Using workplace thriving theory to investigate first-year engineering students' abilities to thrive during the transition to online learning due to COVID-19

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Abstract
Background: During the onset of the COVID-19 crisis, universities rapidly pivoted to online formats and were often unable to adhere to the best practices of online learning highlighted in prior literature. It is well documented that a variety of barriers impeded “normal” educational practices.

Purpose/Hypothesis: The purpose of this paper is to investigate the perceptions of first-year engineering students enrolled in an introductory engineering design course during the rapid transition to online working environments. We view students’ perceptions through the theoretical lens of workplace thriving theory, a framework that allowed us to capture aspects of education required for students to thrive in non-optimum learning settings.

Design/Method: This research employed semi-structured interview methods with 13 students enrolled in an introductory engineering design course that relies on project-based team learning. We analyzed interview transcripts using thematic analysis through an abductive approach and made interpretations through workplace thriving theory.

Results: Results indicated that students’ abilities to thrive are related to four intersecting themes that demonstrate how workplace thriving theory manifests in this unanticipated online setting. These themes demonstrate elements that must be optimized for students to thrive in settings such as this: relationships with others, building and sharing knowledge through interactions, perceptions of experiential learning, and individual behaviors.

Conclusion: Our research, viewed through workplace thriving theory, highlights the mechanisms by which students tried to succeed in suboptimal environments. While not all our participants showed evidence of thriving, the factors required for thriving point to opportunities to harness these same factors in in-person instruction environments.

KEYWORDS
COVID-19, design, online, project-based learning, thriving
1 | INTRODUCTION

In mid-March 2020, over 100 universities across the United States moved online to slow the spread of the COVID-19 pandemic. While the dynamic nature of online learning environments can provide learners with advantages over traditional environments, like the ability to self-pace and flexibility over engagement with course material, online learning environments also require learners to be highly motivated and have excellent time management skills (Arkorful & Abaidoo, 2015). Additionally, fields like engineering that require hands-on components and rely on project-based experiences are at a significant disadvantage with respect to online classrooms (Arkorful & Abaidoo, 2015). Further, appropriate online learning requires a robust technical infrastructure, with successful online courses typically developed over months or years with substantial support from instructional designers to promote successful student learning (Lim, 2004). Given the rapid transition to online environments, it is unlikely that all instructors had the time and resources needed to design and develop online curricula or materials using evidence-based methods. While prior work has examined students’ experiences in well-structured online courses, it is unclear how students’ classroom experiences were shaped during the sudden transition from in-person to online learning and other changing social circumstances due to the COVID-19 pandemic. We sought to fill this gap through this study, and approached it with the following research questions:

How do the aspects of thriving manifest in students’ classroom experiences as a result of the rapid shift to online learning?

How do these facets of thriving interact with each other during students’ classroom experiences?

In this study, we explore students’ experiences during the rapid transition to online learning through workplace thriving theory to highlight the mechanisms by which some students struggled while others thrived in the online environment and subsequently augment educational best practices in online and in-person learning environments.

2 | REVIEW OF RELEVANT LITERATURE

It is well documented that COVID-19 disrupted life for those involved in any capacity with educational systems. Literature has captured how the rapid transition disproportionately affected those already disadvantaged with respect to technology or resources (Harper, 2020); and which factors are particularly problematic for university students (Browning et al., 2021). In engineering particularly, several researchers have released work in recent special editions on the rapid transitions to remote learning which characterize the factors and difficulties of instructors and students during the transition (Benitz & Yang, 2020; Deters et al., 2020; Leung & Chu, 2020).

We posit that “online learning” is not an accurate representation of what happened during the onset of the pandemic, where neither instructors nor students expected to teach or learn online. All instructors may not have been equipped with the resources, time, or training to reorient their courses; students were stranded away from campus without books or materials; and no one could foresee the duration or impact of the pandemic. For these reasons, in reviewing prior work, the “online learning” literature seems insufficient. Instead, we leverage other relevant scholarly domains, such as organizational behavior and workforce literature, to elicit understandings of the unique circumstances students encountered. Our findings from this work, related to four interacting themes with 11 total subthemes, point to several takeaways that are valuable additions to engineering education literature.

2.1 | Reframing the transition to unanticipated online learning at home as telework

We argue that viewing the educational setting imposed on students as telework accurately captures issues with life balance, access to appropriate workspaces and technology, and psychological attributes required for successful remote working conditions. Prior research demonstrates that certain outcomes, such as worker satisfaction, frustration, and productivity, are highly dependent on the individual’s perception of autonomy (Gajendran & Harrison, 2007) and the perceived suitability of their job for remote work (Bosua et al., 2017). It is important to note that many studies in this body of research study teleworkers with the choice to work remotely. Little work has explored the effect of forced telework on worker experiences, which is the situation faced by students during COVID-19.
Online learning allows increased opportunities for self-direction and autonomy (Reisetter & Boris, 2004). In workforce development literature, an individual’s perception of the extent to which they can control their job tasks is likely to increase in a telework environment (Sewell & Taskin, 2015), an effect linked with increased perceptions of productivity among teleworkers (Bailey & Kurland, 2002). Within a virtual classroom environment, perceived autonomy could manifest in students’ choices to participate synchronously via lectures or asynchronously via recordings. At the same time, however, online learning during a global pandemic may have reduced perceived autonomy due to reduced interaction with others outside one’s immediate family and various sets of quarantine protocols.

Prior telework literature remains split on the effect of telework on the work-family interface. Some studies suggest teleworking can improve work-life balance (Raghuram & Wiesenfeld, 2004), while others suggest teleworking may erode the boundaries between work and home (Igbaria & Guimaraes, 1999). Within the context of a virtual classroom, the boundary between work and family may have significantly diminished for some students, contributing to a blurred sense of academic experiences. These boundaries are not typical of a traditional face-to-face college environment, where students are immersed in the campus sphere. Social exclusion and limited face-to-face interaction with colleagues can negatively affect overall job satisfaction, performance, and interpersonal bonds between coworkers and supervisors (Golden et al., 2008). The severity of these outcomes increases with the frequency of remote work (Gajendran & Harrison, 2007). We posit that continued indirect interactions between instructors and students via digital technologies may have significantly eroded students’ connections with instructors and hindered the formation of relationships with peers.

2.2 Theoretical framework

The theoretical orientation for this research is workplace thriving theory by Spreitzer et al. (2005). By definition, thriving is a psychological state that is relatively temporary and comprises the elements of vitality and learning in an environment. Vitality refers to the affective component of thriving where an individual experiences a sense of aliveness and positive feelings of energy, and learning captures the cognitive aspect of thriving, where an individual feels like they are acquiring and applying new knowledge and skills. Together, these elements form thriving—a psychological state that represents one’s ability to have a sense of personal progress and development.

