

Fostering Reflection in Narrative Inquiry: Designing Interviews for Exploring Professional Engineering Identity Development of Early Career Engineers

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Introduction

In this theory/methods full paper, we report on the design and implementation of a two-interview approach within a Narrative Inquiry framework to study how early career engineers make sense of their experiences in becoming professional engineers and how they reflect on that process. Engineering education research has increasingly emphasized understanding engineers' experiences, identities, and meaning-making processes across educational and professional contexts [1], [2], [3], [4]. As the field has expanded beyond technical competence to include professional formation, identity development, and reflective practice, there is growing interest in qualitative methodologies capable of capturing the temporal, relational, and complex nature of these phenomena [1], [5], [6], [7]. Narrative inquiry, with its focus on lived experience and storied meaning-making, offers a promising approach for addressing these aims [6], [8]. Despite this alignment, narrative inquiry remains relatively underutilized in engineering education, and when it is employed, its methodological design is often left implicit [9]. Narrative studies frequently report findings without fully articulating the philosophical commitments, theoretical grounding, and design decisions that shape how narratives are elicited and interpreted. This lack of methodological transparency risks positioning narrative inquiry as descriptive rather than as a rigorous, theory-driven methodology [10], [11], [12].

Moreover, existing narrative work in engineering education has tended to focus on specific populations, most notably underrepresented students, or on discrete interventions [9]. While this work has been essential, limiting narrative inquiry to these contexts' risks obscuring its broader potential as a foundational approach for understanding how engineers more generally make sense of experience, engage in reflection, and construct professional identities across the student-to-practitioner trajectory. This theory/method paper responds to these gaps by opening the "black box" of narrative inquiry design in engineering education research. Rather than presenting empirical findings, the paper focuses on the theoretical rationale, methodological commitments, and design processes involved in developing a narrative inquiry approach intended to support reflective meaning-making and professional engineering identity (PEI) development. Grounded in Dewey's theory of experience and reflection and informed by narrative theory, this work conceptualizes narrative inquiry not only as a means of studying experience, but also as a methodological space for supporting reflection and identity reconstruction.

Specifically, this paper reports on the design and development of a two-interview narrative inquiry approach embedded within a larger empirical study of early career engineers. These design choices reflect a commitment to narrative inquiry as a relational, reflective, and theoretically grounded methodology. By making explicit the connections among narrative inquiry, Dewey's theory of experience, reflection, and professional engineering identity, this paper contributes to methodological scholarship in engineering education. It offers a transparent account of how narrative inquiry can be intentionally designed to align theory, method, and purpose, and it invites

greater engagement with narrative methodologies as tools for understanding experience and PEI formation.

Background and Theoretical Framework

Foundational work by Connelly and Clandinin [8] conceptualizes narrative inquiry as “thinking about life,” grounded in the assumption that humans are fundamentally storytellers who live and understand their lives through stories. From this perspective, experience does not automatically take narrative form; rather, narratives are constructed through reflective processes in which individuals draw on memories, knowledge, emotions, and interpretations to make sense of lived events [13], [14]. Narratives function as meaning-making structures that organize experience across time. As Polkinghorne [15] argues, narrative creates meaning by configuring actions and events into coherent episodes that explain how particular outcomes came to be. This configurative function distinguishes narrative inquiry from approaches that fragment experience into themes or variables. Narratives emphasize temporal continuity, causal linkage, and intentionality, showing how past experiences inform present understandings and anticipated futures [16]. In this way, narrative inquiry foregrounds experience as dynamic, evolving, and situated within broader social and cultural contexts [17].

