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Piloting an Assessment of Entrepreneurial Habits of Mind for First-Year Engineering Students

Nicholas Burkhart, University of Cincinnati

Nick Burkhart is a doctoral student within the Quantitative and Mixed Methods Research Methodologies program at the University of Cincinnati. His work examines the conditions that lead students to find success in their higher education pursuits and how to align institutional structure with students' expectations as well as capacities to enhance the diversity of students who obtain a college degree. Current research focuses include student motivation, student satisfaction, and measures of student success.

uchenna Clinton John uchechukwu, University of Cincinnati

Biography: Uchenna is a PhD student in the Department of Engineering and Computing Education at the University of Cincinnati, College of Engineering and Applied Science. He holds a bachelor's degree in mechanical engineering from the Federal Polytechnic Owerri, Nigeria, with a concentration in production and manufacturing. During his undergraduate studies, he served as a teaching assistant, where he developed strong instructional skills and meaningful connections with students. Prior to his doctoral studies, Uchenna taught Chemistry and Mathematics at Government Secondary School, Lambar Tureta, where he gained valuable experience supporting diverse learners in foundational STEM subjects. He currently serves as a teaching assistant while pursuing research interests at the intersection of engineering design thinking, entrepreneurial mindset, broadening engineering, and STEM foundation in engineering education.

Dr. Cedrick Kwuimy, University of Cincinnati

Cedrick A. K. Kwuimy, PhD, is an Associate Professor–Educator in the Department of Engineering and Computing Education at the University of Cincinnati. His work examines how experiential learning becomes transformative and how such transformation expands students' capabilities and agency across formal and informal engineering education contexts. A Fulbright Scholar and Carnegie African Diaspora Fellowship Program Fellow, Dr. Kwuimy has designed and led capacity-building workshops on engineering formation in both Africa and the United States.

Prof. Youn Seon Lim, University of Cincinnati

Dr. Youn Seon Lim is an Assistant Professor of Psychometrics and Educational Measurement at the University of Cincinnati. Her research focuses on cognitive diagnosis modeling, Q-matrix theory, and survey, instrument, and test development, including scale development and construct validation. She also conducts interdisciplinary research on STEM career development and serves as Co-Principal Investigator on two NSF-funded projects supporting computer science pathways. She is an Associate Editor of the Journal of Classification.

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Abstract: This Complete Research pilots an investigation on whether entrepreneurial habits of mind can be meaningfully measured in first-year engineering students using a reflection-based instrument grounded in transformative learning theory. The Entrepreneurial Habits of Mind Reflection Survey (E-HOM) integrates Likert-scale items across eight entrepreneurial mindset dimensions with open-ended prompts coded using Mezirow's framework to capture both dispositional and reflective aspects of mindset. Content validity will be established through expert review, while quantitative analyses will assess internal consistency and construct validity; qualitative responses will be coded for depth of reflection with interrater reliability calculated. Using a convergent mixed-methods design, findings will compare survey subscale scores with levels of reflection. Anticipated results include variation in entrepreneurial dispositions, with stronger creativity and proactivity and more limited ethical and resilience-oriented reflection. This study offers initial evidence on the feasibility of assessing entrepreneurial mindset early in engineering education and informs future instrument refinement and curricular design.

Introduction

Entrepreneurial mindset has been widely recognized as a central outcome of engineering education, encompassing dispositions such as opportunity recognition, informed risk-taking, and value creation under conditions of uncertainty [1], [2], [3]. National initiatives, including the Kern Entrepreneurial Engineering Network (KEEN), have further articulated entrepreneurial mindset through learning outcomes related to curiosity, making connections, and creating value [4], [5]. Despite increased curricular emphasis on these constructs, assessment approaches in engineering education have primarily relied on self-reported intentions, attitudes, or venture-oriented outcomes. Such measures offer limited insight into how entrepreneurial thinking develops, particularly during the early stages of students' academic experiences.

