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The Undergraduate Engineering Mental Health Help-Seeking Instrument (UE-MH-HSI): Development and validity evidence

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Abstract

Background: Undergraduate engineering students experiencing distress are less likely than peers to ask for professional help. A population-specific instrument to facilitate the identification of factors that influence mental healthcare utilization could guide development and testing of interventions to increase help seeking.

Purpose: We used mixed methods guided by the Integrated Behavioral Model (IBM) to develop and evaluate the Undergraduate Engineering Mental Health Help-Seeking Instrument (UE-MH-HSI).

Method: First, we adapted existing measures of mental health help-seeking intention and mechanisms (i.e., attitudes, perceived norm: injunctive, perceived norm: descriptive, personal agency: autonomy, personal agency: capacity). Second, we coded qualitative interviews ($N = 33$) to create population-specific mental health help-seeking belief measures (i.e., outcome beliefs, experiential beliefs, beliefs about others' expectations, beliefs about others' behavior, beliefs about barriers and facilitators). Third, we tested the psychometric properties using data from 596 undergraduate engineering students at a historically White, research-focused institution in southern United States.

Results: Psychometric analyses indicated that (1) help-seeking mechanism and intention measures demonstrated unidimensionality, internal consistency, construct replicability, and sufficient variability; (2) mechanism measures demonstrated criterion evidence of validity; and (3) most items within the belief measures demonstrated sufficient variability and convergent evidence of validity.

Conclusions: The UE-MH-HSI is an evidence-based tool for investigating mental health help-seeking factors and their relationship to help-seeking behavior, well-being, academic success, and engineering identity formation. Guidelines for use are provided.

KEYWORDS
help seeking, mental health, psychometric analysis, scale development, validity

1 | INTRODUCTION

Mental health is of increasing concern on college campuses, with significant increases in students' self-reported symptoms of mental illness, such as depression and suicidal ideation (Lipson et al., 2018). While national data do not reveal significant differences in mental health distress between undergraduate engineering students and their non-engineering peers (Whitwer et al., 2023), mental health distress has been shown to differentially impact students who are historically excluded from engineering, including women, (Armstrong et al., 2022; Jensen & Cross, 2021), first-generation (Jensen & Cross, 2021), gender-expansive (Hargis et al., 2021), and LGBTQ students (Cech & Rothwell, 2018). These differences are likely due to experiences such as discrimination and systemic inequities that are outside the control of students from these groups (Holland et al., 2008). For instance, experiences of gendered, racial, and/or cultural discrimination were found to impact the psychological well-being of Black, Latina, and White graduate women in STEM (Wilkins-Yel et al., 2022). Additionally, experiences of marginalization or devaluation were found to correlate with poor mental health in LGBTQ undergraduate engineering students (Cech & Rothwell, 2018). Therefore, it is important that structures are adapted to support student wellness as they navigate their engineering education.

Undergraduate engineering students were found to be, on average, significantly less likely than their non-engineering peers to seek professional help from a therapist or counselor after controlling for the impact of sociodemographic factors such as gender and race/ethnicity (Lipson et al., 2016). Professional help seeking can reduce mental illness symptoms, improve prognosis of a mental health concern, and reduce progression to more severe or chronic disorders (Barnett et al., 2021; Mitchell et al., 2017). Further, untreated mental health distress can lead to poor academic outcomes such as decreased academic performance and student dropout (Bruffaerts et al., 2018; Deberard et al., 2004; Eisenberg et al., 2009; Hartley, 2011). This is particularly important for groups such as Asian, Black, Hispanic, multi-racial, and women students who report more mental health distress (Eisenberg et al., 2013) and/or are less likely to access mental health care (Hunt et al., 2015). Therefore, the treatment gap identified within the undergraduate engineering student population puts them at risk, motivating the need to understand and increase mental health help-seeking behavior.

To address this treatment gap, identification of the factors that most strongly influence mental health help seeking in undergraduate engineering students can facilitate the development of evidence-based interventions that increase treatment access. This can result in improved mental health and academic outcomes for students, including students with mental health disabilities (Zongrone et al., 2021). However, there remains a need for a comprehensive, help-seeking theory-driven investigation of the factors that influence mental health help seeking within the undergraduate engineering student population. Further, there is a need to adapt, develop, and validate self-report measures to allow rigorous assessment of these mental health help-seeking factors among undergraduate engineering students. Therefore, our interdisciplinary research team sought to answer the following research questions:

RQ1. What are the factors that influence mental health help seeking in the undergraduate engineering student population?

RQ2. How can we adapt, develop, and psychometrically evaluate measures for incorporation of these factors into a comprehensive instrument battery?

This paper reviews what is known about the factors that may influence mental health help seeking among undergraduate engineering students, introduces the Integrated Behavioral Model (IBM), articulates the need for the Undergraduate Engineering Mental Health Help-Seeking Instrument (UE-MH-HSI), and details our mixed-methods approach to developing and evaluating the UE-MH-HSI.

1.1 | Mental health help seeking in undergraduate engineering

Factors that influence mental health help seeking within the undergraduate student population have been well studied, with a recent review identifying common barriers such as self-reliance, stigma, and poor mental health literacy, and facilitators such as social encouragement (Lui et al., 2022). Financial burden and scheduling difficulties due to high demand and shortage of providers, including those who can offer culturally responsive services, pose additional structural barriers for some college students (Bruns et al., 2023; Ebert et al., 2019; Shea et al., 2019). Within engineering

undergraduate students, similar barriers have been identified. For instance, undergraduate engineering students reported an unfavorable perceived norm around mental health help seeking (Wilson et al., 2022), and stigma was associated with negative mental health help-seeking attitudes (Sanchez-Pena et al., 2021). Further, structural barriers such as appointment availability and ability to find the right provider have been identified within undergraduate engineering students and the general undergraduate population (Jensen et al., 2023; Wright et al., 2023). Because 81% of the psychology workforce in 2021 identified as White (APA, 2022), the challenge of finding the right treatment provider can be further exacerbated for Black, Latino/a/x, and international engineering students (Wilson et al., 2024) due to a preference for finding a therapist that matches one's own race/ethnicity (Cabral & Smith, 2011). Similarities in factors that influence help seeking also exist between undergraduate engineering students and students from other high-stress academic majors. For instance, factors such as the future need for security clearance might influence an undergraduate engineering student's willingness to seek mental health treatment (Beddoes & Danowitz, 2022). Similar findings have been found for professional degree programs such as law (Organ et al., 2016) and medicine (Chew-Graham et al., 2003; Dyrbye et al., 2015; Ey et al., 2000; Galbraith et al., 2014; Knipe et al., 2018), where perceived stigma, fear of disclosure, and detriment to career success impact mental health help seeking. While these factors might not be unique to the undergraduate engineering student population, they are important to consider when developing interventions aimed at improving mental health help seeking within this population.

Undergraduate engineering students also navigate a unique educational context that has the potential to influence their willingness to seek mental health care. The engineering education system is known to operate as a meritocracy where success is assumed to directly correlate with hard work and dedication, ignoring the potential impact that systematic differences in opportunity can have on individuals (Cech, 2014). This has also been described as "a meritocracy of difficulty" (Stevens et al., 2007, p. 1), where students perceive that they must work hard and make sacrifices to navigate a discipline that is more challenging than non-engineering disciplines (Stevens et al., 2007). This is supported by students being portrayed as "heroes" navigating their rigorous education in pursuit of a lucrative career (Sochacka et al., 2021). To navigate this academic environment, many undergraduate engineering students perceive that seeking mental health help would mean they must sacrifice time, which in turn would be a sacrifice of their academics (Wright et al., 2023). Further, because undergraduate engineering students feel that stress and poor mental health are "normal if not necessary" within engineering (Jensen et al., 2023, p. 13), they may be more likely to be resigned to their mental health struggles. This can contribute to the "stress culture" that has been identified in engineering (Cross & Jensen, 2018; Jensen & Cross, 2021), and might lead students to prioritize support from their peers who face similar challenges rather than access professional help (Jensen et al., 2023). Further, peer support might be perceived as a more efficient way to gain mental health support, where students do not have to navigate the inefficiencies of the mental healthcare system such as waiting lists and long treatment processes (Wright et al., 2023). Engineering students have also expressed concern that a therapist might not understand their experiences in engineering (Wilson et al., 2024), or that their experiences may be minimized because of the therapist's perception of what it takes to become an engineer (Beddoes & Danowitz, 2022). Together, this environment results in mental health concerns being minimized and ignored as students navigate their education because, "you have to prioritize the education and the work that goes towards it instead of ... yourself" (Wright et al., 2023, p. 974).

Help seeking is likely further influenced by the hegemonic masculine norms infused in engineering culture, such as self-reliance, toughness, and emotional stoicism (De Pillis & De Pillis, 2008; Godfrey & Parker, 2010; Sagar-Ouriaghli et al., 2020), which have been linked to reduced help seeking in the general population (Juvrud & Rennels, 2017; Levant & Richmond, 2016; Mahalik & Di Bianca, 2021; McDermott et al., 2018). Undergraduate engineering students have identified that they are more likely to try to solve their own mental health problems rather than seek out professional help (Wright et al., 2023). Further, the traditional ideology of "technical/social" dualism in engineering results in the devaluation of human-centered competencies compared to technological competencies (Faulkner, 2000). While there has been a shift toward the integration of social competencies (e.g., communication, teamwork, social justice, ethics) into the engineering curriculum, a majority of courses still prioritize the development of knowledge that is analytical, objective, and detached from emotion (Kellam et al., 2018). This focus is often misaligned with student interests, where many students, especially those who are marginalized by race and/or gender, are driven to engineering as a result of their equity ethic (e.g., concerns over social justice and addressing inequity) (McGee & Bentley, 2017; Naphan-Kingery et al., 2019). These students are interested in curricula that contextualize the societal impact of engineering. However, there is often a disconnect between students' humanitarian career goals (Garriott et al., 2023; McGee & Bentley, 2017) and the engineering focus on advancing the economic interests and global competitiveness of the United States (Sochacka et al., 2021). Consequently, students may feel as though their personal goals are misaligned

with their education (McGee & Bentley, 2017), leading to diminished sense of belonging and decreased retention. Additionally, many undergraduate engineering students feel that emotions should not be involved in the engineering problem-solving process (Lönngren et al., 2020). This belief can carry over into their personal lives, where they feel that they do not have time to acknowledge their emotions (Wright et al., 2023). These cultural norms within engineering have the potential to not only influence the prioritization of mental health but also help seeking within the undergraduate engineering student population.

While the literature has identified several factors that appear to influence mental health–related help seeking in undergraduate engineering students, to our knowledge there are no help-seeking theory-driven studies that have comprehensively identified and compared the factors that influence undergraduate engineering students' help seeking. There is also limited understanding of which factors most greatly influence a student's decision to seek help for their mental health. Therefore, there is a current gap in the literature around the specific factors that most strongly influence help-seeking behavior in undergraduate engineering students, and hence the most promising targets for behavioral interventions remain unidentified.

To address these gaps in the literature, there remains a need to conduct a help-seeking theory-driven assessment of the factors that have the potential to influence help seeking within the undergraduate engineering student population and determine which factors have the strongest influence on help seeking. Analyses should also be conducted within key sociodemographic segments of the population that are at high risk for suicide (e.g., White men [Curtin & Hedegaard, 2019]), high risk for mental health distress (e.g., women [Jensen & Cross, 2021]), low likelihood for accessing treatment (e.g., Asian, Black, Hispanic, multi-racial students [Eisenberg et al., 2013]), and/or underrepresented in engineering (e.g., Black women [Garrison, 2013; National Academies of Sciences & Medicine, 2020]). Such comprehensive assessment requires the availability of psychometrically sound measures of these factors. While measures for some help-seeking factors do exist and have been validated in the undergraduate engineering student context (e.g., stigma [McAlister et al., 2023], attitude [Sánchez-Peña & Kamal, 2023; Wilson et al., 2022], perceived norm [Wilson et al., 2022]), there are many factors that could influence help seeking in this population for which measures do not exist (e.g., anticipated reactions from members of the engineering community to one's seeking help). Therefore, there is a need to develop an instrument battery that permits this comprehensive assessment of help-seeking factors among undergraduate engineering students. This paper documents the development and psychometric evaluation of such a battery: the Undergraduate Engineering Mental Health Help-Seeking Instrument (UE-MH-HSI).

1.2 | Theoretical framework

1.2.1 | Selecting a framework

The reasoned action paradigm is commonly applied to study mental health help seeking (Davis et al., 2015; Rickwood & Thomas, 2012). The reasoned action paradigm began with the Theory of Reasoned Action (Ajzen, 1980), evolved into the Theory of Planned Behavior (Ajzen, 1985), and the most recent articulations include the Integrative Model of Behavioral Prediction (Fishbein & Ajzen, 2010) and the Integrated Behavioral Model (IBM; Montaño & Kasprzyk, 2015). The IBM was developed in line with recommendations from the National Institute of Mental Health behavioral theory integration workshop (Montaño & Kasprzyk, 2015), and the Institute of Medicine has recommended the use of integrated models like the IBM when implementing strategies to change health behavior (Institute of Medicine, 2002).

