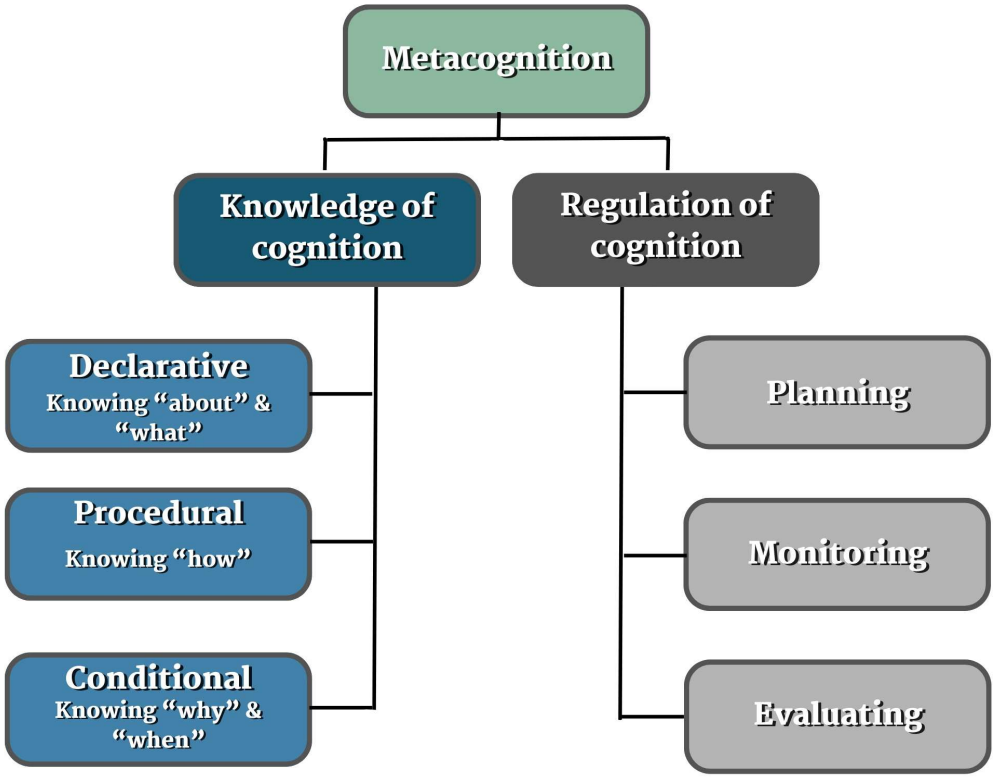
The underlying philosophy behind asset-based pedagogy and inclusive teaching emphasizes that in addition to active learning, the development of science and engineering identity is “as crucial a part” (Dewsbury & Brame, 2019, p. 3) of the learning experience. In recent decades, extensive research has emerged highlighting the favorable outcomes resulting from the deliberate integration of identity development into the pedagogical process (Perez et al., 2014). This integration necessitates active student reflection on various facets of their personalized learning journeys. Thus, when making inclusive pedagogical decisions, it's imperative for faculty to prioritize choices that encompass all elements contributing to the holistic development of students, rather than solely focusing on active learning approaches alone.

Metacognition

Encouraging active student reflection involves the use of metacognition, which is the cognitive process of thinking about one’s own thinking (Flavell, 1979). Metacognitive components, as represented in Figure 4, include: 1) knowledge of cognition, which involves understanding the what, how, why, and when of thinking, and 2) regulation of cognition, encompassing activities such as planning, monitoring, and evaluation (Hartman, 2001; Wengrowicz et al., 2018).

Figure 4

Metacognition Components



Note: Adapted from: Wengrowicz, N., Dori, Y. J., & Dori, D. (2018). Metacognition and meta-assessment in engineering education. *Cognition, metacognition, and culture in STEM education: Learning, teaching and assessment*, 191-216.

Metacognition has been found to play an important role in all cognitive tasks, such as problem solving, decision making, and critical thinking (Winne & Azevedo, 2014). Within the learning sciences and educational research, metacognition is characterized as the possession of "knowledge, awareness, and control over one's own learning" (Baird, 1990, p. 184). Studies in the field of learning sciences emphasize the profound connection between metacognitive abilities and learners' motivations, including their goal orientations, interests, and task values (Winne & Azevedo, 2014).

Explicit instruction in metacognition is essential for students to enhance their metacognitive skills, encompassing both the conceptual understanding of metacognition and the practical ability to apply metacognitive strategies to assess their progress (Pintrich, 2002). In the realm of engineering education, metacognitive knowledge is integral to active learning, further fostering the development of learners' metacognitive abilities (Hartman, 2001; Vos and De Graaff, 2004; Wengrowicz et al., 2018). Research has demonstrated that metacognition enhances team performance among engineering students, bolsters their engagement in the learning process, and equips them to effectively tackle complex problems (Case et al., 2001; De Graaff & Christensen, 2004; Lawanto, 2009).

Project Integrating Metacognitive Practice and Research to Ensure Student Success (IMPRESS) at the Rochester Institute of Technology (RIT) achieved improved retention rates for first-generation STEM college students and deaf and hard of hearing (DHH) students, a historically marginalized group, through the implementation of a metacognition program. The study, spanning four years, revealed significant findings indicating enhanced retention rates in junior and senior years, with over 80% of IMPRESS participants continuing into their 3rd and 4th years. This surpassed the retention rate of fewer than 70% observed among non-IMPRESS first-generation and DHH students (Franklin et al., 2018). Project IMPRESS included both a summer bridge program and a semester-long metacognition course. This metacognition program integrated various learning activities and reflective practices focused on metacognition, Bloom's Taxonomy, self-assessment, and addressing stereotype threat. Importantly, the positive impact extended across diverse demographic groups within the IMPRESS initiative, benefiting DHH students, women, and historically marginalized individuals, narrowing the gap with their counterparts over multiple years.

Growth Mindset

Growth mindset is a term coined by Carol Dweck in her book, *Mindset: The New Psychology of Success* (Dweck, 2006). Someone with a growth mindset believes individuals can improve their skills and abilities through hard work and dedication (Dweck, 2006). This contrasts with someone with a fixed mindset, who views intelligence and abilities as innate traits that cannot be changed and are present from birth. Those with a growth mindset firmly believe in their potential for skill acquisition and approach challenges as opportunities for personal development, regarding failure as a part of the learning process rather than evidence of inadequacy (Dweck, 2006). A comprehensive review of interventions related to growth mindset in engineering education found these interventions were particularly effective for female students (Campbell et al., 2021). This aligns with other studies that have demonstrated the most significant benefits of growth mindset interventions for historically marginalized students and first-generation college students (Broda et al., 2018; Claro et al., 2016).

The combination of a growth mindset, which encourages students to view challenges as opportunities for growth and learning, with metacognition, which fosters self-awareness and reflection on one's own thinking, can empower students to take an active role in their learning process. Incorporating both growth mindset and metacognition into inclusive teaching and active learning practices creates a holistic approach that not only values diversity, but also equips students with the mindset and cognitive tools to thrive. Metacognition and growth mindset were the main topics of the book I chose for my Book Study innovation, *Teach Students How to Learn* (McGuire, 2015).

Previous Cycles of Action Research

In my previous action research (AR) cycles, I completed one initial reconnaissance cycle (Cycle 0) followed by a second semi-reconnaissance cycle in a new context (Cycle 0/1). The primary aim of action research is to provide practical support within specific local contexts (Creswell, 2015). In the spring of 2021, I conducted Cycle 0 while in my previous professional role. During this cycle, my research was focused on understanding the self-concept of first-generation engineering students and identifying the perceived barriers hindering their participation in extracurricular programs, as my role at that time was supporting student-facing entrepreneurial programs. Upon transitioning to my current role with the CTL in the fall of 2021, I maintained my interest in first-generation college students. However, I reevaluated how I would address the challenge of supporting student success and given the responsibilities and roles of my new job, shifted my focus toward faculty professional learning. Below, I elaborate on each AR cycle, including the research methods, rationale, and findings.

Cycle 0

During the initial reconnaissance cycle, Cycle 0, my objective was to develop a deeper understanding of what faculty knew about first-generation students' engagement in extracurricular activities and their self-concept. For this cycle, I chose to conduct structured interviews with faculty and staff members closely connected to extracurricular programs that supported first-generation and historically marginalized students. I interviewed a total of four participants, one faculty and three staff. This approach allowed me to gain a more comprehensive understanding of the experiences and viewpoints of program administrators, including faculty and staff directors.

My qualitative analysis of the interview data revealed several themes. First-generation students encounter several barriers, notably financial and time constraints

that affect their participation in extracurricular activities. For instance, one interviewee highlighted the significant trade-offs first-generation students must make regarding their time and the impact on their academic pursuits, personal life, and financial commitments. Participants also stressed that first-generation students often lack crucial college-going capital and institutional navigation knowledge. With no mentors or family members familiar with higher education systems, these students may struggle with tasks like completing financial aid applications, selecting a major, or understanding the value of networking with faculty or participating in extracurricular programs.

Interview participants also reported observing Imposter Syndrome, characterized by self-doubt and attributing accomplishments to external factors, in first-generation students, hampering their academic success. Interviewees also noted that first-generation students typically work part-time or full-time jobs and often commute to campus. This situation limits their availability to engage in on-campus activities and support services, potentially contributing to their sense of isolation. Interviewees also expressed that first-generation students often hesitated to seek help from faculty members or attend office hours. While this self-reliance could foster determination and problem-solving skills, it sometimes deterred students from seeking assistance when needed. Finally, participants concurred that traditional office hours were outdated, emphasizing the importance of increasing the time faculty spend with students to enhance students' engineering identities and promote persistence in STEM majors. In summary, it is essential to respect and honor the unique challenges first generation students face and provide navigational support to help them make the most of their educational opportunities.

This research cycle provided valuable experience in coding, qualitative analysis techniques, and a deeper understanding of the shared observations and challenges recognized by faculty and staff within their programs.

Cycle 0/1

In my next cycle of AR, Cycle 0/1, I aimed to delve deeper into understanding faculty members' professional learning needs, the obstacles they faced when improving teaching practices, and the beliefs they held about teaching PD. I designated this as Cycle 0/1 because the primary objective remained reconnaissance in my new role at CTL and was not a direct continuation of my Cycle 0. Typically, in our program, EdD students complete Cycle 0 to explore and subsequently build upon their findings with a Cycle 1, often involving a small intervention.

In this cycle, I used a mixed methods design to explore my new context. For the quantitative strand, I analyzed datasets to identify trends in DEW rates (referring to the counts of D grades, failures, and withdrawals) and enrollment from Fall 2018 to Spring 2021. I collected course-level data from SU's Analytics platform, focusing on 13 courses of interest identified by CTL leaders. Notably, significant enrollment disparities were observed across different campuses: identified courses at the Main campus averaged 498 students across sections, while those at the Suburb campus averaged 48 students. It was surprising to find courses with fewer students at the Suburb campus exhibited DEW rates comparable to the larger Main campus class sections (27% DEW rates at Main; 33% DEW at Suburb). These statistics indicated that a third of students needed to retake the course to progress in their degree. Since these courses served as prerequisites for further degree-related coursework (i.e., marked as critical courses in a student's progression plan or major map), this not only prolonged graduation timelines, but also imposed additional financial burdens on students retaking courses.

In the qualitative strand, I conducted semi-structured interviews with four participants, three faculty and one staff member. My qualitative analysis of the interview data revealed several themes. Notably, barriers to growth in improving instruction were intriguing, with participants shedding light on a variety of challenges. One participant highlighted the unique dynamics at SU, emphasizing the broad spectrum of student abilities due to the institution's mission of inclusion and success. Teaching a class with such a wide variation in ability levels posed distinctive challenges for faculty.

Faculty members also expressed a common mindset where they believed their students would learn in the same way they did, potentially hindering instructional growth. Professional development, as another category within the barriers to growth theme, also surfaced as a challenge. Some faculty members admitted to being unaware of the current PD offerings, while others shared their school's encouragement for faculty to attend at least one conference per year as a form of professional development. Additionally, there were contradictory statements regarding the link between improved student learning outcomes and faculty development programs. Some faculty members questioned the effectiveness of such programs, citing the complexities of grading as a factor. On the other hand, one faculty member reported significant improvements in student achievement after integrating active learning strategies.

Regarding motivation for professional learning, participants drew from both internal and external sources. Some were motivated by the desire to contribute to the STEM pipeline and support underrepresented students, while others cited external factors such as financial incentives and maintaining the university's “brand.” One faculty member expressed a simple desire to excel in their teaching role.

All interview participants offered insights into what they found valuable for future opportunities in engineering education research. Classroom observations and

personalized coaching emerged as highly beneficial. Faculty members stressed the value of mentorship, with one participant emphasizing the importance of normalizing the idea of failure in teaching. Another faculty member highlighted the significance of seeking feedback from students, which led to continuous improvements in their teaching methods.

A critical revelation from Cycle 0/1 was the unique challenges at SU, a large public research institution, in supporting its faculty members. These challenges stemmed from the diverse spectrum of student knowledge and abilities entering the classroom. Faculty members also grappled with the demands of a large-scale educational environment, the diverse array of engineering courses they had to teach (e.g., project-based, labs, first-year courses), and the complexities of navigating a competitive, research-oriented academic setting. This culture at SU emphasized the need for high-quality student outcomes and excellence in class performance, leaving little room for faculty experimentation and growth in their teaching. Faculty felt uncertain about where to start when considering new instructional strategies.

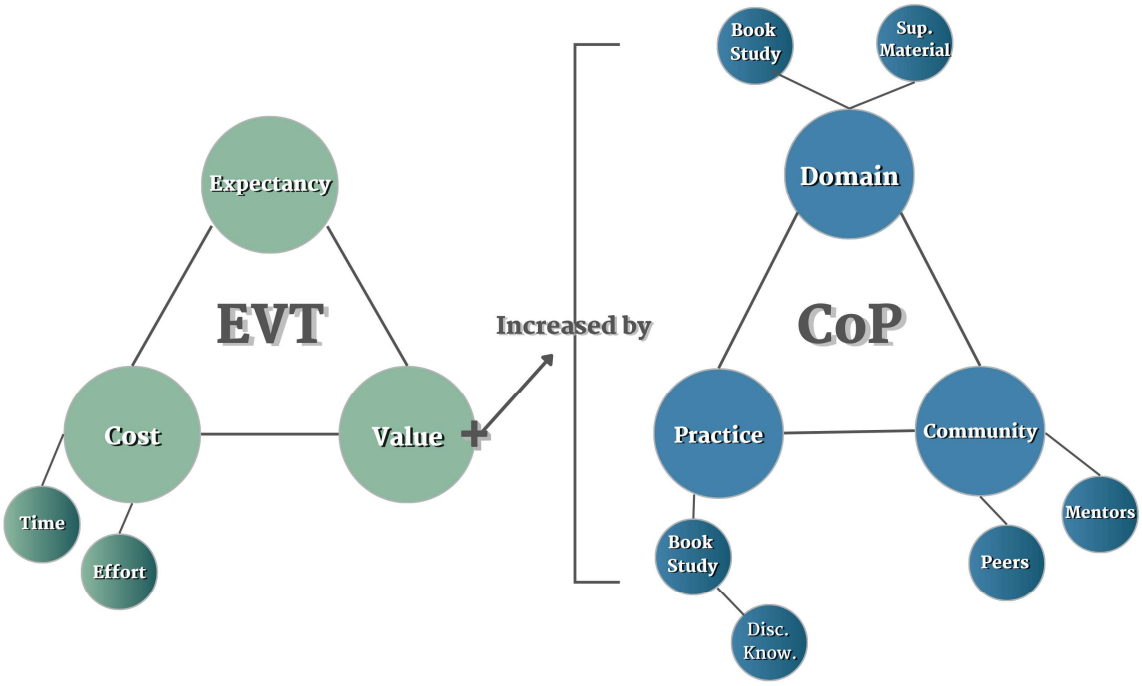
Application to Study Design

I applied these theoretical frameworks and disciplinary knowledge to the design of my innovation and research study. I integrated Communities of Practice (CoP) and Expectancy-Value Theory (EVT), with a specific emphasis on leveraging these frameworks in my innovation design through the incorporation of reflection activities, guided discussions, and informal mentorship opportunities into my book study. Wenger et al. (2002) outlined the principles for a successful CoP, which included 1) designing for evolution, 2) opening a dialogue between inside and outside perspectives, 3) inviting different levels of participation, 4) developing both public and private community spaces, 5) focusing on value, 6) combining familiarity and excitement, and 7) creating a

rhythm for the community. In Figure 5 below, I illustrate how I integrated CoP and EVT theories for this research design, focusing on the intersection of these concepts. The Teaching Community of Practice Virtual Book Study Intervention embodies this integration, emphasizing how the components of a CoP within the book study design were leveraged to enhance the value of EVT. This integration encompasses the book study learning content domain, the community aspect involving peers and faculty mentors, as well as the practice stories and strategies developed.

Figure 5

Theoretical Frameworks: CoP, EVT



I incorporated the perspective of asset-based pedagogy into supplemental materials, which included resources addressing inclusive teaching and the needs of first-generation college students. While the primary content of the book study did not revolve around asset-based pedagogy, it was a lens I consistently applied throughout the design and implementation of my innovation and research study. I deliberately selected *Teach*

Students How to Learn: Strategies You Can Incorporate Into Any Course to Improve Student Metacognition, Study Skills, and Motivation (McGuire, 2015) for the book study because it offered simple, practical strategies related to metacognition and growth mindset, two areas the research shows equip students with the mindset and cognitive skills needed for success (Broda et al., 2018; Claro et al., 2016; Hartman, 2001; Vos & De Graaff, 2004; Wengrowicz et al., 2018). Embracing a growth mindset and promoting metacognition empower students in their learning journey. These metacognitive instructional practices prioritize active learning and contribute to positive faculty-student interactions. These practices are particularly beneficial for first-generation and historically marginalized students, as it aids in the development of their cultural and social capital while simultaneously fostering a sense of belonging and developing their engineering identity.

In regard to my previous action research cycles, although neither was as directly related to my study design as I would have preferred, they both yielded valuable insights into the research process and my context within the CoE at SU. Cycle 0, conducted during my prior professional role, provided me with essential experience in conducting and coding qualitative interviews. Moreover, it shed light on the systems and gaps in our college for supporting first-generation students. The subsequent cycle, Cycle 0/1, taught me a significant lesson about the potential disconnect when employing a mixed-methods approach. It marked my first attempt at incorporating quantitative data into a research cycle. Initially, I intended to establish a connection between institutional data and my qualitative interview findings. However, this alignment did not materialize. My goal was to investigate high-enrollment courses to understand current trends in DEW rates, but there was a disconnect between that quantitative line of inquiry and the needs and barriers expressed by faculty in interviews. Delays in securing new IRB study approval in

my new role at the CTL, coupled with my limited awareness of the types of institutional data I could access, further complicated matters. Despite these challenges, Cycle 0/1 proved to be a valuable exploratory cycle, helping me identify and narrow down a new problem of practice while emphasizing the importance of aligning research methods, research questions, and an innovation plan in my new context.

CHAPTER 3

RESEARCH DESIGN

In the previous chapter, I outlined major theoretical frameworks, disciplinary knowledge, and supporting literature for my study. In this chapter, I present my research design. This includes my theoretical alignment, settings and participants, innovation plan, data collection and analysis, and ethical considerations for my study.

Theoretical Alignment

Theoretical alignment is the intersection of epistemology, methods, and methodology (Noffke, 2009). Epistemology asks, *What is knowing?, What is 'the known'?,* and *What is knowledge?* Methods are the techniques by which data or evidence is gathered, while methodology is both the role of theory and the means of analysis that outline how researchers address the data collected (Noffke, 2009).

Epistemology

I take a pluralist perspective when considering knowledge, with a hybrid lens of constructivism and critical theory. I aim to describe faculty members' perspectives, experiences, values, and socially constructed beliefs around professional development (PD). Their roles, dialogue, and transformation through their teaching and learning experiences as individuals and as a group is important to understand in order to change, negotiate, and transform their teaching practice. I believe the value of the claims made by my research derive from the practical impact that follows. Action research that serves our faculty members should ultimately serve our students - especially our increasingly diverse student body of historically marginalized and first-generation students.

Constructivism

The constructivist theory of learning views knowledge as constructed by the learner (Vygotsky, 1978; Piaget, 1928). This construction is a human and social activity

(Bandura, 1986) where leaners build upon their previous knowledge (Ackermann, 2001). The role of the instructor is to facilitate the conditions and space for learning, rather than supplying knowledge (Alanazi, 2016). A constructivist approach to learning aligns with incorporating active learning strategies which enables students to construct their knowledge, engage with their peers and the instructor, and to have an active role in the learning process. The learning environment is learner-centered, and learners construct their understanding of concepts by integrating new knowledge with pre-existing information. The purpose of a constructivism perspective in research is to design research in such a way "to describe individuals' perspectives, experiences… values and beliefs" (Koro-Ljungberg et al., 2009, p. 689).

Critical Theory

A critical theory of learning considers how "the role of the social structures of oppression [play] out through the lived experiences of people" (Bhattacharya, 2017, p. 74). The role of the instructor in critical culturally sustaining pedagogy, for example, "seeks to perpetuate and foster—to sustain—linguistic, literate, and cultural pluralism as part of the democratic project of schooling" (Paris, 2012, p. 93). The purpose of a critical theoretical perspective in research is to "address equities in order to promote change in communities" (Koro-Ljungberg et al., 2009, p. 689). A critical theory perspective in education research involves a rigorous examination of the societal factors that influence education, aiming to identify and challenge underlying power dynamics, biases, and inequalities.

The power dynamics of the college classroom cannot be overlooked, especially as the aim of my study is to support faculty in seeing the value of teaching PD related to certain instructional practices (i.e., active learning, inclusive teaching) that benefit all learners, but can especially close the gap for first-generation and historically

marginalized students in engineering. Within this framework, I seek to emphasize the intersectionality of social identities and to empower marginalized groups within the education system. I advocate for alternative educational approaches and practical solutions to transform the education landscape and address systemic injustices. This perspective is characterized by its commitment to action, social critique, and a multidisciplinary approach to understanding and improving education.

Action Research

My operational definition of action research (AR) is the "systematic procedures done by teachers (or other individuals in an educational setting) to gather information about and subsequently improve the ways their educational setting operates, their teaching, and their student learning" (Mills, 2011, as cited in Creswell, 2015, p. 577). Action research in education was grounded in John Dewey's theories of the generation of knowledge and the importance of the human experience (Herr & Anderson, 2005). One reason I found AR benefited my problem and context was "its flexibility and responsiveness" allowed me to "engage with the uncertainties of a research situation" (Dick, 2014, p. 58). These characteristics of action research made it ideal for my setting, especially finding myself in a new professional role.