First-year engineering students represent a critical yet underexamined population for entrepreneurial mindset assessment. As students enter the discipline, they are simultaneously developing academic identities and learning to navigate unfamiliar problem spaces, often without prior entrepreneurial experience or self-identification [5],[6]. Many existing instruments were developed for upper-level students or individuals with explicit entrepreneurial backgrounds, limiting their validity and sensitivity when applied to first-year contexts. Consequently, there is a need for assessment tools that are developmentally appropriate and capable of capturing early, emerging expressions of entrepreneurial thinking. A recent contribution from [5] explored students' conceptualizations of entrepreneurial mindset (EM), using concept maps to provide empirical evidence of students' evolving conceptualization of EM.

Building on this evidence of evolving conceptualization, the present study grounded in the Mezirow's concept of Habits of Mind (HOM) [7] addresses this gap through the development and validation of the Entrepreneurial Habits of Mind Reflection Survey (E-HOM), a new instrument designed for use with first-year engineering students. The E-HOM conceptualizes entrepreneurial mindset not as a fixed trait, but as a set of evolving habits of mind that develop through experience, reflection, and meaning-making in authentic learning contexts. The scale integrates Likert-type items with structured reflective prompts to assess both students' self-reported entrepreneurial dispositions and their reflective engagement with course-based design experiences.

The E-HOM emphasizes how students interpret experiences, question assumptions, and construct meaning through reflection [7], [8], [9]. This study reports on the initial psychometric validation of the E-HOM using data collected from first-year engineering students enrolled in a project-based design course. Specifically, the study examines the instrument's factor structure, internal consistency, and stability across pre- and post-course administrations, providing preliminary evidence of its suitability for assessing entrepreneurial habits of mind in early undergraduate engineering education.

Theoretical Framework

Transformative Learning Theory

This study draws on Transformative Learning Theory, which conceptualizes learning as a process of critically examining and revising frames of reference [7], [8], [9]. Central to this theory are habits of mind, which shape how individuals interpret experience. Key categories include epistemic (beliefs about knowledge), sociocultural (social norms and roles), psychological (sense of self), and moral–ethical (values and ethical commitments) [8]. Through reflection—particularly content, process, and premise reflection—learners may transform these habits, leading to more inclusive, integrative, and adaptive perspectives [10].

Positioning entrepreneurial mindset as a set of evolving habits of mind provides a theoretically grounded lens for early assessment. Reflection serves as the mechanism through which students' surface and interrogate assumptions underlying entrepreneurial behavior, making it particularly well suited for first-year contexts [10], [11].

Entrepreneurial Mindset and Habits of Mind

Neck and Corbett [3] define entrepreneurship education as the development of mindset, skill set, and practice necessary not only for venture creation, but also for navigating uncertainty and creating value across professional contexts. This broader conceptualization aligns closely with habits of mind, which emphasize patterns of thinking and action that support intelligent behavior in complex situations]12].

Within engineering education, entrepreneurship-oriented programs have been associated with positive outcomes including academic performance, persistence, and professional development. For example, Ohland et al. [13] reported that participation in an Engineering Entrepreneurship Program was associated with higher cumulative GPAs and improved retention. Similarly, Soutaris et al. [14] found that entrepreneurship education increased students' intentions to pursue entrepreneurial action by fostering inspiration and self-efficacy.

Materials and Methods

Sample Characteristics

Data was collected from first-year undergraduate engineering students enrolled in a required, project-based design course emphasizing entrepreneurial habits of mind. All students enrolled in the course were invited to participate in the study. Of the students invited, 111 completed the survey, yielding a participation rate of 88%. Participation was voluntary, and all responses were collected following informed consent.

Table 1 summarizes the demographic characteristics of the sample. Percentages are reported to aid interpretation. All categories are reported as presented; however, no identifying information is disclosed, thereby ensuring the protection of participant anonymity.

Table 1. Participant Demographics (N = 111)

Demographic	Category	n	%
Gender	Female	13	11.7
	Male	92	82.9
	Other gender identities	2	1.8
	Prefer not to say	4	3.6
Ethnicity	Hispanic	4	3.6
	Non-Hispanic	102	91.9
	Not specified	5	4.5
Race	American Indian or Alaska Native	2	1.8
	Asian	17	15.3
	Black or African American	3	2.7
	Multiracial	8	7.2
	Preferred not to say	4	3.6
	White	77	69.4
International Status	International student	12	10.8
	Domestic student	99	89.2
First-Generation Status	Yes	10	9.0
	No	92	82.9
	Not sure	9	8.1

Instrument

The Entrepreneurial Habits of Mind Reflection Survey (E-HOM) was developed to assess entrepreneurial dispositions among first-year engineering students using Mezirow's habits of mind framework and established entrepreneurship education models [1], [2]. During instrument development, items were initially drafted to reflect eight broad entrepreneurial content domains commonly referenced in the literature (e.g., risk-taking, adaptability, creativity, ethical responsibility, proactivity, networking, opportunity recognition, and self-reflection). These domains served as conceptual guides for item generation, rather than as hypothesized latent factors.