Spreitzer et al.’s (2005) model of thriving posits that there are three agentic behaviors that contribute to the feeling of thriving. The first of these behaviors is heedful relating—when individuals work together effectively to achieve a goal by intentionally pursuing considerate and attentive relationships with one other (Weick & Roberts, 1993). Heedful relating promotes vitality by strengthening an individual’s social support and promoting belongingness, subsequently increasing positive feelings (Carlson et al., 1988; Carmeli et al., 2009). Further, Bandura’s social learning theory (Bandura, 1977) posits that people acquire new behaviors and knowledge about accomplishing tasks from other individuals, implying that heedful relating between individuals also facilitates learning. The second agentic behavior that contributes to thriving is exploration. When a person engages in exploration, they gain new knowledge and skills and discover new ways of working. This increases learning and generates a positive feeling associated with the acquisition of new knowledge (Kaplan & Kaplan, 1989). Last, thriving is brought out by task focus. Task focus can bring out positive feelings associated with the motivation of being engaged in the task or when the task is completed successfully (Carver & Scheier, 1990), hence promoting vitality. Task focus also helps individuals learn by allowing them to identify strategies that enable them to carry out work efficiently.

Workplace thriving is a useful framework for this study for several reasons: First, and most importantly, the concept of workplace thriving is meant for adult learners with multiple aspects of “real life” to attend to. Further, thriving has been applied in prior literature to work-from-home scenarios, which we feel lends holistic consistency to this study, as opposed to theories of student learning that have been applied to date in traditional classroom settings. Second, the theory of workforce learning relies heavily on the importance of learning while nodding to the relationships between environmental and social aspects of the work environment with the psychological factors of learning and vitality. In the theory of workplace thriving, thriving is conceptually different than either survival or flourishing. The removal of all barriers also does not mean that an individual will necessarily thrive, and conversely, the presence of adversity does not imply that an individual cannot thrive. With all sense of working normalcy being toppled due to a global pandemic (Kniffin et al., 2020; Kotera & Correa Vione, 2020; Spurk & Straub, 2020), we agree with this foundational assumption within workplace thriving theory.

Reframing the virtual classroom as a remote work environment and the student as a teleworker enables us to analogically identify characteristics of the workplace that may be detrimental to worker outcomes, such as productivity, satisfaction, or interpersonal relationships with peers and teachers. Further, in the course being studied in this work,
students were both learning about the methods used in engineering design and applying them through real-world design projects. This enables us to draw parallels between our participants and workers in the workforce. We hypothesize that students’ perceptions of classroom experiences may be a critical factor in understanding their ability to thrive during the rapid transition to online instruction.

3 | METHODS

We approached this study with a constructivist epistemological view (Charmaz, 2006; Crotty, 1998) with the intention of understanding how students made meaning of and constructed realities based on their individual lived experiences in their new digital learning environments. We were interested in gaining insight into students’ perceptions about the transition to online learning and identifying the complexities associated with their experiences from their perspective. These insights were then analyzed using a thematic analysis approach due to its applicability to a constructivist paradigm and its flexibility with the incorporation of theory (Braun & Clarke, 2006).

3.1 | Setting

This study was conducted in an R1, predominantly White, public university. In this university, each semester, 550–750 first-year engineering students enroll in the project-based engineering design course of interest, with approximately 32 students per course section. All instructors use the Canvas learning management system to support students in navigating course content, and all instructors leverage a common syllabus and library of course materials. Students are taught a variety of design tools, such as 3D CAD modeling, physical prototyping methods, and communication techniques through two hands-on projects occurring in the first and second half of the semester, respectively. While the first project is instructor-defined, the second project is a common client-sponsored design project across sections. It is important to note that some instructors allow students to remain in their original teams while others form new teams for each project.

During Spring 2020, 12 instructors taught 19 sections of this course. Each section met for 2-h class periods three times per week. At the time of the transition to online learning, all instructors had already completed the first design project. As with typical semesters, instructors continued meeting weekly (albeit over Zoom) to align their teaching to meet common learning outcomes and share best practices. As most instructors had not previously taught online, a general guidance document was initiated and expanded upon by instructors throughout the remote delivery period to share online teaching tips. In addition to laying out a common framework for the second project, this document outlined opportunities for supporting online teaming. Remote delivery also significantly impacted the hands-on nature of the course by necessitating a shift of focus from physical to digital prototyping.

3.2 | Participants and recruitment

We distributed a Qualtrics survey to students in all sections of the course. In the survey, students indicated their interest in participating in an interview regarding their experiences during the shift to online instruction. The survey also queried students’ demographic information, which guided our recruitment process for the interviews, as explained below. The current work reports on those qualitative interviews.

All participants were first-year engineering students with intentions to pursue various engineering majors. Of the 121 students who completed the survey, 34 indicated that they would be interested in participating in a follow-up interview. It should be noted that this study is part of a larger project that seeks to understand the experiences of traditionally minoritized students in engineering during the rapid shift to online learning. As a result, we conducted purposeful sampling during the recruitment for this study. Of the 34 students who expressed interest in participating in the interviews, we first contacted students who identified themselves as belonging to groups traditionally minoritized in engineering, as classified by the National Science Foundation’s report on Women, Minorities, and Persons with Disabilities in Science and Engineering (National Science Foundation, 2019). Subsequently, we expanded our sample to include participants from non-minoritized groups. Ultimately, $n = 13$ students voluntarily participated in the interviews. Based on prior work reviewing recommended sample sizes for qualitative research (Braun & Clarke, 2013; Fugard & Potts, 2015; Guest et al., 1995), specifically when the aim is to gain insight into individual experiences (Morse, 1994),
we viewed this to be a sufficient sample size for this study. However, we kept in mind that additional recruitment would be needed if saturation was not achieved. The adequacy of the sample size was confirmed during the preliminary coding phase of the analysis when the first author observed that no newer codes were identified after the analysis of 11 interviews. This implies that saturation was achieved, and no additional recruitment was conducted. The participants were compensated for their time with a $10 gift card.

Of the 13 participants, 8 students identified as male and 5 identified as female. Seven students identified as Caucasian/White, three students identified as Asian, two students identified as Hispanic/LatinX and Caucasian/White, and one student identified as African American/Black and Caucasian/White. Since this course is mandatory for all first-year students enrolled in the College of Engineering, the participants from this study came from eight different engineering majors.