Narrative inquiry operates as both an epistemological stance and a methodological orientation. Epistemologically, it assumes that knowledge is constructed through lived and told experience and that meaning emerges through interpretation rather than objective extraction [14], [18]. Methodologically, narrative inquiry encompasses a set of strategies for eliciting, analyzing, and representing stories in ways that maintain close proximity to participants’ lived worlds [18], [19]. Since the late 1980s and early 1990s, narrative inquiry has gained prominence across the social sciences and education as part of a broader “narrative turn” toward studying experience as a primary source of knowledge [20]. In education research, Connelly and Clandinin [8] argue that education itself is a narrative enterprise, asserting that “education is the construction and reconstruction of personal and social stories; teachers and learners are storytellers and characters in their own and others’ stories” (p. 2). From this view, learning and development are understood not merely as the acquisition of skills or knowledge, but as processes of meaning-making that unfold through lived experience and reflection [17].

In this way narrative construction can be considered a reflective and identity construction practice [6], [21]. Despite its growing use across education, narrative inquiry remains relatively scarce within engineering education research. When narrative approaches are employed, they have often focused on underrepresented students or participants engaged in specific programs or interventions, reflecting the method’s strength in foregrounding identity, belonging, and lived experience [9]. Responding to calls for expanded use of narrative inquiry in engineering education research, this work seeks to extend narrative approaches beyond their predominant application to underrepresented groups or isolated interventions. While such work has been essential for amplifying marginalized voices, limiting narrative inquiry to these contexts’ risks positioning narrative methods as supplementary rather than foundational. Rather than treating stories solely as representations of experience, we conceptualize narrative inquiry as a method that can actively support reflective sensemaking, both as a research outcome and as a process embedded within the research design. In doing so, this work contributes to a growing body of methodological scholarship that positions narrative inquiry not only to document engineering experiences, but as

a framework for understanding how engineers interpret, reflect on, and re-story their professional lives over time [9], [22].

Dewey's theory of experience and reflection and PEI

The narrative inquiry commitments outlined in the previous section are grounded in Dewey's conception of experience as temporal, relational, and meaning-laden [23], [24]. Dewey's theory of experience is frequently cited as the philosophical underpinning of narrative inquiry [25], as it explains how individuals construct meaning through lived and reflected experience over time. From this perspective, narratives are not simple accounts of events, but reflective reconstructions through which experience becomes intelligible and educative [8]. Central to Dewey's theory are the principles of continuity and interaction, which position experience as an unfolding process shaped by prior experiences and social contexts. Experience gains educational value not through occurrence alone, but through reflection, defined as the active reconstruction of experience that adds meaning and informs future action [8], [17], [24], [26]. Reflection enables individuals to perceive relationships and continuities across experiences, transforming experience into learning rather than routine or mis-educative action [24].

This framing is particularly salient for narrative inquiry because reflection is the process through which experience becomes story. Narratives emerge as individuals revisit experiences, identify tensions or disruptions, and configure events into coherent accounts that link past, present, and anticipated futures [18]. Dewey's theory thus provides a conceptual bridge between lived experience and narrative meaning making, reinforcing narrative inquiry's emphasis on temporality, relationality, and sensemaking [22], [27]. Reflection also plays a critical role in PEI development [28], [29], [30]. Becoming an engineer involves navigating experiences across education and professional practice that challenge assumptions about competence, values, and professional roles. Reflection supports the interpretation and integration of these experiences into evolving professional self-understandings [3], [29], [31]. From a Deweyian perspective, PEI is not a fixed outcome of training but an ongoing process of becoming, shaped through reflective engagement with experience [32].

Importantly, Dewey emphasized that reflection is inherently social and dialogic, occurring through interaction with others and within institutional contexts [30]. This relational view aligns with narrative inquiry approaches that create dialogic spaces for meaning making [17]. Building on Dewey's view of experience and reflection, Polkinghorne's theory of narrative provides a complementary account of how reflected experience is organized into meaning.

Polkinghorne and Narrative as Meaning-Making

Polkinghorne argues that narrative meaning is created by linking actions and events into wholes that explain how particular outcomes came to be [15]. These narrative configurations connect past experiences to present understandings and anticipated futures, allowing individuals to make sense of continuity, change, and disruption over time [33]. Importantly, narratives often contain tensions, contradictions, and turning points, features that signal moments of uncertainty or transition and invite deeper reflection rather than analytic resolution. Such features are especially relevant for studying professional formation, where identity is shaped through negotiation rather than linear progression [18].

