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Telling Their Stories: A Narrative Intervention to Support Belonging, Identity, and Persistence in Engineering Students

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Abstract

Engineering programs in the United States continue to struggle with high attrition and limited diversity. This study investigates an unconventional solution: a narrative-based intervention where students write and perform their own engineering stories to build resilience and improve retention. While engineering curricula typically emphasize technical rigor, this research explores how a storytelling intervention influenced undergraduate students' perceptions of their sense of belonging, professional identity, and persistence. The intervention, implemented across six semesters in diverse engineering disciplines, engaged students in developing and performing personal stories about their engineering journeys. Utilizing inductive thematic analysis of semi-structured interviews with 17 participants, we investigated how the narrative process influenced student perceptions. Results: Participants reported that the intervention positively influenced their identity development. Most participants reported a strengthened or reaffirmed intention to remain in the field. Our findings suggest that storytelling provided students with a structured way to discuss struggle, connect with peers, and see themselves more clearly as part of engineering. Those shifts may matter for retention, especially for students who otherwise feel isolated.

Keywords: engineering; storytelling; imposter syndrome; belonging; identity; persistence

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1. Introduction

The field of engineering faces ongoing challenges of high attrition and a lack of diversity (National Center for Education Statistics, n.d.). These persistent issues are deeply interconnected, as the factors driving students away from engineering programs often disproportionately affect underrepresented groups. Research suggests that fostering a sense of belonging and professional identity can improve retention, especially among underrepresented groups, and, in turn, decrease the diversity gap (Doran & Swenson, 2022; Dost, 2024; Patrick et al., 2018; Strayhorn, 2015; Verdín, 2021; Verdín et al., 2018).

The diversity gap remains despite institutions' investments in mentorship and support programs. It stands to reason that traditional interventions like these must be missing a piece of the puzzle (see Master et al., 2021; Muenks et al., 2020; Murphy & Dweck, 2010). Research, though, has shown narrative and storytelling as promising tools for shaping identity, building community, and encouraging reflection (Alterio & McDrury, 2003; Bruner,

2004; Burk, 1997, 2000; Huber et al., 2013). Despite its potential to humanize engineering and connect personal and professional identities, storytelling remains largely untapped in undergraduate engineering curricula (Riemer, 2007; Shuman et al., 2005).

To examine this issue, we studied a storytelling intervention in which engineering students wrote and performed personal narratives about science. We set out to explore how students perceive the influence of a storytelling intervention on their identity, sense of belonging, and persistence. In the following paper, we present the results of our inquiry and implications for future research and practice.

2. Literature Review

2.1. Persistence in Engineering Education

Persistence in engineering education essentially refers to students' continued enrollment and plans to complete an engineering degree (Kuley et al., 2015). In this study, we defined persistence as participants' plans to continue in their engineering program. We recognize that these plans reflect intentions and do not capture whether students actually remain in their programs over time. To complicate matters, research has shown multiple factors, such as college/faculty-level factors (e.g., institutional climate, curriculum, mentorship, peer influence, and sense of belonging), teacher-level factors (e.g., classroom culture, teacher attitudes), and student-level factors (i.e., academic achievement, motivation, and attitude, self-efficacy, and demographics) influence persistence in engineering education (Kuley et al., 2015).

Students who persist often begin with a strong academic preparation, feel a strong sense of belonging and identification with the field, and have access to support systems such as mentors, faculty, and peers (Kuley et al., 2015). Those who do not persist often struggle with a lack of representation, imposter syndrome, rigid curriculum, weed-out cultures, and a lack of access to support (Kuley et al., 2015). In response, institutions have tried shifting cultural paradigms (Godwin et al., 2024; Walton et al., 2015), incorporating diverse perspectives throughout the curriculum (Benson et al., 2020; Boudreau et al., 2019; Casper et al., 2024), implementing peer communities (Bielefeldt et al., 2021), giving students mentors (Dennehy & Dasgupta, 2017; Rayford et al., 2022), and increasing representation in positions of authority (Atadero et al., 2016; Liptow et al., 2016). While some past interventions have focused on improving student reflection (Godwin et al., 2024; Walton et al., 2015) or helping students develop a stronger sense of connection with course content (Benson et al., 2020; Boudreau et al., 2019; Casper et al., 2024), the potential of narrative-based approaches remains largely underexplored.

2.2. Sense of Belonging in Engineering Education

Sense of belonging has been defined as an individual's subjective feeling of being accepted, valued, and included within a particular community or environment (Strayhorn, 2012). In engineering education, this encompasses students' perceptions that they fit within their program, are welcomed by peers and faculty, and are legitimate members of the engineering community. In a recent review of the literature, Lawrence et al. (2025) showed that a sense of belonging in engineering education has been defined and operationalized in varied ways. That is, some studies focus on a student's general sense of belonging on campus or to a university, while others focus on a student's sense of belonging within their discipline. Differences like these make it difficult to compare results across studies and suggest a need for a shared definition. In this study, we define a sense of belonging as participants' feeling of connection to their engineering peers, faculty, and program—in other words, a sense that they are accepted members of the engineering community.