3.3 Data collection

The first author conducted semi-structured interviews with the 13 participants. Interview durations ranged from 22 to 52 min. Sample interview questions included but were not limited to “How do you feel the switch to online instruction affected your experience in the course?”, “How did you interact with your design team during the second project, and how did this compare with the first project?”, “Did you face any challenges in the transition to online instruction?”, and “How do you feel your learning was impacted due to the transition?” Follow-up questions and probes (Rubin & Rubin, 2012) were employed based on participants' answers to gain richer insights into students' experiences. The first author conducted all interviews and recorded them via Zoom. We used a professional transcription service to transcribe the audio files and later verified them for accuracy.

3.4 Data analysis

To analyze the interviews, we employed qualitative and thematic analysis methods using open and axial coding methods (Braun & Clarke, 2006) employing a constructivist paradigm (Charmaz, 2006) and abductive approaches (Timmermans & Tavory, 2012) to highlight how situational characteristics can modify existing theory, specifically with attention to workplace thriving theory, the lens for this study, the tenets of which we have mapped to the resulting superordinate themes (Figure 2). NVivo (version 12) qualitative data analysis software was employed during the iterative codebook development process. In the presentation of quotes from participants, note that ellipses (three spaced dots) denote pauses made by the speaker, and ellipses enclosed in square brackets denote editorial omissions.

Prior to the analysis, the first author read each transcript multiple times to immerse himself in the data and highlight excerpts with preliminary tags. The entirety of each transcript was analyzed, and through an iterative process, these preliminary tags were transformed into the codes seen in the Supporting Information. As an example of the coding process, the statement below was coded as Access to Learning Utilities (describing issues around access to WiFi at home) and Control over Learning Experiences (having to coordinate with a family member to set aside times when he could use the WiFi): “The biggest hurdle was definitely internet connectivity. [...] So having to coordinate with my father on figuring out, ‘Okay, here’s when I’m gonna be doing work, here’s when you’re gonna be doing work’ was definitely a hurdle to overcome.”

Following the creation of codes, the first author began searching for themes in the data. We conducted the search for themes through an abductive lens (Timmermans & Tavory, 2012). Employing an abductive analysis approach allowed us to use prior theory to guide the identification of themes while noting that these themes may appear as modifications of or go beyond prior theory (Timmermans & Tavory, 2012).

3.5 Trustworthiness of this study

We additionally detail how our study adhered to the multiple facets of trustworthiness in qualitative research as described in the guidelines by Walther et al. (2017). During data collection, to capture the breadth of students' experiences, we ensured our sample included sufficient representation from students traditionally minoritized in engineering. The first author, who conducted the interviews, also ensured that the interview protocol was malleable enough to adapt to any variations in how students described their experiences, hence upholding the communicative validation of this research.
We ensured ethical validation by assuring students that the accounts of their experiences in the class would be kept confidential and would be used purely for research purposes. Further, whenever we shared data with the fourth author, who was one of the instructors of the course, the first author removed all identifiable information. During the data analysis stage, although the first author was responsible for conducting the analysis, the research team met on a regular basis to discuss the development of the codebook and the identification of themes. Using an inter-rater reliability measure ensures that multiple coders are applying the developed codes in a similar manner, which increases the trustworthiness of the analysis even when conducted with a constructivist approach. Hence, when the first and second authors coded the data, they ensured a strong agreement between their coding practices, as indicated by the intercoder reliability coefficient value of $\kappa = .85$ (Cohen, 1960; McHugh, 2012). These actions upheld the standards of procedural validation in this study. We ensured process reliability by storing the data appropriately, verifying transcripts against the recorded interviews, and maintaining an audit trail of all the decisions made during data collection and analysis (Bowen, 2009), such as tracking the rationale behind decisions made during the iterative process of codebook development.

### 3.6 Positionality statement

The first author, who collected and interpreted the data, identifies as a male and is a graduate student with experience in engineering design and design education. As a graduate student during the COVID-19 pandemic, he also experienced the effects of the global pandemic and shifted to online learning in the same academic institution. While some degree of human bias is inevitable, throughout the data collection and analysis processes, he reflected on his perspectives to disentangle his and the participants’ experiences to mitigate bias as much as possible. The second author, who aided in the qualitative analysis following the creation of the codebook, is a male graduate student in the same academic institution. The third, fourth, fifth, and sixth authors are faculty members with expertise in engineering education, design theory and methods, and design education. The fourth, fifth, and sixth authors regularly teach the course in which the participants of this study were enrolled. During the Spring 2020 semester, only the fourth author was teaching the course and was also the lead instructor who coordinated most aspects of the course. It should be noted that, however, the data analysis and interpretation of findings were primarily made by the first, third, and sixth authors, none of whom were instructors for the course during that particular semester.

### 3.7 Limitations

As with all studies, this research has limitations. We did not ask participants to provide the names of the instructor who taught their section. While unlikely, it is possible that the participants of the study were taught by only a small number of the 12 instructors who taught the course. Instructor preferences may also have impacted student perceptions, particularly if the students remained in the same teams for both projects in some sections or joined new teams for the second project. There is also the possibility of self-selection bias in recruitment for the study. For example, students with adverse home environments may not have volunteered to participate in the study, and these students would have likely also experienced difficulties and hardships during the transition to online learning. Because of these limitations, we note that the themes in our data, while rich, are not generalizable. Further, we note that the timeline of the research study may have contributed some limitations to our work. The transition to online learning took place in March 2020, and we conducted the interviews during the months of July and August 2020. While it is plausible that students’ recollections were vivid and salient after the 4-month gap, some students may not have fully recollected and described their experiences due to the time passed. However, we recognized and attempted to address this limitation by probing students during interviews and encouraging them to provide as much detail about their experiences as possible.

### 4 RESULTS

The findings from our thematic analysis provide a detailed picture of students’ experiences in the first-year design course following the shift to online instruction. We identified four themes (with associated subthemes), namely relationships with others, building and sharing knowledge through interactions, perceptions of experiential learning, and
individual behaviors. Figure 1 denotes the themes (circles) and subthemes (rectangles) from our analysis. The relationship between themes and subthemes is denoted by the dotted lines. Further, we observed interactions between subthemes in students’ accounts of their experiences during and after the transition to online learning, and these relationships between subthemes are indicated by solid lines.

Figure 2 depicts the three agentic behaviors that contribute to the feeling of thriving—heedful relating, exploration, and task focus, the definitions for which are seen in Figure 2 (Spreitzer et al., 2005). These agentic behaviors contribute to an individual feeling of learning and vitality, which together form the sense of thriving. In Figure 2, we have also mapped how the themes in our analysis relate to the primary tenets of the workplace thriving theory, and these relationships are denoted by the dashed lines.