Action research is done in the researcher's own local context to grow the knowledge base of teaching, explore how a researcher's personal beliefs impact their teaching and learning, and ultimately use research methods to leverage social change and improve or innovate for participants in a researcher's setting (Noffke, 2009). AR is grounded in theory and research-based practices that lead to practical application for the researcher practitioner. I use constructivist and critical theories with a practical action research design, which involves innovating the practice of education by studying a small, local problem of practice (Creswell, 2015).

The critics of AR say it lacks formality as educators are not academic researchers (Creswell, 2015). I would argue that this thinking is a reflection of the power dynamics within higher education. I would question who has the power and privilege to conduct research. I see action research as a first step for any educator to conduct meaningful research in their settings. Carr & Kemmis (2009) argue that education is inherently connected to power and politics, and thus educational action research must be approached through a critical lens. Another critique of AR centers on educational action research not being generalizable to a larger population when the focus is local problems of practices (Herr & Anderson, 2005). Qualitative approaches come under fire for similar reasons (Tracy, 2010). However, through ethical considerations detailed later in this chapter, I describe how I ensured a high quality mixed methods approach in my research design, and later in Chapter Five, I discuss the implications of this work to other engineering schools in other higher education contexts.

Research Methodology

The combination of constructivist and critical theories in my AR study allowed me to both understand the individual experiences and social dynamics in my setting and to take practical steps toward addressing an issue. Constructivism guided the learner-centric approach and active learning strategies adopted in the study, emphasizing the construction of knowledge by book study participants. Simultaneously, the critical theory perspective supports my study's goal to ultimately empower marginalized groups. This epistemological and methodological approach worked within my AR design to enable practical changes within my local educational setting while acknowledging and challenging the power dynamics inherent in higher education.

This was a qualitatively driven, concurrent, mixed methods action research (MMAR) study in which both quantitative and qualitative data were conducted

independently. As this was qualitatively driven, the majority of my data collection tools and analysis were qualitative, given the nature of my research questions and the aim of the study. Recall, my research questions were:

1. How and to what extent does the participation in a TCPVBS impact a faculty member's:
    a. Knowledge of how students learn, metacognition, motivation/emotions, and growth mindset?
    b. Perceptions of first-generation college students in engineering?
    c. Plans to implement inclusive instructional practices in their course?
2. What happens when participants engage in a TCPVBS innovation?
    a. What do they learn about their own educational journey?
    b. What are their reflections on their practice?
    c. What from the innovation do they find valuable?
3. What are the reflections of Faculty Mentors?
    a. What are their reflections on their role and integration of the book study?
    b. What are their reflections on mentoring faculty through a community of practice model?

Settings and Participants

As my study aimed to focus on faculty members' perspectives, experiences, and values, I positioned the study within the Center for Teaching and Learning (CTL), particularly within the CTL Teaching Community of Practice. The participants included faculty members, faculty mentors, and staff members from the College of Engineering (CoE) and CTL Teaching Community of Practice.

Setting

This study occurred during the Spring 2023 semester at Southwest University (SU) within the CoE. As discussed in Chapter 1, SU is a large, public research university in the southwest with over 100,000 students across multiple campuses. In fall 2023, the CoE had over 31,000 students enrolled in its engineering programs. This study took place in the CTL, which is its own unit in the CoE. The CTL provides engineering faculty with a number of resources, including professional development (PD) opportunities, instructional coaching, and collaborative course redevelopments.

I embedded this study within the established CTL Teaching Community of Practice (TCP) and Faculty Mentors program. The TCP and Faculty Mentors are separate initiatives within CTL, but offer complementary support for faculty learning and mentorship to improve instruction. TCP Meetings occur monthly and are centered around various engineering education topics. The TCP Meeting structure is similar to a speaker series, where a guest speaker presents on a topic (e.g., student motivation, assessment) for the majority of the meeting and attendees ask questions and exchange dialogue for a small portion at the conclusion of the meeting. There are over 600 full-time faculty members employed at the CoE and faculty engagement in the CTL offerings was optional at the time of the study. This book study was meant to be a subgroup of the TCP, to allow for hands-on, small group learning experiences.

Faculty Mentors (FMs) are paid engineering faculty members who serve as teaching mentors to their peers. FMs provide insight and dissemination streams for CTL's PD offerings. As part of their paid role, FMs are expected to attend CTL workshops and events, connect with faculty one-on-one, and provide strategy for the CTL's future PD offerings. At the time of this study, there were four FMs employed by CTL. Two mentors were teaching-track faculty and two were tenure-track faculty.

Participants

A total of 14 individuals attended the book study meetings during the semester, with 12 of the 14 providing consent to participate in the research study. This research participant group consisted of 3 CTL staff members, 3 FMs, and 6 faculty participants. There were six different engineering disciplines represented across the faculty and faculty mentors, and one non-engineering faculty member who was from a STEM discipline. A comprehensive breakdown of participant characteristics and demographics is available in Table 1.

Table 1

Demographics and Characteristics of Participants

Demographics	n	%
Gender		
Male	4	33%
Female	7	58%
Non-binary	-	-
Another gender not listed	-	-
Prefer not to answer	1	8%
Race/Ethnicity		
American Indian or Alaska Native	-	-
Asian	3	25%
Black or African American	1	8%
Hispanic or Latinx	1	8%
Native Hawaiian or Other Pacific Islander	-	-
White	7	58%

Table 1 (continued)

Demographics	n	%
Other	-	-
Prefer not to answer	1	8%
Characteristics	**n**	**%**
Highest Education Completed		
Bachelor's degree	-	-
Master's degree	6	50%
Doctorate degree	6	50%
First-generation College Student		
Yes	3	25%
No	9	75%
Title/Position		
Assistant Teaching Professor	4	33%
Assistant Professor	1	8%
Associate Teaching Professor	4	33%
Staff	3	25%
Years of Teaching College- Level Courses (n=9)		
0-1 years	-	-
2-4 years	1	11%
5+ years	8	89%
Course Type(s) taught (n=9)		
First year course	5	56%
Technical elective	1	11%
Capstone course	2	22%

Table 1 (continued)

Characteristics	n	%
Graduate course	1	11%
Required non-first year course	4	44%
Other	1	11%
Course(s) Modality (n=9)		
Online	3	33%
In-person	8	89%
Hybrid	3	33%
Other	-	-

Note. The average age of participants was 41.67 years old (SD = 5.84).

Note. With a range of 12 students to up to 1050, the average number of students that each participant with a course load taught was 284 (SD = 309.6; median=180).

Note. For Race/Ethnicity, Course Type, and Course Modality, participants were able to select multiple options.

Following IRB approval in January 2023, I employed three virtual methods for participant recruitment, two for faculty/staff participants and one for recruiting FMs. Firstly, I conducted marketing efforts by disseminating information via email to the TCP distribution list and in a CoE-wide communications email newsletter. The second recruitment method involved a targeted email outreach to faculty responsible for teaching courses at the 200 and 300 levels within the CoE and teaching-track faculty in the Academic and Student Affairs unit of CoE. Upon expressing interest in the book study, faculty and staff received invitations to participate in the research and were provided with a consent form. I made it explicitly clear that joining the book study did

not obligate them to partake in the research study. Finally, I recruited the FMs contracted with the CoE CTL through separate virtual recruitment emails and consent forms, asking them to serve as mentors to participants during the book study. See appendices for IRB approval (Appendix A), recruitment materials (Appendix B) and consent forms (Appendices C & D).

Role of the Researcher

My role in this study was a dual role of facilitator and researcher. During the research study, I served as a Program Manager at the CTL, where in this capacity, I led monthly TCP meetings and oversaw the FM program, in addition to other professional learning initiatives. For this study, my responsibilities included developing and curating learning materials for and facilitating discussions and activities during the Teaching Community of Practice Virtual Book Study (TCPVBS) innovation. I conducted investigations by collecting electronic pre- and post-survey data, gathering meeting artifacts, and conducting post-innovation interviews and a focus group. These roles exemplify the distinctive characteristics of action research compared to more traditional research designs, which include collaboration and breaking down of typical knowledge hierarchies (Gergen & Gergen, 2008). It was through this dual role that I was able to design and implement the TCPVBS innovation.

Teaching Community of Practice Virtual Book Study Innovation

Drawing from the epistemology of constructivist and critical perspectives, as well as the theoretical frameworks and disciplinary knowledge detailed in Chapter 2, I designed the TCPVBS Innovation to prioritize a learner-centered approach, fostering collaborative knowledge construction among participants on book study topics through learning materials aimed at promoting an inclusive lens.

After consulting with CTL leadership and my committee members, I embraced a 'less is more' approach in this innovation plan. The primary objective was to establish a small-scale, localized learning opportunity, with research questions specifically tailored to participants' experiences in the innovation. Recognizing the time constraints typically faced by faculty members for PD, I made a deliberate choice to curate the pre-work and reading materials before each meeting, limiting participants to a total of 35-40 pages. At the beginning of each meeting, I provided a concise overview of the pre-work materials. This overview and the limited reading requirements were essential to guarantee every participant had a low cost to engage and was adequately prepared for the reflective and planning activities. The review of materials ensured participants felt confident in engaging in meeting discussions, even if they had not completed all the readings. Additionally, it served as a helpful reminder for those who had engaged with the readings some time ago. This choice allowed me to create something manageable for both my roles as a researcher and facilitator, while also ensuring that the innovation did not place an excessive burden on faculty participants.

With all these considerations in mind, the goals of the TCPVBS innovation were:

1. Create a learning environment where faculty and instructional staff can:
    a. Gain awareness and knowledge of topics such as: metacognition, growth mindset, inclusive teaching, Bloom's Taxonomy, study cycles, and first-generation college students.
    b. Reflect and discuss instructional practices and strategies with their peers.
    c. Plan incorporating new strategies in their own classroom or practice.
2. Increase the perceived value of teaching PD opportunities through:
    a. Practical strategies for engineering faculty to implement with little planning time.

b. Receive mentorship and engage with Faculty Mentors.

Book Study Meetings and Activities

I held a total of four, 60-minute virtual book study meetings in the spring of 2023. The meetings were held every three weeks, and the fourth meeting was a focus group discussion. Faculty members practiced a form of praxis (Gadotti, 1996) throughout the innovation, following cyclical steps of learning, reflecting, and planning. I provided faculty with accessible learning materials, including a physical copy of the book, access to an eBook through the SU library, and supplemental articles uploaded to a centralized Google Folder. Each learn, reflect, and plan description is included in more detail in Table 2, along with the Action Research Innovation timeline with activities and topics.

Learning Materials

I chose *Teach Students How to Learn: Strategies You Can Incorporate Into Any Course to Improve Student Metacognition, Study Skills, and Motivation* (McGuire, 2015) as the primary book study material. This book was one recommended for further reading in the previous semester's book study on *Small Teaching: Everyday Lessons From the Science of Learning* (Lang, 2021). I did an extensive search to identify a practical book I believed would cater to the needs of faculty members. Feedback from my committee members and colleagues within my context suggested a book study solely focused on critical pedagogy or inclusive teaching might not draw a significant audience of engineering faculty. Thus, I selected *Teach Students How to Learn* as the main content for the book study because it offered simple strategies to promote students' thinking critically about their learning and fostering a growth mindset. Additionally, the book featured anecdotes from a STEM author that highlighted the diverse backgrounds of students, adding a valuable dimension to our discussions. In addition to the chosen

book, I also provided several supplemental materials for each meeting. These included an Inclusive Teaching Checklist, a book chapter and a conference paper on first-generation college students, and Teaching Reference Guides on Growth Mindset and Student Motivation. I began each meeting by presenting several slides overviewing highlights from the book readings and the supplemental materials. See Appendix E for an example of meeting slides.

Table 2

Action Research Innovation timeline

Date	Innovation Steps	Data Collection
Dec 2022	IRB approved	
Jan - Feb 2023	Recruitment of book study participants and consent	• Pre-survey • Researcher Reflection Journal

2/20/2023	Meeting 1: Kick-off – Group Intros, Study Cycles + Bloom's Taxonomy
	• Goals of the book study and introductions
	• **Learn:**
	  ○ Chapters: 2, 4
	  ○ Supplemental Materials: Inclusive Teaching Checklist
	• **Reflect:** Educational Journey
	• **Plan:** Adding concepts to course
		• Book Study Meeting Activity artifacts (Polls, Jamboards; See Appendix F for examples)
		• Researcher Reflection Journal
		• Faculty Mentors Reflection Journal
		• Post-survey

3/13/2023	Meeting 2: 'True North': Student Success & Metacognition
	• **Learn:**
	  ○ Chapters: 3, 5
	  ○ Supplemental Materials: First-Generation College Students materials
	• **Reflect:** Vowel Activity Exercise
	• **Plan:** Adding concepts to course	

4/3/2023	Meeting 3: Supporting all learners - Growth Mindset & Motivation • **Learn:** ○ Chapters: 6, 7, 8	

Date	Innovation Steps	Data Collection
	○ Supplemental Materials: Teaching Reference guides on Growth Mindset and Student Motivation • **Reflect:** Growth mindset • **Plan:** Adding concepts to course	
4/24/2023	Meeting 4: Debrief – Book Study Reflection & Resource Identification • See Appendix G for focus group questions	
April - June 2023	Conducted individual, semi-structured interviews • See Appendix G for interview questions	• Interview transcript • Researcher Reflection Journal

Data Collection and Analysis

The data collection and analysis of my MMAR study included both qualitative and quantitative data. The qualitative data collection instruments included a pre- and post-survey with majority open-ended questions, a focus group interview, individual interviews, and reflection journals. Meeting artifacts were also generated and collected. See Table 3 for a full data collection timeline and alignment to my research questions.

Survey

The survey instruments included an electronic pre- and post-survey through QuestionPro. The surveys were used to better understand faculty level of familiarity, attitudes, beliefs, and assumptions before and after the book study. Surveys are valuable tools for gathering data to capture the perspectives and opinions of various stakeholders regarding a particular problem or issue and when used in conjunction with qualitative data, surveys can offer a comprehensive assessment of the problem and insights into the effectiveness of actions taken to address it (Ivankova, 2015).

I also used the pre-survey to gather comprehensive demographic data from the participants. Both surveys included scale questions on familiarity of book study topics (e.g., metacognition, growth mindset), inclusive instructional practices (e.g., accessible learning materials, reducing anonymity), and active learning strategies (e.g., think-pair-share, muddiest points). I utilized questions from an already validated survey instrument, Sturtevant and Wheeler's (2019) STEM Faculty Instructional Barriers and Identity Survey (FIBIS), to ensure validity of the survey instruments. FIBIS is a tool to capture faculty identity and levels of familiarity of evidence-based instructional practices.

My pre- and post-surveys asked participants to reflect on their perceptions of first-generation students, engineering students, and SU students. The post-survey also included an experience and feedback section to inquire about their degree of confidence implementing new strategies, their perceived value of meeting components, and the quality of the overall book study. See Appendix H for the pre- and post- surveys.

Artifacts and Journals

Collecting documents, or artifacts, is a common qualitative research method to provide the researcher "better contextual understanding" (Bhattacharya, 2017, p. 52). The artifacts I collected allowed me to document participants' thoughts, reflections, and plans during the TCPVBS. With the exception of the fourth meeting, the focus group, I did not record the book study meetings for research purposes, as I wished to create a learning environment where everyone was comfortable to openly share.

Book Study Meeting Artifacts

Artifacts encompass a wide range of tangible objects and materials, such as photographs, memorabilia, tools, and paintings (Given, 2008). They serve various purposes and can offer valuable historical insights. Common types of artifacts frequently

employed in qualitative research include written texts, including documents, diaries, journals, and meeting minutes, which provide insights into past events and experiences (Given, 2008). In my study, the artifacts I collected across the TCPVBS innovation allowed me to examine reflection and planning activities during the book study meetings. These included poll results and Google Jamboards (see Appendix F for examples), designed to align with the meeting's topics and promote collaborative group engagement.

Faculty Mentors Reflection Journal

FMs who consented to participate in the research study completed individual reflection journals. Journals serve as highly effective research tools for delving into the personal experiences and emotions of participants and can offer introverted or marginalized individuals a private space to express their ideas (Given, 2008). The purpose of the FM journals was to document FM's experiences, opinions, and thoughts throughout the TCPVBS. They also served as a means to capture and document small group discussions that occurred in Zoom breakout rooms, which I was not always able to participate in. The journals included prompts that encouraged the FMs to reflect on 1) their own learning, 2) the significance of this learning, 3) any meaningful interactions with other participants, and 4) general feedback on the meetings. FMs completed an individual entry in their own, private journal (Google Doc) after each book study meeting.

Interviews

I used two forms of interviews for my study: a focus group interview and individual, semi-structured interviews. The final book study meeting of the semester served as a focus group interview, providing 9 of the consenting research participants with the opportunity to engage in deeper reflections on the topics covered, the perceived

value of professional development offerings, and the impact of their experiences. This focus group allowed the group to collectively make sense of their co-constructed perspectives and experiences (Wilkinson, 1998). Focus group interviews are particularly effective when participants share similarities and cooperate with each other, which was the case with my participants who voluntarily participated in the TCPVBS innovation.

Additionally, I conducted individual semi-structured interviews to obtain detailed and contextualized descriptions of each participant's perspectives (Frey, 2018). Semi-structured interviews involve asking "predetermined but open-ended questions" (Given, 2008b, p. 810), which enabled me to engage participants in discussions about their perceptions and experiences within the TCPVBS. See Appendix G for all interview questions (focus group, participant individual, and FM individual).

Researcher Reflection Journal

The final data collection tool I utilized was a researcher reflection journal, which contained reflective memos and notes spanning the planning, innovation, and research study phases. Reflective journaling through memos allowed me to document "written ideas or records about concepts and their relationships" (Given, 2008a, p. 505). These journal entries contributed to the "credibility and trustworthiness of qualitative research and served as a record of the meanings derived from the data" (p. 505).

Beyond enhancing the qualitative methodological rigor, reflection journals also provided a platform for me to critically self-reflect throughout the research process. My journal served to document changes made to my research approach and to "make the messiness of the research process visible" (Ortlipp, 2008, p. 704). This documentation of the research messiness held particular significance for me as a first-generation college student. Academic research is often presented as a polished and flawless end product for public consumption. In reality, my research and doctoral journey were far from linear or

perfect. My journal served as a record of the obstacles I encountered and the adjustments I made, allowing me to reflect on the sometimes challenging, yet ultimately achievable, nature of conducting research in higher education.

Table 3

Data Collection Timeline and Research Question Alignment

Data Source	Collection Timing	Research Question
Electronic Pre-Survey	Prior to Meeting 1	1, 2
Artifacts: Reflection & Planning Activities	Meetings 1-3	1
Electronic Post-survey	Post-Meeting 4	1, 2
Focus Group & Individual Interviews	After Post-Survey	1, 2
Faculty Mentors Journals	Meetings 1-4	1, 3
Researcher Reflection Journal	All phases	2, 3

Data Collection Confidentiality

I obtained the necessary Institutional Review Board (IRB) approval before commencing my study. I securely stored all data in a password-protected cloud storage drive (Google Drive) via SU. After transferring audio recordings of interviews to the password-protected Google Drive folder, I removed them from the recording account in Zoom. I downloaded transcripts from the Zoom recordings and uploaded them to the qualitative software, MAXQDA, on a password-protected computer. Each interview recording was labeled with a study ID instead of the participant's name. I explicitly advised interview respondents not to mention any names in their responses to interview questions.

Analysis

The aim of this qualitatively-driven, concurrent, mixed methods action research (MMAR) study was to better understand what happens when engineering faculty engage

in a virtual book study. Data collection included both quantitative and qualitative instruments detailed in the previous sections, including surveys (pre-survey and post-survey), meeting artifacts, FM reflection journals, a focus group interview, semi-structured individual interviews, and my researcher reflection journal. My data analysis included quantitative analysis (descriptive statistics, paired samples *t*-test, Wilcoxon test) to analyze my survey data and qualitative analysis (thematic analysis) to analyze the remaining data collected. I include further details of my analysis in Chapter 4.

Ethical Considerations

There were several ethical considerations to consider when I implemented a MMAR, including quality, confidentiality, and transparency.

Quality

I implemented several strategies to ensure the quality of both my quantitative (validity and reliability) and qualitative (trustworthiness) strands of research. The research design itself achieved a high level of quality by establishing multiple validities legitimation (Johnson & Christensen, 2017). Multiple validities legitimation involved ensuring my mixed methods research study effectively incorporated the appropriate combinations of quantitative, qualitative, and mixed methods validities, enabling the development of robust meta-inferences (Onwuegbuzie & Johnson, 2006).

For the quantitative strand, I utilized an already validated survey instrument and assessed internal consistency reliability using Cronbach's alpha to ensure my survey measured its intended constructs (Salkind & Frey, 2019).

In the qualitative strand, I employed several strategies to ensure the trustworthiness of my findings, given that this was a qualitative-driven MMAR. Trustworthiness criteria in my qualitative research strand included credibility,

transferability, dependability, and confirmability (Ivankova, 2014). To achieve these criteria, I employed the following three strategies:

1. Member Checking: I conducted member checking, where one member from each audience group (faculty, Faculty Mentor, and staff) reviewed the accuracy of the themes and provided input in developing the study conclusions (Creswell, 2015). Member checking not only contributed to establishing credibility, but also aligned with the collaborative and participatory nature of the action research process (Ivankova, 2014).
2. Rich, Thick Descriptions: My findings included rich, thick descriptions of each theme, characterized by in-depth portrayals of the context, participants, and situations. These descriptions enhanced the transferability criteria of trustworthiness (Creswell, 2009).
3. Researcher Memos: I maintained a researcher reflection journal that served as a memo during the study, qualitative coding, and analysis. This journal provided an audit trail of the data collection, analysis, interpretations, and allowed for reflexivity throughout the research study, ensuring dependability and confirmability.

Finally, as a means of ensuring quality of the mixed methods, I focused on complementarity and legitimization. I used both qualitative and quantitative data to provide complementary insights into the research question, enriching the understanding of the phenomenon from multiple data sources. This was so that my "results from different methods serve[d] to elaborate, enhance, deepen, and broaden" (Greene, 2007, p. 101) the interpretations and findings from my study. Legitimization is used to assess the quality of inferences derived from mixed methods research (Onwuegbuzie & Johnson, 2006; Onwuegbuzie & Johnson, 2017). Legitimation is rooted in the notion

that assessing the quality of research is an ongoing and integral process, encompassing all stages of the research study, from the initial formulation of the research objectives to the ultimate creation of high-quality meta-inferences (Onwuegbuzie & Johnson, 2006; Plano Clark & Ivankova, 2016).

The use of these strategies across different aspects of my study ensured its validity, reliability, and trustworthiness as a quality MMAR study with multiple validities legitimation.