The complete questionnaire consisted of 66 Likert-type items organized into eight survey sections for administrative purposes: optimism, learning from failure, intrinsic motivation, communication, creative thinking in problem-solving and decision-making, group dynamics, perseverance, perceived workload, and personal life circumstances. Of these eight sections, six sections were designed to measure entrepreneurial habits of mind (optimism, learning from failure, intrinsic motivation, communication, creative thinking/decision-making, and group dynamics). The remaining two sections (perceived workload and personal life circumstances) were included to capture contextual conditions and were not intended to function as part of the measurement model.

Table 2 includes only the six measurement sections, because it presents the theoretical alignment between the E-HOM measurement content and Mezirow's habits of mind categories (epistemic, socio-linguistic, moral–ethical, philosophical/psychological, instrumental, and aesthetic). The two contextual sections are excluded from Table 2 because they do not represent habits of mind and were not designed to load on latent entrepreneurial constructs. Thus, for the psychometric analyses reported in this study, only the 48 items drawn from the six measurement sections were retained for exploratory and confirmatory factor analyses leading to the empirical analyses yielding a four-factor structure, which is reported in the Results section. Two response formats were used across items: a five-point confidence scale and a six-point agreement scale.

Table 2. Survey Sections on Habits of Mind

Sections of the survey	Habits of mind	Definition
Decision-making Learning from failure Intrinsic motivation Perseverance	Epistemic	Assumptions about knowledge, truth, and how we know what we know
Group dynamics Communication	Socio-linguistic	Assumptions shaped by language, social norms, and cultural expectations
Decision-making Group dynamics	Moral-ethical	Beliefs and values about what are right or good
Confidence Intrinsic motivation	Philosophical/ Psychological	Assumptions about oneself and broader worldview such as beliefs about existence, purpose, or meaning
Confidence Perseverance Creative thinking Optimism	Instrumental	Focused on task-oriented problem solving, cause–effect analysis, and controlling or manipulating the environment to achieve specific goals
Communication Group dynamics	Aesthetic	Assumptions related to tastes, preferences, and judgments of beauty or expression

Procedure

The development of the Entrepreneurial Habits of Mind Reflection Survey (E-HOM) followed a multi-stage process. An initial pool of items was generated based on Mezirow's habits of mind framework and established models of entrepreneurial mindset in engineering education. Items were designed to reflect developmentally appropriate expressions of entrepreneurial thinking for first-year engineering students. The draft items were reviewed by members of the research team and by content experts in engineering education to evaluate clarity, relevance, and construct alignment. Minor revisions were made based on this feedback. Reflective prompts were developed in parallel to elicit students' meaning-making related to course-based design experiences.

To support clarity and interpretability, the draft instrument was also reviewed by a small group of first-year engineering students, who provided feedback on item wording and response formats. Revisions were made as needed prior to full administration.

The finalized instrument was administered using Qualtrics. Data was collected from first-year engineering students enrolled in a project-based design course. Prior to participation, students provided informed consent and completed the survey, including the E-HOM items and basic socio-demographic questions. Participation was voluntary, and responses were collected anonymously. This data was subsequently used for exploratory and confirmatory factor analyses to evaluate the internal structure of the instrument as well as provide evidence of construct validity for the E-HOM.

Data Analysis

Quantitative analyses were conducted in RStudio using the psych, GPA rotation, and Sem Tools packages. Item distributions were evaluated with the Shapiro–Wilk test and indicated non-normality ($p < .05$). Because responses were collected on Likert-type scales and factors were expected to be correlated, the instrument was validated using a two-stage approach: exploratory factor analysis (EFA) followed by confirmatory factor analysis (CFA).