4.1 Relationships with others

Interpersonal relationships are central to workplace thriving theory and have been identified as one of the most difficult aspects to foster in online learning. Through the three subthemes embedded in this thematic category (sense of camaraderie, empathetic understanding, and personal bonds with professors), we note how students perceive tension as it relates to their ability to relate with others. Participants described developing stronger bonds with their design teams while mourning other relationships built in the class. Others struggled to make sense of their relationships with peers and professors via digital platforms. These subthemes are often connected to one another and other themes, especially individual behaviors such as perceptions of motivation and building and sharing knowledge through interactions.

In the subtheme sense of camaraderie, we found that students experienced both expansions and contractions in their personal relationships with their peers. Students described growth in camaraderie with their teammates after the switch to online instruction, which in turn fostered a sense of togetherness. Alice felt that maintaining the same project teams after the transition to online learning fostered a sense of closeness in the team and helped improve the quality of their second project—“We already knew each other pretty well. So, I feel just team-wise, we grew stronger, we grew better, and I seriously think our second project was a lot better than our first.” Denise felt that her virtual interactions helped her maintain relationships in a time of COVID-induced isolation, boosting her empathy for her teammates.
It was like, I do actually care about what they did today, like did you guys, like leave your house, are you guys still in the red phase. It was refreshing to hear not just about coronavirus, and not just about my town, and it was cool think to think of us still working together, even though, we weren’t. Because they were ... I had no other classes where my cameras were on, my mics were on ... So to be able to sit, and see my teammates, and talk to them and see their emotions, see their brains working. I think that made me care for them, as people a lot more. (Denise)

There are nuances in these accounts, however. Denise later identified that the lack of interactions with the rest of her classmates, some of which she knew well from high school—not just her design team—negatively impacted her happiness and experience in the class, and she noted feeling “just very unhappy, stuck.”

For other students, although, the virtual experience did not suffice to maintain team relationships, degrading the quality of interactions and relationships. Gregory reflected on his perceptions of his teamwork: “To be honest, through the computer, it’s not the same. You lose some of that human aspect, that connection that we have. ... It was more just like computer work and just talking with people in Zoom meetings.”

The data captured by theme subtheme empathetic understanding describes how students understood the challenges their teammates may have faced during the transition to remote learning. Specifically, students described finding empathy to navigate their new environments and overcome difficulties. Heather described how, following the transition, she and her teammates modified their team dynamics to allow each other to complete their assigned tasks on
their own time. Heather described that she and her team understood the challenges associated with learning from home and how home environments may differ significantly between students: “...especially now being in a home setting. That might be different for some people.” Similarly, Lawrence explained how, despite it becoming more challenging to contact his teammates after the transition, his feelings about his teammates had not changed because he “knew everyone had stuff to do, and it was such a difficult time.”

In the subtheme empathetic understanding, we also noted how participants articulated the importance of empathy and understanding both with respect to their teammates and professors. Our participants perceived that during the transition, professors were largely understanding of any adversities that students experienced in their new learning environments. However, some professors may have been less comfortable with technology, leading to challenges in facilitating these relationships between professors and students. As an example of a success, Denise explained that her professor “was understanding of any circumstance.” This sense of understanding, combined with her professor’s frequent communication over email, helped Denise continue to get the support she needed from her instructor after the transition to online learning. Here we note an interaction between the subthemes of empathetic understanding and perceptions of autonomy and control as the understanding from her professor gave Denise a greater sense of control over her learning experience when she experienced issues with technology. At the same time, other students perceived a disconnect with instructors. John noted how, prior to the transition, he would approach his professor after class and speak with them about extracurricular opportunities he could get involved in. After the transition, however, John noted that these interactions became much more infrequent because in the online classroom, it was “easier to leave without physically seeing the professor.” Gregory echoed this sentiment:

When [the professor] would go through the breakout room, stuff like that, his camera would be off and [...] I don’t know, I like seeing a face and being able to talk to them, seeing their body language, seeing them smile when I say something. It just makes me feel better. It makes me feel like we’re having a connection, having a ... trying to build a relationship. ... I just thought a little bit of that was lost when we transitioned to an online setting. (Gregory)

Students further described how, prior to the transition to online learning, their professors would often share insights into prior experiences in engineering and how these interactions became much more uncommon in the online classroom. Joshua recalled how prior to the transition, his professor would share their prior experiences as an engineer and how that shaped his learning experience in the class:

During the in-person courses [the professor] shared a lot of insight into just the general engineering world and ... sharing his past careers in engineering and that was a helpful experience when looking at the scope of engineering design as well, to be able to hear about those past experiences that he had. (Joshua)

Joshua stated that these interactions became much more infrequent after the transition to online learning, which then lowered his interest in the class. It is in Joshua’s experience that we note an interaction between the subthemes of personal bonds with professors and perceptions of engagement: “I felt that my general interest in the class might have lowered a little bit, just purely due to there wasn’t quite as much of that personal experience injecture [sic] into the lessons.”

These students’ descriptions about the changes in their interactions with instructors underscore the importance of relationships between students and instructors. It is here, too, that interactions between themes are seen: different students’ temperaments and strategies for academic success (such as seeking out communication with professors), their interest in the class, and perceptions of their ability to control the situations (such as the ability to reach out if things were to go awry, such as in Denise’s case). We do note, however, that both students and instructors were adapting to sudden changes around them during a tenuous time, and it is possible that instructors recognized these issues in the online classroom but were not adequately equipped with the resources or skills needed to address them.

4.2 Building and sharing knowledge through interactions

We chose to separate this theme from the theme relationships with others to call attention to aspects of learning and transmission of knowledge that were both enhanced and prohibited during the rapid transition to online learning.
Exploration is an essential tenet of workplace thriving theory and was at risk of being completely disturbed during the rapid transition to online formats. While instructors were identifying the best ways to replicate a classroom environment online, students were attempting to navigate a digital classroom landscape. Our results revealed that the transition shifted students' perceptions of peer interactions as a mode of learning, which impacted how students navigated through the course. We identified two subthemes under this theme: (1) peer-to-peer learning and (2) new formats for transmission of technical material. We often observed this theme interacting with the theme relationships with others in students' accounts, showing how the interpersonal dynamics of a team perhaps affected the transmission of knowledge.