We chose the IBM to ground the development of the UE-MH-HSI for four reasons:

1. Unlike most other theories, the IBM provides researchers with concrete guidance for developing a self-report instrument that can comprehensively assess the wide range of factors that influence behavior.
2. Given its comprehensive nature, the IBM accounts for many of the factors embedded in other theories, as recently summarized (Hammer et al., 2024).
3. The IBM provides a sequential roadmap for applying mixed methods to systematically identify the most important factors that drive a given behavior within a specific population (Montaño & Kasprzyk, 2015).
4. The IBM is explicitly designed to be tailored to a specific behavioral context and population of interest by incorporating constructs that are relevant regardless of the behavior or population in question. This permits the applicability

of the IBM to this behavior (e.g., mental health help seeking) and this population (e.g., undergraduate engineering students).

Help seeking can vary across populations and is generally less prevalent among distressed undergraduate engineering students compared to their non-engineering peers (Lipson et al., 2016). The IBM literature highlights that "the relevant underlying beliefs for a particular behavior may be very different for different populations...although an investigator can sit in an office and develop measures... this process may not identify the correct beliefs relevant to the behavior" (Montaño & Kasprzyk, 2015, pp. 107–108). Therefore, it is crucial that development of a comprehensive, population-specific measure of the beliefs that influence decision making is grounded through interviews with members of that population. This ensures that the most important factors influencing behavior are incorporated into the measure and, therefore, are able to be identified as targets for future intervention (Montaño & Kasprzyk, 2015). In summary, the IBM was a suitable theoretical framework to ground the development of UE-MH-HSI.

1.2.2 | Applying the IBM to mental health help seeking

In the context of mental health help seeking, the IBM posits a causal sequence of factors that influence a person's prospective help-seeking behavior (Figure 1). Prospective help-seeking behavior is defined as mental health "problem focused, planned behavior, involving interpersonal interaction with a selected health-care professional" (Cornally & McCarthy, 2011, p. 286). In turn, help-seeking intention is a person's self-reported degree of readiness to exert effort to seek help from a mental health professional. According to the IBM, help-seeking intention is the primary antecedent to prospective help-seeking behavior, which is why intention is the dependent variable of interest in most IBM and mental health help-seeking studies (Fishbein & Ajzen, 2010; Hammer & Spiker, 2018; Montaño & Kasprzyk, 2015). Intention is influenced by help-seeking mechanisms: attitude, perceived norm, and personal agency. Attitude is a person's overall evaluation (positive vs. negative) of seeking help. Perceived norm is a person's perception of the social pressure/encouragement from others to seek or not seek help. Personal agency is a person's self-perceived ability to seek help.

Each mechanism is shaped by the mental health help-seeking beliefs underlying that mechanism. Attitude is shaped by outcome beliefs (i.e., anticipated negative or positive outcomes of the person's help seeking) and experiential beliefs (i.e., negative or positive emotional responses to the idea of seeking help). Perceived norm is shaped by beliefs about others' expectations for their behavior (i.e., do they believe that their friends or family expect them to seek help?) as well as their beliefs about others' behavior (i.e., do they believe that their friends or family would seek help for themselves?). Personal agency is shaped by beliefs about barriers and facilitators, which include control beliefs (i.e., perception of personal autonomy to seek help) and self-efficacy beliefs (i.e., confidence in their ability to seek
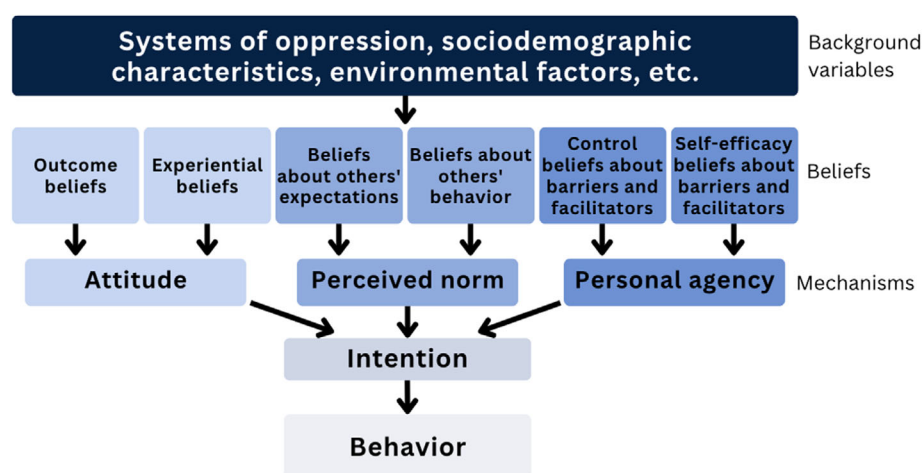

FIGURE 1 Background variables, beliefs, and mechanisms influencing intention to seek help per the Integrated Behavioral Model (Montaño & Kasprzyk, 2015).

help). In turn, help-seeking beliefs are influenced by background variables such as systems of oppression (e.g., sexism, racism).

While the mechanisms can be assessed directly, the strength of the IBM is the use of belief measures to assess the specific beliefs that underlie the mechanisms. For example, a measure of attitude would ask individuals to evaluate mental health help seeking using semantic differential scales such as "My seeking help from a mental health professional would be... good/bad." In contrast, a measure of outcome beliefs would ask individuals to indicate how strongly they disagree or agree with belief statements such as "My seeking help from a mental health professional would be a sign of weakness." Whereas the measure of attitude allows the researcher to understand an individual's overall evaluation of help seeking, the measure of outcome beliefs allows the researcher to understand which specific beliefs influence that evaluation. Identifying and measuring these specific beliefs helps researchers to understand the factors that ultimately drive help-seeking intention and behavior.

Published mechanism and intention measures for mental health help seeking exist (refer to Table 2 in the Method section) but require (a) adaptation to be suitable to study mental health help seeking in the undergraduate engineering student context and (b) psychometric testing to verify that they provide reliable and valid measurement of these constructs in this population. Preliminary evidence of validity of these mechanism measures can be found for first-year engineering students (Wilson et al., 2022). In contrast, IBM recommends that beliefs be assessed with population-specific self-report survey measures tailored to the specific behavior under study (Montaño & Kasprzyk, 2015). While the IBM has been applied in a qualitative study to understand beliefs about barriers and facilitators to mental health–related help seeking in undergraduate engineering students (Wright et al., 2023), we are aware of no published IBM-aligned measures of mental health help-seeking beliefs for undergraduate engineering students, much less for any college student population.

1.3 | The two objectives of the present study

To address the current gap in the literature around mental health–related help seeking in undergraduate engineering students, we established two objectives for this mixed-methods study. Our first objective was to adapt and quantitatively verify the psychometric properties of existing IBM survey measures within undergraduate engineering students, specifically measures of help-seeking mechanisms and intention. Our second objective was to generate and quantitatively assess new survey items specifically scoped to help-seeking behaviors of undergraduate engineering students. Completing these objectives resulted in a comprehensive and psychometrically sound survey instrument, the Undergraduate Engineering Mental Health Help-Seeking Instrument (UE-MH-HSI).

2 | POSITIONALITY STATEMENT

The first author is a tenured counseling psychology professor, White man, and licensed psychologist with expertise in creating mental health help-seeking measures (e.g., Hammer et al., 2018; Hammer & Spiker, 2018). The second author is a Black woman counseling psychologist in training with expertise in culturally relevant and affirming mental health treatment and critical-constructivist qualitative research methods. The third author is a White woman counseling psychologist in training with expertise in mental health treatment, large-scale survey development, and the provision of culturally relevant academic coaching to college students. The fourth author is a White woman, tenure-track professor in chemical engineering who uses her skills in mixed methods to better understand mental health in engineering, with a focus on understanding strategies for improving student success and well-being. Thus, the research team is a mix of engineering and non-engineering professionals, has a mix of insider and outsider status (Secules et al., 2021), and collective domain expertise in mental health help seeking, engineering education, and culturally sensitive scale development.

Collectively, the authorship team believes that good mental health is important and a fundamental right for all humans, and that seeking professional help can enhance mental health. We perceive that engineering training environments implicitly socialize their members to prioritize professional productivity over mental health and self-care and that there are intrapersonal, interpersonal, and systematic barriers to distressed undergraduate engineering students having robust access to mental health care. Each member of the research team has experienced first-hand the factors

influencing their own help seeking, including barriers related to our individual positionalities as people with an intersectional mix of privileged and marginalized identities, both apparent and hidden.

We relied on intragroup dialogue to balance each other's perspectives, identify unwarranted assumptions, and work toward a shared understanding of how we could best address potential threats to validity (Walther et al., 2013). This included discussions on our motivations and the impact of our identities, biases, and personal experiences on the project (Sochacka et al., 2018). Quality strategies were integrated through the qualitative data collection process through purposeful sampling, use of a documented interview protocol that was grounded in theory, and integrated reflective practices which allowed for adaptation of the interview protocol (Walther et al., 2013). They were integrated throughout the handling of qualitative data through ongoing engagement of all team members with the data, consistent discussions across the research team, and connecting our findings to both theory and the broader literature (Walther et al., 2013). We considered how the institutional context and identity of the individuals in our study might reflect on our identification of salient beliefs and ensured that the perspectives of diverse individuals were represented within our findings. We meaningfully engaged in conversations that considered our diverse perspectives as team members, and challenged our interpretations of the findings based on our status as insiders and outsiders within engineering (Sochacka et al., 2018).

3 | METHOD AND RESULTS

3.1 | Overview of the instrument development process

To develop and psychometrically evaluate the UE-MH-HSI, we followed IBM measurement development guidelines (Montaño & Kasprzyk, 2015) and social science scale development guidelines (DeVellis, 2012). Figure 2 provides an overview of this mixed-methods process, including how the mental health help-seeking mechanism and intention measures were adapted and quantitatively tested (Objective 1) and the help-seeking belief measures were qualitatively developed and quantitatively tested (Objective 2).

In short, we defined help-seeking behavior for the context of our study and the help-seeking intention and mechanism measures were adapted to fit this definition. The help-seeking beliefs were investigated using elicitation interviews, allowing for the coding and development of help-seeking beliefs measures. Quantitative data were then used for the investigation of the psychometric properties of both the adapted and novel measures related to undergraduate engineering student mental health help seeking. The following sections detail these processes.

3.2 | Defining mental health help-seeking behavior

In line with extant help-seeking research (Hammer et al., 2018; Hammer et al., 2019; Hammer & Spiker, 2018), we defined mental health help-seeking behavior as "seeking help from a mental health professional within the next three months if experiencing a serious mental health concern." This definition is clear in terms of action (seeking help), target (from a mental health professional), time (in the next 3 months), and condition (i.e., if experiencing a serious mental health concern). The time frame aligns with published mental health help-seeking research (Hammer & Spiker, 2018) and limits the time frame to within the current semester. The condition aligns with published mental health help-seeking research (Fischer & Turner, 1970; Hammer & Spiker, 2018; Vogel et al., 2006; Wilson et al., 2005) and permits a hypothetical mental health distress framing to allow all students (even those not currently distressed) to provide valid responses to the instrument.

3.3 | Participants for qualitative elicitation interviews and quantitative survey

Table 1 provides demographic information for the undergraduate engineering students from a southern US, historically White, research-focused institution who participated in the elicitation interviews and the quantitative survey. It also provides demographic information about the undergraduate engineering student population in the US based on the distribution of undergraduate degrees in 2022 (ASEE, 2023). Our targeted sampling for qualitative elicitation interviews prioritized the oversampling of students who are historically excluded in engineering. Although Black and Latine/ Hispanic students were the same or lower than national averages, three out of the five bi/multiracial students identified
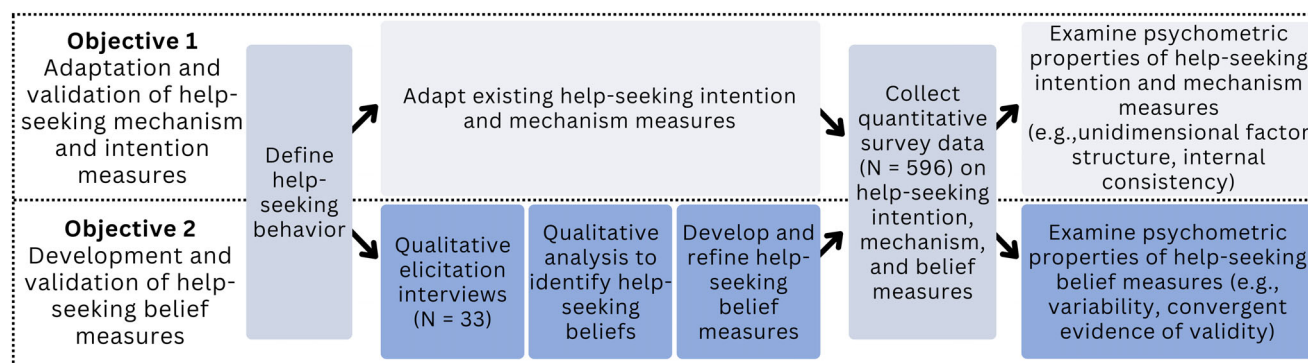
FIGURE 2 Overview of the mixed-methods process used in the (1) adaptation and validity testing of existing help-seeking mechanism measures and (2) development and validity testing of help-seeking belief measures.

TABLE 1 Research participants' demographics.