Research suggests that a sense of belonging plays an important role in shaping professional identity. Building this sense of belonging is particularly important for engineering students from historically marginalized groups (Fisher et al., 2019; Good et al., 2012; Jensen & Cross, 2021; Master & Meltzoff, 2020; O'Brien et al., 2020; Rainey et al., 2018; Trenor et al., 2008; Wilson et al., 2015). Students who feel they belong are more motivated to persist, report better mental health, and see themselves as more capable engineers (Fisher et al., 2019; Jensen & Cross, 2021; Lewis et al., 2017; Smith et al., 2013; Walton & Cohen, 2011; Wilson et al., 2015). A sense of belonging can also help counter the effects of impostor syndrome and stereotype threat (Walton & Cohen, 2011).

There exists a "culture of genius" in engineering education in which success is perceived to depend on innate brilliance (e.g., being naturally smart, fast, and effortlessly right) (Murphy & Dweck, 2010). In such settings, mistakes are stigmatized, effort is seen as a sign of weakness, and students feel pressure to hide their struggles. Opportunities to cultivate a growth mindset and reshape self-narratives can be a powerful tool for countering these dynamics (Smith et al., 2013). Research has shown that effective methods include mentorship programs, community learning, representation, environments aimed at promoting a sense of connectedness, and inclusive teaching strategies (Brobst et al., 2023; Campbell-Montalvo et al., 2022; Chrysochoou et al., 2021; Dennehy & Dasgupta, 2017; Godwin et al., 2024; Hain et al., 2018; Motaref, 2022; Rayford et al., 2022). In a recent study, Bahnson et al. (2025) found that a belonging intervention in a first-year engineering programming course that integrated stories from previous students to normalize struggle supported academic help-seeking, increased students' comfort with being wrong, and improved continued enrollment, particularly for Black, Latino/a/x, and Indigenous students.

2.3. Identity in Engineering Education

Engineering identity is often understood as the degree to which an individual sees themselves as an engineer. It is widely conceptualized in terms of three interrelated dimensions: performance/competence, recognition, and interest (Carlone & Johnson, 2007; Godwin, 2016). While operationalizations of this construct vary (Morelock, 2017), identity development is often thought to be shaped by both individual and broader social and institutional norms (Huff & Ross, 2023). Building on these frameworks, this study views engineering identity as both a personal sense of self ("I am an engineer") and a socially constructed recognition negotiated through peers, faculty, and the curriculum.

However, forming this identity is often undermined by systemic barriers within engineering's' culture of genius.' Challenges such as impostor syndrome and stereotype threat further complicate identity development by making students fear they will be exposed as frauds or by reinforcing negative stereotypes (Clance & Imes, 1978; Murphy & Dweck, 2010; Spencer et al., 2016). These effects are especially pronounced for underrepresented students, who regularly face stereotyping, discrimination, and the dismissal of their professional contributions (Camacho & Lord, 2011; Campbell-Montalvo et al., 2022; Leyva et al., 2022a, 2022b; Morton et al., 2019; Morton & Nkrumah, 2021; Morton & Parsons, 2018; Rodriguez & Blaney, 2021). These marginalizing experiences actively undermine the "recognition" dimension of engineering identity, reinforcing students' doubts about their legitimate place within the field.

Compounding these barriers is a lack of diverse representation in the curriculum (Leyva et al., 2022a; Rodriguez & Blaney, 2021). Research has shown that the opportunity to express cultural values through their work is a key motivator for students. When the curriculum does not provide this opportunity or reflect those values, it creates a gap between students' professional and personal identities, placing those with intersectional underrepresented identities at even greater risk (Leyva et al., 2022a, 2022b; Morton et al.,

2019). To navigate this, reflection is an integral tool; providing students with an opportunity to think critically about their experiences, challenges, and progress aids in healthy identity formation and professional development (Bruner, 1996; Ibarra, 1999; Mackay, 2017).

2.4. Storytelling in Education

Identity formation occurs through the stories people tell about themselves (Bruner, 2004). Reflection on past experiences can reveal new perspectives, allowing identity to evolve (Bruner, 2004; Foote, 2015; Huber et al., 2013). A growing body of research suggests that storytelling builds personal connections in education, enabling students, especially those from underrepresented groups, to express struggles and experiences in ways that foster deeper engagement (Alterio & McDrury, 2003; Burk, 1997; Huber et al., 2013). Hearing peers or authority figures share similar struggles can combat imposter syndrome (Clance & Imes, 1978), while counter-stereotypical narratives can reshape beliefs and humanize engineering (Adichie, 2009; Clance & Imes, 1978).

Educators have long used personal storytelling to help students connect with academic content and make learning more meaningful (Bruner, 1996; Mott et al., 1999; Zull, 2004). Reflection and storytelling can also help students bridge their personal and professional identities (Gee, 2000; Minichiello & Hanks, 2020; Secules et al., 2018). When narrative is built into the curriculum, it can promote critical thinking and help students see their ideas from new perspectives (Zull, 2004). Stories are also central to how knowledge, values, and cultural norms are passed on, shaping both individual and group identities and strengthening community ties (Bruner, 2004). Through storytelling, students can connect with others who share similar experiences or learn about different perspectives, helping to break down stereotypes—something especially important for historically marginalized individuals who are often left out of dominant field narratives (Adichie, 2009).