The subtheme peer-to-peer learning refers to students' perceptions of knowledge transmission, and these perceptions were observed to be both positive and negative. For Jeremy, his team chose to overcome the obstacle of virtual collaboration using a divide-and-conquer approach rather than a collaborative sharing of ideas:

I really feel that being educated in engineering has a huge part to do with working with other people. And once it went online, it was really... Our communication within our design team was just like, “Alright, I’ll do this, you’ll do this, you’ll do this,” and that’s it. And we weren’t really working closely together and communicating, it was like just kind of default. (Jeremy)

In Jeremy’s account, we also observed an interaction with the subtheme future orientation. Jeremy’s perception of a professional engineer, or his future self, was solely associated with active collaboration with other people on the team, rather than the distributed working style his team selected. Jeremy did not discuss whether his team had explored other models for knowledge transmission or collaboration other than the approach of delegation. Other students noted that the biggest barriers occurred during brainstorming sessions and were often related to the nature of virtual collaboration on online meeting platforms, like Zoom. For example, Howard felt that the rate at which design ideas were discussed decreased after the transition to online learning:

In person, when four people are just throwing ideas at each other, it’s a lot easier to pick out what everyone's saying, whereas online it just becomes just a massive sound being thrown around and it becomes a little bit difficult to discern what's being said. (Howard)

Students also felt that the lack of a common, physical working space, as they had during in-person instruction, impeded the flow of ideas. For instance, Joyce said that sharing ideas is “easier to do when you are in person, just with body language and being able to draw stuff out rather than having to show it through a screen.”

While students like Jeremy, Howard, and Joyce saw Zoom collaborations as a fundamental barrier to the design process, others saw some advantages of the Zoom platform. For instance, John described that not seeing his teammates during discussions gave him a “sense of security,” which then enabled him to communicate with his team more openly:

After we transitioned to online learning, interacting with our project group was, at least for me, a lot easier especially because nobody used their webcams or nobody had webcams which made it easier for me to like... I don’t know, like, I can hide behind my screen, if that makes sense? So it made it... It made me feel like I could communicate easily or I can speak my mind more easily and still have a sense of security so it made it easier for me to communicate my needs and it made it easier for my group mates to communicate their needs. (John)

John described how this greater sense of security and subsequent ease of communication helped him establish interpersonal relationships with his teammates and work more collaboratively, and we note an interaction between the subthemes of peer-to-peer learning through interactions and sense of camaraderie:

So because they saw me as that when I opened up to them and was able to communicate more effectively with them, it showed them that they could be more vulnerable and more open with me. So once I was able to get past that. ... Yeah, once I was able to show them that I was willing to work with them or at least I was more able to work with them, they were more willing and more able to work with me, if that makes sense. (John)
The subtheme new formats for transmission of technical material identified how the unforeseen barriers related to the transmission of knowledge within teams extended into the classroom environment as well, particularly manifesting in a hesitancy to ask questions during online lectures or engage more generally with the course. When contrasting her online and in-person learning experiences, Alice recalled that in person, her professor was “good at reading facial expressions” and was able to gauge when students were confused or had questions. However, Alice felt that this aspect was lost in the online environment, primarily because of the lack of face-to-face communication. Alice also noted that she became more wary of asking questions during a lecture because she did not want to interrupt her instructor—“sometimes there were parts of confusion where I was like, ‘I don’t really understand what you’re saying, but I don’t wanna interrupt anything, so I’m just gonna wait until after,’ but then I just forgot.” Todd also described similar perspectives on asking questions, and noted that to ask a question in Zoom, he would have to “stop the whole class.” He also noted an increased apprehensiveness due to a fear of his classmates’ judgments for asking a “stupid question.”

The quotes above demonstrate linkages with the subthemes of sense of camaraderie and personal bonds with professors. For example, Alice explained that her professor’s ability to interpret confusion while in-person did not translate to an online setting—perhaps because student videos were not on (at this institution, video cannot be mandated by faculty), which would have played a role in the personal bonds between students and faculty. It is also plausible that students who had not yet developed a sense of camaraderie with their teammates or classmates at large may have been hesitant to ask “stupid questions” in front of others, a fear exacerbated by an online environment.

However, it appears as though for some students, the wariness of asking questions was addressed by their instructors using the breakout room feature on Zoom to tend to students who had any questions. Students navigated to a separate room in the Zoom lecture, where either the instructor or teaching assistant would answer their questions. John noted that this feature helped him “talk to [the instructor] easier without worrying about what the other students ... or if the other students needed to talk to her.” Students also appeared to have varying perceptions about the efficacy of the chat feature on Zoom. While Denise appreciated having a way to privately ask her instructor questions, Joyce described how her instructor would not always watch the chat window while simultaneously teaching, and hence, would lose track of the questions students were asking.

Through these quotes, we note how students’ perceptions of their engagement were often dictated by the perceived barriers of attending lectures over Zoom. However, it was unclear whether our participants took active or passive roles in their course engagement, such as keeping their webcams on, using the chat function of Zoom, or experimenting with different group management styles in the distribution of knowledge during collaboration.

### 4.3 Perceptions of experiential learning

This theme captures students’ perceptions about what and how they were learning following the transition to online learning in this hands-on, project-based design course. The data exemplifying this theme is psychological in nature as it does not have to do with outward relationships but in how students situated whether they were learning what they needed to be successful. We characterized students’ perceptions of experiential learning via three subthemes: (1) access to learning opportunities and resources, (2) future orientation, and (3) reframing learning experiences.

In the first subtheme, learning opportunities refer to the new skills students hoped to learn during the course (such as prototyping skills), and learning resources refer to the utilities that students need to successfully learn (such as computers or a stable internet connection). A lack of access to the utilities needed to learn often interacted with the control students perceived over their learning experiences. For instance, Jeremy stated how the lack of access to a stable WiFi connection posed significant challenges in keeping up with the class as they were learning computer-aided design tools like SolidWorks:

> My whole family was on the WiFi, so I only got halfway through every time and it would just cancel automatically. So I ended up using the student portal version through, I think, web files, yeah. And it was really slow and at times, it was unusable, so there were only certain windows where I could use it. (Jeremy)

Students also described a sense of loss due to perceived access to certain learning opportunities, such as developing hands-on prototyping skills. This perceived loss often interacted with the second subtheme future orientation, which refers to students’ perceived impact of the transition to online learning on their futures. For instance, Joyce worried...
about her lack of access to learning opportunities (especially hands-on training in the university machine shop) and whether other professors in her future would be cognizant that they had not had these opportunities:

I don’t know, things, that we would need to know going into the workforce and stuff. Like I said, with the work, the workshop, and just using different tools, cut, sand down, just stuff like that where ... I think this really was a great environment that we could have learned in this class. And then coming home, obviously, you can’t expect people to have access to those things, we can’t learn that from home. [...] I guess just if there are other classes where those skills would have come into play, whether other students learn them or not, either the instructor will have to take extra time out of the curriculum and teach them, or if students have learned it in a previous semester or whatever, then I will personally feel behind, along with the other students are in the same boat as me. But then you still kinda have to take a step back from what the teacher’s usual schedule is and be like, “Hey, half of us don’t know what we’re doing.” (Joyce)