For the EFA, sampling adequacy was evaluated using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity. EFA models were estimated to have an oblique rotation (allowing factor correlations) and Kaiser normalization. Where items used different Likert response ranges, responses were standardized prior to factor modeling to place items on a comparable metric. Item retention and refinement followed pre-specified criteria to support a clear simple structure: items were removed if they demonstrated low primary factor loadings ($|\lambda| < .40$), problematic cross-loadings (e.g., secondary loading $\geq .30$ and/or an insufficient gap between primary and secondary loadings), or low communalities ($h^2 < .40$). Items were removed iteratively and the EFA was re-estimated until a stable and interpretable factor solution was obtained.

Following the EFA, CFA was conducted to test whether the factor structure identified in the exploratory stage was supported in a measurement model. Model adequacy was evaluated using standard global fit indices (e.g., CFI, TLI, RMSEA, SRMR) and by examining standardized factor loadings and factor correlations for interpretability, and consistency with the proposed constructs.

Results

Exploratory Factor Analysis (EFA)

Exploratory factor analysis (EFA) was conducted to identify the latent factor structure of the newly developed Entrepreneurial Habits of Mind Reflection Survey (E-HOM) and to determine item–factor associations, as a priori assignments of items to dimensions were not specified. Analyses began with 48 candidate items drawn from the six survey sections intended to measure entrepreneurial habits of mind. Item refinement was conducted as part of the EFA process using an iterative re-estimation approach. Items were removed when they failed to define a clear factor (i.e., weak primary loadings, substantial cross-loadings, or inadequate communalities). This process resulted in a final 23-item solution.

EFA was conducted using complete cases (N = 111). Sampling adequacy supported factor analysis (Kaiser–Meyer–Olkin measure, KMO = 0.877), and Bartlett's test of sphericity was statistically significant, χ^2 (253) = 2027.59, $p < .001$, indicating that the correlation matrix was appropriate for factor extraction. Factors were extracted using principal components analysis with oblique rotation, allowing for correlated latent factors. Factor retention decisions were guided by scree plot inspection and interpretability. As shown in Figure 1, the scree plot for the refined 23-item set exhibited a clear elbow after the fourth factor, supporting retention of a four-factor solution.

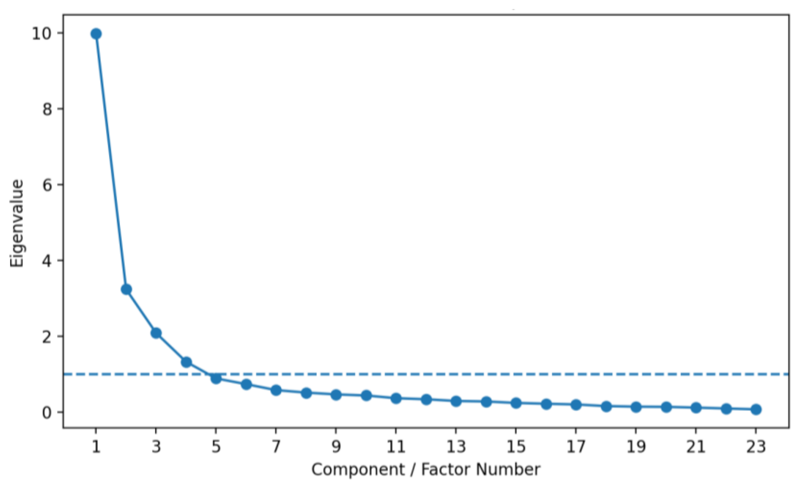

Figure 1. Scree plot for the final 23-item E-HOM model (N = 111), supporting retention of a four-factor solution.

The rotated four-factor solution demonstrated a clear and interpretable simple structure. Primary pattern loadings ranged from 0.624 to 0.885, with minimal cross-loadings across factors. The rotated sums of squared loadings were 5.023, 4.153, 3.249, and 2.680, corresponding to 65.7%

cumulative variance explained. Inter-factor correlations were positive and of small-to-moderate magnitude (approximately r = 0.15–0.47), indicating that the factors represent related but distinct dimensions of entrepreneurial habits of mind.