Beyond reflection, sharing stories publicly can strengthen identity by encouraging people to act in ways that are consistent with their beliefs (Abelson et al., 1968; Cialdini, 2001). It also provides underrepresented students with opportunities to articulate and take ownership of their experiences (Adichie, 2009). Within engineering, storytelling empowers students to define their identities as scientists and engineers (Korte, 2013) and to reframe academic failures into narratives of persistence (Minichiello & Hanks, 2020; Secules et al., 2018). This process helps students feel seen and heard, offering validation and a sense of belonging (Secules et al., 2018). Despite storytelling's recognized value as a pedagogical tool, it remains underutilized in undergraduate engineering education because, as some have pointed out, the field has historically emphasized technical rigor over interpersonal and reflective competencies (Riemer, 2007; Shuman et al., 2005).

3. Method

This study investigated the effects of a storytelling intervention on undergraduate engineering students' sense of belonging, identity, and persistence by trying to answer the following research questions:

- RQ 1: How do participants perceive the influence of a storytelling intervention on their identity, sense of belonging, and persistence?
- RQ 2: What are the overarching themes of the stories students told?

3.1. Setting and Participants

This study was conducted at a large, predominantly white (71%) doctoral-granting institution in the Northwestern United States, with approximately 17,000 undergraduate students. After receiving IRB approval, the intervention was implemented in undergraduate classrooms across six engineering programs (i.e., civil engineering, mechanical

engineering, materials science and engineering, computer science and engineering, electrical engineering, and engineering plus), targeting sophomore-level courses where students are most likely to question whether to continue their studies. A total of 17 students were interviewed across the six semesters (n = 9 women, n = 8 men).

To protect participant anonymity, demographic data beyond gender was intentionally not collected or reported. In qualitative studies involving small samples and sensitive personal narratives, collecting detailed demographic information can compromise participant privacy—particularly when the sample includes as few as 1–5 participants per semester from specific engineering programs. This ethical consideration took precedence over demographic analysis.

Additionally, our approach focused on understanding participants' perceptions of the intervention's influence rather than comparing outcomes across demographic groups. This study's research questions did not require demographic disaggregation, and our semi-structured interview methodology was designed to capture the depth and nuance of individual experiences across a diverse sample.

While we acknowledge that demographic analysis could provide valuable insights into how the intervention functions across different student populations, participants' narratives suggest the intervention reached students experiencing various forms of marginalization. Several participants explicitly discussed navigating stereotypes and discrimination related to race, ethnicity, gender, and mental health, and these students reported meaningful impacts on their belonging and identity. Future research with larger samples should examine whether and how intervention effects vary across demographic groups.

3.2. Intervention Details

The intervention was developed in partnership with the Story Collider, an independent nonprofit organization founded in 2010 and incorporated in 2012 with the mission of revealing the role that science plays in people's lives through personal storytelling (www.storycollider.org, accessed on 1 January 2024). The organization produces live storytelling shows and a podcast. The Story Collider offers storytelling workshops, coaching, and seminars to universities and organizations. The Story Collider has partnered with institutions ranging from large research universities to community colleges, and its approach centers on one-on-one story coaching in which trained producers work with individuals to develop and refine personal narratives about their experiences with science. The partnership in this study was initiated through a federally funded project; the Story Collider served as an external collaborator, providing storytelling expertise and facilitation. One week prior to the workshop, which was usually around week four or five of the semester, a member of the research team visited each participating class to introduce this study, distribute informed consent forms, and administer a pre-survey. Students were given approximately 10 min of class time to review the study information and complete the consent process if they chose to participate.

The intervention began with a 75–90 min hybrid workshop co-facilitated via Zoom by the course instructor, a member of the research team, and a Story Collider producer. After listening to two Story Collider podcast episodes as pre-work, students were introduced to the Story Collider's storytelling framework, which focuses on believable characters experiencing meaningful events and coping with the consequences. The workshop guided students through four elements: (a) identifying meaningful events such as moments of change or struggle; (b) exploring consequences through iterative "But why?" and "What else?" partner questioning; (c) developing character using prompts such as "I'm [not] the kind of person who. . ." and "The lie I was telling myself was. . ."; and (d) crafting a narrative arc around personal transformation, with attention to openings, sensory scene-building,

and endings (Rogers et al., 2023). Throughout, students engaged in paired brainstorming, story pitching, and peer feedback. A companion workbook scaffolded each activity.

Following the workshop, students developed an 800- to 1200-word personal narrative about a meaningful experience connected to their engineering journey, focusing on a specific moment of change rather than a chronological account. Each draft received individualized written feedback from a Story Collider producer on narrative clarity, emotional honesty, and story structure. After revision, students recorded a five-minute performance of their story for course credit, graded primarily on participation. A select group of four to five students per semester was invited to perform at a live Story Collider show on campus.