While many students focused on the learning opportunities lost due to the transition to online learning, the subtheme reframing learning experiences focuses on students’ descriptions of the skills gained in an online environment. We observed that some students tended to reframe their learning experiences, stating that the transition to online learning helped them discover new ways to problem-solve and learn new skills they would not have otherwise had the opportunity to learn. For instance, Alice found a personal commitment to her future role as an engineer as she developed her academic resilience:

“I mean I feel like that’s kind of what engineering is ... just figuring out different ways of doing stuff.” Similarly, John felt his experience highlighted the importance of creative problem solving within engineering, stating:

It also showed me how important it is to be able to think out of the box or to be able to come up with a solution that people may not be able to think of to a problem. For example, the lack of resources. I had to think out of the box to create a prototype, and yeah. I think, overall, it shifted my perspective from just like, “Okay, here are a bunch of like rules in physics, or here is a bunch of math, learn how to, or like, learn how to do this to create a design.” It showed me that it’s also very important to be able to think out of the box when it comes to creating a solution. (John)

For Mary, working with her team over Zoom showed her the importance of dedicating additional hours outside of class time to achieve outcomes of higher quality and helped her link classroom experiences with perceptions of the “real world” and future work:

I think being on Zoom kinda taught us that it’s good to do work outside of class. [...] And because in the real world, you kinda don’t sit down for two hours to solve a big project, so the more time you spend on it, the better it’s going to be. (Mary)

We see how students’ perceptions about losing access to learning opportunities, and the associated impact on their future, interact with their perceptions of control. For instance, Joyce demonstrated a perceived lack of control in her learning in both this class and future classes and felt that she would have to depend on her future professors to accommodate students who might not have learned hands-on building skills due to the transition. At the same time, we also observe a link between students’ reframing of learning experiences, motivation, and perspectives of their future roles as engineers. Both Mary and Alice point toward their motivation to develop an engineering identity—how adapting to challenges, developing a work ethic, and discovering new ways to problem solve were all critical to becoming an engineer in the future, and this would have positively impacted their feeling of thriving in the online environment.

### 4.4 Individual behaviors

Students also described experiencing changes in affective and socio-emotional states as a result of the transition to online learning. Changes in course structure, learning modality, and students’ environments were all identified as contributors to changes in students’ individual states. On further observation, we noted how much of the data captured by this theme relates to self-regulated learning. Zimmerman (1989) defines self-regulated learning as “metacognitively,
motivationally, and behaviorally active participants in their own learning process” (p. 329). Specifically, this theme encompasses three subthemes: (1) perceptions of engagement, (2) perceptions of motivation, and (3) perceptions of autonomy and control. These facets relate to the aspect of thriving related to task focus and the agency or ability to focus on a particular task. For our participants, many seemed to both blame the lack of structure for decreases in motivation and self-regulation, but simultaneously enjoy the autonomy that remote learning provided. In the subtheme perceptions of engagement, we noted how students described a lack of self-regulation in distancing themselves from distractions in their home environment and being unable to completely focus on the class material. This was largely driven by the inherent autonomy associated with online learning, highlighting the interaction between the subthemes of perceptions of engagement and perceptions of autonomy and control. For example, Lawrence described how his online design class allowed him more freedom to engage in distractions, stating:

I would say, I don't think 100% of my focus when I was working on something for [this course] was 100% there. [...] I was always distracted on something else in my phone or something else. And I think that negatively impacted how I learned and focused. And I feel like I could have done a lot more if it was in-person. In an in-person setting, you're forced to listen and I kind of need that. I think making things stricter with instruction, and I think it would benefit it greatly. (Lawrence)

Anthony described how his inability to separate home and work life resulted in a lack of productivity:

I was eating, I was sleeping, I was working in the same place. And I strive [sic] in the disconnect [ed] environment where I'm like, at home, I don't do any work, and that's how I was [on campus], I would not do any work at home, I would not do any work in my dorm, but as soon as I was in ... As soon as I got out of that and I was in the computer lab, it'd be work, work, work. (Anthony)

The inability to self-regulate engagement due to distractions also extended to project discussions among students and negatively impacted how students worked together in the online environment. Gregory attributed the decline in the quality of the interactions in his team to these distractions at home, saying: “Our focus wasn’t entirely there. And I’ll be honest, my focus wasn’t there entirely either. Sometimes I’d be sitting on my phone, other times someone else would be playing Xbox or something like that, barely on the Zoom connection.” These students point to the inherent challenges associated with learning from home. We also note interactions between the subthemes perceptions of engagement and sense of camaraderie, in that the lack of focus during team meetings detracted from the relationships between students.

The subtheme perceptions of motivation captures how students also indicated changes to their motivation after transitioning to online learning in varying levels of detail. While not specifically mentioning changes to her motivation, Joyce explained that as online learning progressed, she began to start seeing changes in how seriously she took her classes because she began to “start pushing those barriers and the limits of what ... how comfortable you really can get while still doing well enough in the class.” Denise, however, was much more specific about the decline in motivation she experienced in the online learning environment. Denise associated this decline with the cost of higher education and the perceived lack of rewards, noting, “I’m paying so much money for no reason” without the “fun college stuff.”

Some students, like Alice, acknowledged the need for greater self-motivation in online learning. Describing learning online as a “different experience,” Alice said, “it was a lot more self-motivating, self. ... You had to make sure you’re doing this yourself, getting your work done, so I think that was definitely a different experience.”