Internal consistency estimates for the refined scale are reported in Table 3. Reliability for the full 23-item scale was high (Cronbach's α = 0.938; McDonald's ω = 0.962). Subscale reliabilities were also strong: Factor 1 (8 items), α = 0.936, ω = 0.946; Factor 2 (7 items), α = 0.906, ω = 0.888; Factor 3 (4 items), α = 0.914, ω = 0.914; and Factor 4 (4 items), α = 0.894, ω = 0.896.

Table 3. Internal Consistency Estimates for the Final 23-Item E-HOM Scale

Factor	Number of Items	Cronbach's α	McDonald's ω
Factor 1	8	0.936	0.946
Factor 2	7	0.906	0.888
Factor 3	4	0.914	0.914
Factor 4	4	0.894	0.896
Total scale	**23**	**0.938**	**0.962**

Interpretation of the factors was guided by the conceptual content of the highest-loading items (Table 4). Factor 1 reflected group-based idea development and iterative improvement processes; Factor 2 captured openness and a positive orientation toward challenges and future possibilities; Factor 3 represented persistence and tenacity in problem solving; and Factor 4 reflected organization and effective use of tools and information. Together, the EFA results support a stable and interpretable four-factor structure for the final 23-item E-HOM scale.

Table 4. Exploratory Factor Analysis Pattern Matrix for the Final 23-Item E-HOM Scale

Item	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1: Group-Based Idea Development and Improvement				
Q15_1 Set team goals	**0.68**	0.12	0.08	0.05
Q15_2 Joint products	**0.84**	0.07	−0.04	−0.05
Q15_4 Media literacy	**0.47**	0.08	0.07	0.24
Q16_1 Test ideas	**0.85**	0.01	−0.05	0.06
Q16_2 Invent solution	**0.94**	−0.11	0.08	−0.04
Q16_3 Create something new	**0.71**	0.03	0.07	0.01
Q16_4 Change approach	**0.64**	0.13	−0.04	0.16
Q16_6 Use feedback	**0.76**	0.06	−0.05	0.06
Factor 2: Openness and Positive Orientation				
Q53_4 Future optimism	−0.17	**0.67**	−0.02	0.15
Q58_3 Enthusiasm	0.03	**0.84**	0.06	−0.06
Q58_4 Initiative	−0.01	**0.73**	0.12	−0.08
Q62_1 Solution exploration	0.22	**0.56**	0.09	0.06
Q64_1 Optimism under difficulty	0.10	**0.74**	0.08	−0.01

Q64_2 Positive mindset	0.03	**0.89**	−0.08	0.04
Q68_1 Willingness to try new approaches	0.05	**0.71**	0.04	−0.02
Factor 3: Persistence and Tenacity				
Q55_1 Persistence	−0.01	0.05	**0.77**	0.04
Q55_2 Overcome challenges	−0.06	0.09	**0.82**	0.00
Q55_3 Critical self-assessment	0.05	0.00	**0.84**	0.01
Q55_4 Avoid discouragement	0.05	−0.03	**0.88**	0.02
Factor 4: Organization and Technological Literacy				
Q17_2 Draw ideas	0.02	0.11	0.07	**0.63**
Q17_3 Analyze arguments	0.08	−0.01	0.22	**0.65**
Q17_5 Track assignments	0.00	−0.05	−0.08	**0.91**
Q17_6 Share information	0.02	0.02	0.00	**0.93**

Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) was conducted to formally test the four-factor measurement structure identified in the EFA. Whereas EFA was used to discover the number of latent factors and empirically determine how items clustered, CFA was necessary to evaluate whether this empirically derived structure could be specified as a coherent measurement model and whether the proposed item–factor relationships were supported by the data. In other words, CFA was used to assess whether the four-factor solution identified through EFA provided an adequate representation of the observed covariance structure.

A correlated four-factor CFA model was estimated for the final 23-item scale using N = 111 complete cases. Each item was specified to load on only one latent factor, consistent with the EFA results, and the four latent factors were allowed to correlate. No cross-loadings were specified.

Baseline Four-Factor CFA Model

The baseline CFA model (with no correlated residuals) demonstrated adequate but not optimal global fit: χ^2 (224) = 452.53, $p < .001$; CFI = 0.883; TLI = 0.867; RMSEA = 0.097; SRMR = 0.076 (NFI = 0.794; IFI = 0.884). Although the chi-square test was significant, which is common in CFA models with moderate sample sizes and multiple indicators, the SRMR indicated acceptable average residual discrepancies, and incremental fit indices approached commonly cited thresholds. Importantly, all standardized factor loadings were strong, ranging from 0.668 to 0.953, indicating that each item was associated with its intended latent factor. These results provide direct support for the item–factor assignments identified in the EFA, demonstrating that the discovered factor structure could be successfully specified and tested within a confirmatory framework.