3.3. Data Collection and Analysis

This study was conducted over six semesters from 2022 to 2025. At the end of each semester, students who completed the storytelling assignment were invited via email to participate in a voluntary semi-structured interview and were offered a $25 gift card as compensation. Interviews were conducted by a doctoral researcher affiliated with the funded project who had no role in grading or evaluating participants. Informed consent was obtained prior to each interview. Although the storytelling assignment was a required course activity, participation in interviews was voluntary, not disclosed to course instructors, and facilitated by a researcher without grading authority. The storytelling intervention was typically implemented during the fourth or fifth week of each semester, with slight variation by course. Interviews took place at the end of the semester, approximately 10–12 weeks after the intervention. This interval allowed for time for reflection but may have introduced some recall limitations.

The semi-structured interview protocol was developed to align with this study's research questions and the constructs of identity, belonging, and persistence identified in the literature. It was iteratively refined across semesters based on emerging themes and interviewer reflections. The protocol addressed four areas: (a) participants' overall experience with the intervention, (b) its perceived influence on identity, belonging, and persistence, (c) the content and meaning of their stories, and (d) their experience performing the story. Interviews lasted approximately 20–30 min. Sample questions included:

- "How has developing your story influenced how you think of yourself as a future engineer?"
- "How has developing your story influenced how you think of yourself as belonging to an engineering community?"
- "How has developing your story influenced your thoughts about your intentions to continue in your engineering program?"
- "What about this story stood out to you? What made it rise to the top of all the other options you generated?"

We based this study solely on interview transcripts collected as part of a larger funded project. Although students produced written narratives during the intervention, we are analyzing those in related studies. Therefore, we did not use the written texts as data here; we focused only on the interviews and on how students verbally discussed their personal stories. We adopted a pragmatic approach to thematic analysis that combines systematic coding procedures with attention to researcher reflexivity and interpretation (Saldaña, 2016). While we drew on established coding methods to ensure rigor and transparency, we recognize that theme development is inherently interpretive work shaped by researchers' perspectives and engagement with the data (Braun & Clarke, 2019). This positioning acknowledges both the value of systematic analysis and the role of researcher judgment in meaning-making.

We recorded and transcribed all Zoom interviews verbatim. Analysis followed Saldaña's (2016) two-cycle coding method, beginning with inductive, open coding to identify initial patterns, then grouping these into broader themes to address our research questions. While "identity," "sense of belonging," and "persistence" acted as sensitizing concepts (Bowen, 2006) to guide our analytic focus, specific themes emerged inductively from participants' own language and emphasis. We maintained a working codebook and analytic memos throughout the process to document coding decisions, track theme development, and support interpretive consistency as new transcripts were analyzed across semesters.

3.4. Trustworthiness

Multiple strategies were employed to improve the trustworthiness of the findings. To promote dependability, a consistent, semi-structured interview protocol was used across all semesters, with iterative refinements to clarify the interview questions based on interviewers' reflections. For example, adding follow-up probes about specific intervention components that earlier participants had spontaneously mentioned. To support credibility, two coders independently analyzed a subset of transcripts, then met to compare interpretations, discuss divergent readings, and refine code definitions through collaborative dialogue. This process served to deepen our understanding of the data, surface alternative interpretations, and ensure codes captured the nuances of participants' experiences rather than imposing predetermined categories (Saldaña, 2016). We did not calculate inter-rater reliability statistics, as our goal was interpretive consistency and theoretical coherence rather than statistical agreement. The primary coder revisited earlier transcripts after developing the full coding framework to ensure thematic coherence across the dataset and to confirm that emerging themes were well supported throughout the data.

The first author, who conducted all interviews, reflected on their positionality as a doctoral researcher affiliated with the project but external to the classroom, and on how their familiarity with the intervention may have shaped both interview dynamics and analytic attention.

4. Results

When participants talked about the intervention, they most often described changes in how they saw themselves, how connected they felt to others in engineering, and whether the field still felt worth staying in. The most common themes that emerged across the participants were building confidence, bonding/connecting with peers/faculty, and a positive change in intentions to persist in engineering (see Table 1). Each theme is discussed in more detail in the following paragraphs.

Table 1. Themes that emerged.

Identity (I): Participants experienced significant shifts in their professional identity, most prominently through building confidence in calling themselves engineers and recognizing their accomplishments. Many also reflected on personal growth over time and described learning to view mistakes as opportunities for learning rather than failures.

Sense of Belonging (B): Participants described an enhanced sense of belonging, primarily through stronger bonds and connections with peers and faculty during the shared storytelling experience. Previously isolated students found these connections meaningful, noting that the experience fostered deeper interpersonal engagement than typical coursework and helped normalize struggles within their community.

Persistence (P): Most participants reported either strengthened motivation to continue in engineering or reaffirmation of their existing commitment to the field. Participants attributed these outcomes to a revised outlook on their future possibilities, self-reflection on their progress, and a sense of community support.