	Qual.	Quant.	Nat.		Qual.	Quant.	Nat.
Asian	25%	8%	17%	Men	47%	70%	76%
Black	6%	3%	5%	Women	41%	26%	24%
Bi/multiracial	16%	3%	–	Gender expansive	15%	1%	–
Latine/Hispanic	6%	7%	14%				
Indigenous	3%	1%	–	First generation	31%	–	–
White	47%	75%	56%	International	9%	–	11%

Note: Qual. = qualitative elicitation interview respondents; Quant. = quantitative survey respondents; Nat. = national average (ASEE, 2023).

as Black and/or Latine/Hispanic. Within the quantitative data collection, Black, Latine/Hispanic, and Asian students were lower than national averages, likely due to the study taking place at a historically White institution. The quantitative data over-sampled from first-year engineering students (78% of responses) due to the completion of the survey as an assignment within the first-year engineering courses. Finally, students were experiencing differing levels of mental health distress in both the qualitative and quantitative data collection, and had differing experiences with prior mental health–related help seeking.

3.4 | Quantitative survey procedure

After IRB approval, survey participants were recruited during the 2021–2022 academic year from two sources: (a) students completed the measures as part of an assignment in a course for first-year engineering students, and (b) an email invitation was sent to all sophomore, junior, and senior-level engineering students. Participants were able to skip survey questions they did not wish to answer and could opt out of their responses being used for research. Cases with more than one incorrect response to the three attention check items ($n = 64$) were deleted, resulting in a retained sample of $N = 596$. Start-of-survey instructions were developed to clarify the definition of "mental health professional" (adapted from Hammer et al., 2018) and describe a hypothetical mental health concern scenario (adapted from Wilson et al., 2011) that respondents were asked to use as the basis for their responses to the UE-MH-HSI measures (refer to Supplemental Material, Data S1).

A planned missingness design (Graham, 2009) was used to reduce the length of the survey (refer to Supplemental Material, Data S1). In the retained sample ($N = 596$), unplanned missing data on study measures ranged from a low of 1.8% to a high of 6.6%. The unplanned missing data rate for the overall variable set was approximately 3%, which is unlikely to bias statistical analyses (Graham, 2009; Schafer, 1999). We used Mplus version 8.8 for all analyses, which uses full information maximum likelihood (FIML) estimation to handle missing data (Graham, 2009).

TABLE 2 Published mechanism and intention measures.

Construct name	Construct definition	Sample item	Reference	Scaling	No. of items in UE-MH-HSI	Published reliability evidence	Published validity evidence
Intention	Readiness to exert effort to seek help	I would intend to seek help from a mental health professional in the next 3 months.	(Hammer & Spiker, 2018)	Seven-point Likert	3	$\alpha = 0.93$	Unidimensional factor structure, FD = 0.97, H index = 0.94, and predictive evidence of validity
Attitude	Overall positive versus negative evaluation of seeking help	My seeking help from a mental health professional in the next 3 months would be very [bad/good].	(Hammer et al, 2018)	Seven-point semantic differential	9	$\alpha = 0.94$	Unidimensional factor structure; FD = 0.97; H index = 0.94; and content, convergent, incremental evidence of validity
Perceived norm: Injunctive	Perception of others' expectations regarding one's seeking help	Most people who are important to me would want me to seek help from a mental health professional in the next 3 months.	(Hammer et al., 2019)	Seven-point Likert	3	$\alpha = 0.75$	Convergent evidence of validity
Perceived norm: Descriptive	Perception of others' own help seeking	Most people who are important to me would seek help from a mental health professional in the next 3 months.	(Spiker et al., 2019)	Seven-point Likert	3	$\alpha = 0.84$	Convergent evidence of validity
Personal agency: Autonomy	Sense of personal control over one's help seeking	My seeking help from a mental health professional in the next 3 months would be up to me.	(Spiker et al., 2019)[a]	Seven-point Likert	3	$\alpha = 0.62$	Convergent evidence of validity
Personal agency: Capacity	Confidence in one's ability to seek help	I am confident that I could seek help from a mental health professional in the next 3 months.	(Spiker et al., 2019)[a]	Seven-point Likert	3	$\alpha = 0.62$	Convergent evidence of validity

[a]Indicates that the cited reliability and validity results are based on a four-item personal agency measure consisting of a mix of autonomy and capacity items.

3.5 | Objective 1: Adapt and verify mental health help-seeking mechanism and intention measures

3.5.1 | Adapting mechanism and intention measures

The first step to complete Objective 1 (Figure 2) was to adapt existing mental health help-seeking mechanism and intention measures. For context, Fishbein and Ajzen (2010) and Ajzen (2019) have provided guidelines and sample items to create measures of constructs from the reasoned action paradigm (of which the IBM is an extension). Researchers have used these guidelines and sample items to create mechanism and intention measures specific to mental health help seeking (Table 2). The wording of these measures' items was adapted for inclusion in the UE-MH-HSI to ensure consistency with our definition of mental health help-seeking behavior. The Supplemental Material (Data S1) provides a complete copy of all UE-MH-HSI measures.

3.5.2 | Validation strategy for adapted mechanism and intention measures

For the five mechanism measures (attitudes, perceived norm: injunctive, perceived norm: descriptive, personal agency: autonomy, personal agency: capacity) and the intention measure, the following psychometric properties were examined: unidimensional factor structure, internal consistency, factor determinacy, construct replicability, variability, and criterion evidence of validity (DeVellis, 2012; Rodriguez et al., 2016). Confirmatory factor analysis was used to confirm that the items composing each of the six measures were unidimensional measures of their respective factors (Fishbein & Ajzen, 2010), as these measures were adapted from existing measures. All six latent factors (i.e., five mechanisms and intention) were modeled simultaneously using the corresponding items as manifest indicators, resulting in a measurement model with six correlated factors. The MLR estimator in Mplus (Muthén, 1998–2017) was used to estimate the model χ^2 and associated fit indices that protect against deviations from multivariate normality. The scaled chi-square statistic (scaled χ^2), root mean square error of approximation (RMSEA), comparative fit index (CFI), Tucker–Lewis index (TLI), and standardized root mean square residual (SRMR) were used to assess the goodness of fit for each model. The following fit criteria were used: RMSEA ≤ 0.06, CFI ≥ 0.95, TLI ≥ 0.95, and SRMR ≤ 0.08 for good fit; and RMSEA ≤ 0.10, CFI ≥ 0.90, TLI ≥ 0.90, and SRMR ≤ 0.10 for acceptable fit (Hu & Bentler, 1999; Weston & Gore, 2006). A good or adequate fitting model, along with evidence of strong item loadings on their respective factors, would indicate that the six item sets are appropriate unidimensional measures of their respective factors.

Cronbach's-α was used to determine the internal consistency for the six measures. Measures with six or fewer items demonstrate excellent internal consistency at $\alpha = 0.85$, good internal consistency at $\alpha = 0.80$, and moderate internal consistency at $\alpha = 0.75$ (Ponterotto & Ruckdeschel, 2007). Similarly, 7–11 item scales demonstrate excellent internal consistency at $\alpha = 0.90$, good internal consistency at $\alpha = 0.85$, and moderate internal consistency at $\alpha = 0.80$. The factor determinacy (FD) and construct replicability (H index) for the six measures were then determined. An FD > 0.90 would indicate that any observed differences in the measure factor score is indicative of true individual differences on the factor, while a H index > 0.80 would indicate that the measure latent variable is likely to be replicable across studies and useful in a SEM measurement model (Rodriguez et al., 2016).

To ensure that the measures demonstrated sufficient variability, the means, skewness, and kurtosis were examined for the mean score of the six measures. This allowed the determination of potential strong ceiling/floor effects (means within 1 scale point of the scale minimum or maximum), problematic skewness (> 3), or problematic kurtosis (> 10) that would limit the ability of the measures to be used in demonstrating covariance with other variables of interest (DeVellis, 2012; Weston & Gore, 2006).

In line with IBM recommendations, it is important to ensure that the mechanism measures explain sufficient variance in the intention measure. Therefore, regression was used to determine that the five mechanism measures collectively account for practically significant variance in intention to seek mental health help, which would constitute criterion evidence of validity. Given that meta-analytic evidence found that mechanism measures collectively accounted for an average of 39% of the variance in intention (Armitage & Conner, 2001), we defined practical significance as $R^2 > 39\%$ for the purposes of validity testing.

Soper's (2022) sample size calculator for structural equation models (SEM) was used to calculate the minimum sample size needed for adequate power in the current study (effect size = 0.20, power = 0.80, α = 0.05, number of latent variables = 6, number of observed variables = 24) (Soper, 2022). Because all quantitative survey participants were presented with the mechanism and intention measures, the present sample (N = 596) exceeds the sample required (N = 403) by the most complex statistical analysis (i.e., the six-factor confirmatory factor analysis measurement model) used in the present study. All other analyses required smaller sample sizes to achieve adequate power.

3.5.3 | Validation results for adapted mechanism and intention measures

Results of the confirmatory factor analysis determined that the six correlated factors measurement model demonstrated approximate fit, χ^2 (237, N = 595) = 549.12, $p < 0.001$; RMSEA = 0.047 [90% CI: 0.042–0.052]; CFI = 0.957; TLI = 0.950, SRMR = 0.039, and the manifest indicator loadings (β's > 0.73) on the latent variables were all significant at $p < 0.001$. These results indicate that the six measures are appropriate unidimensional measures of their respective latent factors (Table 3). The Cronbach-αs for all six measures were either excellent or good, which suggests that the six measures possess sufficient internal consistency. The FD (≥ 0.91) and H index (≥ 0.83) scores were above the recommended thresholds for all six measures, which suggests that the latent variables for these six measures are likely to be replicable across future studies and useful in future SEM contexts. Finally, the mean scores of the six measures did not exhibit strong ceiling/floor effects ($4.02 \leq M \leq 5.64$), problematic skewness (-1.07 to -0.10), or problematic kurtosis (-0.91 to 1.08), indicating appropriate variability.

The five mechanism measures accounted for 66% of the variance (R^2 = 0.66) in the intention measure, which exceeded the practical significance cutoff of 39% (Armitage & Conner, 2001). This suggests that the mean scores for attitudes, perceived norm, and personal agency collectively account for practically significant variance in intention to seek professional mental healthcare within this undergraduate engineering student population. This robust effect also increases confidence that the relevant influences on intention in this population are adequately captured by these mechanism measures. In summary, the results provide initial support for the psychometric properties of the mental health help-seeking mechanism and intention measures.

3.6 | Objective 2: Create and verify mental health help-seeking belief measures

3.6.1 | Conducting and coding elicitation interviews

The first step toward completing Objective 2 (Figure 2) was conducting semi-structured interviews with members of the population of interest. The elicitation interviews (N = 33) were conducted as described in Wright et al. (2023). IBM guidelines recommend interviewing at least 15–20 individuals from the target population, about 7–10 of whom have performed or intend to perform the behavior and 7–10 whom have not performed it (Montaño & Kasprzyk, 2015). Out of the 33 students interviewed, 10 had previously sought help and 22 had never sought help.

TABLE 3 Psychometric analysis results for the mechanism and intention measures.

Construct score	Mean	SD	Skewness	Kurtosis	α	FD	H index	β
Intention	4.02	1.74	−0.10	−0.91	0.92	0.97	0.94	0.89–0.92
Attitude	5.26	1.28	−0.44	−0.32	0.93	0.97	0.95	0.73–0.87
Perceived norm: Injunctive	4.32	1.61	−0.31	−0.66	0.86	0.94	0.88	0.76–0.86
Perceived norm: Descriptive	4.27	1.45	−0.23	−0.39	0.87	0.94	0.88	0.81–0.87
Personal agency: Autonomy	5.64	1.32	−1.07	1.08	0.88	0.94	0.88	0.81–0.86
Personal agency: Capacity	5.31	1.28	−0.59	0.06	0.82	0.91	0.83	0.74–0.81

Note: N = 596. For all scores, the minimum is 1 and the maximum is 7. β is the range of standardized factor loadings of that measure's items on its corresponding latent factor, derived from the six correlated factors measurement model, χ^2 (237, N = 595) = 549.12, $p < 0.001$; RMSEA = 0.047 [90% CI: 0.042–0.052]; CFI = 0.957; TLI = 0.950, SRMR = 0.039.

TABLE 4 Example interview questions used to elicit mental health help-seeking beliefs.

Type of help-seeking belief	Type of information	Example interview question
Outcome beliefs	Positive or negative attribute or outcome of seeking help	What would be the advantages/disadvantages of seeking help?
Experiential beliefs	Positive or negative feeling about the idea of seeking help	How do you feel about the idea of seeking help?
Beliefs about others' expectations	Individuals or groups (i.e., normative referents) who might favor or oppose one's seeking help	Who would approve/disapprove of your seeking help?
Beliefs about others' behavior		Who would/would not seek help for themselves?
Beliefs about barriers and facilitators	Situational factors that might make it easier or harder to seek help	What things would make it easy/hard for you to seek help?

Example interview questions used to elicit information relevant to each type of mental health help-seeking belief articulated by the IBM (refer to Figure 1) are provided in Table 4. In addition to these questions, we asked participants additional questions, including how their (a) cultural identity, (b) stressors associated with their engineering training, and (c) being an undergraduate engineering student shaped their mental health help-seeking beliefs. The interview transcripts were deductively coded with MAXQDA software by a team of undergraduate and graduate research assistants trained by the first author, who developed a code book directly derived from the "types of information" required by the IBM (refer to p. 108 of Montaño & Kasprzyk, 2015). Table 4 illustrates the correspondence between interview questions, types of information, and type of mental health help-seeking belief. The team semantically coded (Braun & Clarke, 2012) an initial set of transcripts, were provided with corrective training feedback by the first author, and then coded the remaining transcripts. Next, the first author verified all code lists, and coding discrepancies were discussed and resolved.