Mary recognized this need for self-motivation and said her learning was not affected by the transition to online learning because of the drive she had: “I don’t think that my learning was affected by it because I still gave my 100%.” Mary also added that once she knew she could access SolidWorks from home, she began to spend more time on individual CAD assignments, which increased her appreciation for the class. “I think once I spent more time at home, that's when I appreciated [the class] more because I spent more time on it.” Mary felt that her teammates were similarly motivated and used the course as a distraction from the ongoing global turmoil, stating:

I think we all took a lot of accountability for wanting to still do well in the class because even though the rest of the world’s off, we still had to finish our semester. I think that kind of drove us to want to do better. And just being online, we always wanted to spend more time on the project, it kinda became a fun thing to do because we were just at home. (Mary)
Associations were observed between the subthemes of perceptions of motivation and perceptions of autonomy and control. The issue of first-year engineering students’ motivation was observed to be at odds with their appreciation for the perceived autonomy and control embedded into online learning. The participants often spoke positively about being able to do things on their own time and pace in the online environment. For Joshua, having access to SolidWorks from home meant that he could work on his projects and assignments at his own time and pace, and said that “being able to do [SolidWorks], really, at my own pace and being able to find my own time to do those kinds of assignments was definitely helpful.” Todd’s professor gave students more guided work time during the class, which he enjoyed:

I felt I could do [the work] more on my own time rather than the time that the teacher set off. Obviously, the class wasn't bad. I joined the class in-person, but when we were online, it would more be like ... the teacher would say, “Okay. Go do whatever work you have for this class during this time, and if you have any questions, you can ask me.” And I could just really do whatever work I had on my computer with the class, and it was just a lot better to do the stuff that I wanted to do rather than be told exactly what to do in this time. (Todd)

Students also reported having more free time to work on their projects or contact teammates due to the absence of nonacademic commitments in the online environment. This made it easier for students to find common times to collaborate on their projects, highlighting how motivated students were able to work more collaboratively, learn from one another, and build relationships between themselves. For instance, when explaining why her team performed better in the second project as compared to the first, Alice said:

If we counted the hours the first time we worked on a project and counted the hours the second project, I would say, the second project was double, if not more than that, the time we spent on it just because like, I don’t know, it was just easier to find time, easier to work for a long period of time and make it really how we wanted it. (Alice)

Students also found it easier to set up meetings with their instructors to clarify questions. For example, Denise found it much easier to attend her instructor’s office hours online:

It was just ... I know myself and you know, the walk from [the dorms to the engineering building], that's not something you wanna do to ask one simple question. So the fact of having it right at my hand just to send a message was super easy for me. (Denise)

The sense of agency, control, and motivation that students exhibited (or did not exhibit) interacted with their perceptions of engagement within the course. These behavioral traits and abilities to self-regulate interacted with relationships with teammates (recalling Anthony’s and Gregory’s reflections on the disengagement of their team members) and the peer-to-peer learning required in the course.

5 | DISCUSSION

In this work, we sought to understand how elements of workplace thriving theory manifested for first-year engineering students in a project-based design class that was forced to be remote due to the COVID-19 pandemic. By working with our data through a lens of workplace thriving theory, we can see how students’ experiences and behaviors layer together to provide a nuanced perspective on why and how some students did and did not thrive during the unexpected transition to online learning. The findings point to several takeaways that can be applied to online teaching and also augment engineering education in project-based courses taught in the traditional in-person environment.

Spreitzer et al. (2005) argue that heedful relating promotes thriving, as the development of interpersonal relationships between individuals creates social support systems and increases the likelihood of individuals helping one another. In our study, heedful relating manifested in the relationships with others theme, and students’ accounts indicated that the strong interpersonal relationships with their team members were a key contributor to their sense of thriving in an online learning environment. Smith (1995) posited that successful cooperative problem-based learning in engineering classrooms creates more caring and supportive relationships between students. It is likely that the
teamwork-focused, project-based learning structure of the class created opportunities for students to develop their interpersonal relationships and contributed to their sense of thriving. For Alice, the relationships forged between her teammates prior to the transition to online learning not only helped smooth the transition but also improved their performance in the online class format. Further, at a time when social relationships were especially strained for college students due to the circumstances surrounding the COVID-19 pandemic (Son et al., 2020), the relationships with team members created much-needed social support systems for students, as in the case of Denise. Although noting that not being able to see her entire class negatively impacted her happiness, Denise stated that working with her team helped counter the feelings of loneliness experienced during the pandemic. These accounts underscore the critical role positive interpersonal relationships play in the engineering classroom and how heedful relationships between students can promote thriving, even in the face of adverse situations. These relationships may be especially important for first-year engineering students as they progress through engineering as positive interpersonal relationships have been linked to reduced attrition rates (Gray et al., 2017) and the development of a greater sense of belonging in the engineering classroom (Schar et al., 2017).

Interestingly, some students reported being able to communicate more openly with their teammates online as compared to in-person, which led to them becoming closer with their teams. Two students alluded to an inherent “sense of safety” that was associated with not having to speak to people physically. While this is contradictory to prior work that has highlighted the challenges of communicating effectively in online environments (Baruch, 2000), it is possible that for some students, the lack of physical communication may have been more comfortable. John described how the sense of security he perceived led him to open up with his team more and work more collaboratively—indicators of John engaging in heedful relating. However, it should be noted that John could not point to a specific reason as to why he associated online communication with a greater sense of safety. Investigating the underlying reasons behind preferences in communicative habits and their effect on psychological safety, a variable known to be essential to creativity and teamwork (Burningham & West, 1995; Cole et al., 2020), could be an interesting area for future research.

We also observed the relationships with others theme often interacting with the individual behaviors theme. In Mary’s account, we see how the motivation to persist with their project despite the changes due to the pandemic drove her and her team to spend more time working together and perceive their time together as “fun.” Vitality, a key contributor to the feeling of thriving (Spreitzer et al., 2005), is experienced when individuals heedfully relate to one another and work together effectively to achieve a common goal (Paterson et al., 2014). It is likely that focusing on a successful project as a common goal helped the team experience a sense of vitality and subsequently contributed to their sense of thriving.

At the same time, however, some students were not prepared to build or maintain relationships in a virtual environment. Maintaining interpersonal relationships has been cited as one of the key challenges of teleworking (Baruch, 2000), as social isolation can lead to a decline in performance (Crandall & Gao, 2005). Gregory perceived that an absence of face-to-face communication, combined with challenges in self-regulating focus, led to a decline in the quality of his interactions with his teammates. It is here that we again notice the interaction between the themes of individual behaviors and relationships with others. Self-regulation may vary across learning contexts (Zimmerman, 2000), and the inherent autonomy that is characteristic of online learning makes self-regulation an important determinant of success in online learning environments. Prior work has demonstrated that students who exhibit strategies to self-regulate their learning display greater academic success (Bradley et al., 2017; Inan et al., 2017). Our data revealed how some students saw the digital divide as a barrier, noting that either they or their teammates would still not attend meetings and engage in other activities during Zoom lectures and meetings. These challenges in self-regulation may also be considered emblematic of the blurring of home and work environments for students, a phenomenon that is established in both online learning (Hollis & Was, 2016) and teleworking literature (McNaughton et al., 2014). Teleworkers usually rely on several strategies to maintain boundaries when their home and work environments share the same physical space (Basile & Beauregard, 2016). However, these strategies are built over time, and it is unlikely that students were able to develop these strategies or self-regulation skills during the sudden and complete transition to online learning environments. Further, perceived self-efficacy is known to mediate the motivation that individuals have to engage in self-regulatory behavior (Bandura, 1997; Zimmerman, 2010), and it is possible that the sudden transition to online learning did not give students sufficient time to develop their online learning self-efficacy (i.e., how well they can continue learning in an online environment). Online learning self-efficacy is determined by self-efficacy in using online technology, computer-based learning, and maintaining relationships in online environments (Shen et al., 2013), and students with lower efficacies in one of these areas may have tended to struggle with developing strategies to self-regulate their behaviors.
Relationships between students and instructors became much more nuanced and complex. While some students enjoyed that instructors were more accessible (e.g., not having to trudge across campus for office hours), they also felt their instructors were less approachable, a feeling that likely varied from professor to professor. Building on the work of Jones et al. (2014), in the eyes of the students, the role of an instructor goes beyond merely communicating course material. Students see their instructors as individuals who can guide them into and through engineering by connecting them with resources and opportunities outside of the classroom or providing insight into their own experiences as an engineer. Maintaining these personal relationships with students is crucial because, as noted in the case of Joshua, the absence of this personal relationship could contribute to a decline in their interest in the class or perception of lack of advancement. This is similar to research indicating teleworkers perceive fewer opportunities for advancement because of social impoverishment and lack of connections with supervisors (Bailey & Kurland, 2002).