Story Themes (ST): Participants' stories most frequently centered on three recurring themes: overcoming obstacles such as discrimination, mental illness, and imposter syndrome; learning from mistakes by reframing perfectionism and failure as valuable opportunities for growth; and breaking stereotypes by challenging assumptions about who belongs in engineering based on race, ethnicity, gender, and mental illness. These narratives allowed students to share vulnerable experiences, build confidence, and create deeper connections with peers who could relate to their struggles.

4.1. Identity

Multiple overarching themes emerged from participants' discussions of the intervention's influence on their identity, the most central being the development of confidence. This newfound confidence was touched on in multiple ways. Participants expressed greater confidence in their achievements and choice of major, frequently citing an identity shift from "not an engineer yet" to "engineer." One participant who had been in school for six years reflected, "I've always been like, 'Yeah, I'm going to engineering school, you know, don't look at me.' But now I'm like, 'Yes, I'm an engineer.'. . . And now I feel like I really am proud of that." Another described how the storytelling process itself dissolved her self-doubt: "The imposter syndrome kind of disintegrated while developing this. It just gave me more confidence in myself." This confidence also extended to communication skills, including public speaking and writing. One participant noted a "meta experience," in which the lessons of confidence from their own story about imposter syndrome helped them craft the story itself. Among participants who reported increased confidence, more than half also reported a stronger sense of bonding with peers or faculty. While building confidence emerged as the most commonly reported identity shift, not all participants experienced the intervention's impact on identity in the same way. Some participants emphasized different aspects of identity development, including personal growth over time, learning to value community and teamwork, and challenging stereotypes about who belongs in engineering.

This confidence was associated with their intentions to persist in engineering. Participants reflected on changes in their work ethic, accomplishments, and self-view. One participant discussed their growth as an engineer and leader, highlighting how people often sought their advice and understanding of engineering concepts. Another participant detailed how they had grown as an engineer since beginning the program, detailing how the growth resulted in more confidence in calling themselves an engineer:

> "I was like, wait a minute, future scientist? My title is Research Technician. I'm a scientist now, and I heard that come out of my mouth, and I kind of looked down, and [was] like I'm a scientist now and I had a similar thing while I was writing this. This is not something that will happen. This is not something I'm preparing for. This is where I am. This is my life. These are my accomplishments. And I think that iterating on the story gave me a chance to reflect on really the first professional STEM work I had done. . . It was just a really awesome opportunity for me to reflect on, uh, and legitimize how far I've come."

Participants who reflected on their personal growth reported stronger bonds with peers and faculty, as well as an increased intention to persist in their studies. A major recurring theme within this growth was a cognitive shift in how students viewed failure. Participants learned to reframe mistakes as vital learning opportunities and to view the classroom as a low-stakes environment for experimentation, which motivated them to avoid errors in future high-stakes settings.

Beyond these most prominent themes, a smaller number of participants described other meaningful shifts in their professional identity. Some spoke about learning to value community and teamwork more deeply, recognizing that engineering is fundamentally a collaborative endeavor. A few participants reflected on how the intervention helped them challenge stereotypes they had encountered—particularly related to gender and personality traits—about who belongs in engineering. One participant noted feeling more recognized as an engineer by others during the public performance, which strengthened their professional identity. Importantly, while these themes were less frequently mentioned, they represented significant identity transformations for those who experienced them.

4.2. Belonging

Participants described an enhanced sense of belonging, most commonly through stronger bonds with peers and faculty, normalizing struggles, and fostering a sense of community. Participants most frequently reported stronger connections with both peers and faculty. This is meaningful for those who had previously felt isolated, including non-traditional students who noted that such community-building opportunities were rare in their program. One participant reflected that the experience "helped me remember that everyone is going to make mistakes. If I get something wrong or don't understand it, everyone else is probably feeling the same way. So it really helped build that bond with me and my classmates." Participants described the experience as fostering deeper interpersonal engagement than typical coursework. As one participant explained, "It was such an amazing opportunity to be able to connect with my peers on a level that wasn't just collaborating on homework. . . to get to know them as actual human beings instead of just classmates." This helped students recognize and appreciate their classmates' diverse backgrounds. Through the shared creative process, students developed a strong sense of camaraderie as they connected over common interests and experiences. Despite these positive outcomes in belonging, over half of the participants reported no change in their intentions to persist, while four reported a strengthened commitment.

However, participants described their sense of belonging in diverse ways beyond bonding with peers and faculty. A few participants emphasized the value of being part of a community of knowledge and collaboration, recognizing the wealth of expertise among their engineering peers. One participant reflected on how sharing their story helped normalize struggle, making them feel less isolated after making a mistake. Another participant felt more seen and recognized as an engineer by the public audience during the performance. Notably, one participant reported that the intervention did not impact their sense of belonging to the engineering community, highlighting that the storytelling experience was not universally transformative in this dimension.

4.3. Persistence

No participants reported a negative effect on their desire to persist. Responses fell into three categories: the majority reported increased motivation to continue, seven participants described the experience as "affirming," strengthening an already strong commitment to the field, and only two indicated no effect. The two participants who reported no effect were not dissatisfied with the intervention; rather, their intentions to persist were already firmly established. One noted that their uncertainty centered not on commitment to engineering but on whether their specific program aligned with their professional goals. The themes related to it are presented below.