Confidentiality

Several strategies were implemented to ensure the confidentiality of meetings and my research study. I maintained confidentiality with the FMs and their reflection journals by not recording any personal identifying information in their journals. The work participants generated in the book study meetings (discussion, reflection, planning) and the ideas shared during interviews were de-identified, meaning names or anything connecting participants to their work were removed before findings were shared publicly. However, even though every participant was encouraged to maintain confidentiality, complete confidentiality could not be guaranteed due to the nature of group activities.

Additionally, pseudonyms were used for institutions, departments, programs, and participants to safeguard their confidentiality. This decision was primarily made to strike a balance between transparency and confidentiality throughout the research process. Given the limited number of FMs, additional steps were taken to protect their identities and confidentiality. To achieve this, findings and direct quotes in Chapter 4 are presented in the form of one composite character named Alex. A composite character is a representation created by a researcher using data collected from various sources, such as interviews, observations, and texts (Corman, 2021). Alex combines elements from three

FMs to illustrate broader patterns or themes within this research. I used a composite character to retain the complexity and nuances of real-life situations while ensuring further anonymity for interviewees holding public positions (Willis, 2019). This approach was chosen to maintain the integrity of my research while upholding the privacy and anonymity of the FMs, acknowledging the unique challenges posed by their distinctive roles within the study.

Transparency

Using reflection journals, as detailed in the Researcher Reflection Journal section, not only added rigor to the research but also allowed for critical self-reflection throughout the research process. These journals provided a means to document modifications to the research approach and to "make the messiness of the research process visible" (Ortlipp, 2008, p. 704). Maintaining this personal transparency throughout the research process held significant ethical importance in the study to me, particularly as a first-generation college student. I made intentional efforts to specify moments when certain stages of the analysis process became intricate and challenging. I viewed transparency in documenting the changes and complexities of the experience as an essential aspect of my work.

CHAPTER 4

DATA ANALYSIS AND FINDINGS

"I think that's the way I want to go now. I just need to *find the time* to do all that."

-Jamie, Faculty Member

In Chapter 3, I presented my research design, including theoretical alignment, settings and participants, innovation plan, data collection, and ethical considerations. In this chapter, I present my data analysis and findings. The aim of this study was to better understand what happens when engineering faculty, faculty mentors, and staff engage in a Teaching Community of Practice Virtual Book Study (TCPVBS).

This was a qualitatively driven, concurrent, mixed methods action research (MMAR) study. A concurrent MMAR is a study design in which quantitative and qualitative data were "collected and analyzed separately" (Ivankova, 2014, p. 128), and "the results from the quantitative and qualitative study strands and their interpretations [were]... synthesized to find corroborating evidence or to reveal discrepancies" (p. 156). Teddlie & Tashakkori (2009) argue the main benefit of this approach in action research is it allows the researcher to explore a range of confirmatory and exploratory research questions simultaneously (as cited in Ivankova, 2014). This approach aligned well with the goals of my research questions. As my study was mostly based on qualitative methods, due to the innovation design and research questions, I used mostly qualitative data collection tools and analysis. These tools included surveys (pre- and post-surveys), meeting artifacts, journals from Faculty Mentors (FMs), a focus group interview, semi-structured individual interviews, and my own research journal.

While there are many purposes for mixing data with a mixed methods design (Schoonenboom & Johnson, 2017), my purpose was complementarity, which "seeks

elaboration, enhancement, illustration, [and] clarification" (p. 110) of both qualitative and quantitative results. I begin this chapter with the presentation of my quantitative data analysis and findings, followed by my qualitative analysis. Next, I present my qualitative findings organized by theme, and where applicable, incorporate quantitative data. I conclude the chapter by using my findings to answer my research questions.

Quantitative Data Analysis

My quantitative data analysis included both a parametric (paired *t*-test) and non-parametric test (Wilcoxon test), along with descriptive statistics to analyze my survey data. The paired samples *t*-tests and Wilcoxon test were used to determine if there was a significant difference in pre-survey scores and post-survey scores for the level of familiarity of book study topics. Descriptive statistics provided a comprehensive overview of my participants' characteristics, their expectations for the book study, and their quality rating of the book study after the intervention. In Chapter 3, Table 1 provided detailed demographics of my participants. The remaining descriptive statistics, detailed in the following sections, allowed a broader understanding of my data set in general, including averages and standard deviations (Ivankova, 2014).

I developed and utilized a pre-survey and post-survey to collect data on several categories. The pre-survey was divided into two parts: Part 1 included open-ended book study expectations, familiarity scale questions on knowledge of book study topics, and open-ended student perceptions questions. Part 2 of the pre-survey included personal demographics and teaching experience questions. The post survey instrument repeated the familiarity scale questions on knowledge of book study topics and the open-ended student perceptions questions. It also included a section on book study experience, with both scale and open-ended questions.

To ensure internal consistency of the surveys, I used SPSS to identify the Cronbach alpha reliability coefficient of the pre-survey and post-survey instrument for the familiarity scale instrument on knowledge of book study topics. This scale measured participants' level of familiarity with book study material concepts (e.g., metacognition), inclusive teaching (e.g., modeling), and active learning (e.g., project-based learning). I found that the instrument overall is reliable, with a Cronbach alpha score of 0.88 (pre-survey) and 0.78 (post-survey). Although the STEM Faculty Instructional Barriers and Identity Survey (Sturtevant & Wheeler, 2019) instrument I used is still in the early stages of development (Carroll et al., 2023), previous studies have found it to exhibit similar internal consistency (McAlpin et al., 2022).

The survey instrument asked participants to indicate their level of familiarity with each topic on a five-point Likert scale of Never heard of (1) to Very Familiar (5). Each topic was also given a brief description (see survey instruments in Appendix C). The averages of each topic and standard deviations are below in Table 4.

Quantitative Findings

Despite the small sample size (n=12), I was interested to see the difference in reported levels of familiarity from the survey instruments. I first had to determine if my sample had a normal distribution to choose an appropriate statistical method (Ghasemi & Zahediasl, 2012). I visually inspected my data and completed a Shapiro-Wilk test on the paired differences between the pre-survey and post-survey familiarity scores. This did not show evidence of non-normality for the topics of: study cycles ($p=0.106$), inclusive syllabus ($p=0.077$), and modeling inclusive language ($p=0.077$). However, other topics showed the distribution departed significantly from normality, including metacognition, growth mindset, first-generation college students, accessibility, reduced anonymity, diverse perspectives ($p<0.05$). This meant I could only assume a normal

distribution for study cycles, inclusive syllabus, and modeling topics. Based on this, I completed both a parametric (paired *t*-test) and non-parametric test (Wilcoxon test) in SPSS and reported findings in Table 4.

A paired samples *t*-test allowed me to analyze "a single group of the same subjects… being studied under two conditions" (Salkind & Frey, 2019, p. 216). For this statistical test, I formulated the null hypothesis that no difference existed between the pre-survey and post-survey scores of participants. The alternate hypothesis posited a difference in scores.

The paired samples *t*-test results in Table 4 indicate that participants scored significantly better on post-survey level of familiarity in two categories, with large effect sizes:

- **Inclusive Syllabus**, by 0.58 score (t_{11}=2.58, p<.05), with a large effect size of d=0.79.
- **Modeling Inclusive Language**, by 0.58 score (t_{11}=2.58, p<.05), with a large effect size of d=0.79.

I rejected my null hypothesis for survey score comparisons having no difference in mean scores, meaning there would be no difference in average scores. Note that metacognition was also found to be statistically significant, however not with normally distributed data (Metacognition, by 0.58 score (t_{11}=3.02, p<.05), with a medium effect size of d=0.67).

I also completed a Wilcoxon test as the non-parametric test. I wanted to ensure my inferential statistical analysis was appropriate for all pre-survey and post-survey scores. For this statistical test, I again formulated the null hypothesis to be that no difference existed between the pre-survey and post-survey scores of participants. The

alternate hypothesis posited a difference in scores. The Wilcoxon test results in Table 4 indicate that participants scored asymptotic significantly different scores in:

- **Metacognition** ($Z = -2.333$, $p < 0.05$)
- **Inclusive Syllabus** ($Z = -2.111$, $p < 0.05$)
- **Modeling Inclusive Language** ($Z = -2.111$, $p < 0.05$)

Table 4

Means and Standard Deviation for Survey Measures

	Descriptive			Shapiro-Wilk		Paired t-test		Wilcoxon	
Measure	Pre-survey Scores	Post-survey Scores	Mean Difference	W	*p*-value	t_{11}	*p*-value	Z	*p*-value
Metacognition	3.42 (1.08)	4.00 (0.74)	0.58	0.768	0.004	3.02	**0.012**	-2.33	**0.020**
Study Cycles	3.17 (1.03)	3.67 (0.78)	0.50	0.886	***0.106***	2.17	0.053	-1.89	0.058
Growth Mindset	4.17 (0.94)	4.42 (0.79)	0.25	0.479	0.000	1.39	0.191	-1.34	0.180
First-Gen College Students	3.25 (0.75)	3.50 (1.00)	0.25	0.780	0.006	1.39	0.191	-1.34	0.180
Inclusive Syllabus	3.17 (0.84)	3.75 (0.87)	0.58	0.875	***0.077***	2.55	**0.027**	-2.11	**0.035**
Accessibility	3.92 (0.67)	4.08 (0.52)	0.16	0.818	0.015	0.80	0.438	-0.81	0.414
Reduce anonymity	3.83 (0.72)	4.25 (0.75)	0.42	0.768	0.004	2.16	0.054	-1.89	0.059
Modeling	3.33 (0.78)	3.92 (0.79)	0.58	0.875	***0.077***	2.55	**0.027**	-2.11	**0.035**
Diverse Perspectives	3.33 (1.07)	3.75 (1.05)	0.42	0.768	0.004	2.16	0.054	-1.89	0.059

Note. Means and standard deviations are presented for each survey measure. Standard deviations are given in parentheses. The mean difference represents the change from pre-survey to post-survey.

Note. Shapiro-Wilk, paired samples *t*-tests, Wilcoxon tests were conducted to compare pre-test and post-test scores for each measure. Normality *p*-values ($p > .05$) are indicated in bold, italics for Shapiro-Wilk. Significant *p*-values ($p < .05$) are indicated in bold for paired samples *t*-tests and Wilcoxon tests.

Across these parametric and non-parametric statistical analyses, I concluded participants' mean difference in their level of familiarity to be significantly higher for metacognition, inclusive syllabus, and modeling.

In addition to the above, I inquired about participants' familiarity with various active learning strategies on the surveys, such as Muddiest Points, Think-Pair-Share, Interactive Lecture, and Project-based learning. Although the TCPVBS and my research did not primarily center on these strategies, I aimed to assess the participants' knowledge in these areas to gain insight into the teaching strategies and the extent of their pre-existing knowledge as they entered the TCPVBS. It is noteworthy that the participants consistently reported substantial familiarity with these active learning approaches, spanning the entire spectrum of active learning methods. Although self-reports of instructional strategies may not accurately reflect real-world practices (Dancy et al., 2016), when paired with other data (e.g., years teaching at the college level, participant majority were in teaching track positions, and my own observations during discussions), the self-reported accuracy could be supported. Researchers have found that STEM faculty can accurately report levels of familiarity with terminology (Emenike et al., 2013). The pre- and post-survey score means and standard deviations, along with the mean difference in pre- and post-survey level of familiarity scores for active learning strategies are presented in Table 5.

Table 5

Active Learning Means and Standard Deviations

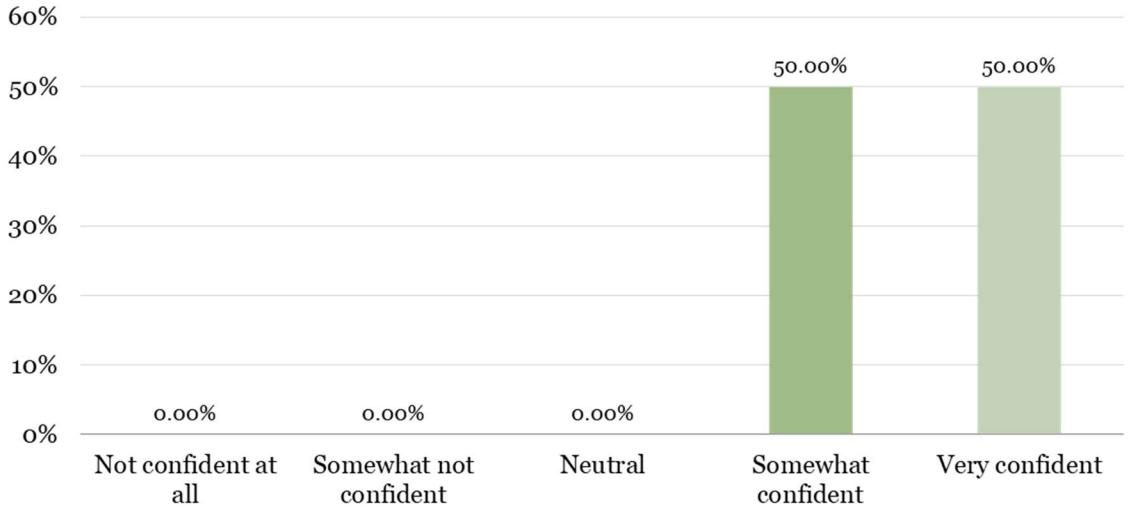
Measure	Pre-survey Scores	Post-survey Scores	Mean Difference
Muddiest Points	4.58 (0.67)	4.75 (0.45)	0.17
Interactive Lecture	4.58 (0.79)	4.83 (0.39)	0.30
Think-Pair-Share	4.58 (0.67)	4.58 (0.67)	0.00
Project-based Learning	4.08 (0.79)	4.67 (0.49)	0.58

Note. Means and standard deviations are presented for each survey measure. Standard deviations are given in parentheses.

I now shift my focus to the post-survey data. As mentioned previously, the post-survey instrument repeated the familiarity scale questions on knowledge of book study topics and the open-ended student perceptions questions. It also included a section on book study experience, with both scale and open-ended questions. In the post-survey, participants reported positive and negative factors influencing their confidence in implementing teaching strategies from the book study on the post-survey. Participants reported their confidence was positively impacted because they perceived many of the strategies as relatively easy to put into practice. Furthermore, as a few participants engaged in experiments with these strategies during the book study, they boosted the confidence of others in implementing them. This occurred as others had the chance to hear about the experiences of those who had previously tried out a particular strategy. Several participants noted their years of experience teaching also enabled their confidence to implement a strategy from the book. Overall, all participants reported that they were ‘somewhat confident’ or ‘very confident’ to implement a strategy from the TCPVBS.

Figure 6

Confidence to Implement a Strategy



Alternatively, the participants reported several factors that negatively influenced their confidence. These adverse effects primarily stemmed from limited time constraints and concerns about how students might perceive the strategies.

On the post-survey, participants noted they found the book study meetings to be well-organized and interactive, with useful discussions and resources. Overall, participants found the book study to be a valuable learning experience and suggested continuing with similar initiatives in the future. Value scores for TCPVBS elements and overall quality scores are in Figure 7 and Figure 8, respectively.

Figure 7

Level of Agreement Statements Related to Book Study Elements

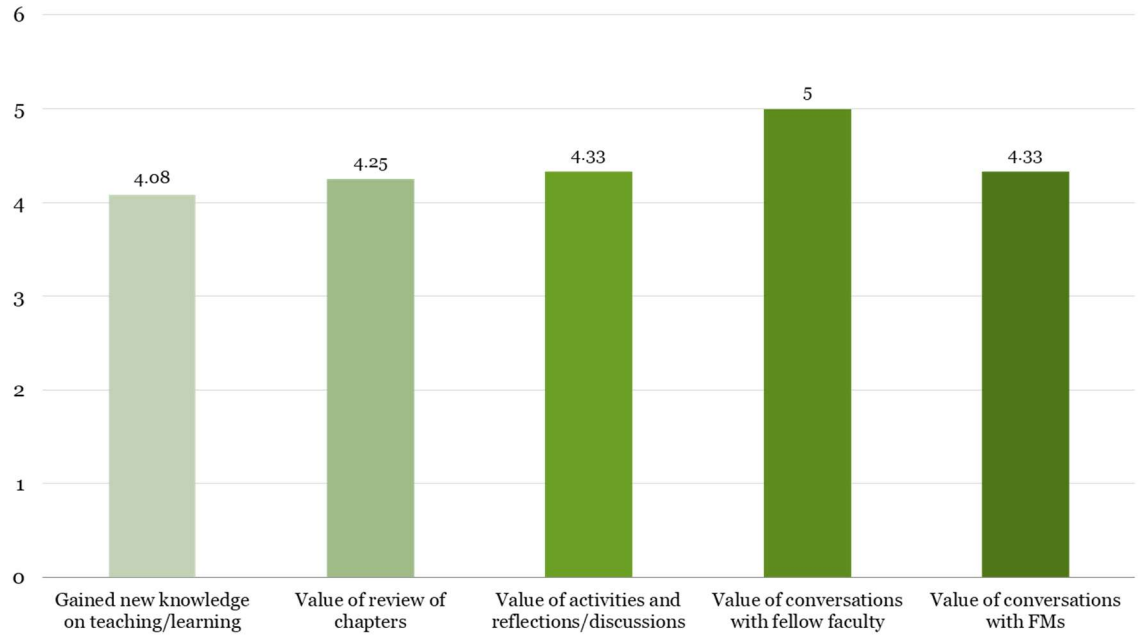
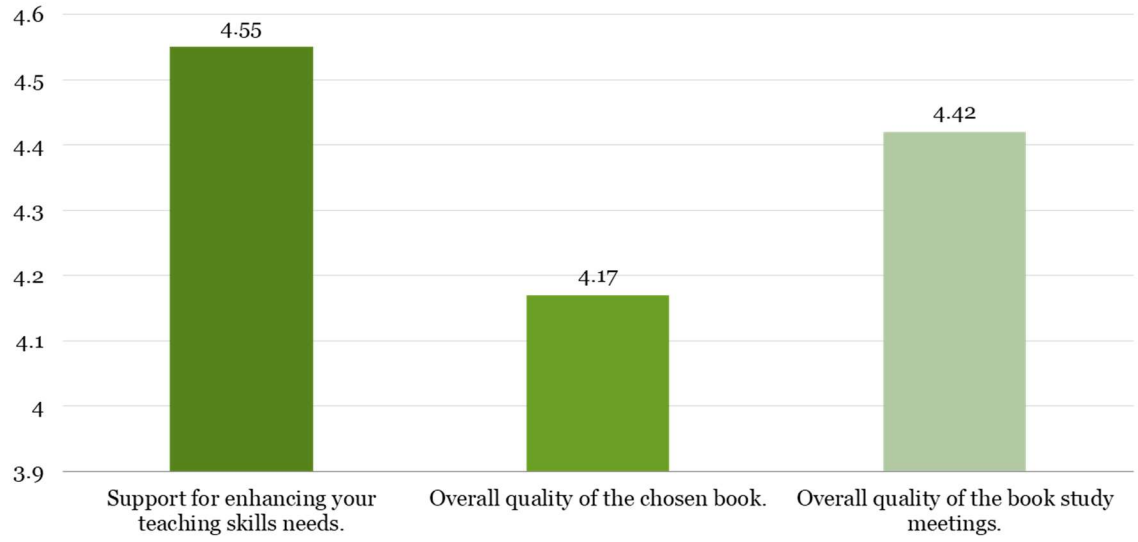


Figure 8

Quality Ratings of Book Study



Qualitative Data Analysis

To analyze my qualitative data, I used thematic analysis (TA), "a method for systematically identifying, organizing, and offering insight into patterns of meaning (themes) across a data set" (Braun & Clarke, 2006, p. 57). In order to conduct a TA of my data, I followed the iterative process outlined by Braun and Clarke (2006) and across these steps utilized strategies for coding and making sense of the data suggested in Saldaña's (2016) coding manual.

Braun and Clarke (2006) describe TA as consisting of 6 steps. While described numerically in a linear order, researchers move backward and forward between steps as they make progress through the process:

Step 1: Familiarize yourself with the data

Step 2: Generate codes

Step 3: Search for themes

Step 4: Review potential themes

Step 5: Define and name themes

Step 6: Report out

Below I utilize Braun and Clarke's (2016) steps to structure the presentation of my analysis process. While this process includes six steps, I added Step 0 as a place to share the analysis I did simultaneously with data collection during the innovation. Steps 1-6 represent my TA work post study and data collection completion. While I present these steps linearly below, I want to emphasize that I engaged in a significant amount of iteration within the analysis process. This iteration occurred both across steps and within each step.

I made sense of the data through an iterative analysis process, employing various methods. These methods included printing out codes and themes, physically arranging

them to identify connections, drawing ideas and concept maps on a whiteboard, writing memos in my researcher reflection journal, and engaging in conversations with my chair as an analytical method. This process was complex and involved multiple iterations, emphasizing the non-linear nature of research (Ortlipp, 2008).

Step 0: Data Collection and Analysis Across the Innovation

I actively engaged in data collection and analysis as I facilitated the book study, which involved reviewing pre-survey responses to understand participants' expectations and comments. I continually adapted the meeting structure and the balance between discussion and activities by incorporating feedback from the review of FM reflection journals. I also maintained a reflective journal and regularly made notes during and after each book study meeting. These efforts allowed for a dynamic and responsive approach to facilitating the book study. I made notes in my journal on discussion topics and questions, which allowed me to tentatively identify potential themes and the perceived impact or value of the TCPVBS.

Step 1: Familiarize

The aim of Step 1 of TA is "to become intimately familiar with your data set's content" (Braun & Clarke, 2006, p. 61). While I acquired some understanding of the data from reading and reviewing during collection and by conducting the focus groups and interviews, in this step, I worked to become more familiar with the data. To do so, I cleaned and organized my transcripts from the focus group and interviews. I then read and re-read through the cleaned transcripts. I then revisited my other datasets, immersing myself once again in FM journals. Additionally, I re-examined the open-ended question responses from the surveys and reviewed meeting artifacts, such as polls and Jamboards. It was during this step that I conducted my quantitative analysis to familiarize myself with average survey scores.

Throughout this familiarization process, I kept memos in my researcher reflection journal and captured ideas that stood out to me on a whiteboard. See Appendix E for several examples of whiteboard ideations. I found that utilizing both methods simultaneously to familiarize myself with the data at this step was helpful for keeping notes (memos in my journal) and for visualizing the data (whiteboard).

Step 2: Code

The second step was coding. Codes form the fundamental components of TA, and support researchers in actively identifying and labeling data features that potentially relate to their research questions (Braun & Clarke, 2006). They are usually short words or phrases that symbolize or assign a brief, important, essence-capturing description for a piece of text or visual data (Saldaña, 2016). I used two cycles of coding for this step, In Vivo and pattern codes, along with some landscape coding to help me transition from the first and second coding cycle.