Polkinghorne's distinction between analysis of narratives and narrative analysis further clarifies the methodological implications of a narrative approach. Analysis of narratives applies paradigmatic reasoning to derive themes across stories, often prioritizing generalization over narrative wholeness. In contrast, narrative analysis focuses on constructing coherent stories that preserve the temporal, contextual, and interpretive integrity of individual experience [33], [34]. For research concerned with professional engineering identity, this distinction matters: understanding how engineers make sense of becoming professionals requires attention to narrative coherence, re-storying, and meaning making across time rather than decontextualized thematic fragments.

Taken together, Dewey's theory of experience and Polkinghorne's narrative framework foreground reflection as a central narrative act through which individuals revisit experiences, surface relationships and tensions, and reconfigure those experiences into evolving professional narratives. From this perspective, narrative inquiry offers a theoretically aligned approach for examining professional engineering identity as a dynamic process of becoming, continually reconstructed through reflective sensemaking. These frameworks provide the conceptual foundation for the methodological approach advanced in this paper, justifying narrative inquiry methods that attend to temporality, relationality, and reflective meaning-making and motivating interview designs that create space for participants to narrate, revisit, and reinterpret experiences central to professional identity development.

Methods: Operationalizing Narrative Inquiry

Following a Narrative Inquiry methodology, this paper reports on the design and development of a qualitative interview approach intended to study the PEI development of early career engineers. Situated within a larger empirical study, the focus of this paper is not on reporting empirical findings, but on articulating the theoretical commitments, methodological decisions, and design processes that informed the construction of our narrative inquiry methodology specifically, the development and implementation of a two-interview approach. The goal of this methodological contribution is to make explicit how narrative inquiry can be intentionally designed to elicit temporally rich, reflective, and identity-relevant stories. Narrative Inquiry provides a lens for examining how experiences across time are connected, interpreted, and woven into coherent stories that shape PEI development. These theoretical commitments informed our decisions about how interviews should be structured to support temporal depth, meaning making, and reflection.

The broader empirical study retrospectively explores the experiences of early career engineers from their undergraduate education through their current professional practice and is guided by two research questions: (RQ1) How do early career engineers story their understanding of what it means to be an engineer at different points along the student-to-practitioner trajectory? and (RQ2) What features of these stories can inform the development of a conceptual model of professional engineering identity (PEI) reflection? While these research questions motivate the methodological design, they will be addressed empirically elsewhere. The present paper centers on the methodological framework developed to support their investigation. As part of the larger study, we first designed a survey incorporating multiple-response, Likert-scale, and open-ended questions to support participant recruitment and contextual understanding. Participants who completed the survey were invited to take part in the two-interview narrative inquiry process. To

date, fifteen early career engineers (2-10 years) have been recruited and have participated in narrative interviews.

Interviews in Narrative Inquiry

Narrative inquiry, as a qualitative research methodology, centers on the collection of stories through in-depth interviews that foreground individuals' experiences with educational and professional phenomena [35]. Within narrative research, interviews are not treated as neutral mechanisms for extracting information, but as relational encounters shaped by social interaction and power dynamics [18], [36]. As such, the knowledge generated through interviews is inherently contextual, interpersonal, and co-constructed. Interviews offer unique insight into the complexity of individuals' lives and can create opportunities for self-reflection through which new understandings emerge [18]. Prior research suggests that interviews may also have developmental or therapeutic effects [37], [38] and can encourage reflexivity [39]. Through their capacity to foster reflection, interviews may therefore function as interventionist practices that support participants in developing new or revised understandings of their experiences [38].