Participants who reported a positive change in their intentions to persist attributed it to a combination of a revised outlook on the future, self-reflection on their progress, and a sense of community support. For many, this meant realizing their path was open and full of possibilities. One previously indecisive student credited this realization with enhancing their resolve, while another gained confidence by connecting their personal strengths to a future career. Reflection mattered too; looking back at how far they had come and how their work habits had improved gave participants a stronger sense of commitment. Community support also played a role. One student, after temporarily leaving the program due to a medical emergency, credited the sense of community built during the intervention with strengthening their resolve to persist.

> "It has helped me to be a little bit more resolved in completing it. . . I'm actually off track right now in school, and so the Story Collider was the last school experience that I had for the semester. And so it was really interesting for me to be able to be

> there and be like, man, I really miss this, and I really want to be back and doing this, which is something that, in the middle of all the things going on in my life, I hadn't really thought that I would feel. So it definitely helped me out a lot. It was just a really awesome opportunity for me to reflect on, uh, and legitimize how far I've come. And it was really cool for me to be able to come back and to see and to really feel that that community that came not only from the story Collider, but also from this desire that I had to continue to be a part of it."

Participants who reported strengthened persistence intentions also described building confidence, personal growth, and stronger bonds with peers and faculty. These patterns were consistent with those reported in the identity and belonging findings.

Almost half of the participants described the intervention as reaffirming rather than transformative. As one participant put it, "It just affirmed that, hey, I like rockets, I'm gonna continue to do rockets." These participants had already moved beyond questioning whether to continue in engineering and described the experience as validating their existing commitment. Their stories reflected resilience and growth, with many recounting how they overcame obstacles and broke stereotypes. These varied responses to the intervention—increased motivation, reaffirmation, and no effect—demonstrate that participants were at different points in their persistence journeys, and the intervention met them where they were rather than producing a one-size-fits-all outcome.

4.4. Story Themes

The most common theme that emerged from the stories students told in the interviews was overcoming obstacles. Participants emphasized their resilience and ability to persevere through setbacks. One participant shared how they overcame discrimination and being labeled as someone with "low potential" in school due to their background. Others discussed their battles with mental illness and imposter syndrome, illustrating the personal challenges they had navigated alongside their academic work.

> "In the past, I've been insecure about myself, and I feel like I'm never smart enough. I'm never good enough. There's that imposter syndrome of: Yes, I am doing this, but it doesn't mean I shouldn't be here. I don't know if I'm smart enough to do this. So I think it shows that I suffer from imposter syndrome. But it's okay. And I'm still continuing on and being an engineer. And I just sometimes have to step back and remind myself that this is hard for everyone in this class, and I'm not the only one who's struggling. I just gotta do the best I can."

Participants who told stories about overcoming obstacles frequently discussed building confidence, experiencing personal growth, and learning to view mistakes differently. These participants also described forming stronger bonds with peers and faculty. For some, recounting these obstacles reaffirmed their existing commitment to engineering, while for others, reflecting on how they had overcome adversity strengthened their resolve to persist.

Learning from mistakes was the second most prominent theme described by participants. These participants shared stories about their struggles with perfectionism, recounting specific moments when the pursuit of perfection had dominated their lives and how they eventually moved past it. For some, reflecting on past mistakes provided the clarity needed to pivot or choose a new direction in their academic journey. Participants who shared these stories often connected this theme to building confidence and experiencing personal growth. Multiple participants also emphasized the value of community and teamwork, recognizing that learning from mistakes is easier in supportive environments. Some described finding belonging through collaborative knowledge-building, where mistakes could be shared openly without judgment. Many of these participants also reported a strengthened commitment to persist in engineering.

Breaking stereotypes emerged as another significant theme in participants' stories. These participants shared how their experiences challenged common assumptions about engineering and who belongs in the field, addressing stereotypes based on race, ethnicity, gender, and mental illness. Female participants, in particular, reflected on how they navigate and confront stereotypes in a male-dominated field. One described how she "was pushed out of my passion based on people and their stereotypes of it, and what they would tell me," only to reclaim that passion through engineering. These stories, which were often connected to building confidence and publicly claiming space in engineering despite facing bias, were often accompanied by descriptions of increased professional self-assurance. Many of these participants also described forming stronger bonds with peers and faculty. Most reported no change in their existing intentions to persist and described the experience as validating.

While overcoming obstacles, learning from mistakes, and breaking stereotypes were the most common themes in participants' narratives, the narratives also reflected a broader range of engineering experiences. Some participants' stories centered on demonstrating their competence as engineers, while others emphasized determination and persistence in the face of challenges. A few participants reflected on their reliance on others—peers, mentors, and family—as a crucial element of their engineering journey. This diversity suggests that the intervention provided students with space to tell their own authentic stories rather than conforming to a prescribed narrative of what an engineering journey should look like.