In Vivo Coding

In Vivo Codes are verbatim excerpts, capturing words or brief phrases directly from the data, with the aim of prioritizing and respecting the participants' voices (Saldaña, 2016). In Vivo Coding was an important method for my first cycle of coding because it allowed me to identify my participants' precise language in order to "keep the 'story' intact" (Riessman, 2008, p. 74). This approach, aligned with my critical theory perspective, facilitated the contextualization of learning within the unique experiences of the participants. By prioritizing participants' own words in my initial coding, In Vivo Coding served as a valuable tool for understanding the social context, norms, intersectionality, and intricate realities within the complex system of faculty experiences in the TCPVBS. I utilized MAXQDA software for coding. At the end of this cycle of

coding, I had 757 In Vivo Codes across my interview transcripts, focus group transcripts, and FM reflection journals. See Table 6 for a few selected In Vivo Codes.

Table 6

In Vivo Code Examples

Participant	Participant Type	In Vivo Code
Alex	Faculty Mentor Composite Character	"you know all students benefit"
Morgan	Faculty	"mistakes is brave"
Jesse	Faculty	"they've got a perfect class"
Jamie	Faculty	"do my peers agree with me?"
Ash	Faculty	"putting in my 2 cents worth"
Jordan	Faculty	"her insights and her perspectives"
Kendall	Faculty	"communicate with your actual colleagues"
Charlie	Staff	"things that are reasonable"
Tatum	Staff	"hear similarities"
West	Staff	"improve our practice"

Between Coding Cycles

Saldaña (2016) overviews several ways that researchers can transition from one coding cycle to the next, in order to "strategically cycle forward" (p. 212). To do this, I utilized code landscaping, more commonly known as Word Clouds, to continue to visualize my data and to get "a 'first draft' visual look" of the "most salient words and thus potential codes and categories" in my data across the first cycle of coding (Saldaña, 2016, p. 223). When I generated the Word Cloud using all the data, I did not discern any noteworthy patterns. This might be attributed to the size and complexity of my datasets or, as noted by Saldaña (2016), the fact that this transitional step is intended to be exploratory and is not always a reliable indicator of what may hold significance in the

data. Nevertheless, I subsequently crafted Word Clouds for each participant group, which revealed divergent emphases based on the audience. For instance, faculty participants emphasized words and phrases related to their students, while FMs' and staff's data emphasized ideas concentrated on other faculty members. Recognizing this audience-based difference, I proceeded to the next cycle of pattern coding, beginning with FMs, followed by faculty, and finally staff transcripts.

Pattern Coding

I used Pattern Coding as a second cycle coding method to group the initially summarized segments of data from the first cycle into smaller numbers of categories, themes, or concepts (Saldaña, 2016). According to Saldaña (2016), "The goal during the second cycle coding is to develop a sense of thematic organization from the array of first cycle codes" (p. 234).

Pattern codes helped clarify and uncover emerging themes and structures, simplifying a significant amount of data from the initial coding phase into more understandable and concise analytical units (Saldaña, 2016). I examined the first cycle of In Vivo codes by participant group to identify commonalities and then linked them to pattern codes, with the aim of giving them a sense of purpose and organization (Saldaña, 2016, p. 235). See Table 7 for examples of pattern codes, with direct excerpts, and my interpretation for more context.

Table 7

Pattern Codebook

Pattern Code	Excerpt	Interpretation
Reinforced Current Teaching	"It was a good reminder of some things that I think I do already, but maybe could do them more intentionally. Or just a good reminder that oh, it is important to do these	Reflection on book study material not being new ideas or new content, but reinforcing current instructional practices.

Pattern Code	Excerpt	Interpretation
	things. It's good that I'm doing these things." (Jordan, individual interview)	
Knowledge-sharing Dialogue	"Talk to your peers and kinda see what it is that they're doing. And you know, see what kind of success stories and pitfalls are related to some of the things that they've been doing." (Kendall, individual interview)	Conversation with peers seeking practical advice and insights, with the intention of applying that knowledge.
Welcoming Classroom Environment	"But another part of it was also sort of normalization and welcoming in the classroom environment. And this one was sort of subtle… How the author was expressing how to approach these things, and a lot of it was like, 'Hey my career is not been linear. I was a terrible student. Here's how I learned to do it.'" (Alex, individual interview)	Reflection on a major takeaway from the book text being the author sharing her academic journey, normalizing failure in STEM, and using this to create a more welcoming environment for students.
In Practice Impact	"And I did that this semester, based on what she recommended in her book, and I had, I'm going to probably say 4 or 5 students that came to me after class. Just bowled over, saying, 'We never realized that's what you were trying to get us to do.' And then it made an impact in those particular students that just got it. Their practice in their reasoning just blossomed over the remainder of the semester." (Ash, individual interview)	Sharing the experience of implementing one of the strategies from the book text and an anecdote from conversations with several students afterwards on impact seen.
Faculty Learning Needs	"When I read the book, I think, 'Okay, wait there's 76 strategies in this book, right? And this person's implemented everything. And they've got a perfect class.' Actually, that's probably not true. And it helps to see that with other people." (Jesse, individual interview)	Comment on the value of talking with peers on implementing strategies in the class and that there does not need to be an expectation of perfection.

My pattern coding underwent numerous iterations. Initially, there were 45 pattern codes, but I eventually consolidated and renamed several of them. By the end of this process, I had condensed the pattern codes to 37. While I grouped most of the In

Vivo Codes under pattern codes, there were a few In Vivo Codes that did not conform to any discernible pattern. Additionally, these In Vivo Codes lacked sufficient alignment with other In Vivo Codes to justify the creation of their own pattern code.

Steps 3: Search and Name Themes

Across the remaining steps, I searched for and named themes. Themes can be discerned within the data by observing recurring ideas and even the absence of certain topics not discussed or present (Saldaña, 2016). According to Saldaña (2016), themes can also be found in "participant or indigenous terms, metaphors and analogies" and "linguistic connectors" (p. 203). My approach to searching for these themes involved a hands-on approach with the data; I printed the pattern codes from MAXQDA and examined them for connections or common elements. For instance, I grouped the 'Reinforced Current Teaching' pattern code listed in Table 7 with other pattern codes such as 'Blind Spot Recognition,' 'Student Blind Spots,' 'Faculty Blind Spots,' 'Personalized Teaching Needs,' and 'Fear of Missing Out' to construct a theme that will be detailed in a later section of the chapter (*reflection on practice*). Following my examination of the grouped pattern codes, I assigned names to the clusters of pattern codes that formed into distinguishable themes.

Steps 4-5: Review and Define Themes

I reviewed and defined themes by constructing a themes table from the clusters I was seeing in the pattern codes. This enabled me to refine each theme's name, definition, excerpts from the data, and alignment with my research questions. Initially, I assessed the themes to ensure their distinctiveness and relevance to my dataset. Then, I evaluated the themes in the context of my entire dataset, as recommended by Braun and Clarke (2006). This process allowed me to establish the boundaries for each theme, assess the

presence of meaningful and diverse data points supporting each theme, and make the determination of whether it constituted a theme or merely a code.

While initially attempting to organize the themes by research question, I found this approach ineffective and unrepresentative of my data. To address this, I printed the themes and sub-themes and physically arranged them, as illustrated in Figure 9 in the conclusion portion of the qualitative findings section. This approach provided me with a clearer understanding of how the themes interrelated. Subsequently, I proceeded to compose the qualitative findings report, organizing it by theme.

Step 6: Report Out

The reporting process remained continuous and iterative. While documenting my findings in this chapter, I made revisions to the themes and their respective definitions. Initially, I incorporated sub-themes under each major theme. However, as I progressed toward the final reporting stage, I realized that these subthemes had primarily functioned as useful headings during earlier stages to make sense of my data and establish connections among my pattern codes. In the context of presenting my findings, they became less pertinent. This realization prompted me to shift my focus to major themes.

I briefly describe each theme in Table 8 before proceeding to present my qualitative findings in the next section.

Table 8

Themes Table

Theme	Short Description
Centerpiece	A central element or shared topic that served as a reference point to anchor participant commitment and engagement throughout the Teaching Community of Practice Virtual Book Study (TCPVBS).
Camaraderie	A strong sense of mutual trust, togetherness, cooperation, and support within the TCPVBS group, which fostered a positive atmosphere.
Reflection on Practice	The role of reflection in shaping teaching practices, from reinforcing existing approaches to identifying and addressing blind spots.
TCPVBS Culture	This culture relates to the characteristics (attitudes and behaviors) seen inside TCPVBS, which at times run counter to the outside engineering faculty culture.
Motivations	The diverse motivations that drive participants to engage in TCPVBS and the unexpected values they discovered, despite facing various constraints.
Mentorship in a CoP	Faculty Mentors acted as resource bridges, promoting enriching conversations, facilitating connections, and nurturing a safe and inclusive learning environment within the TCPVBS by modeling and being learners themselves.

Qualitative Findings

I present the following themes: *centerpiece, camaraderie, reflection on practice, TCPVBS culture, motivations,* and *mentorship in a CoP*. To do so, I report on each theme with a more detailed description of each theme (than the above Table 8) and use evidence from the various data points (i.e., focus group transcripts, interviews, FM reflection journals). When appropriate, I also weave in quantitative data (i.e., survey findings). I aim to showcase the complementarity of the different strands of data to "elaborate, enhance, deepen, and broaden" (Greene, 2007, p. 101) the interpretations and findings from my study.

Theme 1: Centerpiece

> I do think, having that kind of common centerpiece… this time being the book, is helpful in terms of providing this engagement. It's not just… we're gonna talk about this topic… It's 'Read this, and then let's discuss it.' (Kendall, Focus Group Interview)

Throughout the TCPVBS innovation, having a *centerpiece,* or shared topic, served as a reference point to anchor participant commitment and engagement. *Centerpiece* referred to a central element used as a starting point for discussions and collaborative understanding in the TCPVBS. As Kendall noted in the opening quote, having specific readings beforehand was helpful to ground the discussion during meetings. This *centerpiece* was often strategies related to *Teach Students How to Learn* or topics from supplemental materials, but participants did not feel limited to just these learning materials. I envisioned the book study as a scenario where all participants sat around a circular table with a *centerpiece*, in which each participant viewed the *centerpiece* from their unique perspective and used it as a starting point for conversation.

Before book study meetings, each participant was required to individually engage with assigned learning materials. This engagement entailed a commitment to reading and understanding the book chapters and supplemental materials. This ensured that everyone had a baseline understanding of the shared topic, thereby fostering more meaningful, grounded group discussions.

> I liked having a task to do outside and bringing it back. It kind of gave a central purpose to it, gave us a focus. But also had people prepared so that it wasn't trying to come up with ideas on the fly. (Alex, individual interview)

> To kind of learn something new, like discuss and have those discussions, but with the context of a shared reading experience. (Jordan, individual interview)

However, the shared topic often evolved beyond the book chapter texts or supplemental materials. Rather than requiring the book's strategy to be perfectly

relevant, having a *centerpiece* allowed the learning materials to serve as a starting point for discussion. Alex shared that even if the reading material was not perceived as a good fit for their classrooms, it still offered an opportunity for further learning.

> The leading activity to start the discussion was excellent and served to break the conversation ice very well. I think the group kind of hijacked the agenda, but we still shared a lot of good experiences and thoughts, and the conversation stayed topically close to the book material… I've found it challenging to fit these metacognitive strategies into my courses, having a practical discussion was very helpful. (Alex, FM journal entry)

The discussion being "topically close" to the book chapter text was also in part due to participants finding a problematic and deficit perspective in some of the book's content. Some also mentioned the less accessible nature of certain approaches. As noted by Alex, despite the book's content presenting challenges, it still served as a focal point (*centerpiece*) for facilitating meaningful discussions.

> I had a long conversation prior to the book study [meeting] about if what the book was doing was teaching 'learning' or 'studying' habits. The title of the book bothered me… [and] the question I was left asking - is it enough to get students to A's or do we need to teach in a way that allows them to take the material past our classroom? My obvious answer is the latter but are we truly doing that in our classrooms?" (Alex, FM journal entry)

A student-centered approach to teaching consistently emerged as a shared topic of discussions, occasionally viewed through an inclusive lens. This approach was an intentional outcome of my research study design. While the primary learning material for the TCPVBS was chapters from the book, I complemented each meeting with supplementary materials that illustrated inclusive teaching strategies and considerations for first-generation college student experiences. Many of the discussion topics and questions I presented to participants were framed within this context. Jesse commented on how their teaching practices evolved to better meet the changing needs of learners and Alex reflected on how strategies benefiting all students could bridge gaps for specific subpopulations.

> And it's not just learning styles, too. And the book did this a little bit, but thinking about the different backgrounds and experiences that students bring into the classrooms and everyone's K-12 experience or their level of knowledge about engineering and math, and and everything is, could be a little bit different, right? (Jesse, individual interview)

> What we should be focusing on, the goal, is that everybody benefits and that you're narrowing.. and you're narrowing this gap. But the strategies they've employed weren't specific to any population. Right? They were just the strategy that should work for everybody. (Alex, individual interview)

This *centerpiece* to the conversation also included connecting to practical strategies to help one another find solutions to problems, as Morgan mentioned.

> People were open to find solutions…When professors meet together, we like to complain. We don't find solutions, but in this group, I find that there were solutions, so they wanted to here. (Morgan, individual interview)

Connecting to the complementarity of this theme, the value of having a *centerpiece* was also reflected in pre-survey data, where participants shared their expectations for book study meetings. Many stated they expected to discuss and implement strategies from the book, such as metacognition and motivation. Participants also wanted an opportunity to discuss with peers, with a particular focus on the practical application of strategies.

Having a *centerpiece* as a starting point for shared understanding provided participants with a common foundation they could all buy into, even if they had different perspectives. It offered a platform for discussions, provided an anchor for exploration of applications. The theme *centerpiece* provided a firm foundation for other themes. This collective and shared experience across time allowed the book study group to build *camaraderie* and *reflection on practice*.

Theme 2: Camaraderie

> It's just if nothing else.. camaraderie. To be able to say, 'Hey? This thing that you say you're having trouble with? Yeah, I'm experiencing that, too.' (Kendall, individual interview)

Camaraderie refers to a strong sense of mutual trust and unity among a group of people who share common interests, goals, or experiences. *Camaraderie* in the TCPVBS involved a feeling of togetherness, cooperation, and support within the group, which fostered a positive atmosphere. The presence of open-minded and motivated colleagues within the group proved instrumental in enhancing the collective experience. *Camaraderie* served as a source of support and empathy for faculty. This theme highlighted the importance of togetherness in finding solutions to challenges faced in teaching. Through the *camaraderie* fostered in the TCPVBS, faculty were assured they were not alone in the challenges they were facing.

> I think we all kind of know that the challenges we face are, you know, widely universal in many respects. But it is always kind of nice to kind of see everyone come together. (Kendall, individual interview)

> I really felt that it's useful to have somebody to talk about or talk to this stuff about, rather than just reading books on my own. (Jesse, individual interview)

Participants also valued the chance to strengthen their connections with colleagues they were already familiar with and to gain new insights. Morgan emphasized the importance of not only meeting new people but also getting to know her colleagues more deeply. Alex expressed gratitude for the opportunity to gain a fresh perspective from a peer.

> Also meeting new people or people that I know, but also getting to know them better and deeper. (Morgan, individual interview)

> We didn't even interpret the question the same way, like I, I love differences like that. (Alex, individual interview)

In their reflection journal, Alex documented their conversation with others regarding student resistance to strategies and the difficulty of assisting students facing external barriers, such as employment. These discussions took place within randomly assigned, small breakout rooms on Zoom, which were employed in multiple book study meetings.

> I spoke to my group a lot about the resistance that students might have especially as it relates to time management. Many of our students are working part- or full-time jobs and to add this on top of that may seem overwhelming. (Alex, FM journal entry)

The concept of faculty grappling with student resistance to change was also broached by Jamie, who noted that engaging in discussions with others proved beneficial in addressing her challenges regarding her allocation of time and effort, particularly concerning students who were "open" to change.

> So, it's like there's only so much time we can devote to a particular student, and we need to focus on the rest who are open to changing. But yeah, that's a painful pill to swallow. Because we want to help everybody... It also felt like, okay, I'm not the only one struggling with this particular issue. No, that was a nice thing. (Jamie, individual interview)

Faculty did not expect to discover *camaraderie* when they joined the book study, but as they reflected during the interviews, this became evident as a valued theme. In summary, c*amaraderie* was found through building trust by discussing shared experiences and fostering togetherness. Using the *centerpiece* as a foundation, trust was built through c*amaraderie*, and this trust fostered *reflection on practice*.

Theme 3: Reflection on Practice

> Maybe this was the circle. And now it's a triangle... it's slightly different than it was before, but that doesn't mean that it's completely gone. (Alex, individual interview)

This theme explored the challenges and significance of reflection for faculty members. *Reflection on practice* involved not only acknowledging effective strategies

they wished to implement, but also reinforcing their current strategies and plans for future enhancements in their courses. As Kendall observed, some participants discovered the TCPVBS reinforced their existing teaching approaches. Jamie also commented on her future implementation plans, which were further supported by the content of the book study.

> You know what's interesting. Is that a lot of what the book club at least kind of reinforced for me was content that I, you know, kind of already cover. (Kendall, individual interview)

> So, like this study, this book study has been kind of reinforcing I think that's the way I want to go now [with a new strategy]. I just need to find the time to do all that. (Jamie, individual interview)

Recognizing blind spots also surfaced as a crucial aspect of *reflection on practice*. Identifying these blind spots involved faculty recognizing areas or elements of their teaching methods, strategies, or beliefs they might have overlooked or not fully understood. Faculty members, including Jamie, noted engaging in the TCPVBS was an essential step in uncovering these blind spots.

> And well, you don't know what you don't know, so I always thought maybe this [participating in the book study] might introduce some concept that I have never thought of. (Jamie, individual interview)

Alex also acknowledged their own blind spots in two areas: teaching approaches and the knowledge of other faculty members, as documented in their reflection journal.

> My teaching has focused on belonging and involvement, but I have not well integrated these other aspects [re: Metacognition and Growth Mindset strategies for motivating learners, specifically autonomy and self-esteem]. (Alex, FM Journal Entry)

> In helping faculty consider growth mindset in their teaching, I assumed that most knew about or utilized these ideas. I'll now come in with a different assumption and collect some data to share that demonstrates that these ideas and techniques are beneficial. (Alex, FM Journal Entry)

Recognition of blind spots is not solely an individual endeavor; it also encompasses actively engaging with and soliciting feedback from others. This

collaborative approach allows individuals to gain diverse perspectives and insights, fostering a more comprehensive understanding of their blind spots. By involving peers in this process, participants could collectively work towards addressing and rectifying these hidden areas of their practice or knowledge. I observed this blind spot recognition occur in conversations and discussions during book study meetings as faculty reflected on their instructional practices and student learning.

Several participants also experienced a "fear of missing out" and expressed a desire to observe what others were doing and learning. Both Kendall and Jordan mentioned their curiosity about “who” was participating in professional development (PD) opportunities from CTL and “what” was happening within these learning experiences.

> I did the teaching community of practice meetings. And those were always really interesting... and then, you know, since then they've always conflicted [with my schedule]. So, I was again kind of anxious to get back to, to kind of, see what was going on. (Kendall, individual interview)

> I thought this was a really kind of cool idea to see like who comes to these kinds of things [the TCPVBS]. (Jordan, individual interview)

In summary, *reflection on practice* showcases the role of reflection in shaping teaching practices, from reinforcing existing approaches to identifying and addressing blind spots. Faculty members benefit from sharing experiences and learning from their peers to continually enhance their teaching methods.

Theme 4: TCPVBS Culture

> The norm is not humanized, flexible professors. Especially if you're someone who's been through a PhD program, or something like that, that's been in it for a really long time. It's sort of like you *survived* rather than you were *cultivated*. (Alex, individual interview)

TCPVBS culture relates to the cultural characteristics observed within the TCPVBS, which at times ran counter to the outside engineering faculty culture. While, the findings discussed in this chapter are based on participants' experiences across the

TCPVBS, it is essential for me to acknowledge that the attitudes and behaviors (Chen et al., 2008) that participants brought to the book study were influenced by various factors, including engineering culture, faculty culture, the College of Engineering (CoE) culture, and the institutional culture at SU. These external influences, brought in participants' 'backpacks' to every meeting, played a significant role in shaping conversations during the TCPVBS and interviews.

The *TCPVBS culture* emphasized the individuality and distinct teaching styles of faculty members. Engineering faculty members participating in the TCPVBS prioritized authenticity in their teaching methods, incorporating their unique identities and styles into their pedagogical approaches. They aimed to build meaningful relationships with students and redefine the faculty's role in the classroom.

> And when it comes to learning how to be a better teacher, or learning how to be a better you know, how do I put it? A support person for the student. Right? A lot of students come to class or they come to office hours, and they're dealing with other issues. And it may not be something I can help with. I can always point them to somebody who can help them with that. (Jesse, individual interview)

> I want to make sure that they have their studies, their priorities, like they prioritize their studies. But in a healthy way. I don't want the old school model, like with the teacher being the authority, and the student being the person that you know only listens or they don't have the freedom to express themselves in an honest way. But always, you know, with boundaries like respect. (Morgan, individual interview)

> And it's just like that's my job is to teach you how to learn. It's not my job to dump information into your head. So, they're pretty uncomfortable with that. Which really makes me happy because it's not until they become uncomfortable with something that they then begin to grow. (Ash, individual interview)

Faculty culture, particularly within the field of engineering, frequently encourages risk aversion. Faculty members, being experts in their respective disciplines and having succeeded in their own educational journeys, often hold themselves to a standard of perfection when it comes to teaching. This mindset makes them reluctant to embrace new instructional strategies. Faculty members typically only take steps to

improve their teaching skills when they receive direct feedback, such as course evaluations or student complaints. This faculty culture was evident in Cycle 0/1 as well. Counter to this, as part of the *TCPVBS culture* several participants in the book study emphasized the importance of faculty members' role in modeling failure. They believed this helped establish meaningful connections with students and normalize faculty members' humanity.

> It's like modeling successful failure… I think if you can see that in your professor, then that makes a relationship bridge. It makes it easier to reach out for help, and students are more likely to you know say, like, 'Oh, failure is normal, and I can keep doing it and develop that persistence and develop that grit'. (Alex, individual interview)

> Sharing stories about being a living, breathing human who overcame obstacles. (Book Study Meeting 3 Jamboard Sticky Note, Anonymous)

The Jamboard Sticky Note was in response to asking participants to share a student motivation strategy they had previously employed to promote autonomy, competence, belonging, self-esteem, and enjoyment. The five elements, as discussed in *150 Ways to Increase Intrinsic Motivation in the Classroom* (Raffini, 1995; as cited in McGuire, 2015) constitute the foundations of intrinsic motivation outlined in *Teach Students How to Learn* (McGuire, 2015).