Guided by this perspective, we intentionally designed our interview process to serve dual purposes: to elicit rich narrative accounts of participants' engineering journeys and to support critical reflection on experiences spanning undergraduate education, transition to practice, and early professional work. Because PEI develops across time and contexts, the stories collected needed to be detailed, comprehensive, and temporally expansive depth that is rarely achievable within a single interview session. Accordingly, we employed a two-interview design to generate and deepen narratives of PEI development. The first interview focused on extended storytelling through a narrative interview format, while the second employed a Reflective Emancipatory Interviewing approach to prompt critical reflection and re-storying. The design and structure of each interview are described in the following subsections.

Interview 1: Narrative Interview

Narrative interviews place participants at the center of the research process by prioritizing their lived experiences and the stories they construct about those experiences [35]. Designed to elicit participants' own accounts of how they perceive, organize, and make meaning of their lives, narrative interviewing foregrounds the storyteller's perspective rather than imposing a predetermined analytic agenda. As such, these interviews attend to *how*, *why*, and *what* questions common to qualitative inquiry while emphasizing participants' narrative sensemaking [18], [40], [41]. In contrast to more structured interview formats, narrative interviews allow participants to largely control the direction, content, and pacing of the conversation. Interviewees determine which experiences to share and how to frame them, while interviewers adopt a facilitative role that supports storytelling rather than directing it [18]. This approach aligns with Narrative Inquiry's emphasis on understanding identity as it is narrated and constructed through experience. Consistent with recommendations for narrative inquiry interview design, the first interview was structured using two distinct phases: a narration phase and a conversation phase [18]. Drawing on prior literature and our experience from a pilot study, interviews were designed to last approximately 60 to 90 minutes, with the narration phase occupying 45 to 60 minutes and the conversation phase 15 to 30 minutes.

During the narration phase, participants were invited to provide extended, uninterrupted accounts of their pathway into engineering, undergraduate experiences, transition to professional practice, and current roles. Interviewer intervention was intentionally minimized to support narrative flow and encourage narrative thinking. Following the narration phase, the interview transitioned into the conversation phase, which involved more focused and in-depth questioning. This phase supported clarification of earlier narratives, exploration of specific experiences, and the introduction of topics aligned with the study's theoretical interests, most notably PEI [42]. Here, the interviewer adopted a more active role as a co-constructor of meaning, engaging participants in dialogue to deepen understanding and surface identity-relevant insights that may not have emerged during the initial narration [43]. Together, these two phases enabled the first interview to generate rich, temporally extended narratives while also allowing for deeper exploration of identity-related themes. The design of Interview 1 thus established the narrative foundation for the reflective work that will be undertaken in the second interview.

Interview 2: Reflective Emancipatory Interviewing

Following the establishment of participants' core narratives through the first interview and a preliminary narrative analysis informed by Polkinghorne's narrative analytic approach, the second interview will employ a reflective emancipatory interviewing methodology [38]. This interview is designed to prompt participants to revisit and reconsider their previously articulated narratives, interrogate underlying assumptions, explore tensions between current and possible selves, and identify moments of reflection and re-interpretation. In contrast to the primarily story-generative focus of the first interview, the second interview explicitly positions reflection as both an analytic focus and an intended outcome of the research process, creating opportunities for what we conceptualize as "flickers of transformation" through dialogic exchange [38], [44].

Emancipatory interviewing is grounded in the premise that personal and social change can be enabled through critical questioning of participants' beliefs, assumptions, and previously articulated views [44], [45], [46]. Among qualitative interview approaches, it makes explicit the interventionist intent of the interview. Researchers may enter with a deliberate agenda to facilitate critical self-examination [44] or encourage participants to interrogate their identifications, attitudes, and behaviors through sustained dialogic engagement [46]. A central feature of emancipatory interviewing is its emphasis on critical dialogue. Rather than treating the interview as a space for unchallenged expression, this approach reframes the interview as a dialogic encounter in which meanings are co-examined, contested, and refined [45]. Knowledge outcomes are expected to emerge not solely from participants' initial accounts, but through dialogic engagement in which assumptions are surfaced, questioned, and re-evaluated. In this sense, the interview functions as a form of democratic debate that encourages the articulation and justification of evolving perspectives [38].