Model Refinement Using Theoretically Justified Residual Covariances.

To evaluate whether localized sources of misfit could be addressed without altering the substantive factor structure, residual diagnostics were examined. Two item pairs within the same factors showed notable residual associations, suggesting shared variance not fully captured by the latent construct (e.g., similarity in wording or closely related behaviors). A modified CFA model was therefore estimated to allow within-factor residual covariances between: Q68_1 and Q68_2, and Q15_3 and Q16_4. These covariances were specified within factors only and did not introduce cross-factor associations or change item–factor assignments. The modified model demonstrated improved model fit: χ^2 (222) = 416.78, $p < .001$; CFI = 0.900; TLI = 0.886; RMSEA = 0.090; SRMR = 0.075 (NFI = 0.811; IFI = 0.902). A nested chi-square difference test indicated that the modified model fit the data significantly better than the baseline model, $\Delta\chi^2$ (2) = 35.75, $p < .001$.

Interpretation and Confirmation of the EFA Structure

Figure 3 presents the standardized CFA solution for the modified four-factor model. As shown in the figure, items loaded strongly on their respective latent factors, and the latent factors exhibited moderate positive correlations, consistent with the EFA results. Critically, no changes to the factor structure were required to achieve improved fitness, and the four-factor configuration identified in the EFA was retained intact.

Taken together, the CFA results confirm the four-factor structure identified through EFA, while indicating that a small number of closely related item pairs share residual covariance beyond the latent construct. Such localized dependencies are common in multi-item instruments and do not undermine the substantive measurement model. Rather, the CFA demonstrates that the empirically derived EFA structure can be represented as a coherent, interpretable, and statistically supported measurement model.