Engineering as a discipline places a significant emphasis on learning from failure, which enhances problem-solving skills, fosters creativity, and encourages innovative thinking. As quoted at the beginning of this theme, engineering faculty culture often prioritizes survival over cultivation. This culture also places faculty members under pressure to maintain control and perfection in the classroom while navigating their evolving identities as educators. Within the *TCPVBS culture*, faculty members preferred to infuse their teaching materials with their personal style and ensure that the content aligns with their comfort and presentation preferences.

> There's a there's another sort of sense of authority that comes with running a classroom.
> The expectation is that as a teacher I'm perfect and as a teacher I don't make mistakes.
> I have to show strength at all times, otherwise I risk losing control of my classroom. (Alex, individual interview)

> I tend to even if there was something that was completely just, you know, designed to be plug and play... I tend to like to add at least my own style to it, or you know, just make sure that it makes sense and flows in a way that I would be, you know, comfortable presenting or giving the information. (Kendall, individual interview)

> I always found what worked out best is as they're doing some particular assignment or project - teaching it as they're going through it. That seems to work better for me. I could just see my particular teaching style. That seems to click. (Jamie, individual interview)

Additionally, faculty members acknowledged their teaching styles are deeply connected to their identities, counter to being something perfect. Alex emphasized that their teaching style reflected their personality, which has proven beneficial.

> I teach the way I am. And I teach very differently because of that. I think it's been a benefit to me. (Alex, individual interview)

It was for this reason Alex recognized the challenge of incorporating new teaching strategies from the successful experiences of other faculty. Alex noted this is because the effectiveness of a strategy depends on the unique characteristics and skill sets of individual faculty members. Alex pointed out that studies highlighting the success of a single professor's teaching approach may not necessarily translate well to other classrooms due to the distinct identities and circumstances of each faculty member.

> A lot of times you'll see these studies. It'll be like a single professor in their classroom, and they saw these great benefits.... [But] you can't pull out that one new thing that they did versus who they are as a human being... Because it's not necessarily going to translate. It's not necessarily going to do well in everyone else's classroom. (Alex Transcript, individual interview)

In summary, the *TCPVBS culture* theme emphasized the importance of individuality in teaching methods, the value of authenticity, and the role of modeling failure. It highlighted the intricate relationship between faculty identities, approaches,

and the broader faculty culture. Through the foundation of having a *centerpiece*, trust was built through c*amaraderie*, and fostered *reflection on practice*. As faculty engaged in this *reflection on practice*, they brought up how the *TCPVBS culture* both encouraged new teaching practices and identified aspects of the external culture that acted as barriers to experimentation. This *TCPVBS culture* could have been counter to the outside culture because of the identities and mindsets of the participants that opted to voluntarily participate in the TCPVBS.

Theme 5: Motivations

> I like my own time to process everything. And again, I like to listen to people and then I feel more comfortable to share when it's one on one or smaller groups like what we did in breakout rooms. That's the perfect environment for me to learn, and you know, also share. (Morgan, individual interview)

The theme, *motivations,* explored the motivations driving faculty, faculty mentors (FMs), and staff to engage in the TCPVBS and the factors behind their participation. This theme also includes the unexpected values participants derived from the experience. While this theme centered on motivation, it is essential to acknowledge participants encountered barriers along their PD journey - most specifically, limited time.

Participants shared several PD characteristics, in general, that motivated them to attend the TCPVBS, including wanting to learn from peers and gain insights into innovative teaching strategies. As noted in the opening quote from Morgan, faculty were also motivated to find opportunities that allowed them to actively engage in the content, with others, and in varied ways. Additionally, faculty and FMs recognized the utility value of performance evaluations.

> Typically, it's really, I'm trying to figure out how to patch things that I perceive as weaknesses in my own teaching skills lately. (Alex, individual interview)

> I definitely look for active engagement… that's what I like. And a chance to learn something new. (Jordan, individual interview)

> But you know, to be frank, of course, there is… professional development expectations in terms of our growth and in our evaluation. (Kendall, individual interview)

Additionally, faculty uncovered unexpected values during the TCPVBS. These unexpected values are important to note and use in the future to motivate faculty to participate in other PD opportunities.

> I like the fact that there are people from different sorts of groups of classes, and we can discuss these strategies across. Not just, you know, one class, but a set of different classes. (Jesse, individual interview)

Alex noted an unexpected value, from a FM role, was how the structure of the TCPVBS allowed for reciprocal mentoring.

> I got additional ideas for how I could do that better. Whereas most of the time I'm talking to people… So, I'm just kind of giving information. And so, it was really nice to be able to have a conversation about something I was already doing, and how I could do that better. (Alex, individual interview)

While many of the themes and excerpts up until this point in the chapter have been representative of all participants (faculty, FMs, and staff) it is in the *motivations* theme that I make a distinction for staff participants. Distinct from faculty and FMs, staff participants played a unique role as "connective tissue" for faculty, aiming to anticipate faculty needs, share resources, and gain insights into teaching strategies. Their participation in the TCPVBS was driven by the goal of better supporting the larger faculty body.

> I think faculty are so used to just sharing a document or a resource. And especially when we help them design… that connective tissue between things. Like, 'Why are we doing this? How does this relate to that?' (West, individual interview)

> It's always helpful to hear either anecdotal stories or how faculty are dealing with challenges or things that they're focusing on in terms of their teaching… to go beyond just kind of like what we might anticipate or predict what would be faculty challenges, but also hearing from them. (Tatum, individual interview)

> It's just something else to add to kind of the toolbox….If there is anything that I can learn that I can reference to and use as a source to support faculty. Then why not? (Charlie, individual interview)

Despite their *motivations*, all participants faced barriers, primarily related to high job demands and limited time, which occasionally hindered their full engagement in the TCPVBS.

> I would change that I would have more time for it. I didn't get to finish. I finished I think the readings 1 or 2 out of the 3 times. (Jordan, individual interview)

These motivations and challenges were consistent with participants' pre-survey responses, where they articulated expectations of acquiring new instructional techniques, resources, and tools, as well as engaging in interactive discussions and reflection during book study meetings. In summary, this theme shed light on the diverse *motivations* that drove participants to engage in the TCPVBS and the unexpected values they discovered, despite facing various constraints. *Motivations*, which stem from personal values and beliefs, are directly influenced by the *TCPVBS culture*, which for book study participants, was a culture that encouraged and supported experimentation in trying new instructional practices.

Theme 6: Mentorship in a CoP

> I'm still developing as an instructor… I feel like I could help be a bridge, but also learn a lot while I'm there. (Alex, individual interview)

Faculty Mentors (FMs) played a pivotal role in facilitating meaningful conversations and forging connections among participants. Alex, the composite character of 3 FMs, served as a bridge, connecting individuals to valuable resources and nurturing peer-centered discussions, thereby creating an environment conducive to open dialogue. Interestingly, Alex did not view themselves solely as a guide but as an active learner, recognizing that knowledge, experiences, and perspectives flowed in both directions across this bridge.

In the TCPVBS, FMs actively fostered engaging conversations by posing questions and providing illustrative examples. While the *centerpiece* content may not have always been groundbreaking, the FMs' primary role revolved around maintaining dynamic and thought-provoking conversations, fostering *camaraderie*, and facilitating *reflection on practice*.

> I always tried to ask questions again, to try and get prompts going and get people thinking about things and just things I legitimately wanted to know…I felt like none of the content was necessarily new. But my role was to help you know keep the conversation moving. (Alex, individual interview)

> I kind of viewed my role as to try to get the other people engaged and trying to get them talking and thinking about things… Within the smaller groups, I was trying to encourage them to talk more. I was asking them more questions, so I was trying to encourage them to be more conversational. (Alex, individual interview)

Despite some initial uncertainty about their effectiveness ("I hope I was useful in there," Alex commented in their interview), the post-survey results and interview data indicated participants placed a significant value on their interactions with FMs. Participants rated conversations with FMs as the second most valuable aspect of the book study, just behind peer discussions. Tatum, a staff member at CTL, reflected on how well FMs encouraged conversations in the TCPVBS.

> You know, there's a tendency that maybe because they're [Faculty Mentors] that they would dominate the conversation…. But I thought they did a really good job of hearing, and sometimes, even like encouraging other faculty members to share their thoughts. (Tatum, individual interview)

Furthermore, FMs served as connectors, linking different topics and ideas while aiding faculty in establishing connections to additional community resources. Although this role of bridge-building wasn't always deliberate, it frequently emerged from shared experiences and the mutual exchange of information.

> Maybe not intentionally is just sort of a shared experience sort of thing. I think that's kind of what the [Faculty Mentor role] is, anyway. So if there was something that I could weigh in on about a particular topic… like referring to [another FMs research] and sort of trying to make those connections to other resources that exist. (Alex, individual interview)

> [I felt that my role was to] interject and provide like legitimate examples to go with the narrative that the author was providing. (Alex, individual interview)

Notably, one FM shared a slide deck connected to content of one of the book chapters, which garnered praise from multiple participants for its helpfulness.

In a more profound sense, FMs played a pivotal role in cultivating a safe space for discussion. While I, as the meeting facilitator, contributed to this environment by structuring the TCPVBS and sharing personal experiences, FMs played a crucial role in sustaining this safe space.

> I think part of the value is knowing that [Faculty Mentors] we're still asking questions. And we're okay showing we don't know all the answers. I think that makes it feel like a safer space. So other people can then not feel embarrassed to ask questions and can be vulnerable. (Alex, individual interview)

Engineering faculty not only help students see themselves as humans who are learning and growing, as detailed in *TCPVBS culture,* but FMs also model this behavior for their faculty peers. In summary, FMs acted as resource bridges, promoting enriching conversations, facilitating connections, and nurturing a safe and inclusive learning environment within the community of practice model of the book study. Through the foundation of having a *centerpiece*, trust was built through c*amaraderie*, and fostered *reflection on practice*. This was impacted by the characteristics of the *TCPVBS culture*, which also influenced participants' *motivations*. The safe space for this learning, discussion, and collective growth was supported through the mentorship offered by the FMs.

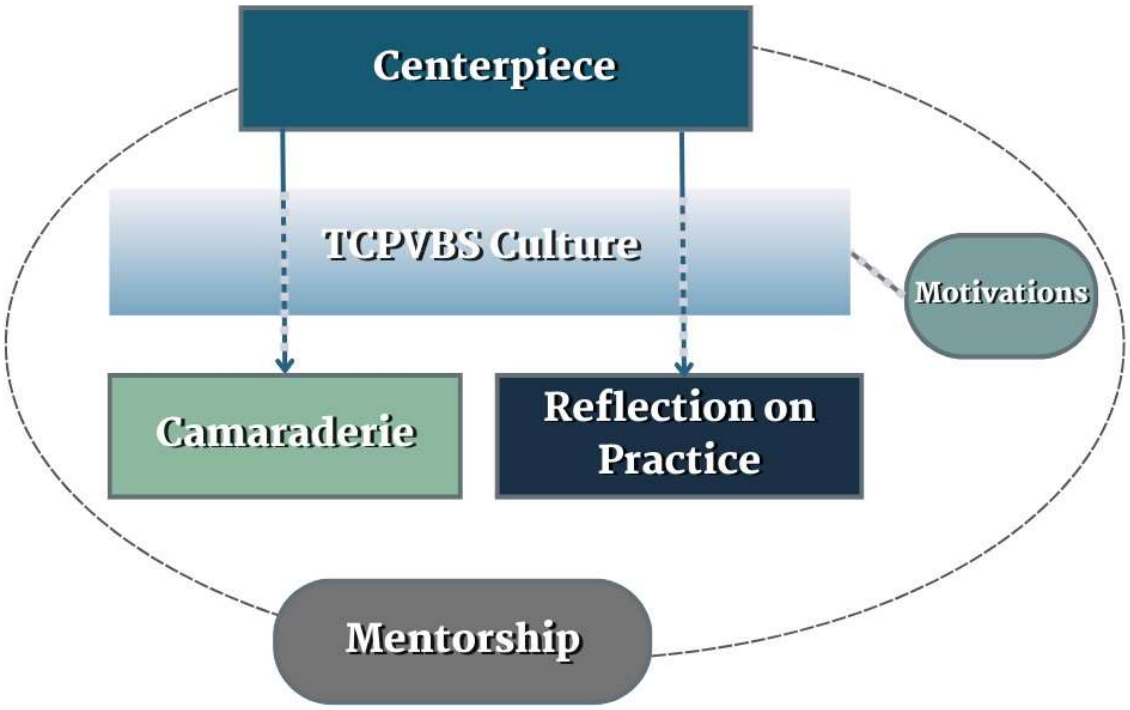
Themes Conclusion

I represent the connections of the six themes in Figure 9. Having a *centerpiece* as a starting point serves as the foundational point of departure for the other themes within the TCPVBS. Built from having this *centerpiece* are the themes of *camaraderie* and *reflection on practice*. These two themes are intricately linked to and viewed through the

lens of the *TCPVBS culture*, a factor that directly influences *motivations* regarding teaching PD opportunities. Surrounding all these themes is the theme of *mentorship* and the pivotal role FMs played within the TCPVBS.

Figure 9

Theme Connections & Graphic Sense Making



Note: The acronym TCPVBS is the shortened name of the innovation, Teaching Community of Practice Virtual Book Study.

Responses to Research Questions

In an MMAR study, it is important to explore how different sets of data work together to enhance our understanding. I demonstrate complementarity with the findings from both my quantitative and qualitative data sets, thereby expanding the interpretation and instilling greater confidence in the study's inferences (Greene, 2007). In the following section, I integrate my findings, explicitly noting whether the results

from both data types align or diverge, to address each research question (Ivankova, 2014).

1. How and to what extent does the participation in a TCPVBS innovation impact faculty and staff members':
    a) Knowledge of how students learn, metacognition, motivation/emotions, and growth mindset?

Based on the collected and analyzed quantitative data, knowledge of the book study topics did increase. The results indicated participants rated their level of familiarity significantly higher on the post-survey in several categories: metacognition, modeling inclusive language, and inclusive syllabus. Metacognition was described in the instruments as: Thinking about thinking; Metacognition is the ability to be consciously aware of oneself as a problem solver and accurately judge one's level of learning. Inclusive syllabus was described as: Include a syllabus statement that fosters an inclusive learning environment for all students; These statements typically include how diversity, equity, inclusion, and belonging impact your teaching philosophy, student resources, and expectations regarding creating and maintaining class space where differences are respected and valued. And modeling inclusive language was described as: Use language that acknowledges and values different experiences/perspectives. The mean scores increased across all measures surveyed for level of familiarity.

    b) Perceptions of first-generation college students in engineering?

In the pre- and post-survey responses, many participants noted their hesitation to make generalized statements about student groups when asked to reflect on their knowledge and perceptions. However, some demographic characteristics (i.e., age, gender, socioeconomic status) were mentioned in some perceptions, but not others. For SU students, age was mentioned in the surveys and it was assumed that most SU

students were traditional college student age (18-24 years old). For engineering students, male gender was mentioned. And for first-generation students, lower socioeconomic status or minority background were mentioned.

Overall, participants' perceptions of students, as noted on the pre-survey and post-survey, remained similar. Diverse backgrounds and 'hard working' were characteristics prescribed across all three student groups (first-generation college students, engineering students, and SU students). These characteristics align with findings from other studies investigating faculty members' perceptions of the student characteristics contributing to success in STEM fields (Ghandi-Lee et al., 2015). These attributes encompass both skills perceived as malleable and open to development, such as problem-solving ability and written and oral communication, as well as characteristics perceived as inherent in students, such as inquisitiveness and work ethic. Faculty perception of first-generation college students as 'hard working' is a characteristic seen through an asset-based lens, shifting focus to possibilities rather than challenges (Schreiner & Anderson, 2005).

The diverse needs and backgrounds of students was seen in the *centerpiece* theme previously mentioned, as participants commented on how their teaching practices evolved to better meet the changing needs of learners and reflected on how strategies benefiting all learners could bridge gaps for specific student populations. This recognition by faculty members highlights an acknowledgment of the unique experiences students bring to the classroom, along with students' diverse strengths and needs that are inherent to their lived experiences.

c) Plans to implement inclusive instructional practices in their course?

I answer this question with both quantitative and qualitative findings. In the post-survey, participants reported both positive and negative factors influencing their

confidence in implementing teaching strategies from the TCPVBS. Participants reported their confidence was positively impacted by the belief that many strategies were relatively simple to put into practice. Several participants also noted their years of experience teaching enabled their confidence to implement a strategy. Additionally, the awareness that fellow participants had already successfully employed these strategies contributed to their confidence. This knowledge, combined with the opportunity to overhear discussions about their implementation, further enhanced faculty confidence in applying these strategies. This was also evident in *reflection on practice*, which showcased the role of reflection in shaping teaching practices, from reinforcing existing approaches to identifying and addressing blind spots.

The outside engineering faculty culture often cultivates a tendency toward risk aversion, resulting in faculty members exhibiting hesitance to embrace new teaching strategies unless they are assured of student approval. In the *TCPVBS culture*, faculty placed high priority on authenticity in their teaching practices, integrating their unique identities and individual styles into their pedagogical approaches. Although I invested time and effort in selecting a book and supplemental materials that were practical and applicable to a wide range of faculty members, faculty members had their own teaching style and preference I could not account for in the TCPVBS, making plans for implementation challenging to support. Furthermore, faculty were constrained by the type of class they taught and the academic level of their students.

2. What happens when participants engage in a Community of Practice innovation?
    a) What do they learn about their own educational journey?

I found this research question harder to answer than others. I recognized post-innovation that if I were to do this study again, I would approach this question and the data collection methods necessary for answering it differently. Nevertheless, I had a few

data sources on which I relied to address this question, including a meeting artifact and my qualitative themes findings.

My preliminary ideas for answering this research question would be that participating in the book study offered faculty both the time and opportunity to reflect on their own educational journeys. The majority (75%) of my research participants did not identify as first-generation college students. When asked about their transition from high school to college, participants anonymously contributed various descriptors in a Word Cloud poll. The resulting word cloud featured a mix of terms, from "freeing," "easy," and "humbling," to "jarring," "confusing," "scary," and "overwhelming." During the subsequent discussion prompted by this poll, participants acknowledged their responses encompassed a range of emotions related to both the academic and social dimensions of transitioning to college. They recognized their responses were influenced by one of these viewpoints (academic versus social), and as a collective, they found common ground in shared challenges. For example, while one person may have encountered academic challenges like failing calculus, another might have experienced social difficulties such as making new friends. The shared element among them was the act of the struggle itself, fostering a sense of connection within the group.

Their educational journeys were also evident in the *TCPVBS culture* theme, in which participants commented that the engineering faculty culture prioritized survival over cultivation. As detailed in the theme's findings, the *TCPVBS culture* often centered on the complex relationship between identities and teaching practices, and their changing roles as faculty members guiding students. TCPVBS faculty members had shifted away from the traditional 'sage on a stage' method to embrace a more facilitative 'guide on the side' approach. However, I recognize the participants in my book study willingly opted for engaging in the TCPVBS and they are faculty members who are

actively interested in learning and enhancing their teaching practices. As noted, this research question needs further investigation as I do not feel as confident in this research question response as others.

b) What are their reflections on their practice?

I utilize qualitative findings to respond to this research question. Faculty reflections on their practice during the innovation involved not only recognizing new effective teaching strategies, but also strengthening existing methods and planning for future improvements in their courses. As described in the *reflections on practice* theme, some participants found that the book study experience reinforced their established teaching approaches and reaffirmed their instructional strategies. Additionally, faculty identified blind spots in teaching methods, strategies, or beliefs that they may have overlooked or not fully understood through reflection. In their pre-survey responses, many faculty members expressed an expectation to acquire new strategies and tools, viewing the book study as a means to attain this knowledge. Faculty members recognized the need for self-reflection and actively sought perspectives from others to uncover these blind spots. Moreover, they acknowledged their own blind spots in teaching and mentorship related to teaching, identifying areas where they needed to enhance their knowledge and strategies.

c) What from the innovation do they find valuable?

Based on the quantitative and qualitative data I collected and analyzed, I found participants identified many aspects of the TCPVBS valuable. In the post-survey, they highlighted the well-organized and interactive nature of the book study meetings, along with the discussions and resources they offered, were valuable. On the post-survey, the faculty reported the highest level of value for conversations with other faculty members, interactions with faculty mentors, and engaging in reflection and discussion activities. In

contrast, the book material and review of the book study chapters received lower ratings in terms of perceived value. This aligned with the findings from the *centerpiece* theme, where participants found the most value in having a *centerpiece* that facilitated collective conversation, rather than the specific content of the *centerpiece* itself. *Camaraderie* and having a sense of togetherness was unexpectedly valuable. Participants noted across the focus group, individual interviews, and post-surveys that connecting with their colleagues was a valuable aspect of the book study. Overall, participants considered the TCPVBS a valuable learning experience and recommended the continuation of similar initiatives in the future.

3. What are the reflections of Faculty Mentors?
    a) What are their reflections on their role and integration of the book study?

I intentionally did not give the FMs strict expectations or instructions on how to integrate themselves into the book study structure. The aim was to foster organic participation and mentorship, allowing them the flexibility to establish meaningful connections with other faculty members in any way that felt suitable. Based on both qualitative and quantitative data, the FMs viewed themselves as facilitators of meaningful conversations, ensuring a supportive environment for open dialogue and serving as a bridge to connect participants to resources, as detailed in the *Mentorship in a CoP* theme. FMs mentioned similar expectations to regular faculty participants in the pre-survey instrument as well. They also perceived their role as encouraging questions and facilitating discussion around the *centerpiece*, a role that ultimately stimulated more conversation, provided opportunities for diverse perspectives, and bolstered *camaraderie* and *reflection on practice* within the group.

b) What are their reflections on mentoring faculty through a community of practice model?

Mentorship within the Community of Practice (CoP) model of the book study was characterized as informal and reciprocal. The FMs saw themselves primarily as participants and learners, perhaps even more so than as mentors. While many of them offered practical advice and facilitated group problem-solving, they all understood the importance of asking questions rather than merely delivering information to participants, due to the unique dynamics of the *TCPVBS culture*. They recognized the need to demonstrate that they were learning alongside and with the participants and to model this approach. This was vital in creating and maintaining the safe space mentioned in the *Mentorship in a CoP* theme. The FMs acknowledged that modeling behaviors such as vulnerability, making mistakes, and asking questions was one of the avenues to establish a conducive environment for learning and mentorship.