Within this study, the reflective emancipatory interview serves two complementary purposes. First, it allows participants to elaborate and complete their professional narratives by addressing gaps or ambiguities from the first interview. Second, it creates structured space for critical reflection on how experiences are interpreted and integrated into developing professional engineering identities. Through this design, the interview is conceptualized not merely as a data collection tool, but as an interventionist practice intended to support re-storying and

reconsideration of what it means to become and be an engineer. We anticipate that the emancipatory interview questions will be highly specific to each individual.

Ensuring Reflexivity on Researcher part

Guidance on conducting qualitative research interviews has traditionally emphasized procedural mechanisms, such as asking the “right” questions through interview schedules or protocols [47], [48]. However, scholarship on interview-based research increasingly calls for the explicit incorporation of reflexivity frameworks that foreground the researcher’s role in the production of knowledge [49], [50]. Reflexivity involves the researcher’s capacity to “self-consciously refer to [themselves] in relation to the production of knowledge about research topics” (p. 116). In qualitative inquiry, such reflexive engagement is closely tied to transparency, self-awareness, and iterative self-examination as strategies for establishing trustworthiness [51], [52].

Reflexivity is a central component of Narrative Inquiry, as researchers actively participate in the co-construction of stories and shape the interview experience [17]. To strengthen reflexive practice and enhance methodological rigor, we adapted the Interview Quality Reflection Tool (IQRT) into the protocol development process for the first (narrative) interview. Developed by Huff and Brooks [53], the IQRT supports structured reflection on interviewer performance, conceptualized not only as question wording but also as interviewer responsiveness, probing decisions, use of silence, and the creation of an open and accessible interview environment. Although the IQRT was originally developed within an interpretive phenomenological analysis (IPA) framework, we adapted it to support a narrative interview approach. In this study, the IQRT functioned as a reflexive mechanism for the iterative refinement of interview protocols and questions (Appendix A.1).

Design Procedure

In this section, we describe the procedure, protocol, and interview questions developed for the first narrative interview, with particular attention to the reflective and iterative design process through which the interview approach evolved. Rather than treating the interview protocol as fixed, we engaged in an ongoing cycle of design, enactment, reflection, and revision. This process began with the development of an initial interview protocol and question set, followed by the conduct of an interview. After each interview, the two researchers met to engage in structured reflection on the narratives elicited, discussing the clarity of questions, the depth and coherence of participants’ stories, and moments of ambiguity or confusion. These reflective discussions informed decisions to revise question wording, clarify prompts that were not generating the intended narrative depth, and identify questions that unintentionally constrained participants’ storytelling. Through this iterative process, we also developed a set of flexible probing questions to support participants who were less forthcoming or descriptive. These probes were designed to invite elaboration and surface detail without directing content, helping participants articulate experiences with greater narrative richness.

In parallel, we reflected on our positionality as interviewers and the relational nature of narrative interviewing. To support rapport and reduce hierarchical distance, we incorporated intentional self-disclosure at the beginning of the interview by briefly sharing aspects of our own backgrounds and professional trajectories, positioning ourselves as co-participants in the narrative space. In addition, we integrated a reflective rating activity into the conversation phase of the first interview

to prompt deeper reflection aligned with our theoretical interest in professional engineering identity. This activity invited participants to rate their level of agreement with a set of statements focused on recognizing oneself as an engineer and being recognized by others as a particular kind of engineer. Participants were then asked to justify and explain their ratings, creating structured opportunities for reflection, sensemaking, and identity articulation that extended beyond descriptive narration.