5. Discussion

Participants in this study reported that the storytelling intervention influenced their perceptions of their identity, sense of belonging, and persistence intentions. Below, we discuss how these reported experiences connect to and extend existing literature while recognizing that participant perceptions represent one form of evidence that warrants further investigation through complementary research methods.

5.1. Strengthening Persistence Intentions

The way participants in this study continued to strengthen their intentions to persist in Engineering merits discussion. Interestingly, more than half of the participants who reported an increased sense of belonging reported no shift in their intentions to persist; however, they still credited the storytelling experience with strengthening their relationships with both peers and faculty. For these students, the intervention's primary contribution may lie in validating their existing commitment to persist and strengthening interpersonal bonds rather than generating new motivation to persist.

Participants who described gains in confidence, personal growth, and a growth mindset also tended to report stronger intentions to persist. Although this study cannot determine whether these relationships are causal, the pattern is consistent with prior research suggesting that growing confidence and learning to reframe mistakes may support persistence, especially among historically marginalized students (Bielefeldt et al., 2021; Burtner & Backer, 2004). This finding points to an important direction for future research, particularly whether structured narrative interventions can help foster these mindsets. The association between confidence and intentions to persist is noteworthy given evidence that women with lower confidence are significantly more likely to leave engineering programs (Cech et al., 2011).

Our results also suggest that educators should emphasize bonding and connecting with peers and faculty, as this emerged as the most common factor associated with a sense of belonging among participants who experienced positive shifts in their persistence

intentions. Our results align with existing literature on relationship-based belonging interventions (Abrica et al., 2022) and complement recent findings by Bahnson et al. (2025), who showed that normalizing struggle improves help-seeking and retention for underrepresented students. While Bahnson et al. relied on curated stories from past students, our intervention empowered current students to craft and share their own narratives. Ultimately, this suggests that both receiving and generating stories of struggle are powerful tools for building a sense of belonging.

The story themes most strongly associated with positive persistence shifts (i.e., learning from mistakes and overcoming obstacles) highlight the types of reflective experiences that may support student retention and improve persistence. Participants who wrote about overcoming obstacles reframed their narratives from accounts of failure to accounts of success, whether through achieving a goal or gaining a meaningful lesson. Similarly, those who wrote about learning from mistakes frequently described moving beyond negative beliefs or challenges. These stories may have been effective because they allowed students to see difficult experiences in a new light, recasting what once felt like a defining failure instead as a single but important step in a longer journey. As Rogers et al. (2023) suggest, framing one's life as a hero's journey can increase meaning, and students are more likely to persist when course content connects to their personal experiences. Participants who wrote about learning from mistakes also frequently described increased confidence and personal growth, suggesting that reframing mistakes as learning opportunities may strengthen resilience. This aligns with Murphy and Dweck's (2010) argument that viewing effort and error as productive, rather than an inadequacy, supports sustained engagement in demanding academic environments. Three-quarters of students who tied their identity to reframing mistakes reported both increased persistence and a sense of community-based belonging. This pattern highlights how reframing failure may reinforce the relationship between identity, belonging, and persistence.

5.2. Engineers: The Whole Person

Bruner (2004) emphasizes the usefulness of storytelling in education as a means of infusing personal meaning into academic content, thereby deepening students' understanding of the material. Research also highlights the importance of students' ability to express their identities in their work (Leyva et al., 2022a). Throughout this project, we witnessed students connecting their backgrounds to their work, expressing long-held dreams of becoming engineers, describing how engineering has enriched their lives on a personal level, and reflecting on how they have grown as engineers. Participants also reflected on their unique struggles in the field and how these struggles shaped their identities, including instances of discrimination. Participants' descriptions of shifting from "not an engineer yet" to "engineer" align with Godwin's (2016) recognition dimension. The intervention appeared to provide a context in which participants could claim, and feel claimed by, an engineering identity. The confidence-building theme similarly maps onto the performance/competence dimension, as participants described growing assurance in their engineering capabilities.

Participants who discussed identity in terms of breaking stereotypes were able to reframe their experiences, find pride in their identities and unique attributes, and embrace self-determination and resilience. These participants invariably shared stories about overcoming obstacles and consistently reported stronger intentions to persist. This pattern underscores the value of allowing students to bring their full selves to the classroom and the potential harm of requiring them to compartmentalize their identities. These findings suggest that stereotypes influence students' persistence intentions and that reflecting on experiences of overcoming and being invalidated by stereotypes may improve those in-

tentions, particularly for historically marginalized students. This aligns with Walton et al. (2015), who demonstrated the effectiveness of integrating personal identity into engineering practice. Similar to our findings, Walton et al. (2015) found that participants came to view adversity as more manageable and held more normative views of women in engineering than a control group. Our results also support the conclusion by Secules et al. (2018) that narrative and reflection can bridge the gap between personal and professional identity.