CHAPTER 5

DISCUSSION

> "So, I think that what you guys are doing is great. Which is just putting out lots of different content, lots of different modalities, and saying, 'Which of these is something that you feel like you could engage in?' But also *stepping out of your fear* and doing it."
> -Alex, Faculty Mentor

In Chapter 4, I presented an in-depth overview of my data analysis process and findings. In this chapter, I discuss my theoretical connections, limitations and delimitations of the study, implications for both my practice and future research, and share personal lessons learned. I end the chapter with closing thoughts.

Theoretical Connections

The purpose of this qualitatively-driven, concurrent, mixed methods action research (MMAR) study was to understand what happens when engineering faculty, staff, and faculty mentors engage in a professional development (PD) opportunity focused on improving instructional practices and faculty-student interactions, through researching a Teaching Community of Practice Virtual Book Study (TCPVBS). Two theoretical frameworks guided this study: Communities of Practice (CoP) and Expectancy Value Theory (EVT). CoP is a social learning theory that considers social interactions in the construction of knowledge (Wenger, 1998). EVT is a motivation theory that asserts persistence and performance on a task can be explained by a person's beliefs on how well they will do and how much they value the activity (Eccles et al., 1983; Wigfield & Eccles, 2000).

Communities of Practice (CoP)

My study's results demonstrated numerous connections with existing literature related to CoP. A CoP is a group that shares a concern or passion for a specific domain and collaboratively enhances their expertise through regular interactions (Wenger-

Trayner & Wenger-Trayner, 2015). Through pursuing knowledge and improvement of this shared interest (domain; book study materials and teaching PD), members of the community (community; faculty, FMs, staff) built relationships through shared discussion, activities, and learning (practice; book study meetings).

The *centerpiece* theme highlights how a shared focal point, such as a book or learning materials, plays a pivotal role in facilitating meaningful interactions and discussions within the community. This mirrors the CoP principle of a shared domain, where faculty unite around a common interest or concern (Buckley et al., 2014; Cotter et al., 2017). *Camaraderie* fostered a positive atmosphere and encouraged open dialogue, emphasizing the collaborative and communal nature found in CoPs (Sheu et al., 2020). *Reflection on practice* involved individuals engaging in a process of self-reflection and seeking perspectives from others, aligning with the CoP's emphasis on collaborative learning and the development of a shared repertoire of best practices (Wenger-Trayner & Wenger-Trayner, 2015). Finally, *mentorship in a CoP* required mentors to actively participate as learners, resonating with the bidirectional knowledge flow inherent in CoPs, where a reciprocal mentoring model requires mentors to actively support and guide mentees (National Academies of Sciences, Engineering, and Medicine, 2019). Collectively, these themes demonstrated how the CoP framework actively supported the collaborative and knowledge-sharing dynamics observed within the context of the book study. The shared domain, sense of community, collaborative learning, and mentorship all worked together to create a vibrant and supportive learning environment for the TCPVBS.

Expectancy Value Theory (EVT)

I saw connections between the findings from this study and the theoretical framework and related literature of EVT as well. EVT asserts that an individual's choices,

perseverance, and performance in a task can be explained by their beliefs about how well they will do on the activity and how much they value the activity (Atkinson, 1957; Eccles et al., 1983; Wigfield, 1994; Wigfield & Eccles, 1992, 2000). This theory emphasizes two critical task values: intrinsic value and utility value.

The *motivations* theme explored the driving factors that led faculty and staff to engage in the book study. Participants were motivated by their desire to learn from peers, gain insights into innovative teaching strategies, and recognized the utility value of performance evaluations. In this context, the perceived utility value of PD (Wigfield & Eccles, 2000) and their belief in its potential to enhance teaching skills (Andersson & Palm, 2018; Boström & Palm, 2020) motivated participants to actively engage in these initiatives. EVT's connection to *camaraderie* lay in the sense of togetherness and cooperation. When participants feel supported and part of a cohesive group, this *camaraderie* is “often cited as important for persistence” (McCourt et al., 2017, p. 8) for faculty to engage and persist in teaching PD. *Mentorship in a CoP* discussed the role of mentors, who acted as guides and helped faculty members develop a positive expectancy regarding their ability to implement new instructional approaches (Matusovich et al., 2014). By actively engaging as learners themselves and facilitating connections, mentors enhanced the perceived value of experimenting with new approaches, further motivating faculty to embrace change and engage in professional development activities. Similar to findings in other research, FMs also discovered value in "passing on knowledge" and "providing space" for others (Kuhn et al., 2022, p. 9). In summary, these themes collectively illustrated how EVT principles of perceived value, expectancy, and utility value were interconnected with the *motivations*, *camaraderie*, and *mentorship* observed within the TCPVBS innovation.

Limitations and Delimitations

There were both limitations and delimitations that should be reviewed as part of this study. First, I review the limitations and the measures I took to mitigate them, including concerns related to generalizability, time constraints, and a professional role change that occurred during my EdD program. I end with the delimitations, focused on the scope of the context and research setting, the designated time frame, and the boundaries I established within my research design.

Limitations

Limitations are potential weaknesses or issues within the study the researcher identifies, such as participant loss or attrition, small sample sizes, measurement errors, and other factors typically related to data collection and analysis (Creswell, 2015; Leedy & Ormrod, 2015). Other researchers who may consider conducting similar or replication studies can find valuable information in these limitations. Discussing these limitations also acts as a bridge to recommend future research directions and the extent to which the findings can be applied to other individuals and contexts.

Generalizability

In this study, acknowledging the limited generalizability resulting from the small sample size of just 12 participants is crucial. Although small sample sizes do not always pose a limitation in MMAR studies, I raise the group composition and size to examine how each constrained the study implementation. I adopted several strategies to maximize the richness of insights within the constraints of limited diverse perspectives. I have transparently detailed my participant characteristics and recruitment methods to mitigate potential biases and strived, to the best of my abilities, to include participants representing different populations within my small sample. However, I recognize that eight of the nine faculty participants were teaching faculty, with only one tenure/tenure-

track faculty member. Through a rigorous thematic analysis of qualitative data, I endeavored to extract nuanced perspectives, and I leveraged the mixed methods approach to provide a more holistic view. My findings were context-specific and are meant to share the subjective experience of my participants. To address this limitation, I took steps to clearly specify the population to which my results can be reasonably extended, emphasizing the relevance of my study within these boundaries. Being aware of the small sample size in my study, I collected data which would allow me to present in-depth narratives and participant quotes. In doing so, I was able to highlight the uniqueness of individual experiences within the study's limitations.

Time Constraints

Conducting a mixed methods study within a single, busy spring semester posed limitations. This limited time frame placed constraints on the study's capacity to capture shifts or changes over time. The constrained time frame limited the longevity of data collection and the exploration of my research topic's depth and breadth. To address this limitation, I chose action research methods, like polls, surveys, artifacts, focus groups, and interviews, capable of capturing short-term fluctuations and trends. While the condensed timeline restricted my study's ability to examine more extended processes or transformations comprehensively, it allowed me to target and explore specific dynamics and their implications within the scope of the semester. While the faculty in this study exhibited positive shifts in their knowledge, reflection, and perceived value of teaching professional development (PD), it remained uncertain whether extending the duration of the study could have allowed for more profound and sustained growth.

Another dimension of the time constraints was the participants' own time limitations. Participant availability during this short period proved challenging, making scheduling meetings and interviews difficult and potentially resulting in a smaller, less

diverse sample. To address this challenge, I worked closely with participants to identify suitable time slots and designed many of the book study structures to support limited time, including small amounts of pre-learning materials (book chapters, supplemental materials), providing a brief overview at the start of every meeting of the pre-learning materials, and a centralized resource folder that participants could refer to easily.

Change in Job During Program

A final limitation in this study was the unexpected change in my job position in the middle of the EdD program. This change forced me to adapt quickly by altering my problem of practice, research design, and acquiring a new understanding of my context of faculty PD. Action research (AR) principles value iterative research cycles within practical, field-based contexts. While I was able to complete multiple AR cycles, including the initial reconnaissance cycle (Cycle 0) and a second semi-reconnaissance cycle in a new context (Cycle 0/1), this limitation meant that I was not able to complete two continuous cycles of AR in my context and for my problem of practice before implementing my innovation. To mitigate this limitation, I conducted Cycle 0/1 as an exploratory step to better understand the faculty development landscape in my new context. This allowed me to refine my research questions and adapt my research design to align with the current needs and priorities of the faculty.

Delimitations

Delimitations are intentional boundaries researchers establish for their study, defining what aspects are included and excluded from the research focus (Leedy & Ormrod, 2015). In this study, I set delimitations to provide clarity and structure to the research.

Context and Research Setting Scope

This study exclusively focused on a specific educational institution (the CoE at SU) and the experiences of faculty who participated in a localized book study within this context (TCPVBS innovation). This deliberate focus enabled an in-depth exploration of the unique challenges and opportunities within my particular research setting.

Time Frame

I conducted this study during one academic semester (spring). This temporal delimitation could have influenced the number of faculty participants and the available data. Therefore, the findings reflect the conditions, experiences, and outcomes within this delimited time frame.

Research Questions

The research questions in this study delimit the scope of investigation to the participants' experiences and perspectives related to their engagement in the innovation (TCPVBS). I clearly delimited the research questions to avoid straying into unrelated areas or collecting extraneous data (Leedy & Ormrod, 2015). Staying focused on the defined problem area was essential for maintaining research precision and relevance.

Implications

Through examining the lessons I have learned and considering the potential implications of these findings on both practice and research, I provide insights to inform and guide future actions in faculty professional development and improving instructional practices to support all learners.

Practice

Through implementing the TCPVBS and conducting this research, I have learned several implications for my practice including the intention to continue book studies in future semesters, expand valuable CoP model elements to other professional learning

offerings in CTL, integrate Teaching Reference Guides (TRG) in these efforts, and permeate a culture of teaching and learning.

Continuing Book Study as a Method for Faculty Learning

Through this experience, I have gleaned valuable insights into the role a book study can play in providing a *centerpiece* for learning, building *camaraderie*, and encouraging *reflection on practice*. I found the book study was a valuable means of teaching PD for faculty. I will continue to encourage the continuation of book studies in future semesters at CTL, as I recognize their value as an accessible entry point for teaching PD. Faculty are familiar with the concept of a book study, understand the expected engagement and pre-learning, and appreciate the interactive and collaborative nature of the meetings.

Continuing the book study serves as a valuable mechanism for assisting faculty in maintaining changes to their instructional practices as well. Leveraging John Kotter's (2021) well-established steps for successful change from his extensive research in corporate and organizational change management, which encompass removing barriers to facilitate action, generating short-term victories, sustaining acceleration, and embedding new approaches within the organizational culture, the book study, alongside other teaching PD opportunities, provides a platform for faculty and staff to eliminate obstacles, devise action plans, celebrate achievements, and uphold changes in their teaching practices. Furthermore, Bentley's (2009) theory of change emphasizes the significance of specific features critical for the successful innovation and diffusion of change, particularly the establishment of open, networked, and user-driven processes and programs. These elements, when combined, empower community members to autonomously organize activities, relying on emergent structures and decentralized decision-making to allocate resources and coordinate projects. Significantly, the user-

driven element emerges as a potent driving force, empowering stakeholders to contribute their expertise and unique perspectives to the process or program, thereby enhancing their level of engagement and participation. The CoP model, when applied within a book study PD framework, effectively facilitates these features, thereby enabling a sustained and continuous approach to change (Dearing, 2009).

Expanding Valuable CoP Elements in CTL

At the time I facilitated the book study, the CTL had a limited range of professional learning opportunities. During the study period, many of the PD opportunities offered by the CTL followed a traditional 'sit and get' workshop format. Even the Teaching Community of Practice lacked the sustained engagement of a central theme and had insufficient time allocated for members to engage in substantive discussions and practical application of any acquired knowledge (Wenger-Trayner & Wenger-Trayner, 2015). At the time of writing this dissertation, CTL is actively working to address this issue, including launching true Communities of Practice. In the future, in my role as the Program Manager of the CTL, I intend to infuse as many PD offerings as possible with the essential elements of a CoP, such as active participation in discussions, the sharing of valuable insights, and a collective commitment to pre-learning materials. My intention is to incorporate these principles to foster a more vibrant and engaging professional learning community.

Additionally, I am inclined to explore more explicit ways of incorporating FMs into book studies and other PD offerings. Specifically, I would grant FMs the autonomy to establish their own objectives and goals, and I would enhance the transparency of these integrations and objectives for all participants. While I highly valued the organic nature of the TCPVBS and its alignment with the CoP model, I recognized the merit of deliberate and purposeful communication within a group.

Teaching Reference Guides

Teaching Reference Guides (TRGs) provide valuable resources, offering timely and targeted pedagogical insights to effectively address common teaching tasks and challenges. The CTL website hosts an impressive repository of over 40 TRGs, each designed to offer just-in-time solutions to teaching and learning dilemmas. In alignment with the findings of this study, I intend to update TRGs centered around the most critical topics (i.e., metacognition, growth mindset) identified by participants in the TCPVBS. I also hope to embed inclusive teaching practices across TRGs. Furthermore, I plan to remain attuned to emerging teaching tasks and challenges that continue to surface within our book studies and other PD offerings. These insights will inform the revision (or creation) of TRGs tailored to the unique needs of the engineering community at SU.

Permeating a Teaching and Learning Culture

One final significant implication for my practice is the imperative to infuse a culture of teaching and learning throughout the broader engineering community. The *TCPVBS culture* was a counter story, presenting stark differences when compared to the engineering culture within and beyond the CoE. The *TCPVBS culture* offers insights and ideals the broader engineer culture can strive towards. This culture shift requires active efforts to extend the teaching principles of authenticity, modeling failure, and the "humanized, flexible" professor beyond individual classrooms and faculty members. By actively promoting a culture of continuous improvement and inclusivity, we can foster an environment where all engineering educators actively embrace these attitudes and behaviors and apply them to their teaching. This involves continuing to share best practices and creating safe spaces for open dialogue. Additionally, collecting testimonials and additional counter stories from a diverse spectrum of faculty members, detailing their positive experiences with teaching PD, would be a valuable next step. This collective

effort can contribute to the wider dissemination of effective teaching practices and a more inclusive and innovative engineering education culture to support all learners at CoE.

Research

Based on the insights gained from this study, I firmly believe future research is warranted. Action research benefits from replication in diverse contexts (Stringer, 2007). Therefore, it would be valuable to conduct studies that investigate similar PD opportunities designed for faculty, but in different settings or for different groups of participants. This approach can provide a broader and more nuanced understanding of the effectiveness and adaptability of book studies as a means of PD, allowing myself and others to tailor them to suit the unique challenges and dynamics of various environments.

Further research in the use of supplemental materials and discussion questions to embed an inclusive lens is also warranted. While this study provided initial insights into the value of incorporating structures and resources to promote inclusivity, a more comprehensive exploration is essential. Researchers can investigate the specific components of these materials, how they impact participant perceptions and practices, and how they contribute to fostering a more inclusive teaching and learning environment. Additionally, the scarcity of accessible data on faculty members who are themselves first-generation college students showcases the need for further investigation. Future research may also serve as a catalyst for illuminating the experiences of first-generation college students who have gone on to become faculty members and their influences within the research, teaching, and engineering communities.

In my future research endeavors, my experience with mixed methods action research will be invaluable. This approach enabled me to gain a comprehensive understanding of my subject by combining qualitative and quantitative data, which greatly enriched the depth and significance of my findings. The flexibility of a mixed methods approach allowed me to adapt my research design, resulting in robust and insightful results. Despite the time-consuming and challenging nature of qualitative analysis, I found it deeply rewarding and intend to explore purely qualitative research in the future.

Expanding upon my dissertation, my future research will focus on investigating various aspects of engineering culture among different groups. I am particularly interested in studying the long-term effects of teaching PD. This involves conducting research to assess how teaching PD influences faculty satisfaction over an extended period and its connection to student-level data, such as grade and retention rates, (traditional markers of 'success') as well as students' overall sense of belonging in engineering classrooms. By gaining insight into the direct impact on students, this research direction would also reinforce the practical implications previously mentioned of motivating faculty to actively participate in teaching PD programs. The highlight of student success would also connect tangible benefits or the utility value of dedicated efforts to enhance instructional practices.

Personal Lessons Learned

An action research dissertation goes beyond just writing a lengthy document; it can be a profound learning experience and a cultivation of leadership capabilities (Buss & Zambo, 2016; Herr & Anderson, 2014; Somekh & Noffke, 2009). In the previous implication section, I described how the study and my findings will impact my practice

and future research. Conversely, in this section I reflect more on the personal lessons learned, specific to how this process has changed my leadership capabilities and identity.

Above all, witnessing the learner-centered approach embraced by FMs in the book study emphasized, for me, the significance of modeling behavior and cultivating an environment where individuals can openly share their challenges and successes. Although I have completed courses in organizational leadership and have experience leading programs, projects, and teams, I am acutely aware of how much I can still learn from those in my professional community. Simultaneously, this action research dissertation has reinforced my confidence and competence in driving meaningful and impactful change within my immediate context. Furthermore, I firmly believe in the value of transparency and openness when sharing my experiences and acknowledging the complexity and challenges inherent in the learning and research process. Such transparency has the potential to illuminate areas of academia that could benefit from greater openness, as nothing is as straightforward as it may seem. This, I hope, can inspire and motivate others to seek out similar opportunities for their own growth and development.

Closing Thoughts

To close, when engineering faculty, FMs, and staff engaged in a virtual book study focused on improving instructional practices and faculty-student interactions, they found value in having a *centerpiece* to anchor their learning and discussions, they unexpectedly found joy in cultivating *camaraderie*, and they critically engaged in *reflection on practice* with peers and mentors through a lens of the *TCPVBS culture*. It is important for faculty PD practitioners to consider the unique benefits they can add to faculty development. They should also consider ways to mitigate cost, promote motivation, and facilitate mentorship opportunities in the PD they design and facilitate.

I recognized that the discussions in this chapter had been through my voice. And so, to balance my voice, I end by sharing short interview transcript poems from several participants. I have lightly edited the transcripts for brevity, shaped them into a poetic format, and added suggested titles.

I just wished I knew that
as a student.
Like how the brain works
and how we are allowed to make mistakes
and **making mistakes is brave.**

- *Mistakes,* Morgan, faculty

Have you ever seen ducks get imprinted?
Baby ducks can get imprinted on humans.
Why are these little ducks following this human?
Oh, they've been imprinted.
The idea of being like you just follow
You follow the leader.
This is how it's always been done
is how I was taught.
So I'm just going to keep doing that
for better, for worse.
I think that you have to kind of break that cycle.

- *Ducks,* Alex, Faculty Mentor

I tell them, don't focus on
Okay, I spent 5 hours studying
Focus on
What did I learn in those 5 hours?
And then try to **learn it well**
I'd rather you learn 4 things well than 10 things poorly.

- *Learn well,* Jesse, faculty

I think it's challenging for faculty to share about their experiences
It's either [general] instances or
The **peculiarities of situations**
But you know we don't really see it.
We don't see how it goes.

- *Seen Stories,* Tatum, staff

There's a there's another sort of sense of authority
that comes with running a classroom
The **expectation** is that as a teacher **I'm perfect.**
As a teacher, **I don't make mistakes.**
I have to show strength at all times
otherwise I risk losing control of my classroom.
That control part, I think, holds you back
from making **a real sort of human connection** that students
often need to be able to
to be able to learn effectively.

- *Perfect,* Alex, Faculty Mentor

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APPENDIX A

IRB APPROVAL

ASU Knowledge Enterprise Development

EXEMPTION GRANTED

Amy Markos
Division of Educational Leadership and Innovation - West Campus
602/543-6624
Amy.Markos@asu.edu

Dear Amy Markos:

On 1/23/2023 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Supporting all Learners: Engineering Faculty Professional Development Book Study with Faculty Teaching Leads Mentors
Investigator:	Amy Markos
IRB ID:	STUDY00017297
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Pena, Kristen_Consent Form (FTL) - v2 (1).pdf, Category: Consent Form; • Pena, Kristen_Consent Form (Participants) - v2 (1).pdf, Category: Consent Form; • Pena, Kristen_IRB Protocol 20_01_2023 (1).docx, Category: IRB Protocol; • Pena, Kristen_IRB Revisions 20_01_2023 (1).pdf, Category: Other; • Pena, Kristen_recruitment_material_marketing_emails_17_01_2023.pdf, Category: Recruitment Materials; • Pena, Kristen_supporting documents 20_01_2023 - v2 (1).pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Pena, Kristen_TCPVBS Meetings Overview.pdf, Category: Other;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2)(ii) Tests, surveys, interviews, or observation (low risk) on 1/23/2023.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

If any changes are made to the study, the IRB must be notified at research.integrity@asu.edu to determine if additional reviews/approvals are required. Changes may include but not limited to revisions to data collection, survey and/or interview questions, and vulnerable populations, etc.

Sincerely,

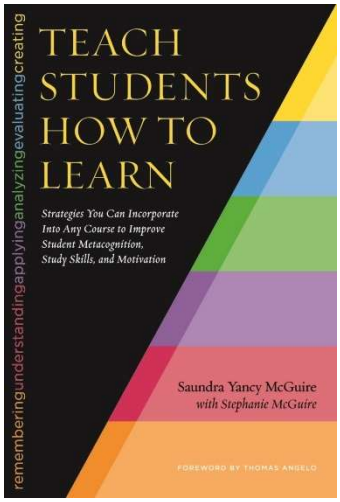
IRB Administrator

cc: Kristen Pena
Kristen Pena
Amy Markos

APPENDIX B

RECRUITMENT MATERIALS

General Marketing Materials (digital flier, blurb for newsletters)



Please join the FSE Learning and Teaching Hub for a virtual book study opportunity this semester - this time on, “Teach Students How to Learn: Strategies You Can Incorporate Into Any Course to Improve Student Metacognition, Study Skills, and Motivation” by Saundra Yancy McGuire. Teach Students How to Learn offers simple strategies faculty can use to have students think critically about their learning, develop study skills, and foster a growth mindset.
The FSE Learning and Teaching Hub will plan four meetings during the spring based on the interested group’s availability. This opportunity is open to anyone interested in the FSE community.

Please complete this form to express your interest in joining!

General Research Recruitment Email

(To be sent to individuals who complete marketing interest form above)

Dear ____,

Thank you for expressing interest in participating in the faculty book study this spring.

I am reaching out to you to see if you are willing to participate in my dissertation research study as a participant. The study aims to explore what happens when engineering faculty engage in an innovation centered on professional development opportunities to improve instructional practices and faculty-student interactions. Please note that participation in the research is not required to participate in the professional learning programs offered by CTL. Participation is completely voluntary. You must be at least 18 years of age to participate, and you may cease participation at any time.