3.6.2 | Developing items for belief measures

The first, third, and fourth authors used the code lists to develop items for the corresponding mental health help-seeking belief measures (Table 5). Through consensus discussion, the team iteratively revised the items to (a) incorporate interviewees' lay language, (b) avoid conceptual redundancy among items, (c) use clear and accessible terminology and syntax, (d) avoid use of double-barreled items, and (e) cohere with the response anchors (DeVellis, 2012). We also sought to ensure that items regarding beliefs related to the impacts of systems of oppression (e.g., result in me being discriminated against by the mental health professional) were worded such that they did not depend on a respondents' social location, but would allow the instrument to capture how the endorsement of these beliefs may vary across sociodemographic segments. Additional items drawn from the mental health help-seeking literature (e.g., the belief that the idea of seeking help could lead one to feel "selfish"; Hammer & Vogel, 2017) that were not captured by the coding of elicitation interviews were also included.

Prior to survey data collection, feedback on the clarity of the instructions and items, as well as inter-item redundancy, was solicited from four undergraduate and seven graduate students from engineering and counseling psychology. The engineering students offered primary feedback from the population of focus, whereas the counseling psychology students offered feedback from the perspective of students who have a sophisticated understanding of mental health and help seeking. This feedback resulted in revisions included dropping certain redundant items, revising instructions, revising scaling, and clarifying item language, resulting in a final set of 37 outcome belief items, 19 experiential belief items, 11 beliefs about others' expectations items, 11 beliefs about others' behavior items, and 20 beliefs about barriers and facilitators items.

The influence of a belief about a behavior is dependent on one's evaluation of the value of that belief (Montaño & Kasprzyk, 2015). For example, attitude can be influenced by one's belief concerning an outcome of the behavior (e.g., "seeking help would result in me being prescribed medication") weighted by the evaluation of the value of that outcome (e.g., "being prescribed medication would be a [bad/good] thing"). Therefore, if people significantly vary in

TABLE 5 Mental health help-seeking belief measures.

Belief type	Definition	Sample quote from elicitation interview	Sample item	Measure prompt	Measure scaling	No. of items in UE-MH-HIS
Outcome beliefs	Anticipated process, attributes, and outcomes of seeking help	"My relationships could improve that I probably have damaged from struggling."	Improve my relationships	In this hypothetical scenario, my seeking help from a mental health professional in the next 3 months would _____.	Six-point Likert from 1 (strongly disagree) to 6 (strongly agree)	37
Experiential beliefs	Emotional responses to the idea of seeking help	"I feel like in that situation I might feel like helpless that I have to reach out for help and I'm not able to do it myself."	Helpless	In this hypothetical scenario, how much would the idea of your seeking help from a mental health professional in the next 3 months make you feel _____.	Five-point Likert from 1 (not at all) to 5 (very much)	19
Beliefs about others' expectations	Anticipated degree to which a referent (i.e., important individual or group in one's life) would approve or disapprove of one seeking help	"I think [my engineering professors] would be mostly very supportive … they are all very happy about students getting support and getting help."	My engineering professors	Please indicate whether the following people in your life would think you should seek help if this hypothetical scenario was happening to you. If a given person/group does not apply to your situation (e.g., religious/spiritual community), please mark "Not Applicable" for that item. _____ would think I should or should not seek help from a mental health professional in the next 3 months.	Six-point Likert from 1 (should not) to 6 (should)	11
Beliefs about others' behavior	Anticipated likelihood that a referent would or would not seek help if that referent had a mental health concern	"[Engineering students] don't have time for it … it's all just 'I don't have time for it'. 'I would love to do that if I could, but I don't have time for it'. because we work from the ****crack of dawn till late at night and don't really have much time for anything else."	My engineering classmates	Please indicate whether the following people in your life would seek help themselves if this hypothetical scenario was happening to them. If they had this mental health concern, _____ would or would not seek help from a mental health professional in the next 3 months.	Six-point Likert from 1 (would not) to 6 (would)	11
Beliefs about barriers and facilitators	Anticipated likelihood that a given barrier or facilitator of seeking help would be present	"Sometimes the workload makes you feel like you have no time, and so when you are stressed and when you do feel like you might need to seek help the reaction is, 'well, I don't really have time to go and talk'."	I would have little free time due to my academic workload	Please indicate how unlikely or likely it is that the following will be true if this hypothetical scenario was happening to you. In the next 3 months, I expect that _____.	Six-point Likert from 1 (extremely unlikely) to 6 (extremely likely)	20

their evaluation of the value of a given belief, it is important to include a matching evaluation measure item for that belief in the IBM instrument so that a weighted belief score can be created. Therefore, we followed the IBM protocol (Montaño & Kasprzyk, 2015) for creating outcome evaluations (e.g., how [bad/good] is each outcome?), referent evaluations (e.g., how much would you care about a specific referent's opinion of help seeking?), and facilitator/barrier evaluations (e.g., how much would the presence each facilitator/barrier influence your help seeking?). However, preliminary analysis of these evaluation items using data from the quantitative survey indicated that most items lacked variance and only seven items could provide practical utility for creating weighted belief scores. Therefore, although we considered a broad array of potential evaluation items, we ultimately retained seven outcome evaluation items for use in validity testing and the final UE-MH-HSI.

3.6.3 | Validation strategy for belief measures

According to IBM, belief measures are analyzed at the individual item level. Unlike the mechanism and intention measures, each belief measure is composed of topically heterogenous items that (a) lack consistent statistical associations with theoretical antecedents/consequences and (b) are not interchangeable reflective indicators of a latent factor measurable with a single mean/total score (Coltman et al., 2008, p. 1252). For example, a respondent who has an overall negative attitude about mental health help seeking might not endorse all negatively valanced outcome beliefs. For instance, that person might agree that seeking help would result in them being stigmatized by other people yet disagree that seeking help is a sign of weakness. Although exploratory factor analysis would be capable of organizing items according to shared response patterns, the resulting factors and their associated mean scores would provide indices of limited practical utility in the eyes of IBM. These subscales would limit one's ability to determine how specific beliefs are linked with undergraduate engineering students' intention to seek mental health help, thereby making the identification of specific intervention targets more difficult. Therefore, unidimensionality, internal consistency, and mean score creation is not a requirement for IBM belief measures (Bleakley & Hennessy, 2012). Thus, the psychometric properties for the belief measures focused on variability and convergent evidence of validity (Montaño & Kasprzyk, 2015). The variability testing approach for the belief items was similar to that used for the mechanism and intention measures. However, in this case, the means, skewness, and kurtosis were determined for each individual belief item score.

For the validity testing of an IBM instrument, it is crucial that the belief measures appropriately assess the constructs that they were designed to measure (Montaño & Kasprzyk, 2015). This can be determined by examining convergent evidence of validity. One form of convergent evidence is data showing that the items of a belief measure demonstrate significant associations with their corresponding mechanism measure's mean score. This provides support that the beliefs captured by a given measure are relevant and important in shaping that population's attitude, perceived norm, or personal agency. Therefore, the belief measures were examined to determine the degree to which their items demonstrated the theoretically expected correlations with their corresponding mechanism's mean score. Furthermore, IBM is designed to help users identify the beliefs that distinguish those who intend to perform the behavior from those who do not, as these beliefs point toward key targets for intervention. These beliefs are theorized to exert an indirect effect on intention via their corresponding mechanism. Thus, a second form of convergent evidence is data showing that the items of a belief measure demonstrate these indirect effects on intention. Therefore, a series of indirect effect models were analyzed to determine the degree to which the items of each belief measure demonstrated an indirect effect on intention.

3.6.4 | Validation results for belief measures

Table 6 summarizes psychometric information about each belief item. As illustrated in the minimum and maximum columns in the first three sections of Table 6, weighted outcome belief item scores (ranging from −12 to +12) were created by multiplying the outcome belief measure item scores (ranging from 1 to 6) by the corresponding outcome evaluation measure item scores (ranging from −2 to +2) for those seven items. When discussing the validity results below, we focus on the weighted outcome beliefs (WOB_31 through WOB_37 in Table 6) in lieu of the unweighted outcome beliefs (OB_31 through OB_37).

TABLE 6 Psychometric analysis results for the belief measure items.

No.	Item wording	Descriptive statistics						r with mechanism measure(s)	β on INT
Outcome beliefs (OB)		Min.	Max.	*M*	SD	Ske.	Kur.	**r with AT**	**β via ATT**
OB_1	Improve my relationships	1	6	4.38	1.16	−0.80	0.78	**0.43**	**0.25**
OB_2	Improve my academic performance	1	6	4.46	1.14	−1.03	1.43	**0.44**	**0.25**
OB_3	Make me feel better	1	6	4.52	1.13	−0.98	1.21	**0.60**	**0.34**
OB_4	Decrease my stress	1	6	4.38	1.19	−0.82	0.63	**0.46**	**0.27**
OB_5	Help me gain a better understanding of my mental health concern	1	6	4.72	1.13	−1.29	2.14	**0.46**	**0.27**
OB_6	Help me find a solution to my problem	1	6	4.50	1.09	−1.09	1.97	**0.49**	**0.28**
OB_7	Help me improve my coping skills	1	6	4.42	1.09	−0.83	1.30	**0.48**	**0.28**
OB_8	Help me feel supported	1	6	4.50	1.09	−0.79	0.97	**0.58**	**0.34**
OB_9	Involve a treatment approach that is tailored to me	1	6	4.28	1.19	−0.86	0.74	**0.25**	**0.14**
OB_10	Hurt my reputation	1	6	2.44	1.29	0.58	−0.50	**−0.34**	**−0.20**
OB_11	Make me look unstable	1	6	2.71	1.44	0.50	−0.69	**−0.38**	**−0.22**
OB_12	Make me look overly emotional	1	6	2.74	1.44	0.44	−0.74	**−0.38**	**−0.22**
OB_13	Be a sign of imperfection	1	6	2.78	1.47	0.41	−0.86	**−0.31**	**−0.18**
OB_14	Be admitting defeat	1	6	2.53	1.42	0.66	−0.52	**−0.40**	**−0.23**
OB_15	Be a sign of weakness	1	6	2.48	1.44	0.71	−0.54	**−0.46**	**−0.27**
OB_16	Be a sign that I'm not independent	1	6	2.63	1.40	0.53	−0.69	**−0.37**	**−0.21**
OB_17	Mean that I can't fix my own problems	1	6	2.91	1.45	0.33	−0.82	**−0.34**	**−0.20**
OB_18	Be stigmatized by other people	1	6	2.77	1.37	0.30	−0.78	**−0.22**	**−0.13**
OB_19	Result in me being negatively judged by others	1	6	2.51	1.24	0.52	−0.44	**−0.30**	**−0.18**
OB_20	Result in me being discriminated against in academic/professional settings	1	6	2.03	1.11	0.99	0.57	**−0.21**	**−0.12**
OB_21	Result in me being penalized in my courses	1	6	2.17	1.29	0.97	0.25	−0.07	−0.04
OB_22	Result in me being treated poorly by the mental health professional	1	6	1.90	0.99	0.95	0.23	**−0.28**	**−0.16**
OB_23	Result in me being discriminated against by the mental health professional	1	6	1.87	1.01	1.27	1.66	**−0.30**	**−0.17**
OB_24	Bring shame on my family	1	6	1.90	1.16	1.26	0.90	**−0.28**	**−0.16**
OB_25	Take time away from my academic work	1	6	3.86	1.35	−0.35	−0.39	**−0.14**	**−0.08**
OB_26	Be emotionally difficult	1	6	3.59	1.51	−0.33	−0.86	**−0.15**	**−0.09**
OB_27	Go against the expectations of the engineering community	1	6	2.27	1.20	0.73	0.02	**−0.23**	**−0.13**
OB_28	Go against the expectations of my gender identity	1	6	2.72	1.79	0.43	−1.37	−0.08	**−0.10**

TABLE 6 (Continued)

No.	Item wording	Descriptive statistics						r with mechanism measure(s)	β on INT
Outcome beliefs (OB)		Min.	Max.	*M*	SD	Ske.	Kur.	*r* with AT	β via ATT
OB_29	Go against the expectations of my racial identity	1	6	2.01	1.35	1.21	0.47	0.03	−0.07
OB_30	Go against the expectations of my religious/spiritual community	1	6	1.99	1.37	1.21	0.35	−0.16	**−0.12**
OB_31	Result in me being prescribed medication	1	6	3.23	1.39	−0.11	−0.79	0.03	0.02
OB_32	Result in a diagnosis	1	6	3.76	1.44	−0.33	−0.71	**0.18**	**0.10**
OB_33	Require me to tell others that I am seeking help	1	6	2.93	1.51	0.33	−0.91	−0.11	−0.07
OB_34	Lead to other people finding out that I was seeking help	1	6	3.24	1.34	−0.14	−0.70	−0.09	−0.06
OB_35	Require me to be vulnerable	1	6	4.35	1.47	−0.82	−0.07	−0.01	−0.01
OB_36	Require me to accept what the mental health professional has to say	1	6	4.09	1.31	−0.62	−0.12	**0.22**	**0.13**
OB_37	Be an unfamiliar process	1	6	4.21	1.58	−0.59	−0.74	−0.05	−0.03