Participants who shared stories about breaking stereotypes also described forming stronger bonds with peers and faculty, suggesting that disclosing experiences of marginalization may create meaningful connections with peers who share similar backgrounds as well as with those who gain a new perspective from hearing these accounts. This is consistent with Adichie's (2009) argument that counter-narratives disrupt dominant assumptions and foster empathy, and it highlights the dual function of stereotype-challenging stories. They support the storyteller's identity development while simultaneously expanding the community's understanding of who belongs in engineering.

5.3. Changing Cultures Changing Minds

Several participants reported that they stopped interpreting mistakes as evidence that they did not belong and began recognizing them as part of learning engineering. Many initially experienced shame and isolation around setbacks, but through the intervention came to view these experiences as integral to their development. Crafting and sharing their stories increased awareness of impostor syndrome patterns and helped participants reframe them. This resonates with Radoff et al.'s (2019) concept of 'meta-affective learning,' in which learners shift their relationship to their emotions, coming to experience uncertainty as productive rather than threatening. The intervention may thus provide a structured opportunity for students to reconstruct their emotional relationship to difficulty in engineering.

By sharing stories and discovering common experiences, participants reported diminished isolation. Rather than concealing their struggles, they found support in hearing peers describe similar challenges. One participant reflected that realizing others were also struggling fundamentally changed their perspective, aligning with Clance and Imes's (1978) observation that hearing peers articulate similar struggles helps individuals recognize their feelings are not unique indicators of inadequacy. Participants who shared stories of overcoming obstacles also described forming stronger bonds with peers and faculty, suggesting that vulnerable narratives may themselves deepen interpersonal connections.

These findings mirror successful strategies in the literature. Godwin et al. (2024) found that normalizing struggle and framing adversity as surmountable reduced isolation while improving confidence, belonging, and academic performance. Murphy and Dweck (2010) suggest that embracing mistakes as part of learning can transform a 'culture of genius,' where innate ability is prized, and mistakes breed shame, into a culture of growth where effort is valued. Participants' reflections suggest that elements of a culture of genius existed within their programs, and the intervention appeared to counter this: the majority who described a shift in how they viewed mistakes also reported stronger intentions to persist, supporting Murphy and Dweck's (2010) findings. This aligns with Kellam et al.'s (2018) observation that emotions are deeply embedded in engineering students' narratives yet often go unacknowledged within the discipline's emphasis on technical rigor.

Through this process, participants came to recognize their accomplishments and take ownership of their identity as engineers rather than viewing themselves as 'just students.' This confidence extended to skills such as public speaking and narrative articulation. Participants also reported that shared storytelling fostered interpersonal bonds, increased confidence, and reshaped perceptions of mistakes, suggesting that belonging and identity

development may be mutually reinforcing, consistent with prior research (Clance & Imes, 1978; Murphy & Dweck, 2010).

6. Conclusions

Participants in this storytelling intervention reported shifts in how they perceived their sense of belonging, identity, and intentions to persist in engineering. Participants most commonly described experiencing belonging through stronger connections with peers and faculty, with previously isolated and non-traditional students finding these connections especially meaningful. Participants described identity shifts centered on building confidence, as many moved from seeing themselves as "not an engineer yet" to claiming an engineering identity, while reframing adverse experiences (such as stereotypes and mistakes) into narratives of resilience and growth. Most reported that their intentions to persist were strengthened or reaffirmed, with no participants reporting negative effects. Story themes of overcoming obstacles, learning from mistakes, and breaking stereotypes frequently co-occurred with these reported outcomes. While these findings suggest that narrative-based approaches warrant further investigation as potential mechanisms for supporting engineering students, experimental designs would be needed to establish causal relationships.

These findings carry practical implications for engineering educators. The intervention's core components, which include a structured storytelling workshop, iterative feedback, and peer performance, could be integrated into sophomore-level courses without significant curricular restructuring. Prompt design matters: narratives of overcoming obstacles and learning from mistakes were most closely associated with positive outcomes. Programs with higher proportions of non-traditional or isolated students may benefit most, while cohort-rich programs may find the intervention serves a reaffirming function by reinforcing existing commitment rather than generating new motivation.

This study has some limitations. The small sample (n = 17), gender imbalance, and reliance on self-reported perceptions limit the breadth and type of claims this study can support. The $25 incentive may have introduced selection bias toward more favorable accounts. This study was conducted at a single, predominantly white doctoral-granting institution in partnership with the Story Collider, and transferability to other contexts remains uncertain, though the core mechanism of structured storytelling with iterative feedback could be adapted locally. Future research should examine this intervention across institutional types, incorporate longitudinal retention data, and explore targeted prompts for specific populations.

In conclusion, participants in this study reported that the storytelling intervention contributed to their sense of community, confidence, and validation. While our findings cannot establish that narrative-based interventions will produce similar outcomes in other contexts, they suggest that structured storytelling warrants further investigation as a potentially feasible, low-cost complement to technical curricula—particularly for isolated students, those experiencing imposter syndrome, and those seeking validation of existing commitments. Future research should examine whether these reported benefits improve retention and whether the intervention functions similarly across diverse institutional contexts. Although narrative interventions cannot resolve broader structural problems in engineering education, this preliminary evidence suggests they may be valuable as one component of comprehensive equity efforts.

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