As a research participant, you will be asked to complete two self-report surveys. The surveys will take no more than 15 minutes (**30 minutes total**). You will be asked to participate in additional data collection sessions that include participating in online focus group discussions (one per semester; final book study meeting) and an individual

interview (one per semester). The focus group discussions and interviews will be conducted online and may be audio and video recorded. All video files will be deleted and only the audio files will be used for transcription purposes. Once the audio files have been transcribed, they will be deleted. No audio or video will be used in the presentation of research findings. Participation in focus group discussion will be in the final book study meeting (no additional time commitment) and interview session will be no more than **90 minutes**. The total research participation time will be **2 hours total**.

If you have any questions concerning the research study, please contact the research team: Kristen Pena (kristen.pena@asu.edu; 480-727-0091) and Dr. Amy Markos (amy.markos@asu.edu; 480-221-1963).

Thank you in advance for considering this request.

Targeted Marketing Materials

(To be sent to targeted 200-300 level faculty members and ASA Meeting)

Dear ____,
I'm reaching out to invite you to participate in a book study for spring and be a part of a research study for my dissertation. My research study aims to explore what happens when engineering faculty engage in an innovation centered on professional development opportunities to improve instructional practices and faculty-student interactions, through a virtual book study of teaching community of practice members.
Please see below book study information:
Please join the CTL for another book study opportunity this semester - this time on, "Teach Students How to Learn: Strategies You Can Incorporate Into Any Course to Improve Student Metacognition, Study Skills, and Motivation" by Saundra Yancy McGuire. Teach Students How to Learn offers simple strategies faculty can use to have students think critically about their learning, develop study skills, and foster a growth mindset.
The CTL will plan four meetings during the spring based on the interested group's availability. This opportunity is open to anyone interested in the community.

Please complete this form to express your interest in joining!

Faculty Mentors Recruitment Email

(To be sent to 4 Faculty Mentors hired for spring)

Dear Faculty Mentors,

Thank you for expressing interest in participating in the faculty book study this spring and serving as a mentor to attendees.

I am reaching out to you to see if you are willing to participate in my dissertation research study as a participant. The study aims to explore what happens when

engineering faculty engage in an innovation centered on professional development opportunities to improve instructional practices and faculty-student interactions. Please note that participation in the research is not required to participate in the professional learning programs offered by CTL or as part of the Faculty Mentor role. Participation is completely voluntary. You must be at least 18 years of age to participate, and you may cease participation at any time.

As a research participant, you will be asked to complete two self-report surveys. The surveys will take no more than 15 minutes (**30 minutes total**). You will also be asked to keep a Faculty Mentor Reflection Journal, which will have short, reflection prompts after every book study meeting. The reflection journal should take no more than 15 minutes to complete after each meeting (**1 hour total**). You will be asked to participate in additional data collection sessions that include participating in online focus group discussions (one per semester; final book study meeting) and an individual interview (one per semester). The focus group discussions and interviews may be audio and video recorded if conducted online. If interviews are conducted in person, they will be audio recorded. All video files will be deleted and only the audio files will be used for transcription purposes. Once the audio files have been transcribed, they will be deleted. No audio or video will be used in the presentation of research findings . Participation in focus group discussion will be in the final book study meeting (no additional time commitment) and interview session will be no more than **90 minutes**. The research participation time will be **3 hours**.

If you have any questions concerning the research study, please contact the research team: Kristen Pena (kristen.pena@asu.edu; 480-727-0091) and Dr. Amy Markos (amy.markos@asu.edu; 480-221-1963).

Thank you in advance for considering this request.

APPENDIX C

PARTICIPANT CONSENT FORM

CONSENT FORM - Participants

Dear CoE/SU Community Member:

I am inviting you to participate in a research study on faculty professional development. I am working under the direction of Dr. Amy Markos, a faculty member at Mary Lou Fulton Teacher College at ASU. The purpose of this research is to better understand what happens when engineering faculty engage in an innovation centered on professional development opportunities to improve faculty-student interactions, through researching the Teaching Community of Practice Virtual Book Study (TCPVBS).

The research study will parallel the TCPVBS, which will run from February 2023 through April 2023. Because you are participating in the TCPVBS I am inviting you to participate in the research study of this professional development opportunity. If you consent to participate in the research, the work you create during the TCPVBS meetings (e.g., reflection activities, implementation planning) will be collected for analysis. Also, if you choose to participate in the research, there will only be 3 additional activities outside of the TCPVBS that you will engage with, 2 surveys and a 1:1 interview at the conclusion of the TCPVBS. The final TCPVBS meeting (a focus group) and interviews will be conducted online and will be audio and video recorded. All video files will be deleted and only the audio files will be used for transcription purposes. Please let me know if you do not want the final TCPVBS meeting (a focus group) or interview to be recorded; you also can change your mind after the focus group or interview starts, just let me know. If you find that some of the questions are difficult to answer, you have every right to skip questions.

Below you can see the amount of time you will spend engaging in TCPVBS activities along with the additional time for the online surveys and interview.

Activity	**Research Time Commitment**
Readings prior to meetings 1-3	No added time *(30 minutes; 1.5 hours total)*
TCPVBS Meetings (4) - which includes the focus group in the final meeting	No added time *(1-hour meetings; 4 hours total)*
2 online surveys	15 minutes each; 30 minutes total
1:1 Interview	No more than 90 minutes
Total TCPVBS Time:	5.5 hours
Total Research Time:	2 hours
Total TCPVBS and Research Study:	7.5 hours

Participation in the research of the TCPVBS is purely voluntary. You must be 18 years or older. If you choose not to participate in the research or withdraw from the study at any time, there will be no penalty whatsoever. You will still participate in the TCPVBS, but the work you produce during the TCPVBS will not be used in the study and you will not participate research components (surveys, focus group, interviews). Through participating in the TCPVBS you will have the opportunity to reflect on and think more about your own instructional practices and educational journey. The goal of the TCPVBS is to improve instructional practice overall, but specifically offer resources and mentorship on faculty-student interactions.

If you consent to participate in the study on the TCPVBS, you may worry about sharing your thoughts with other faculty members or myself/other members of the Learning and Teaching Hub. None of the information shared in discussions will be shared by me with staff at our school or university, and all discussions and responses will be confidential. One of the goals of the book study is to create a safe space for learning and discussing together. With that in mind, confidentiality is imperative for the book study activities, and participants should refrain from discussing information shared in the meetings with anyone outside the group.

The work that participants generate in the book study meetings (discussion, reflection, planning) and the ideas shared during focus groups and interviews will be de-identified, meaning names or anything connecting participants to their work will be removed before findings from this study are shared publicly. Even though I will encourage every participant to maintain confidentiality, due to the nature of group activities, complete confidentiality cannot be guaranteed. Data may be reported in my dissertation, presentations, or publications, but your name will not be used. To ensure confidentiality, the focus group and interview audio recordings will be transferred to a password-protected computer, deleted from the original recording device, then deleted permanently once transcribed. Participants' individual privacy will be maintained in all published and written data resulting from the study. Any de-identified data collected as a part of the current study will not be shared with other investigators for future research purposes.

If you have any questions concerning the study, please contact Dr. Amy Markos (amy.markos@asu.edu; 602-543-6624) or Kristen Pena (kristen.pena@asu.edu, 480-727-0091). If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Thank you,
Kristen Pena, Doctoral Candidate, Mary Lou Fulton Teacher College, Arizona State University
Amy Markos, Professor, Arizona State University

By signing below, you acknowledge that you are 18 years or older and agree to be part of the study.

Name:

Signature: Date:

APPENDIX D

FACULTY MENTOR CONSENT FORM

CONSENT FORM - FM

Dear FSE Faculty Mentor (FM):
I am inviting you to participate in a research study on faculty professional development. I am working under the direction of Dr. Amy Markos, a faculty member at Mary Lou Fulton Teacher College at ASU. The purpose of this research is to better understand what happens when engineering faculty engage in an innovation centered on professional development opportunities to improve faculty-student interactions, through researching the Teaching Community of Practice Virtual Book Study (TCPVBS).

The research study will parallel the TCPVBS, which will run from February 2023 through April 2023. Because you are participating in the TCPVBS as a Faculty Mentor (FM), I am inviting you to participate in the research study of this professional development opportunity. If you consent to participate in the research study, the work you create during the TCPVBS meetings (e.g., reflection activities, implementation planning) will be collected for analysis. Also, if you choose to participate in the research, there will only be a few additional activities outside of the TCPVBS that you will engage with: 2 online surveys, a FM Reflection Journal, and a 1:1 interview at the conclusion of the TCPVBS. The final TCPVBS meeting (a focus group) and interviews will be conducted online and will be audio and video recorded. All video files will be deleted and only the audio files will be used for transcription purposes. Please let me know if you do not want the final TCPVBS meeting (a focus group) or interview to be recorded; you also can change your mind after the focus group or interview starts, just let me know. If you find that some of the questions are difficult to answer, you have every right to skip questions.

Below you can see the amount of time you will spend engaging in TCPVBS activities along with the additional time for the other activities.

Activity	**Research Time Commitment**
Readings prior to meetings 1-3	No added time *(30 minutes; 1.5 hours total)*
TCPVBS Meetings (4) - which includes the focus group in the final meeting	No added time *(1-hour meetings; 4 hours total)*
FM Meetings	No added time *(30 minutes total, onboarding and debrief conversations on TCPVBS integrated in agenda of FM monthly meetings)*
2 online surveys	15 minutes each; 30 minutes total
FM Reflection Journal	15 minutes after every TCPVBS Meeting; 1 hour total
1:1 Interview	No more than 90 minutes
Total TCPVBS + FM Time:	6 hours

Total Research Time:	3 hours
Total TCPVBS and Research Study:	9 hours

Participation in the research of the TCPVBS is purely voluntary. You must be 18 years or older. If you choose not to participate in the research or withdraw from the study at any time, there will be no penalty whatsoever. You will still participate in the TCPVBS, but the work you produce during the TCPVBS will not be used in the study and you will not participate research components (surveys, focus group, interviews, FM reflection journal). Through participating in the TCPVBS you will have the opportunity to reflect on and think more about your own instructional practices and educational journey. The goal of the TCPVBS is to improve instructional practice overall, but specifically offer resources and mentorship on faculty-student interactions.

If you consent to participate in the study on the TCPVBS, you may worry about sharing your thoughts with other faculty members or myself/other members of the Learning and Teaching Hub. None of the information shared in discussions will be shared by me with staff at our school or university, and all discussions and responses will be confidential. One of the goals of the book study is to create a safe space for learning and discussing together. With that in mind, confidentiality is imperative for the book study activities, and participants should refrain from discussing information shared in the meetings with anyone outside the group.

The work that participants generate in the book study meetings (discussion, reflection, planning) and the ideas shared during focus groups and interviews will be de-identified, meaning names or anything connecting participants to their work will be removed before findings from this study are shared publicly. Even though I will encourage every participant to maintain confidentiality, due to the nature of group activities, complete confidentiality cannot be guaranteed. Data may be reported in my dissertation, presentations, or publications, but your name will not be used. To ensure confidentiality, the focus groups and interview audio recordings will be transferred to a password-protected computer, deleted from the original recording device, then deleted permanently once transcribed. Participants' individual privacy will be maintained in all published and written data resulting from the study. Any de-identified data collected as a part of the current study will not be shared with other investigators for future research purposes.

If you have any questions concerning the study, please contact Dr. Amy Markos (amy.markos@asu.edu; 602-543-6624) or Kristen Pena (kristen.pena@asu.edu, 480-727-0091). If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Thank you,
Kristen Pena, Doctoral Candidate, Mary Lou Fulton Teacher College, Arizona State University

Amy Markos, Professor, Arizona State University

By signing below, you acknowledge that you are 18 years or older and agree to be part of the study.

Name:

Signature: Date:

APPENDIX E

MEETING SLIDES EXAMPLE

Book Study: *Teach Students How to Learn*

Meeting 3: Supporting All Learners – Growth Mindset + Motivation

April 3, 2023

Agenda

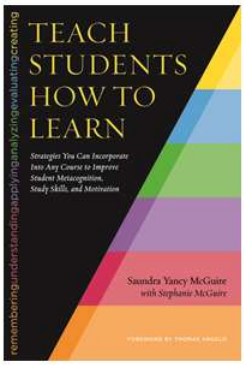
- **Welcome + Overview Reminder** (10)
- **Readings Review** (15)
  - Chapters 6-8
  - Supplemental Materials
- **Small Groups + Jamboard** (30)
- **Wrap up + Final Meeting Details** (5)

Welcome!

- Welcome and welcome back!
- Resource Folder
- **Active participation** (cameras on, emails off) is greatly appreciated.
- **Slido Polls:** A couple during the chapters review.
- **Breakout rooms:** Small group discussions in breakout rooms with a Jamboard.
- **Chat:** Please use throughout for comments or questions.

Book Study Overview

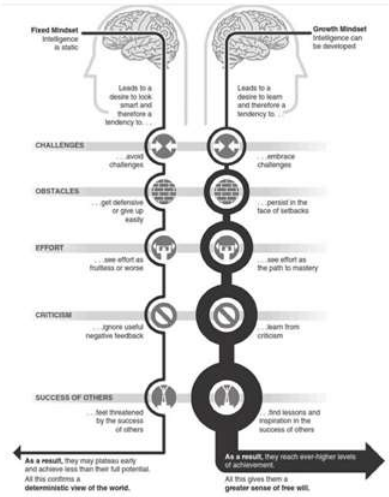
- Meetings:
  - ✓ **Meeting 1 (2/20):** Kick-off – Group Intros, Study Cycles + Bloom's Taxonomy
    - Chapters 2 + 4 *(26 pages)* + Inclusive Teaching Checklist
  - ✓ **Meeting 2 (3/13):** 'True North' – Student Success + Metacognition
    - Chapters 3 + 5 *(32 pages)* + First-Generation College Students
  - → **Meeting 3 (4/3):** Supporting All Learners – Growth Mindset + Motivation
    - Chapters 6 – 8 *(37 pages)* + Growth Mindset
  - **Meeting 4 (4/24):** Debrief – Book Study Reflection + Resource Identification
- **'Innovations'** from last book study:
  - Meeting structure (review, discuss, **plan**)
  - **Supplemental** materials (in our folder)
  - Faculty Mentors



Review of readings (15)

Chapter 6: Mindset Matters

- **Growth Mindset:** Coined by Dweck (2006), is the idea that intelligence is not fixed - individuals with this mindset:
  - embrace challenges
  - use effort to achieve mastery
  - benefit from criticism, and
  - find motivational fuel in the success of others (p. 31)
- 3 Illustrations
  - Uttal (1997) study on American culture towards a fixed mindset
  - Instructor feedback and meeting high standards (Aguilar et al., 2014 cite a study by Yeager et al., 2013) - 80% versus 39% chose to revise essay
  - IDK - Fear of failure
- Emphasize **action**, not ability



Chapter 6: Mindset Matters

4 Strategies for changing student mindset (p. 68)

1. **Inspire belief.** Show students a miracle portfolio (a collection of "before" and "after" scores showing dramatic, rapid improvement), either your students' scores or scores from another professor's students.
2. Ask students to **recall other challenges** they have overcome. Share from your own experience.
3. Explain the neurobiological basis of the **growth mindset**— namely, brain plasticity.
4. Help students achieve **gradual, persistent growth**. Do not give assignments designed to weed out weak students. Instead, give appropriate homework assignments that begin with manageable exercises and increase in difficulty.

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ⓘ Start presenting to display the joining instructions on this slide.

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How often do you find a need to change students mindset on their learning?

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Chapter 7: Connections Between Motivation, Emotions, and Learning

- 3 Levers of Student Motivation (Ambrose et al., 2010)
  - **Value.** How important do I find this goal?
  - **Nature of the environment.** Do I feel supported or unsupported?
  - **Belief in the ability to succeed.** Do I believe I can design and follow a course of action to meet this goal?
- Anxiety and stress - impact on learning
- Obstacles to student motivation
  - Student: outside employment, time management, here for the degree
  - Faculty: unclear expectations, classroom environment

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What obstacles to student motivation do you see/hear the most? Or others not mentioned in the book?

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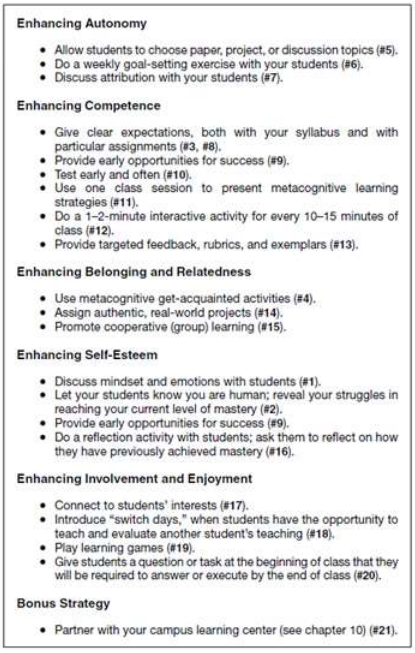
Chapter 8: What Faculty Can Do

- **21 strategies** based on enhancing 5 bases of intrinsic motivation (Raffini, 1995)
  - Autonomy
  - Competence
  - Belonging and Relatedness
  - Self-esteem
  - Involvement and Enjoyment
- **Explicitly, authentically,** and **regularly** express your belief in your students' capabilities



Enhancing Autonomy

- Allow students to choose paper, project, or discussion topics (#5).
- Do a weekly goal-setting exercise with your students (#6).
- Discuss attribution with your students (#7).

Enhancing Competence

- Give clear expectations, both with your syllabus and with particular assignments (#3, #8).
- Provide early opportunities for success (#9).
- Test early and often (#10).
- Use one class session to present metacognitive learning strategies (#11).
- Do a 1–2-minute interactive activity for every 10–15 minutes of class (#12).
- Provide targeted feedback, rubrics, and exemplars (#13).

Enhancing Belonging and Relatedness

- Use metacognitive get-acquainted activities (#4).
- Assign authentic, real-world projects (#14).
- Promote cooperative (group) learning (#15).

Enhancing Self-Esteem

- Discuss mindset and emotions with students (#1).
- Let your students know you are human; reveal your struggles in reaching your current level of mastery (#2).
- Provide early opportunities for success (#9).
- Do a reflection activity with students; ask them to reflect on how they have previously achieved mastery (#16).

Enhancing Involvement and Enjoyment

- Connect to students' interests (#17).
- Introduce "switch days," when students have the opportunity to teach and evaluate another student's teaching (#18).
- Play learning games (#19).
- Give students a question or task at the beginning of class that they will be required to answer or execute by the end of class (#20).

Bonus Strategy

- Partner with your campus learning center (see chapter 10) (#21).

Chapter 8: What Faculty Can Do

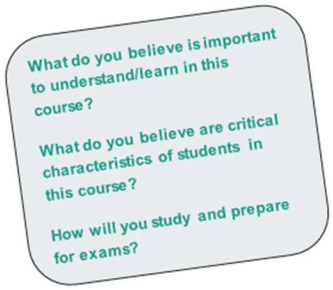
Enhancing Autonomy: Put students in the driver's seat

- Allow students to choose paper, project, or discussion topics (5)
- Do a weekly goal-setting exercise with your students (6)
- Discuss attribution with your students (7)

Enhancing Competence

- Give clear expectations, both with syllabus (3) and assignments (8)
- Provide early opportunities for success (9)
- Test early and often (10)
- Use one class session to present metacognitive learning strategies (11)
- Do a 1– 2-minute interactive activity for every 10– 15 minutes of class (12)
- Provide targeted feedback, rubrics, and exemplars (13)

Chapter 8: What Faculty Can Do



Enhancing Belonging and Relatedness: All in this together

- Use metacognitive get-acquainted activities (4)
- Assign authentic, real-world projects (14)
- Promote cooperative (group) learning (15)

Enhancing Self-Esteem: Get in Touch with Inner Achiever

- Discuss mindset and emotions with students (1)
- Let your students know you are human; reveal your struggles in reaching your current level of mastery (2)
- Provide early opportunities for success (9)
- Do a reflection activity with students; ask them to reflect on how they have previously achieved mastery (16)

Chapter 8: What Faculty Can Do

Enhancing Involvement and Enjoyment: Have fun!

- Connect to students' interests (17)
- Introduce "switch days," when students have the opportunity to teach and evaluate another student's teaching (18)
- Play learning games (19)
- Give students a question or task at the beginning of class that they will be required to answer or execute by the end of class (20)

Bonus Strategy

Partner with your campus learning center (21)

How can faculty engage with CoE tutoring?

- In class marketing
- Host a review session or workshop for tutors to better support your class
- Provide course syllabus and schedule
- Request study groups or additional support services for your courses
- Request your course be added to our list
- Recommend top performing students in high volume courses

Resources at SU/CoE

Engineering Tutoring Center

Other Resources

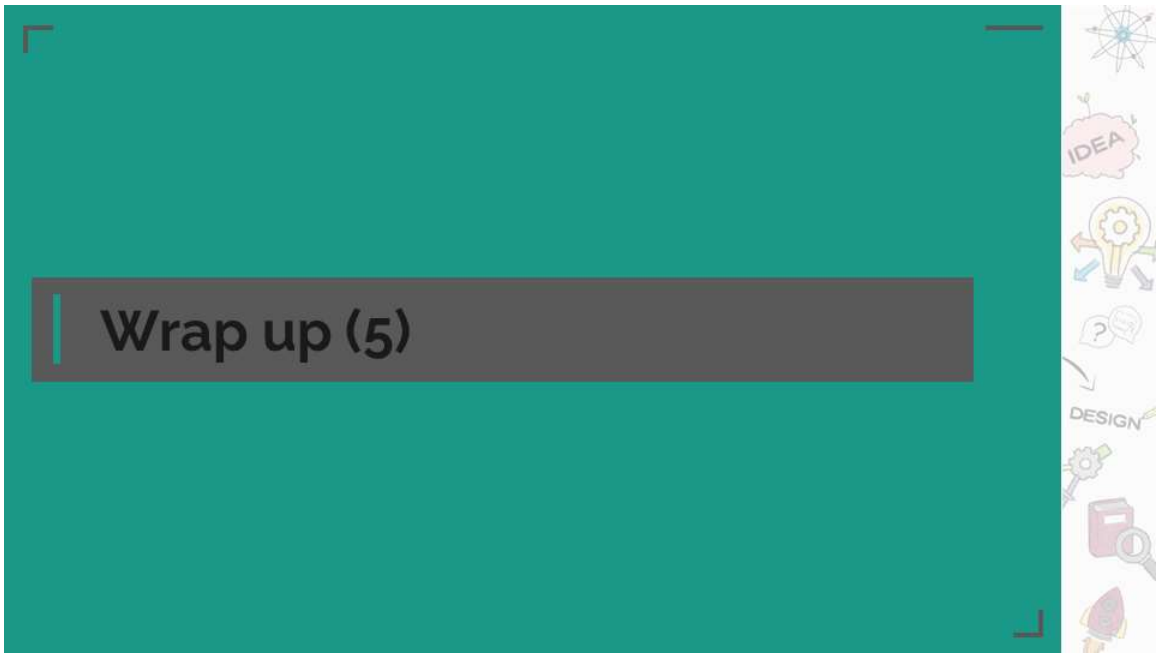
- Engineering Advising
- SU Health Services
- Student Accessibility & Inclusive Learning Services
- Student Pantry
- And more...