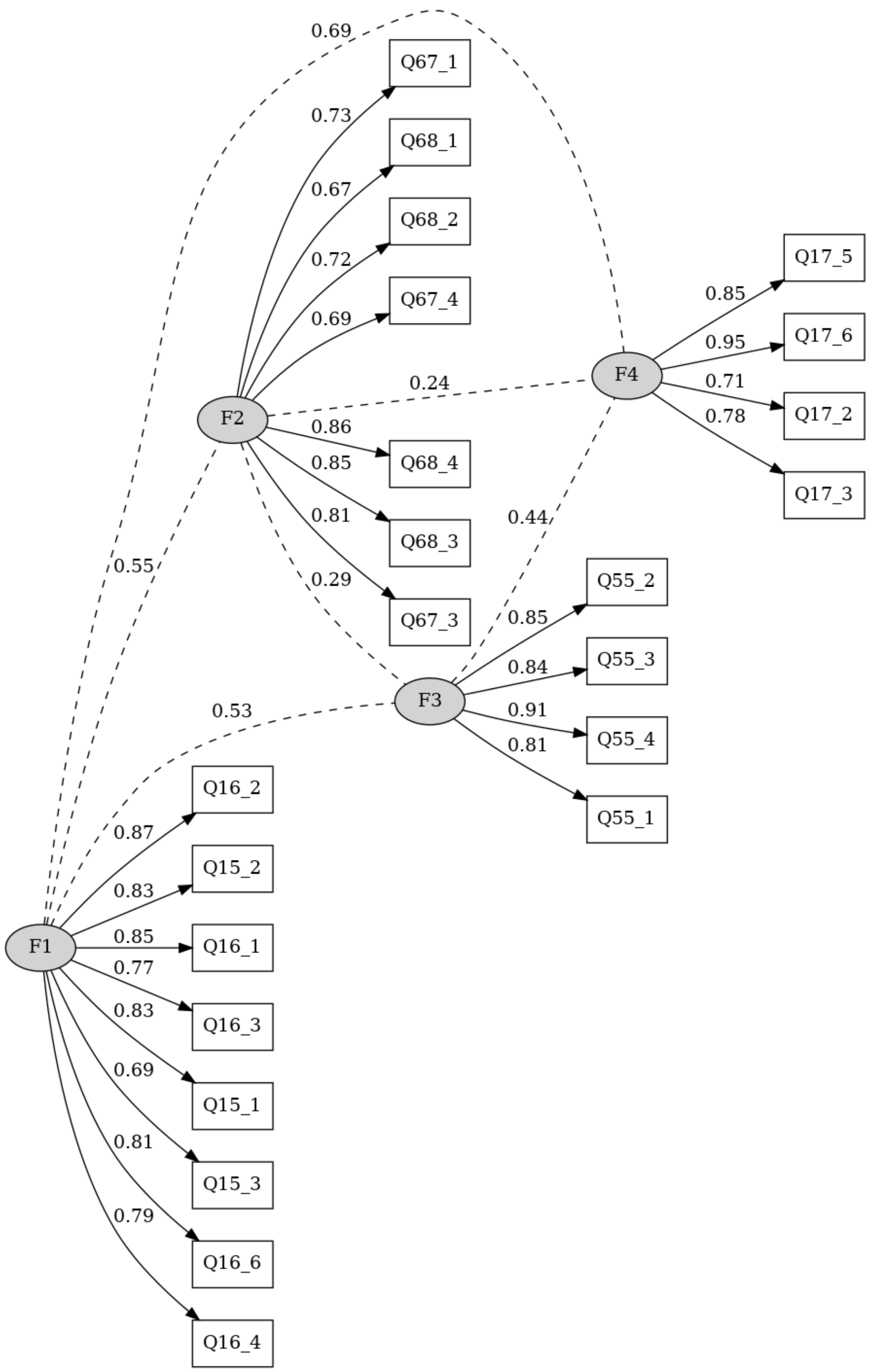

Figure 3. Standardized confirmatory factor analysis (CFA) solution for the final 23-item E-HOM scale. Ellipses represent latent factors, rectangles represent observed items, solid arrows indicate standardized factor loadings, and dashed curved arrows indicate correlations among latent factors.

Discussion

This study developed and validated the Entrepreneurial Habits of Mind Reflection Survey (E-HOM) to assess entrepreneurial mindset among first-year engineering students. Because the dimensional structure of the newly developed instrument was not specified a priori, the validation approach combined exploratory factor analysis (EFA) to identify the latent structure and confirmatory factor analysis (CFA) to test whether the EFA-derived structure could be represented as a coherent measurement model. The E-HOM was grounded in Mezirow's habits of mind and implemented through a reflection-oriented design consistent with Transformative Learning Theory, with the goal of providing an empirically supported measurement tool for an outcome that is increasingly emphasized in engineering education yet remains challenging to assess using consistent, developmentally appropriate instruments.

Analyses focused on the measurement items intended to capture entrepreneurial habits of mind (48 candidate items). Items assessing student characteristics and course/project feedback were excluded from the factor analyses because they were designed as contextual variables that may help explain variation in entrepreneurial mindset development and will be examined as predictors or correlates in subsequent work. Through iterative item refinement within the EFA process, the instrument was reduced from 48 candidate items to a final 23-item solution.

Results supported a four-factor structure that was interpretable and consistent with theoretical framing. The four factors identified through EFA were: (1) Group Dynamics and Improvement Mindset, (2) Openness and Positive Mindset, (3) Organization and Technological Literacy, and (4) Persistence and Tenacity. Together, these factors captured key dispositions emphasized in the habits-of-mind framework (e.g., optimism, perseverance, communication, and adaptive problem solving) while also reflecting features of first-year engineering learning contexts, including collaborative work and technology-mediated task management. The resulting dimensions therefore provide a conceptually meaningful representation of entrepreneurial habits of mind as enacted in early engineering coursework.

The CFA provided confirmatory evidence for the EFA-derived structure. The baseline four-factor CFA model demonstrated adequate but not optimal fit, while allowing two theoretically plausible within-factor residual covariances improved global fit without altering item–factor assignments. Importantly, standardized loadings were substantial across all items, indicating that the retained indicators were strongly associated with their intended factors. Taken together, the EFA and CFA results support the E-HOM as a psychometrically defensible instrument for assessing entrepreneurial habits of mind in first-year engineering students and provide an empirical foundation for future research examining change over time and relationships with course experiences and student characteristics.