The facets relating to autonomy and control within a task also interacted with elements of future perspective and reframing. John noted that the lack of resources forced him to think out-of-the-box in creative ways and gave him a more holistic perspective of the skills needed to excel in engineering. Similarly, Alice described how online learning contributed to her problem-solving skills by making her explore “different ways of doing stuff.” Reframing the lack of resources as a learning opportunity may indicate that these students engaged in exploratory behavior, one of the key contributors to thriving. Mary and Alice, who described themselves as being self-motivated after the transition, detailed how they were able to adapt to the new learning environment and explore new ways to carry out tasks, which likely contributed to their sense of thriving. In their accounts, we also observe an association between the perceptions about their learning and their perspectives about their future roles as engineers. Husman and Lens (1999) proposed that intrinsic motivation is fostered when students can visualize their future selves and associate the value of tasks to the development of their future identities. This development of intrinsic motivation is linked to increased learning in online environments (Youn et al., 2010). At the same time, however, other participants like Joyce felt they were missing out on their educations because of COVID, that this was the only time to learn some of these skills (e.g., the hands-on training with shop tools), and that they would be disadvantaged in the future because of this.

These aspects of future perspective, agency, and heedful relating as they manifested in our data are in part due to the participants’ status as first-year engineering students. The class in which they were enrolled was one of the first proper engineering courses they took in their curriculum. Because of this, there may be aspects of these uncertainties that are due to students’ lack of experience with what engineering actually is, what engineers do, and the engineering curriculum more broadly, topics that have been linked to student identity development in other engineering identity literature (Beam et al., 2009; Fleming et al., 2013; Morelock, 2017).

5.1 | Implications for current- and post-COVID engineering educators

This study has highlighted several areas of recommendation for engineering educators to harness workplace thriving theory within engineering classes that are taught in both in-person and online environments.

5.1.1 | Embed elements of authentic engineering careers into the fabric of classes to motivate course components

While some participants noted that they were reframing the online design experience as a lesson in navigating constraints, none of our participants identified that they might someday work on virtual and distributed teams (or that all professional engineers during the pandemic were also asked to work online). As such, we recommend that faculty explicitly discuss these elements of “the real world” as students navigate new or unexpected situations. This could be considered as a form of “scaffolding” future perspective or reframing, so students can reenvision barriers as professional development opportunities, and instructors can educate students about their future careers along the way.

5.1.2 | Orient new students to the resources to which they have access

We, as researchers and engineering educators, were struck with how few of our participants knew they had access to several online tools and software packages before COVID struck. Similarly, many students’ interviews indicated they
thought this specific design course was the only time they would be introduced to hands-on machine shop skills, when in fact all university students (not just engineers) can be trained and use the machine shop at any (non-COVID) time. We recommend that students be educated on the resources available so they may have the agency to use these resources at will in the future. Further, at the resumption of in-person learning, instructors should be aware that some students may have fundamental gaps in prerequisite knowledge or skills due to the transition to online learning. Instructors should be cognizant that courses may require restructuring to accommodate this cohort or may opt to work with instructors of other courses to provide students with the skills they feel were missed.

5.1.3 | Devote attention to heedful relating immediately for first-year engineering students

This research calls attention to the multiple domains in which our participants were working to find their place in order to thrive in their teams, among their classmates in lectures, with their professors, and within the college of engineering in general. Providing some scaffolding for students in developing operating procedures for online meetings and brainstorming sessions might be salient, as would distributing a modifiable “contract” for team members to be engaged and present during meetings, such that poor performers could be corrected early in the process. Instructors could also consider relatively “easy” things to continue to help make students feel welcome and make sense of their place in these multiple domains. Strategies like keeping videos on during office hours or breakout sessions, acknowledging meaning-making processes, and elevating opportunities for professional development can help students.

6 | CONCLUSION

This study sought to investigate the experiences of first-year students enrolled in an engineering design course during and after the sudden transition to online learning caused by the COVID-19 pandemic. By employing the workplace thriving theory and a thematic analysis approach, we identified four themes and associated subthemes that provide a holistic view of how the concept of thriving manifested in students' experiences in the online learning environment. Further, we also identified unique linkages between subthemes that provide a deeper insight into how different aspects of the online learning environment interact with each other and subsequently shape students’ learning experiences. Our findings indicate that students' relationships with their peers and professors significantly shaped their sense of thriving, and many students perceived an erosion of relationships in the online environment, particularly with professors. Students also described in detail the inherent barriers associated with interacting with their peers and instructors online and how these influenced their acquisition of knowledge. Further, students felt deprived of the hands-on learning skills they would have otherwise learned in a traditional, in-person semester. However, some students articulated developing other crucial skills due to the challenges posed by the transition, which then contributed to the development of their engineering identities. Interestingly, we find a tension with the autonomy that is inherently characteristic of the online learning environment. While some students thrived in being able to complete tasks on their own time and in having more flexibility in their learning experiences, others described a lack of self-regulation in their environments, often succumbing to the distractions in their homes. These findings characterize how students thrived or did not thrive, in the online learning environment, and provide useful implications for engineering educators on how the elements that contribute to thriving can be transferred to traditional, in-person learning environments. We strongly believe that the incorporation of these recommendations would not only create the environments needed for students to thrive in in-person classroom settings but would also enable instructors and students to be better prepared for future adverse events.

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