Supplemental Materials - TRGs

- Fostering Growth Mindset
  - **Set the tone:** Experience, hard work, practice, good strategies, and support lead to skill, not inherent ability. At the very start of each course, set the tone of the class with a focus on learning and growth.
  - **Psychological safety:** Create opportunities in the classroom to make mistakes and not suffer harsh consequences.
  - **Social priming:** The minds of individuals can be "primed" and result in improved assessments - words of encouragement or "think like an engineer."
- Student Motivation
  - **Liking:** Forming closer relationships and finding similarities.
  - **Reciprocity:** People feel obligated to give back when you first give to them. Gifts (e.g., flexible due dates, letting students pick a topic) drive intrinsic motivation.
  - **Social Proof:** People look to what others are doing to decide what they should do, especially when they are uncertain.

Small Group Discussion

- First: any big picture thoughts, questions, or concerns?
- **Small Group Discussion**
  - Think-Jot-Pair-Share on this Jamboard
  - **First Breakout (7):**
    - Introductions (if applicable)
    - 1- What are you already implementing regarding the readings?
    - 2- Any best practices or resources to share with things you've already tried?
  - **Second Breakout (13):**
    - 3- What changes or new strategies would you like to try?
    - 4- What challenges do you anticipate? Do these strategies address the student motivation obstacles you brainstormed?

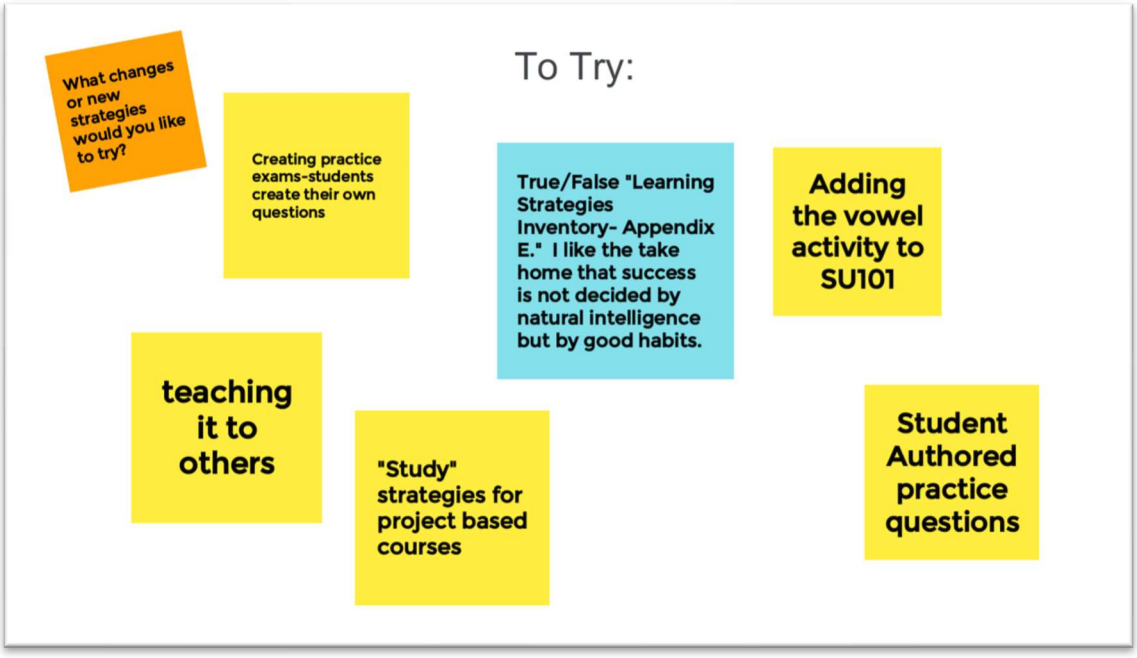


Next (Final!) Session

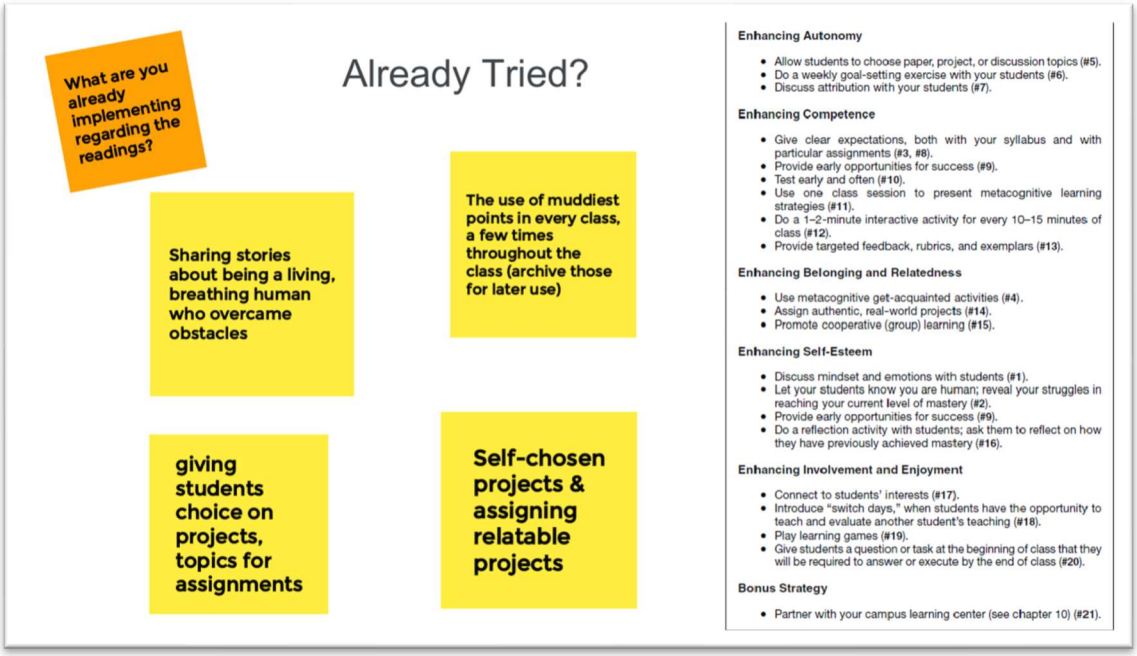
- **Meeting 4 (4/24): Debrief**
  - Book Study Reflection
  - Resource Identification
  - 'Focus group' approach (recorded; dissertation research)
  - *In-person option?*
- **Interviews**
  - Process: Kristen will individually reach out to schedule
  - Timeline: After final meeting through early May

APPENDIX F

JAMBOARD EXAMPLES



Meeting 2 Jamboard



Meeting 3 Jamboard

APPENDIX G

INTERVIEW QUESTIONS

Focus Group Questions for Final Book Study Meeting

1. What techniques are you already implementing that were discussed in the book study?
2. What changes would you like to try in the future?
3. What was most meaningful to you as part of the book study? And why?
    1. Examples: the reading materials, reflection activities, instructional planning, discussion, Faculty Mentors
4. What was one instructional strategy that you think would be most important for our community to have a Teaching Reference Guide resource created on? And why?
5. How does participation in the book study impact your professional development as a faculty member? How does it not?
6. Is there anything else that you would like to add before we close this session?

Faculty Mentor Individual Interview Questions

1. What did you find valuable about the book study?
2. Are there any elements of the book study you would change?
3. Describe your interactions with participants during the book study.
4. How did you use your role as a Faculty Mentor during the book study? How could you in the future?
5. Did you get to mentor anyone related to their teaching? If so, what did that mentorship look like? If not, what would you like mentorship to look like?
6. Is there anything else that you would like to add before we close this session?

Participant Individual Interview Questions

1. What did you find valuable about the book study?
2. Are there any elements of the book study you would change?
3. How do you plan to implement what you learned during the book study sessions?
4. What benefits do you foresee from implementing these changes?
5. What barriers or challenges do you anticipate when you implement what you learned?
6. How did interactions with the Faculty Teaching Leads impact your experience in the book study?
7. When engaging in teaching professional development, what do you look for?
8. Is there anything else that you would like to add before we close this session?

APPENDIX H

SURVEY INSTRUMENTS

Pre-Survey Instrument

PART 1: Book Study Expectations, Knowledge, and Perceptions

Section A: Book Study Expectations

1. What are your expectations for participating in this book study? These expectations can be book study structure, collaboration, or resources provided.
2. Are there specific inclusive instructional practices you are most curious about?
3. Any other comments to share with the planning team?

Section B: Knowledge of book study topics

Please indicate your level of familiarity with each of the following topics. [6]

Knowledge Scale: Never heard of (1) to Very Familiar (5)

1. **Metacognition:** Thinking about thinking. Metacognition is the ability to be consciously aware of oneself as a problem solver and accurately judge one's level of learning [1].
2. **Study Cycle:** This is a 5-step cycle that includes 1) preview, 2) attend, 3) review, 4) study, and 5) assess [1].
3. **Growth Mindset:** Individuals with a growth mindset believe that their academic success can be developed through hard work, good strategies, and input from others [2]. Faculty can encourage this mindset by cultivating an environment where it is okay to make mistakes, and leverage those mistakes to improve learning [3].
4. **First-Generation students:** Being a first-generation college student means that a students' parents did not complete a 4-year college or university degree [4]. There are a number of high-impact learning strategies that faculty can use to facilitate the success of first-gen students in their classroom [5].
5. **Inclusive Instructional Practices** [3]
    1. **Inclusive Syllabus statement:** Include a syllabus statement that fosters an inclusive learning environment for all students. These statements typically include how diversity, equity, inclusion, and belonging impact your teaching philosophy, student resources, and expectations regarding creating and maintaining class space where differences are respected and valued. See here for more specific examples.
    2. **Accessible Learning Materials:** Ensure that resources and assistance provided both in and outside of class is equally available and accessible to everyone. (e.g. offer and record office hours with Zoom, post relevant information for the whole class).
    3. **Reduce anonymity:** Build rapport and get to know students and their individual perspectives and experiences (e.g., greet students as they enter class, interact with students before and/or after class, ask for and use their preferred pronouns).
    4. **Model inclusive language:** Use language that acknowledges and values different experiences/perspectives.
    5. **Incorporate Diverse Perspectives:** Include materials, readings, and images that reflect contributions and perspectives from groups historically underrepresented in the field.

6. **Active Learning Strategies** [6]
    1. **Muddiest Points:** Ask students to quickly identify what they find the "muddiest"—the most confusing or least clear- then address in the following class session.
    2. **Interactive Lecture** (e.g., pause class lecture to pose a question, use classroom response systems to poll students to test knowledge)
    3. **Think-Pair-Share:** Instructor poses a question related to the content for students to *think* about, students *pair* with someone seated closely to them to discuss, and finally *share* out with the larger group what the pair discussed.
    4. **Problem-based learning:** A student-centered approach in which students learn about a subject by working in groups to solve an open-ended problem.
    5. **Other** (detail in comments)
    6. **Comments?**

Section C: Student Perceptions

1. Reflect on your knowledge and perceptions of first-generation college students. Who are they? What does the profile of a first-gen student look like?
2. Reflect on your knowledge and perceptions about engineering students. Who are they? What does the profile of an engineering student look like?
3. Reflect on your knowledge and perceptions about ASU students. Who are they? What does the profile of an ASU student look like?

PART 2: Personal Demographics + Teaching Experience

1. First Name and Last Initial (to create a participant ID; your name will be removed/deidentified)
2. Age
3. Ethnicity/Race
4. Gender
5. Education level
6. First-generation college student status
7. Title (e.g. assistant professor)
8. School Affiliation and Program Name
9. How many years have you been teaching engineering classes at the college/university level? (Choices: 0-1, 2-4, 5 or more)
10. Describe your prior teaching experiences.
11. What courses do you teach during the current term? Select all that apply. (Choices: First-year course, Technical elective Capstone course, Graduate course, Required non-first year course, Other)
12. What modality are your courses? Select all that apply. (Choices: Online, In-person, Hybrid)
13. Overall, approximately how many students are currently enrolled across all your classes this term?

Post-Survey

PART 1: Book Study Experience and Feedback

1. Rate your degree of confidence to implement a strategy from the book study in your classroom this semester.
    1. What is positively influencing your confidence?
    2. What is negatively influencing your confidence?
2. Please indicate your level of agreement with each of the following statements. (Scale: strongly disagree (1) to strongly agree (5))
    1. I gained new knowledge regarding teaching and learning approaches
    2. The review of chapters was a valuable part of book study meetings
    3. The hands-on activities and reflections were a valuable part of this book study
    4. The interaction with Faculty Teaching Leads were a valuable part of this book study
    5. I intend to attend the other learning opportunities (e.g., workshops, book studies)
    6. I see myself engaging with other faculty professional opportunities by the Learning and Teaching Hub
3. How well did the book study support your needs for enhancing teaching skills?
        1. (Scale: not at all (1) to Completely (5))
        2. Please explain your rating above.
4. Rate the overall quality of the book study (Scale: poor (1) to Excellent (5))
    1. Please explain your ratings above.
5. Which support resources (*e.g.*, Journal papers, podcasts, books, workshops, mentorship) do you use to further develop your teaching skills?
6. Please use the following space to share any additional thoughts, including suggestions to improve.

Repeat Section B (Knowledge), Section C (Perceptions) and Part 2 (Demographics) from pre-survey above

Survey Instruments References

[1] McGuire, S.Y., 2015. *Teach students how to learn: Strategies you can incorporate into any course to improve student metacognition, study skills, and motivation*. Stylus Publishing, LLC.

[2] Dweck, Carol S. (2006). *Mindset : the new psychology of success* (1st ed.). New York: Random House. ISBN 1-4000-6275-6. OCLC 58546262.

[3] Center for the Integration of Research, Teaching and Learning. (2020, June 29). *DIA checklist strategies*. Trefny Innovative Instruction Center. Retrieved from https://trefnycenter.mines.edu/strategies-for-dia-checklist

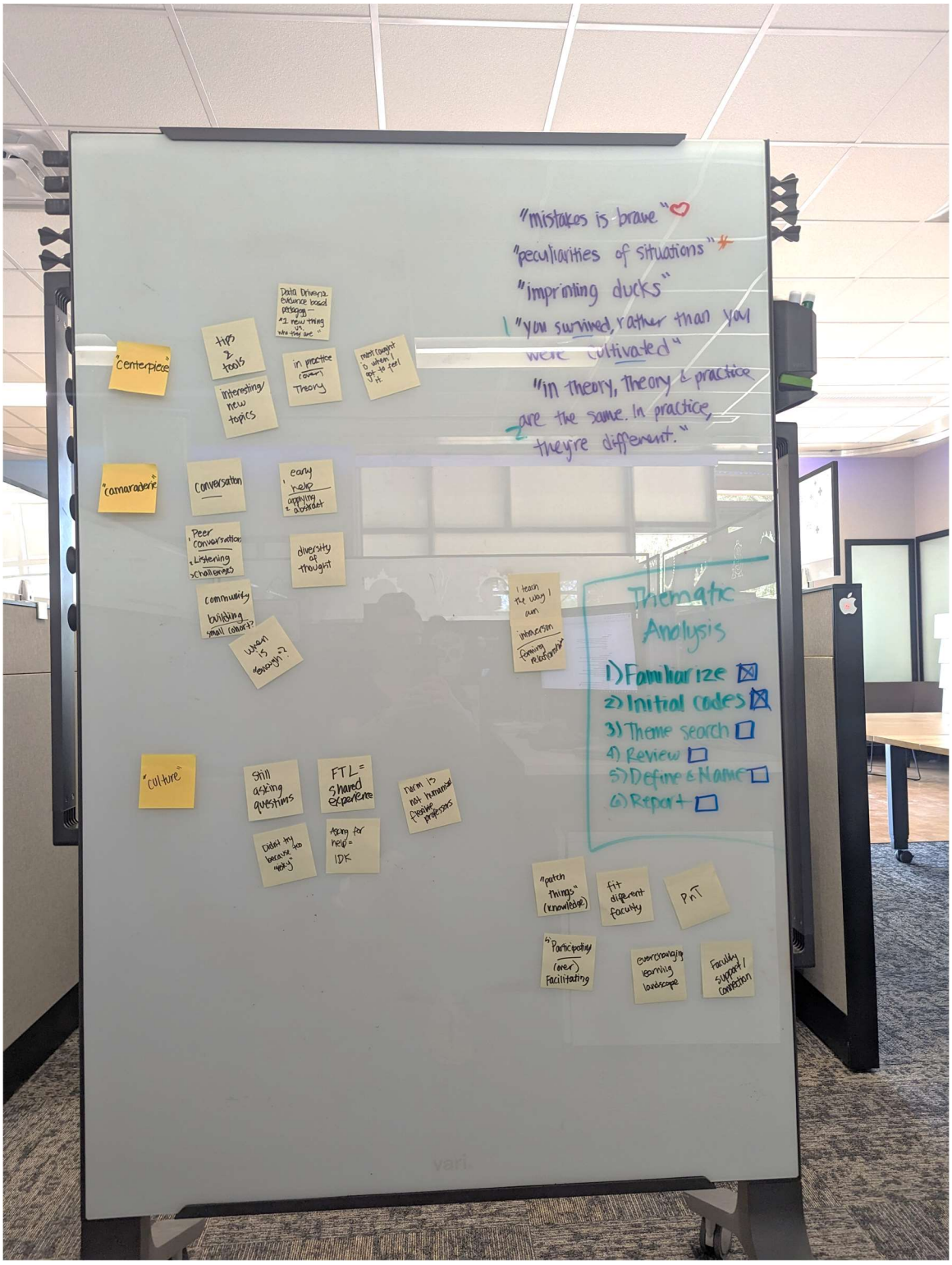
[4] *Are you a first-generation student?* About the Center for First-generation Students. (n.d.). Retrieved from https://firstgen.naspa.org/why-first-gen/students/are-you-a-first-generation-student

[5] Galina, B. (2016). Teaching First-Generation College Students. Vanderbilt University Center for Teaching. Retrieved from https://cft.vanderbilt.edu/guides-sub-pages/teaching-first-generation-college-students

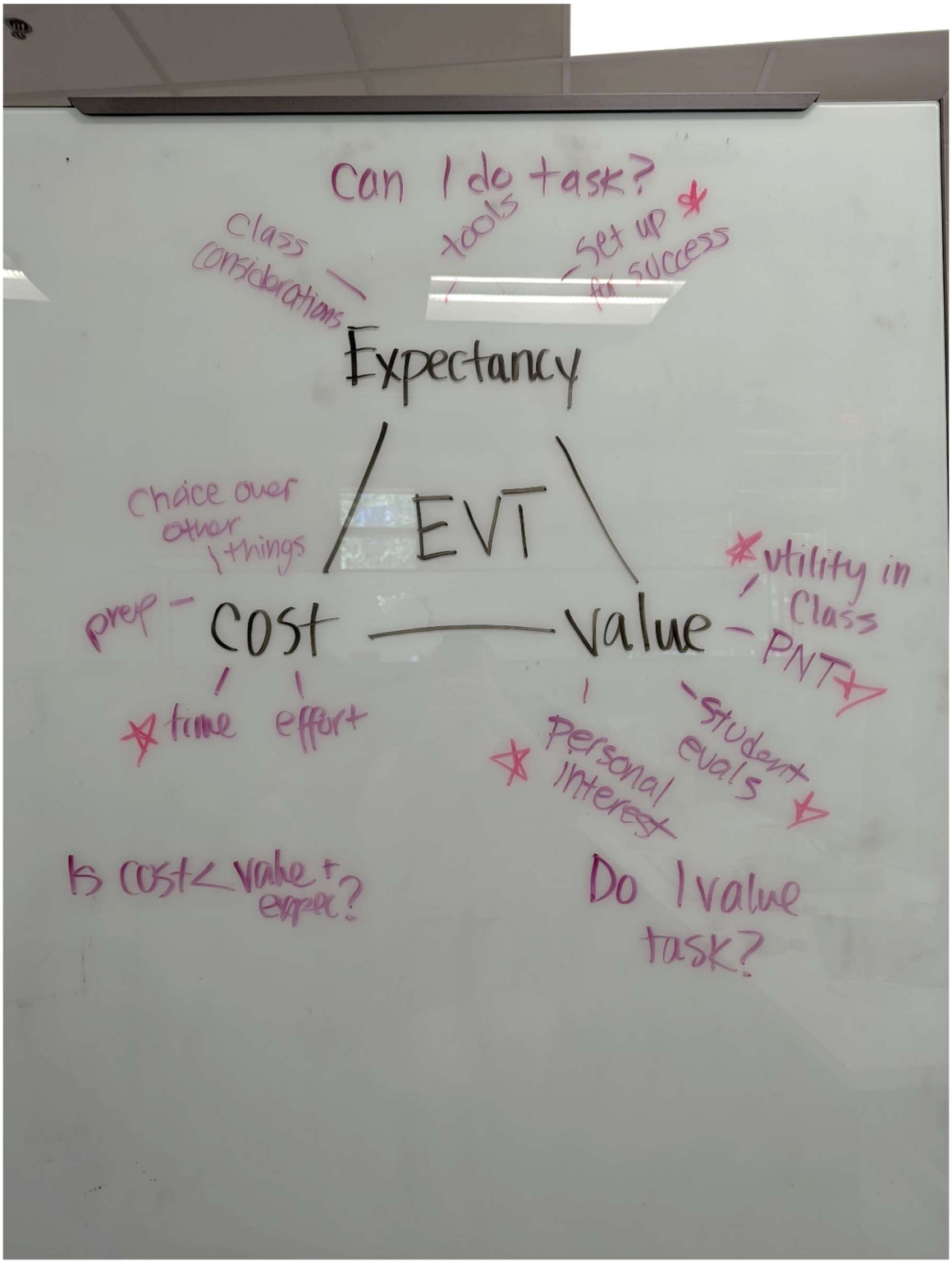
[6] Sturtevant, H., & Wheeler, L. (2019). The STEM faculty instructional barriers and identity survey (FIBIS): Development and exploratory results. *International Journal of STEM Education*, *6*(1), 1-22.

APPENDIX I

WHITEBOARD IDEATIONS



Whiteboard during thematic analysis (July 2023)



Whiteboard with a theoretical framework (June 2022)