No.	Item wording	Descriptive statistics						r with mechanism measure(s)	β on INT
Outcome evaluations (OE)		Min	Max	*M*	SD	Ske	Kur	*r* with AT	β via ATT
OE_31	Result in me being prescribed medication	−2	2	−0.12	1.02	−0.16	−0.45	**0.27**	**0.16**
OE_32	Result in a diagnosis	−2	2	0.34	1.03	−0.32	−0.22	**0.30**	**0.17**
OE_33	Require me to tell others that I am seeking help	−2	2	−0.22	0.83	−0.07	0.65	**0.20**	**0.12**
OE_34	Lead to other people finding out that I was seeking help	−2	2	−0.21	0.80	0.16	1.02	**0.30**	**0.17**
OE_35	Require me to be vulnerable	−2	2	0.07	0.97	−0.04	−0.45	**0.36**	**0.21**
OE_36	Require me to accept what the mental health professional has to say	−2	2	0.29	0.95	−0.20	−0.24	**0.41**	**0.24**
OE_37	Be an unfamiliar process	−2	2	−0.06	0.76	−0.06	0.82	**0.26**	**0.15**

No.	Item wording	Descriptive statistics						r with mechanism measure(s)	β on INT
Weighted outcome beliefs (WOB = Outcome beliefs × Outcome evaluations)		Min	Max	*M*	SD	Ske	Kur	*r* with AT	β via ATT
WOB_31	Result in me being prescribed medication	−12	12	0.04	3.65	0.23	1.81	**0.23**	**0.13**
WOB_32	Result in a diagnosis	−12	12	1.83	4.19	0.48	0.41	**0.28**	**0.17**
WOB_33	Require me to tell others that I am seeking help	−12	12	−0.62	3.04	−0.28	4.11	**0.18**	**0.11**
WOB_34	Lead to other people finding out that I was seeking help	−12	12	−0.73	3.21	0.21	4.22	**0.28**	**0.16**
WOB_35	Require me to be vulnerable	−12	12	0.42	4.79	0.05	0.08	**0.34**	**0.20**

(Continues)

TABLE 6 (Continued)

No.	Item wording	Descriptive statistics						r with mechanism measure(s)	β on INT
Weighted outcome beliefs (WOB = Outcome beliefs × Outcome evaluations)		Min	Max	M	SD	Ske	Kur	r with AT	β via ATT
WOB_36	Require me to accept what the mental health professional has to say	−12	12	1.67	4.32	0.41	0.47	**0.35**	**0.20**
WOB_37	Be an unfamiliar process	−12	12	−0.26	3.68	−0.14	2.32	**0.26**	**0.15**

No.	Item wording	Descriptive statistics						r with mechanism measure(s)	β on INT
Experiential beliefs (EB)		Min	Max	M	SD	Ske	Kur	r with AT	β via ATT
EB_1	Uncomfortable	1	5	2.88	1.23	0.00	−0.97	**−0.42**	**−0.24**
EB_2	Indifferent	1	5	2.57	1.14	0.25	−0.53	**−0.22**	**−0.13**
EB_3	Hopeful	1	5	3.30	1.09	−0.31	−0.55	**0.48**	**0.28**
EB_4	Helpless	1	5	2.16	1.09	0.68	−0.35	**−0.33**	**−0.19**
EB_5	Nervous	1	5	3.22	1.24	−0.27	−0.87	0.00	0.00
EB_6	Embarrassed	1	5	2.53	1.26	0.32	−0.97	**−0.28**	**−0.16**
EB_7	Unsure	1	5	2.82	1.17	−0.04	−0.82	**−0.18**	**−0.11**
EB_8	Confident	1	5	2.62	1.15	0.39	−0.54	**0.35**	**0.20**
EB_9	Whiny	1	5	2.03	1.18	0.88	−0.28	**−0.25**	**−0.15**
EB_10	Irritated	1	5	2.19	1.17	0.67	−0.51	**−0.35**	**−0.21**
EB_11	Scared	1	5	2.56	1.18	0.16	−1.06	−0.06	−0.04
EB_12	Happy	1	5	2.85	1.14	0.10	−0.74	**0.46**	**0.27**
EB_13	Weak	1	5	2.23	1.20	0.61	−0.75	**−0.38**	**−0.22**
EB_14	Selfish	1	5	1.87	1.09	1.13	0.44	**−0.31**	**−0.18**
EB_15	Unsafe	1	5	1.60	0.86	1.46	1.85	**−0.26**	**−0.15**
EB_16	Ashamed	1	5	2.07	1.16	0.87	−0.22	**−0.39**	**−0.23**
EB_17	Worthless	1	5	1.83	1.02	1.28	1.16	**−0.27**	**−0.16**
EB_18	Relieved	1	5	3.16	1.16	−0.25	−0.73	**0.39**	**0.23**
EB_19	Incompetent	1	5	1.98	1.11	0.96	0.16	**−0.36**	**−0.21**

No.	Item wording	Descriptive statistics						r with mechanism measure(s)	β on INT
Beliefs about others' expectations (BOE)		Min	Max	M	SD	Ske	Kur	r with PN:I	β via PN:I
BOE_1	My parent(s)/guardian(s)	1	6	4.77	1.61	−1.14	0.02	**0.40**	**0.31**
BOE_2	My other family members who lived inside of the home growing up	1	6	4.56	1.64	−0.92	−0.38	**0.43**	**0.33**
BOE_3	My other family members living outside the home growing up	1	6	4.42	1.53	−0.83	−0.21	**0.37**	**0.28**
BOE_4	My engineering professors	1	6	4.62	1.47	−1.03	0.25	**0.37**	**0.27**
BOE_5	My engineering advisors	1	6	4.78	1.48	−1.26	0.72	**0.37**	**0.28**
BOE_6	My engineering classmates	1	6	4.36	1.44	−0.73	−0.21	**0.40**	**0.31**
BOE_7	My friends	1	6	4.72	1.41	−1.15	0.63	**0.46**	**0.36**
BOE_8	My romantic partner(s)	1	6	4.86	1.51	−1.28	0.57	**0.41**	**0.34**

TABLE 6 (Continued)

No.	Item wording	Descriptive statistics						r with mechanism measure(s)	β on INT
Beliefs about others' expectations (BOE)		Min	Max	*M*	SD	Ske	Kur	r with PN:I	β via PN:I
BOE_9	The members of my religious/spiritual community	1	6	4.40	1.55	−0.76	−0.34	0.37	0.30
BOE_10	The members of my cultural/identity groups	1	6	4.25	1.57	−0.69	−0.58	0.41	0.33
BOE_11	Most people in my life	1	6	4.51	1.47	−0.96	0.13	0.49	0.37

No.	Item wording	Descriptive statistics						r with mechanism measure(s)	β on INT
Beliefs about others' behavior (BOB)		Min	Max	*M*	SD	Ske	Kur	r with PN:D	β via PN:D
BOB_1	My parent(s)/guardian(s)	1	6	3.89	1.73	−0.32	−1.16	0.38	0.26
BOB_2	My other family members who lived inside of the home growing up	1	6	3.92	1.62	−0.31	−0.98	0.35	0.25
BOB_3	My other family members living outside the home growing up	1	6	3.63	1.62	−0.04	−1.06	0.23	0.16
BOB_4	My engineering professors	1	6	4.27	1.26	−0.37	−0.35	0.22	0.16
BOB_5	My engineering advisors	1	6	4.42	1.28	−0.61	−0.06	0.23	0.16
BOB_6	My engineering classmates	1	6	3.95	1.30	−0.13	−0.54	0.24	0.18
BOB_7	My friends	1	6	4.18	1.41	−0.44	−0.56	0.39	0.27
BOB_8	My romantic partner(s)	1	6	4.45	1.42	−0.80	−0.07	0.38	0.26
BOB_9	The members of my religious/spiritual community	1	6	3.88	1.40	−0.26	−0.56	0.26	0.22
BOB_10	The members of my cultural/identity groups	1	6	3.88	1.41	−0.18	−0.65	0.30	0.21
BOB_11	Most people in my life	1	6	3.98	1.31	−0.15	−0.47	0.41	0.28

No.	Item wording	Descriptive statistics						r with mechanism measure(s)		β on INT	
Beliefs about barriers and facilitators (BBF)		Min	Max	*M*	SD	Ske	Kur	r with PA:A	r with PA:C	β via PA:A	β via PA:C
BBF_1	I would already be familiar with the mental health resources available to me	1	6	3.77	1.53	−0.19	−0.99	0.20	0.32	0.05	0.14
BBF_2	I would know how to find information about the mental health resources available to me	1	6	4.47	1.36	−0.95	0.34	0.28	0.43	0.07	0.18
BBF_3	I would be able to find a mental health professional who would be a good fit for me	1	6	4.40	1.24	−0.74	0.17	0.28	0.35	0.07	0.15
BBF_4	I would be able to choose the right mental health resource for my mental health concern	1	6	4.42	1.25	−0.88	0.67	0.33	0.42	0.08	0.18
BBF_5	My professors and/or advisors would tell me about available mental health resources	1	6	4.56	1.29	−1.02	0.71	0.22	0.32	0.05	0.13
BBF_6	I would be able to find a mental health professional conveniently located near me	1	6	4.51	1.28	−0.86	0.18	0.35	0.41	0.09	0.18

(Continues)

TABLE 6 (Continued)

No.	Item wording	Descriptive statistics						r with mechanism measure(s)		β on INT	
Beliefs about barriers and facilitators (BBF)		Min	Max	M	SD	Ske	Kur	r with PA:A	r with PA:C	β via PA:A	β via PA:C
BBF_7	I would have immediate walk-in access to a mental health professional	1	6	3.90	1.41	−0.47	−0.48	**0.14**	**0.25**	**0.04**	**0.11**
BBF_8	I would have the option to go online to schedule an appointment with a mental health professional	1	6	4.59	1.25	−0.93	0.61	**0.38**	**0.44**	**0.09**	**0.19**
BBF_9	I would have the option to see a mental health professional in person	1	6	4.76	1.23	−1.18	1.26	**0.33**	**0.44**	**0.08**	**0.19**
BBF_10	I would have the option to see a mental health professional through video chat	1	6	4.64	1.29	−0.99	0.64	**0.37**	**0.48**	**0.09**	**0.20**
BBF_11	I would have the option to see a mental health professional off campus	1	6	4.40	1.38	−0.88	0.20	**0.30**	**0.37**	**0.07**	**0.16**
BBF_12	I would have the option to see a mental health professional on campus	1	6	4.69	1.31	−1.18	1.10	**0.39**	**0.44**	**0.10**	**0.18**
BBF_13	I would prioritize my academic success over my mental health	1	6	4.34	1.49	−0.63	−0.66	−0.09	−0.11	−0.02	−0.05
BBF_14	I would have little free time due to my academic workload	1	6	4.10	1.40	−0.44	−0.65	−0.07	−0.06	−0.02	−0.03
BBF_15	I would have little free time due to my non-academic commitments	1	6	3.63	1.44	−0.01	−0.88	−0.10	−0.01	−0.02	0.00
BBF_16	Mental health professionals would have limited appointment availability	1	6	3.87	1.39	−0.25	−0.71	−0.10	−0.04	−0.02	−0.01
BBF_17	The process of setting up an appointment with a mental health professional would be complicated	1	6	3.56	1.42	−0.04	−0.91	**−0.31**	**−0.23**	**−0.07**	**−0.09**
BBF_18	My mental health concern would reduce my motivation to seek help	1	6	3.71	1.49	−0.18	−0.96	**−0.18**	**−0.10**	**−0.04**	−0.04
BBF_19	I would have to pay money to seek help from a mental health professional	1	6	4.10	1.49	−0.59	−0.55	0.01	−0.02	0.00	−0.01
BBF_20	I would have to talk on the phone to schedule an appointment with a mental health professional	1	6	4.10	1.32	−0.45	−0.31	0.09	**0.25**	0.02	**0.11**

Note: AT = attitude measure score, PN:I = perceived norm:injunctive score, PN:D = perceived norm:descriptive score, PA:A = personal agency:autonomy score, PA:C = personal agency: capacity score, Min. = minimum possible value, Max. = maximum possible value, Ske. = skewness, Kur. = kurtosis, r with mechanism measure = correlation between that item score and the corresponding mechanism measure's mean score, β with INT = the standardized indirect effect of that belief on intention via the corresponding mechanism. Bold coefficients were significant at $p < 0.05$.

Per Table 6, no belief measure item exhibited a strong ceiling or floor effect ($-0.73 \leq M \leq 4.86$), problematic skewness (≤ 1.46), or problematic kurtosis (≤ 4.22), indicating appropriate variability. Regarding the first form of convergent evidence, most belief items (88%) demonstrated significant associations with their corresponding mechanism's measure mean score (Table 6). When using the seven weighted outcome beliefs in lieu of their unweighted counterparts, 33 of the 37 outcome belief measure items (89%) were associated with the attitude measure's mean score. In addition, 17 of the 19 (89%) experiential belief measure items were associated with attitude, all 11 (100%) beliefs about others' expectations items were associated with perceived norm: injunctive, and all 11 (100%) beliefs about others' behavior were associated with perceived norm: descriptive. Lastly, 14 of the 20 (70%) beliefs about barriers and facilitators items were associated with both personal agency: autonomy and personal agency: capacity. These results suggest that the beliefs about barriers and facilitators items are significantly associated with both elements of personal agency and that presenting the list of barriers and facilitators a single time is sufficient to allow us to understand how the anticipated presence of these barriers and facilitators may shape both autonomy and capacity elements of personal agency. Regarding the second form of convergent evidence, results for beliefs' indirect effect on intention closely mimicked the results for the first form of convergent validity: 97% of the time, if a belief was significantly correlated with its corresponding mechanism, it also evidenced a significant indirect effect on intention via that mechanism. These results collectively provide evidence of variability and convergent evidence of validity for the five mental health help-seeking belief measures.