Conclusions and Implications of Factors

The exploratory factor analysis identified four distinct but related dimensions of entrepreneurial habits of mind (E-HOM), each representing a meaningful domain of student development in early engineering education. These four factors demonstrate that entrepreneurial habits of mind extend beyond creativity alone. They encompass collaborative innovation, motivational orientation, resilience, and organizational competence. As described below, the E-HOM could function as an assessment instrument and as a strategic tool for curricular design, student support, and continuous program improvement.

Factor 1: Group-Based Idea Development and Improvement

This factor captures students' capacity to collaborate in generating, refining, and implementing ideas. Items reflect teamwork, joint product development, testing ideas, inventing solutions, using feedback, adapting approaches, and creating new solutions.

Programs could use this factor to assess whether students are meaningfully engaging in collaborative innovation processes. Lower scores may signal a need for more structured team-based design projects, peer feedback systems, or scaffolded opportunities for iterative prototyping. High scores suggest students are developing competencies central to entrepreneurial engineering practice.

Factor 2: Openness and Positive Orientation

This factor reflects students' mindset toward challenges, uncertainty, and new opportunities. Items include enthusiasm, initiative, optimism, willingness to try new approaches, and solution exploration.

This dimension highlights the effective and motivational foundations of entrepreneurial behavior. Lower scores in this area suggest need for interventions that might focus on mindset development, resilience-building exercises, and reflective practices that normalize uncertainty and failure. Strength in this factor supports innovation, adaptability, and opportunity recognition.

Factor 3: Persistence and Tenacity

This factor centers on sustained effort in the face of obstacles. Items include persistence, overcoming challenges, critical self-assessment, and avoiding discouragement.

Persistence is essential for long-term innovation and entrepreneurial success. This factor may be used to identify students who require additional coaching in resilience, structured reflection after setbacks, or mentoring support. High scores indicate strong internal resources for navigating complex engineering problems.

Factor 4: Organization and Technological Literacy

This factor reflects students' ability to manage tasks and effectively use tools and information. Items include tracking assignments, sharing information, drawing ideas, and analyzing arguments.

This dimension underscores the operational competencies necessary to translate ideas into action. Lower scores may suggest the need for structured project management training, digital literacy support, or scaffolded analytical exercises. Strong performance indicates readiness for professional engineering environments that demand coordination, documentation, and technical fluency.

Limitations and Future Directions

Several limitations should be considered when interpreting these findings. First, the validation evidence was obtained within a first-year engineering context; additional studies are needed to establish whether the factor structure generalizes to other engineering cohorts, institutions, or disciplinary contexts. Second, the CFA was conducted on the same sample used for EFA-based refinement. Although this approach is common in early-stage instrument development, future work should replicate the CFA into an independent sample and evaluate measurement stability across subgroups (e.g., gender, first-generation status) to strengthen generalizability and fairness. Third, because the instrument was administered in connection with a specific instructional context, future studies should examine sensitivity to different instructional designs and the extent to which scores reflect enduring dispositions versus context-dependent responses.
Future research will therefore focus on (a) cross-validation of the four-factor model with new samples, (b) testing measurement invariance across student subgroups and contexts, and (c) examining longitudinal change (e.g., pre/post and multi-term follow-up) to better understand how entrepreneurial habits of mind develop over time. In addition, the excluded contextual items (student characteristics and course/project feedback) will be leveraged to investigate predictors and support associated with entrepreneurial mindset development.

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Appendix A: Sample Items for the E-HOM

The Table below presents excerpt of the instrument developed. The complete 23-item instrument is available from the authors upon request. The full instrument and additional psychometric details will be described in a forthcoming journal manuscript (in-preparation).

Items	Factor
How confident are you to test out different ideas and work to improve them	1
How confident are you to work in pairs or small groups to complete a task together	1
The project’s structure (deadlines, deliverables, milestones) pushed me to set goals and take initiative	2

Mentorship or guidance from faculty/mentors played a role in shaping my mindset	2
I persisted when progress was slow or uncertain	3
When something did not work, I analyzed what went wrong to improve next time	3
How confident are you to use technology to keep track of your work on assignments	4
How confident are you to draw your own ideas based on analysis of numbers, facts, or relevant information	4