4 | DISCUSSION

This paper detailed our mixed-methods approach (Figure 2) for developing and psychometrically evaluating reliability and validity for the UE-MH-HSI, a comprehensive instrument battery measuring undergraduate engineering students' perceptions related to mental health help seeking. To accomplish this, we pursued two objectives.

Our first objective was to adapt and quantitatively verify the psychometric properties of existing help-seeking IBM survey measures within undergraduate engineering students. Psychometric testing suggested that that the five mechanism measures (attitudes, perceived norm: injunctive, perceived norm: descriptive, personal agency: autonomy, personal agency: capacity) and the intention measure demonstrated unidimensionality, internal consistency, construct replicability, and sufficient variability. Comparison of Tables 2 and 3 indicates that these six measures all had similar (or stronger) internal consistency compared to the original mental health help-seeking measures from which they were adapted. The five mechanism measures also demonstrated criterion evidence of validity, in that they collectively accounted for 66% of the variance in intention. This is a large amount of explained variance, exceeding the average variance in intention accounted for by mechanism measures within (Adams et al., 2022) and beyond (Armitage & Conner, 2001) the mental health help-seeking context. Collectively, this initial psychometric evidence suggests that these six measures adequately assess the constructs that they were designed to assess. The criterion evidence of validity results also indicate that it is possible to achieve a robust understanding of which mechanisms shape undergraduate engineering students' intention to seek mental health care. This is essential to informing effective interventions to close the treatment gap among undergraduate engineering students.

Our second objective was to generate and quantitatively assess new survey items specifically scoped to help-seeking behaviors of undergraduate engineering students. Semantic coding of interviews with 33 undergraduate engineering students led to the development of items to measure the types of mental health help-seeking beliefs incorporated into the IBM (Figure 1). Psychometric testing suggested that most items within the five mental health help-seeking belief measures (outcome beliefs, experiential beliefs, beliefs about others' expectations, beliefs about others' behavior, beliefs about barriers and facilitators) demonstrated sufficient variability and convergent evidence of validity. Variability is important because beliefs that do not vary in degree of endorsement across individuals within a population cannot demonstrate associations with other variables of interest and, therefore, are of limited utility when seeking to identify the things that help or stop undergraduate engineering students from seeking mental health help. Regarding the importance of convergent validity, most belief items were associated with their corresponding mental health help-seeking mechanisms, and these associations varied across items within a given belief measure, indicating that some beliefs are more diagnostic of undergraduate engineering students' attitude, perceived norm, and personal agency, than others. This is useful because it facilitates understanding of which beliefs matter most in shaping undergraduate engineering students' thinking about mental health help seeking, and thus point to priority targets for future intervention. Likewise, most beliefs demonstrated an indirect effect on intention via their corresponding mental health help-seeking

mechanism; the presence of such indirect effects is a prerequisite to being able to use the UE-MH-HSI to identify the specific beliefs that distinguish undergraduate engineering students who intend to seek mental health help from those who do not. However, not all beliefs (e.g., "I feel scared about the idea of my seeking help," "I would prioritize my academic success over my mental health") demonstrated these convergent effects. This could be because (1) despite being mentioned in elicitation interviews, these beliefs may not influence their attitude, perceived norm, or personal agency; (2) these beliefs may not be associated with intention in the overall sample, but could be important within certain sociodemographic groups; and (3) these beliefs may be widely endorsed by most undergraduate engineering students, and thus these beliefs are unassociated with their corresponding mental health help-seeking mechanisms due to statistical ceiling effects. Future research is needed to unpack these complexities, and can help refine which of these non-correlating items are worth retaining in future versions of the UE-MH-HSI.

An important strength of these belief measures is that they assess a wide range of help-seeking beliefs held by undergraduate engineering students, which enhances the measures' utility for identifying the specific beliefs that drive mental health help-seeking intention and behavior in this population. The beliefs assessed span intrapersonal (e.g., "help seeking would improve my academic performance"), interpersonal (e.g., "help seeking would be stigmatized by other people"), cultural (e.g., "help seeking would bring shame on my family"), structural (e.g., "mental health professionals would have limited appointment availability"), and academic (e.g., "I would have little free time due to my academic workload") factors, which can help professionals to think critically about the multiple levels of intervention that may be needed to close the treatment gap. This can help professionals to avoid taking an overly narrow, victim-blaming, and/or individualistic approach. For example, it could be inappropriate to challenge students' belief that they would have trouble accessing campus mental health care, if this belief reflects an accurate perception of the long wait lists at their campus counseling center.

Because validation is an ongoing process, an initial validation paper cannot examine all psychometric properties of an instrument. Further, there are (in)appropriate applications for an instrument given the extant psychometric evidence (Douglas et al., 2016). Therefore, we consider the initial psychometric evidence presented in this paper to constitute sufficient initial evidence of reliability and validity to warrant the use of this first version of UE-MH-HSI for certain applications, but not others, as described in the Guidelines for Use of the UE-MH-HSI section of the Supplemental Material, Data S1.

4.1 | Limitations and future directions

Our research team has plans to provide evidence of additional aspects of reliability and validity of the measures composing UE-MH-HSI, and to make iterative improvements to the instrument over time to help enhance the validity, feasibility, and utility of the instrument. First, we plan to conduct longitudinal research that will permit the calculation of test–retest reliability and examination of predictive evidence of validity (i.e., demonstrate ability of intention measure to account for variance in prospective mental health help-seeking behavior). We are conducting cognitive interviews (Douglas & Purzer, 2015) that integrate elements of the "think out loud" and "direct probe" paradigms to identify ways in which the UE-MH-HSI instructions and items can be further improved, and to provide substantive evidence (data capturing respondents' cognitive response processes) of validity. We are also currently in the process of using UE-MH-HSI to identify the specific beliefs that drive undergraduate engineering students' intention to seek mental health help at our institution, which will guide the development and testing of interventions designed to decrease the help-seeking treatment gap in this population at our institution.

Given that most UE-MH-HSI belief items do not explicitly use the term "engineering," readers may question whether the UE-MH-HSI belief measures sufficiently capture the impact of engineering culture on mental health help-seeking perceptions. Because the items were developed directly from undergraduate engineering students' answers during elicitation interviews (including in response to questions about how their engineering training and identity have shaped their help-seeking beliefs), and endorsement of most of these belief items is associated with their help-seeking intention, we are confident that these items capture some of the important ways that engineering culture impacts help-seeking beliefs. Furthermore, many items capture important engineering culture themes identified in the engineering mental health literature (e.g., be a sign of weakness, make me look overly emotional, mean that I can't fix my own problems, I would have to prioritize my academic success over my mental health, I would have little free time).

We were intentional about using purposeful stratified sampling to achieve a more demographically diverse elicitation interview sample compared to the demographic makeup of the institution. However, not all demographic groups

were strongly represented in this sample (e.g., Latine/Hispanic students), especially when considering diversity beyond single identities (e.g., Latine/Hispanic women). In addition, the pilot survey sample included many first-year students and there was a stronger possibility of self-selection bias (i.e., those more comfortable with this topic may have been more likely to opt in) among upper-class students in our sample when compared to first-year engineering students who completed the instrument as an assignment. Data for this study were also collected during the height of the COVID-19 pandemic, which means that the beliefs generated during interviews and responses provided on the survey were shaped by the salient stressors, dynamics, and mental health help-seeking barriers operating at that time. Finally, analysis of data from the 2018–2019 Healthy Minds Study (Eisenberg et al., 2019) indicates that there are significant differences in undergraduate engineering students' mental health help-seeking perceptions across institutions. These demographic and institutional context limitations of the present study and the resulting implications for the generalizability of the belief measures motivate future research.

Therefore, a future direction will be to create an improved version of the UE-MH-HSI to enhance its validity for select student sociodemographic segments in different institutional contexts. Such improvement can be accomplished through a mix of focus groups, cognitive interviews, and large-scale survey data collection with diverse students at other institutions. For instance, focus groups can help identify salient mental health help-seeking beliefs not yet measured by UE-MH-HSI. This includes beliefs pertaining to the impacts of systems of oppression that disproportionately impact mental health treatment access for marginalized undergraduate engineering students. Multi-institution survey data collection could provide quantitative evidence of validity of the modified instrument across diverse students and institutional contexts, and permit refinement (i.e., instrument length reduction), resulting in a feasible instrument suitable for widespread use in engineering colleges nationwide. These future directions can lead to the creation of a revised UE-MH-HSI that benefits from enhanced cross-cultural validity and feasibility of administration. This will allow the instrument to be used to identify specific beliefs that may be powerful influences within certain populations, but not others, given how systems of oppression differentially structure access to wellness and self-worth (Mitchell et al., 2021). However, it is important to note that an instrument designed for wide use across sociodemographic segments of the engineering student population may not be able to fully capture the help-seeking beliefs of a particular segment. Therefore, another future direction would be to develop tailored versions of UE-MH-HSI contextualized to understand the unique supports and barriers to help seeking among specific marginalized segments of the engineering student population.

The UE-MH-HSI was specifically designed to focus on the salient mental health help-seeking beliefs of undergraduate engineering students. The literature highlights that graduate students broadly (Evans et al., 2018) and specifically within engineering are at high risk for mental health distress (Lipson et al., 2016) and also unlikely to access professional mental health treatment (Lipson et al., 2016). Therefore, an important aspect of future research could be to expand the UE-MH-HSI to the graduate engineering student population, where we expect not only overlap but also divergence from the beliefs of the undergraduate engineering student population. For instance, while peer support has been identified as important for the mental health of engineering graduate students (Bork & Mondisa, 2022), some students have also identified that they would be unlikely to talk to their peers or advisors about their mental health because of prior negative experiences (Wilkins-Yel et al., 2022). Further, the expectation to prioritize academic progress over mental health is likely to also be important in engineering graduate students. This could be particularly important for Black doctoral students who have identified that they feel additional pressure to work harder than their peers (McGee et al., 2019). Thus, focus group and cognitive interviews with graduate engineering students would be an important next step in adapting UE-MH-HSI to maximize its validity for graduate students.

Lastly, it is important to acknowledge that there is no one correct way to define mental health or mental health help seeking, as both concepts are culture bound. The beliefs incorporated into UE-MH-HSI reflect the beliefs that arose when asking undergraduate engineering students about help seeking as defined by the research. The resulting beliefs are a product of this definition, and may differ from beliefs that would have been elicited had we defined help seeking in line with alternative cultural conceptualizations (e.g., seeking help from traditional healers [Gureje et al., 2015]). For instance, literature suggests that near-peer support can result in positive professional, academic, and mental health outcomes in both mentees (Akinla et al., 2018; Lim et al., 2017; Trujillo et al., 2015) and mentors (Akinla et al., 2018; Lim et al., 2017; Pölczman et al., 2024; Taylor et al., 2023; Trujillo et al., 2015). Because engineering students have cited concerns over lack of time (Wright et al., 2023) or a lack of understanding of the engineering context (Beddoes & Danowitz, 2022; Wilson et al., 2024) as reasons for not seeking help from a mental health professional, near-pear support could be a promising pathway for informal mental health support in engineering. Therefore, researchers who wish to study other forms of mental health help seeking to promote wellness may need to develop

novel belief measures and adapt the wording of the instructions and items for the mechanism and intention measures, accordingly.

4.2 | Implications and conclusions

The UE-MH-HSI is a comprehensive survey instrument battery that can be used to identify factors associated with seeking professional mental healthcare among undergraduate engineering students. The instrument provides researchers with an empirically derived tool to identify priority targets for future intervention and prevention efforts aimed at increasing the percentage of distressed undergraduate engineering students who access professional treatment. This evidence-based instrument could also allow users to (1) measure the efficacy and causal change mechanisms of campus mental health interventions; (2) conduct investigations of mental health help-seeking factors and their relationship to undergraduate engineering students' help-seeking behavior, well-being, academic success, and engineering identity formation; and (3) examine how background variables such as systems of oppression exert a downstream influence on the mental health help-seeking beliefs and behavior of marginalized undergraduate engineering students. The knowledge derived from these studies can guide intervention development aimed at redefining engineering identity to support mental health help seeking, creating an engineering community that is inclusive and supportive of those in mental health distress and those with mental health disabilities.

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REFERENCES
Adams, C., Gringart, E., & Strobel, N. (2022). Explaining adults' mental health help-seeking through the lens of the theory of planned behavior: A scoping review. *Systematic Reviews*, *11*(1), 160.

Ajzen, I. (1985). From Intentions to Actions: A Theory of Planned Behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control: From cognition to behavior* (pp. 11–39). Springer. https://doi.org/10.1007/978-3-642-69746-3_2

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Prentice-Hall.

Akinla, O., Hagan, P., & Atiomo, W. (2018). A systematic review of the literature describing the outcomes of near-peer mentoring programs for first year medical students. *BMC Medical Education*, *18*(1), 1–10. https://doi.org/10.1186/s12909-018-1195-1

APA, American Psychological Association. (2022). Demographics of U.S. Psychology Workforce [Interactive data tool]. Retrieved April 19, 2023, from. https://www.apa.org/workforce/data-tools/demographics

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, *40*(4), 471–499. https://doi.org/10.1348/014466601164939

Armstrong, I., Dailey, D., Wilder, K., Blackburn-Lynch, W., Hammer, J., & Wilson, S. (2022). Investigating mental health distress and help-seeking perceptions in first-year engineering students. *2022 ASEE annual conference & exposition*, Minneapolis, MN. https://doi.org/10.18260/1-2-40784

ASEE, American Society for Engineering Education. (2023). *Profiles of Engineering and Engineering Technology, 2022*. American Society for Engineering Education.

Ajzen (2019): https://people.umass.edu/aizen/tpb.html

Barnett, P., Arundell, L.-L., Saunders, R., Matthews, H., & Pilling, S. (2021). The efficacy of psychological interventions for the prevention and treatment of mental health disorders in university students: A systematic review and meta-analysis. *Journal of Affective Disorders*, *280*, 381–406. https://doi.org/10.1016/j.jad.2020.10.060

Beddoes, K., & Danowitz, A. (2022). In their own words: How aspects of engineering education undermine students' mental health. *2022 ASEE annual conference & exposition*, Minneapolis, MN, 40378. https://doi.org/10.18260/1-2-40378

Bleakley, A., & Hennessy, M. (2012). The quantitative analysis of reasoned action theory. *The Annals of the American Academy of Political and Social Science*, *640*(1), 28–41. https://doi.org/10.1177/0002716211424265

Bork, S. J., & Mondisa, J. (2022). Engineering graduate students' mental health: A scoping literature review. *Journal of Engineering Education*, *111*(3), 665–702. https://doi.org/10.1002/jee.20465

Braun, V., & Clarke, V. (2012). *Thematic analysis*. American Psychological Association.

Bruffaerts, R., Mortier, P., Kiekens, G., Auerbach, R. P., Cuijpers, P., Demyttenaere, K., Green, J. G., Nock, M. K., & Kessler, R. C. (2018). Mental health problems in college freshmen: Prevalence and academic functioning. *Journal of Affective Disorders*, *225*, 97–103. https://doi.org/10.1016/j.jad.2017.07.044

Bruns, C. M., LeViness, P., Cardom, R., Chin, C., Fitzpatrick, N. Y., Herman, M., Hurst, T., & Sokolowski, K. (2023). Annual Survey for Reporting Period July 1, 2022 through June 30, 2023. Association for University and College Counseling Center Directors.

Cabral, R. R., & Smith, T. B. (2011). Racial/ethnic matching of clients and therapists in mental health services: A meta-analytic review of preferences, perceptions, and outcomes. *Journal of Counseling Psychology*, *58*(4), 537–554. https://doi.org/10.1037/a0025266

Cech, E. A. (2014). Culture of disengagement in engineering education? *Science, Technology, & Human Values*, *39*(1), 42–72. https://doi.org/10.1177/0162243913504305

Cech, E. A., & Rothwell, W. R. (2018). LGBTQ inequality in engineering education. *Journal of Engineering Education*, *107*(4), 583–610. https://doi.org/10.1002/jee.20239

Chew-Graham, C. A., Rogers, A., & Yassin, N. (2003). "I wouldn't want it on my CV or their records": Medical students' experiences of help-seeking for mental health problems. *Medical Education*, *37*(10), 873–880. https://doi.org/10.1046/j.1365-2923.2003.01627.x

Coltman, T., Devinney, T. M., Midgley, D. F., & Venaik, S. (2008). Formative versus reflective measurement models: Two applications of formative measurement. *Journal of Business Research*, *61*(12), 1250–1262.

Cornally, N., & McCarthy, G. (2011). Help-seeking behaviour for the treatment of chronic pain. *British Journal of Community Nursing*, *16*(2), 90–98.

Cross, K., & Jensen, K. (2018). Work in progress: Understanding student perceptions of stress as part of engineering culture. *2018 ASEE annual conference & exposition*, Salt Lake City, Utah, 31312. https://doi.org/10.18260/1-2-31312

Curtin, S. C., & Hedegaard, H. (2019). *Suicide rates for females and males by race and ethnicity: United States, 1999 and 2017*. National Center for Health Statistics.

Davis, D. E., Ho, M. Y., Griffin, B. J., Bell, C., Hook, J. N., Van Tongeren, D. R., ... Westbrook, C. J. (2015). Forgiving the self and physical and mental health correlates: A meta-analytic review. *Journal of Counseling Psychology*, *62*(2), 329.

DeBerard, M. S., Spielmans, G. I., & Julka, D. L. (2004). Predictors of academic achievement and retention among college freshmen: A longitudinal study. *College Student Journal*, *38*(1), 66–80.

De Pillis, E., & de Pillis, L. (2008). Are engineering schools masculine and authoritarian? The mission statements say yes. *Journal of Diversity in Higher Education*, *1*(1), 33.

DeVellis, R. F. (2012). *Scale development: Theory and applications*. SAGE Publications. https://books.google.com/books?id=Rye31saVXmAC

Douglas, K., Rynearson, A., Purzer, S., & Strobel, J. (2016). Reliability, validity, and fairness: A content analysis of assessment development publications in major engineering education journals. *International Journal of Engineering Education*, *32*(5), 1960–1971.

Douglas, K. A., & Purzer, Ş. (2015). Validity: Meaning and relevancy in assessment for engineering education research: Assessment validity for engineering education research. *Journal of Engineering Education*, *104*(2), 108–118. https://doi.org/10.1002/jee.20070

Dyrbye, L. N., Eacker, A., Durning, S. J., Brazeau, C., Moutier, C., Massie, F. S., Satele, D., Sloan, J. A., & Shanafelt, T. D. (2015). The impact of stigma and personal experiences on the help-seeking behaviors of medical students with burnout. *Academic Medicine*, *90*(7), 961–969. https://doi.org/10.1097/ACM.0000000000000655

Ebert, D. D., Mortier, P., Kaehlke, F., Bruffaerts, R., Baumeister, H., Auerbach, R. P., Alonso, J., Vilagut, G., Martínez, K. U., Lochner, C., Cuijpers, P., Kuechler, A.-M., Green, J., Hasking, P., Lapsley, C., Sampson, N. A., Kessler, R. C., & WHO World Mental Health-International College Student Initiative collaborators. (2019). Barriers of mental health treatment utilization among first-year college students: First cross-national results from the WHO World Mental Health International College Student Initiative. *International Journal of Methods in Psychiatric Research*, *28*(2), e1782. https://doi.org/10.1002/mpr.1782

Eisenberg, D., Golberstein, E., & Hunt, J. B. (2009). Mental health and academic success in college. *B.E. Journal of Economic Analysis & Policy*, *9*(1), 1–40. https://doi.org/10.2202/1935-1682.2191

Eisenberg, D., Hunt, J., & Speer, N. (2013). Mental health in American Colleges and Universities: Variation across student subgroups and across campuses. *Journal of Nervous & Mental Disease*, *201*(1), 60–67. https://doi.org/10.1097/NMD.0b013e31827ab077

Eisenberg, D., Lipson, S. K., Ceglarek, P. M., Zhou, S., Morigney, J., Talaski, A., & Steverson, S. (2019). The Healthy Minds Study: 2018–2019 Data Report. Healthy Minds.

Evans, T. M., Bira, L., Gastelum, J. B., Weiss, L. T., & Vanderford, N. L. (2018). Evidence for a mental health crisis in graduate education. *Nature Biotechnology*, *36*(3), 282–284. https://doi.org/10.1038/nbt.4089

Ey, S., Henning, K. R., & Shaw, D. L. (2000). Attitudes and factors related to seeking mental health treatment among medical and dental students. *Journal of College Student Psychotherapy*, *14*(3), 23–39. https://doi.org/10.1300/J035v14n03_05

Faulkner, W. (2000). Dualisms, hierarchies and gender in engineering. *Social Studies of Science*, *30*(5), 759–792. https://doi.org/10.1177/030631200030005005

Fischer, E. H., & Turner, J. I. (1970). Orientations to seeking professional help: Development and research utility of an attitude scale. *Journal of Consulting and Clinical Psychology*, *35*(1, Pt. 1), 79–90. https://doi.org/10.1037/h0029636

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. Routledge. https://doi.org/10.4324/9780203838020

Galbraith, N. D., Brown, K. E., & Clifton, E. (2014). A survey of student nurses' attitudes toward help seeking for stress: Student nurses and help seeking for stress. *Nursing Forum*, 49(3), 171–181. https://doi.org/10.1111/nuf.12066

Garriott, P. O., Carrero Pinedo, A., Hunt, H. K., Navarro, R. L., Flores, L. Y., Desjarlais, C. D., Diaz, D., Brionez, J., Lee, B. H., Ayala, E., Martinez, L. D., Hu, X., Smith, M. K., Suh, H. N., & McGillen, G. G. (2023). How Latiné engineering students resist white male engineering culture: A multi-institution analysis of academic engagement. *Journal of Engineering Education*, 112(3), 695–718. https://doi.org/10.1002/jee.20536

Garrison, H. (2013). Underrepresentation by race–ethnicity across stages of U.S. science and engineering education. *CBE—Life Sciences Education*, 12(3), 357–363. https://doi.org/10.1187/cbe.12-12-0207

Godfrey, E., & Parker, L. (2010). Mapping the cultural landscape in engineering education. *Journal of Engineering Education*, 99(1), 5–22.

Graham, J. W. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology*, 60(1), 549–576. https://doi.org/10.1146/annurev.psych.58.110405.085530

Gureje, O., Nortje, G., Makanjuola, V., Oladeji, B., Seedat, S., & Jenkins, R. (2015). The role of global traditional and complementary systems of medicine in treating mental health problems. *Lancet Psychiatry*, 2(2), 168–177. https://doi.org/10.1016/s2215-0366(15)00013-9

Hammer, J. H., & Vogel, D. L. (2017). Development of the help-seeker stereotype scale. *Stigma and Health*, 2(2), 121.

Hammer, J. H., Parent, M. C., & Spiker, D. A. (2018). Mental help seeking attitudes scale (MHSAS): Development, reliability, validity, and comparison with the ATSPPH-SF and IASMHS-PO. *Journal of Counseling Psychology*, 65(1), 74–85. https://doi.org/10.1037/cou0000248

Hammer, J. H., & Spiker, D. A. (2018). Dimensionality, reliability, and predictive evidence of validity for three help-seeking intention instruments: ISCI, GHSQ, and MHSIS. *Journal of Counseling Psychology*, 65(3), 394–401. https://doi.org/10.1037/cou0000256

Hammer, J. H., Spiker, D. A., & Perrin, P. B. (2019). Physician referral to a psychologist: Testing alternative behavioral healthcare seeking models. *Journal of Clinical Psychology*, 75(4), 726–741. https://doi.org/10.1002/jclp.22729

Hammer, J. H., Vogel, D. L., Grzanka, P. R., Kim, N., Keum, B. T., Adams, C., & Wilson, S. A. (2024). The integrated behavioral model of mental health help seeking (IBM-HS): A health services utilization theory of planned behavior for accessing care. *Journal of Counseling Psychology*. Advance online publication. https://doi.org/10.1037/cou0000754

Hargis, L., Wright, C., Usher, E., Hammer, J., Wilson, S., & Miller, M. (2021). Relationship between mental health distress and help-seeking behaviors among engineering students. *2021 ASEE virtual annual conference content access proceedings*, 37657. https://doi.org/10.18260/1-2-376573

Hartley, M. T. (2011). Examining the relationships between resilience, mental health, and academic persistence in undergraduate college students. *Journal of American College Health*, 59(7), 596–604. https://doi.org/10.1080/07448481.2010.515632

Holland, P. W. (2008). Causation and race. In T. Zuberi & E. Bonilla-Silva (Eds.), *White logic, white methods: Racism and methodology* (pp. 93–109). Rowman & Littlefield Publishers.

Hu, L. t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. https://doi.org/10.1080/10705519909540118

Hunt, J. B., Eisenberg, D., Lu, L., & Gathright, M. (2015). Racial/ethnic disparities in mental health care utilization among U.S. college students: Applying the institution of medicine definition of health care disparities. *Academic Psychiatry*, 39(5), 520–526. https://doi.org/10.1007/s40596-014-0148-1

Institute of Medicine. (2002). *Speaking of health: Assessing health communication strategies for diverse populations*. National Academies Press. https://doi.org/10.17226/10018

Jensen, K. J., & Cross, K. J. (2021). Engineering stress culture: Relationships among mental health, engineering identity, and sense of inclusion. *Journal of Engineering Education*, 110(2), 371–392. https://doi.org/10.1002/jee.20391

Jensen, K. J., Mirabelli, J. F., Kunze, A. J., Romanchek, T. E., & Cross, K. J. (2023). Undergraduate student perceptions of stress and mental health in engineering culture. *International Journal of STEM Education*, 10(1), 1–23. https://doi.org/10.1186/s40594-023-00419-6

Juvrud, J., & Rennels, J. L. (2017). "I don't need help": Gender differences in how gender stereotypes predict help-seeking. *Sex Roles*, 76(1), 27–39. https://doi.org/10.1007/s11199-016-0653-7

Kellam, N., Gerow, K., Wilson, G., Walther, J., & Cruz, J. (2018). Exploring emotional trajectories of engineering students: A narrative research approach. *International Journal of Engineering Education*, 34(6), 1726–1740.

Knipe, D., Maughan, C., Gilbert, J., Dymock, D., Moran, P., & Gunnell, D. (2018). Mental health in medical, dentistry and veterinary students: Cross-sectional online survey. *BJPsych Open*, 4(6), 441–446. https://doi.org/10.1192/bjo.2018.61

Levant, R. F., & Richmond, K. (2016). The gender role strain paradigm and masculinity ideologies. In Y. J. Wong & S. R. Wester (Eds.), *APA handbook of men and masculinities* (pp. 23–49). American Psychological Association. https://doi.org/10.1037/14594-002

Lim, J. H., MacLeod, B. P., Tkacik, P. T., & Dika, S. L. (2017). Peer mentoring in engineering: (Un)shared experience of undergraduate peer mentors and mentees. *Mentoring & Tutoring: Partnership in Learning*, 25(4), 395–416. https://doi.org/10.1080/13611267.2017.1403628

Lipson, S. K., Lattie, E. G., & Eisenberg, D. (2018). Increased rates of mental health service utilization by U.S. college students: 10-Year population-level trends (2007–2017). *Psychiatric Services*, 70(1), 60–63. https://doi.org/10.1176/appi.ps.201800332

Lipson, S. K., Zhou, S., Wagner, B., Beck, K., & Eisenberg, D. (2016). Major differences: Variations in undergraduate and graduate student mental health and treatment utilization across academic disciplines. *Journal of College Student Psychotherapy*, 30(1), 23–41. https://doi.org/10.1080/87568225.2016.1105657

Lönngren, J., Adawi, T., & Berge, M. (2020). "I don't want to be influenced by emotions"—Engineering students' emotional positioning in discussions about wicked sustainability problems. *2020 IEEE frontiers in education conference (FIE)*, Uppsala, Sweden. https://doi.org/10.1109/FIE44824.2020.9273946

Lui, J. C., Sagar-Ouriaghli, I., & Brown, J. S. L. (2022). Barriers and facilitators to help-seeking for common mental disorders among university students: A systematic review. *Journal of American College Health*, Advance online publication. https://doi.org/10.1080/07448481.2022.2119859

Mahalik, J. R., & Di Bianca, M. (2021). Help-seeking for depression as a stigmatized threat to masculinity. *Professional Psychology: Research and Practice*, *52*(2), 146–155. https://doi.org/10.1037/pro0000365

McAlister, A. M., Kamal, S. A., Sánchez-Peña, M. L., Xu, X., Ramirez, N., & Samuel, D. B. (2023). Stigma of mental health conditions within engineering culture and its relation to help-seeking attitudes: Insights from the first year of a longitudinal study. *2023 ASEE annual conference & exposition*, Baltimore, Maryland. https://doi.org/10.18260/1-2-44256

McDermott, R. C., Smith, P. N., Borgogna, N., Booth, N., Granato, S., & Sevig, T. D. (2018). College students' conformity to masculine role norms and help-seeking intentions for suicidal thoughts. *Psychology of Men & Masculinity*, *19*(3), 340–351. https://doi.org/10.1037/men0000107

McGee, E., & Bentley, L. (2017). The equity ethic: Black and latinx college students reengineering their STEM careers toward justice. *American Journal of Education*, *124*(1), 1–36. https://doi.org/10.1086/693954

McGee, E. O., Griffith, D. M., & Houston, S. L. (2019). "I know i have to work twice as hard and hope that makes me good enough": Exploring the stress and strain of black doctoral students in engineering and computing. *Teachers College Record: The Voice of Scholarship in Education*, *121*(4), 1–38. https://doi.org/10.1177/016146811912100407

Mitchell, C., McMillan, B., & Hagan, T. (2017). Mental health help-seeking behaviours in young adults. *British Journal of General Practice*, *67*(654), 8–9. https://doi.org/10.3399/bjgp17X688453

Mitchell, U. A., Nishida, A., Fletcher, F. E., & Molina, Y. (2021). The long arm of oppression: How structural stigma against marginalized communities perpetuates within-group health disparities. *Health Education & Behavior*, *48*(3), 342–351. https://doi.org/10.1177/10901981211011927

Montaño, D. E., & Kasprzyk, D. (2015). Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. In K. Glanz, B. Rimer, & K. Viswanath (Eds.), *Health behavior: Theory, research, and practice* (5th ed., pp. 95–124). Jossey-Bass/Wiley.

Muthén, L. K., & Muthén, B. O. (1998). *Mplus user's guide* (8th ed.). Muthén & Muthén.

Naphan-Kingery, D. E., Miles, M., Brockman, A., McKane, R., Botchway, P., & McGee, E. (2019). Investigation of an equity ethic in engineering and computing doctoral students. *Journal of Engineering Education*, *108*(3), 337–354. https://doi.org/10.1002/jee.20284

National Academies of Sciences, Engineering, and Medicine. (2020). In R. Colwell, A. Bear, & A. Helman (Eds.), *Promising practices for addressing the underrepresentation of women in science, engineering, and medicine: Opening doors* (p. 25585). National Academies Press. https://doi.org/10.17226/25585

Organ, J. M., Jaffe, D. B., & Bender, K. M. (2016). Suffering in silence: The survey of law student well-being and the reluctance of law students to seek help for substance use and mental health concerns. *Journal of Legal Education*, *66*(1), 116–156.

Pölczman, L., Jámbor, M., Győrffy, Z., Purebl, G., Végh, A., & Girasek, E. (2024). A qualitative study of mentors' perceptions and experiences of a near-peer mentoring program for medical students. *Frontiers in Education*, *9*, 1–9. https://doi.org/10.3389/feduc.2024.1372697

Ponterotto, J. G., & Ruckdeschel, D. E. (2007). An overview of coefficient alpha and a reliability matrix for estimating adequacy of internal consistency coefficients with psychological research measures. *Percept Mot Skills*, *105*(3 Pt 1), 997–1014. https://doi.org/10.2466/pms.105.3.997-1014

Rickwood, D., & Thomas, K. (2012). Conceptual measurement framework for help-seeking for mental health problems. *Psychology Research and Behavior Management*, 173–183.

Rodriguez, A., Reise, S. P., & Haviland, M. G. (2016). Evaluating bifactor models: Calculating and interpreting statistical indices. *Psychological Methods*, *21*(2), 137–150. https://doi.org/10.1037/met0000045

Sagar-Ouriaghli, I., Godfrey, E., Graham, S., & Brown, J. S. (2020). Improving mental health help-seeking behaviours for male students: a framework for developing a complex intervention. *International journal of environmental research and public health*, *17*(14), 4965.

Sánchez-Peña, M. L., & Kamal, S. A. (2023, October 23). A comparative analysis of mental health conditions prevalence and help seeking attitudes of engineering students at two institutions in the U.S.A. *2023 world engineering education forum—global engineering deans council (WEEF-GEDC)*, Monterrey, Mexico. 2023 World Engineering Education Forum—Global Engineering Deans Council (WEEF-GEDC), Monterrey, Mexico. https://doi.org/10.1109/WEEF-GEDC59520.2023.10343627

Sanchez-Pena, M., Ramirez, N., Xu, X. R., & Samuel, D. (2021, July). Work in progress: measuring stigma of mental health conditions and its impact in help-seeking behaviors among engineering students. *2021 ASEE Virtual Annual Conference Content Access Proceedings. 2021 ASEE Virtual Annual Conference Content Access, Virtual Conference*. https://doi.org/10.18260/1-2–38181

Schafer, J. L. (1999). Multiple imputation: A primer. *Statistical Methods in Medical Research*, *8*(1), 3–15. https://doi.org/10.1177/096228029900800102

Secules, S., McCall, C., Mejia, J. A., Beebe, C., Masters, A. S., Sánchez-Peña, L., & Svyantek, M. (2021). Positionality practices and dimensions of impact on equity research: A collaborative inquiry and call to the community. *Journal of Engineering Education*, *110*(1), 19–43. https://doi.org/10.1002/jee.20377

Shea, M., Wong, Y. J., Nguyen, K. K., & Gonzalez, P. D. (2019). College students' barriers to seeking mental health counseling: Scale development and psychometric evaluation. *Journal of Counseling Psychology*, *66*(5), 626–639. https://doi.org/10.1037/cou0000356

Sochacka, N. W., Walther, J., & Pawley, A. L. (2018). Ethical validation: Reframing research ethics in engineering education research to improve research quality. *Journal of Engineering Education*, *107*(3), 362–379. https://doi.org/10.1002/jee.20222

Sochacka, N. W., Walther, J., Rich, J. R., & Brewer, M. A. (2021). A narrative analysis of stories told about engineering in the public discourse: Implications for equity and inclusion in engineering. *Studies in Engineering Education*, *2*(2), 54–77. https://doi.org/10.21061/see.55

Soper, D. S. (2022). A-priori sample size calculator for structural equation models. *Free Statistics Calculators* https://www.danielsoper.com/statcalc/calculator.aspx?id=89

Spiker, D. A., Hammer, J. H., & Parnell, K. J. (2019). Men in unhappy relationships: Perceptions of couple therapy. *Journal of Social and Personal Relationships*, *36*(7), 2015–2035. https://doi.org/10.1177/0265407518775537

Stevens, R., Amos, D., Jocuns, A., & Garrison, L. (2007). Engineering as lifestyle and a meritocracy of difficulty: Two pervasive beliefs among engineering students and their possible effects. *2007 Annual Conference & Exposition, Honolulu*, Hawaii, 12.618.1–12.618.17. https://doi.org/10.18260/1-2-2791

Taylor, L., Mastrogiovanni, M., Lakin, J. M., & Davis, V. (2023). Give and gain: Black engineering students as near-peer mentors. *Journal of Engineering Education*, *112*(2), 365–381. https://doi.org/10.1002/jee.20520

Trujillo, G., Aguinaldo, P. G., Anderson, C., Bustamante, J., Gelsinger, D. R., Pastor, M. J., Wright, J., Márquez-Magaña, L., & Riggs, B. (2015). Near-peer STEM mentoring offers unexpected benefits for mentors from traditionally underrepresented backgrounds. *Perspectives on Undergraduate Research and Mentoring: PURM*, *4*(1), 1–11.

Vogel, D. L., Wade, N. G., & Haake, S. (2006). Measuring the self-stigma associated with seeking psychological help. *Journal of Counseling Psychology*, *53*(3), 325–337. https://doi.org/10.1037/0022-0167.53.3.325

Walther, J., Sochacka, N. W., & Kellam, N. N. (2013). Quality in interpretive engineering education research: Reflections on an example study. *Journal of Engineering Education*, *102*(4), 626–659. https://doi.org/10.1002/jee.20029

Weston, R., & Gore, P. A. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist*, *34*(5), 719–751. https://doi.org/10.1177/0011000006286345

Whitwer, M., Wilson, S., & Hammer, J. (2023). Engineering student mental health and help seeking: Analysis of national data from the healthy minds study. *2023 IEEE Frontiers in Education Conference (FIE)*, College Station, Texas, USA, 1–7. https://doi.org/10.1109/FIE58773.2023.10343045

Wilkins-Yel, K. G., Arnold, A., Bekki, J., Natarajan, M., Bernstein, B., & Randall, A. K. (2022). "I can't push off my own mental health": Chilly STEM climates, mental health, and STEM persistence among black, latina, and white graduate women. *Sex Roles*, *86*(3–4), 208–232. https://doi.org/10.1007/s11199-021-01262-1

Wilson, C. J., Deane, F. P., Ciarrochi, J. V., & Rickwood, D. (2005). Measuring help seeking intentions: Properties of the general help seeking questionnaire. *Canadian Journal of Counselling*, *39*(1), 15–28.

Wilson, C. J., Rickwood, D. J., Bushnell, J. A., Caputi, P., & Thomas, S. J. (2011). The effects of need for autonomy and preference for seeking help from informal sources on emerging adults' intentions to access mental health services for common mental disorders and suicidal thoughts. *Advances in Mental Health*, *10*(1), 29–38. https://doi.org/10.5172/jamh.2011.10.1.29

Wilson, S., Wilder, K., Blackburn-Lynch, W., Hammer, J., & Dailey, D. (2022). Investigating mental health distress and help-seeking perceptions in first-year engineering students. *2022 ASEE annual conference & exposition*, Minneapolis, MN. https://doi.org/10.18260/1-2-40784

Wilson, S., Hammer, J., Henderson, J., & Frizell, S. (2024). Research in the formation of engineers: Improving the validity of an instrument to measure mental health help-seeking beliefs for diverse institutional contexts. *2024 ASEE annual conference & exposition*, Portland, Oregon, 46889. https://doi.org/10.18260/1-2-46889

Wright, C. J., Wilson, S. A., Hammer, J. H., Hargis, L. E., Miller, M. E., & Usher, E. L. (2023). Mental health in undergraduate engineering students: Identifying facilitators and barriers to seeking help. *Journal of Engineering Education*, *112*(4), 963–986. https://doi.org/10.1002/jee.20551

Zongrone, C., McCall, C., Paretti, M., Shew, A., Simmons, D., & McNair, L. (2021, January). "I'm looking at you, you're a perfectly good person ...": describing non-apparent disability in engineering. *2021 CoNECD virtual conference. 2021 CoNECD*. https://doi.org/10.18260/1-2-36059

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