In the following sections, we present selected examples of revisions and additions made after each interview with the first three participants. These examples illustrate how the interview design evolved through iterative, reflexive engagement with participants' narratives and reflect our commitment to a responsive, theory-aligned approach to narrative inquiry.

Design Insights and Methodological Implications

This section presents selected examples illustrating how the interview design evolved over time. The first example pertains to the narration phase, while the second and third correspond to revisions made during the conversation phase.

Example 1: Adding Probing Questions

Consistent with narrative interview literature, the narration phase was initially designed around broad, open-ended prompts that invited participants to “tell the story of” their experiences. However, early interviews revealed substantial variability in participants' ability to respond to these high-level prompts with detailed, temporally rich narratives. Some participants struggled to elaborate or provide sufficient contextual detail without additional support. To address this, we developed flexible probing questions intended to support richer storytelling without directing content (Table 1). These probes were aligned with key narrative and identity-related dimensions and were used selectively when participants' initial responses lacked depth or specificity. This revision enabled participants to more fully articulate their experiences while preserving the open-ended, participant-led nature of the narration phase.

Table 1: Examples of Iterative Interview Design Revisions

Initial Question	Added Probing Questions
Q6: Tell us the story about your experience with the engineering curriculum year-by-year during your undergrad.	Q6A: What were courses like? Do any courses really stand out? Why? Q6B: What were your relationships and interactions with faculty/staff around course like? Do any of those relationships or interactions stand out? Why? Q6C: What were your relationships and interactions with your peers like? Do any of those relationships or interactions stand out? Why? Q6D: How did your course experiences make you feel about yourself as an engineer? What courses/experiences do you think of explicitly for this?

Q12: Now we want to know about your experience going from college to the profession. Can you tell us the story about your transition from being a college student to entering professional practice?	Q12A: How did you cope with adjusting to your new role? What was it like for you emotionally, intellectually, and socially? Q12B: Is there a significant event, moment, or interaction that really stands out in this transition? Q12C: What was most surprising when you first started working? Q12D: Can you describe a particular moment when you felt you were unprepared? Q12E: Can you describe a particular moment when you felt well prepared? Q12F: What advice would you give to a student about that transition?
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Example 2: Adding the definition of Professional Engineering Identity

Initially, to avoid leading participants or rendering the conversation overly academic or theory-laden, we deliberately did not introduce formal definitions of the study's theoretical construct. However, after conducting the first two interviews, we identified a need to more explicitly introduce concepts aligned with the study's theoretical interests, PEI, to better support participants' reflection and interpretation. While participants narrated rich experiences, they varied in how explicitly they articulated identity-related meanings. To address this, we revised the interview protocol to include a brief explanation of PEI during the conversation phase of the first interview. We introduced our working definition of PEI before asking targeted identity-related questions. Participants were then invited to reflect on (a) how they recognize themselves as professional engineers and (b) how they believe others recognize them as professional engineers. This explicit framing created a shared conceptual reference point aligned with the study's theoretical grounding and supported deeper, more intentional reflection on identity-related experiences that may not have surfaced through narrative storytelling alone.

Example 3: Revision of the Rating Activity

Because the initial interview protocol did not include an explicit definition of identity or the dual nature of identity as both self-recognition and recognition by others, the first version of the reflective rating activity focused primarily on participants' self-recognition as engineers. This version did not use the explicit language of recognition and did not address the complementary dimension of being recognized by others, which is central to our theoretical definition of professional engineering identity. As a result, the activity did not elicit the depth or type of reflection needed, and participants often interpreted statements such as "*I see myself as a professional engineer*" in ways that were disconnected from identity meaning making. Following the introduction of an explicit PEI definition, we revised the rating activity to align more closely with this theoretical framing. The revised activity incorporated parallel rating prompts that invited participants to reflect on both how they recognize themselves as professional engineers and how they believe they are recognized by others in professional contexts. This revision strengthened

theoretical coherence and supported more nuanced reflection on identity as relational and socially situated, rather than solely individually constructed (Figure 1).

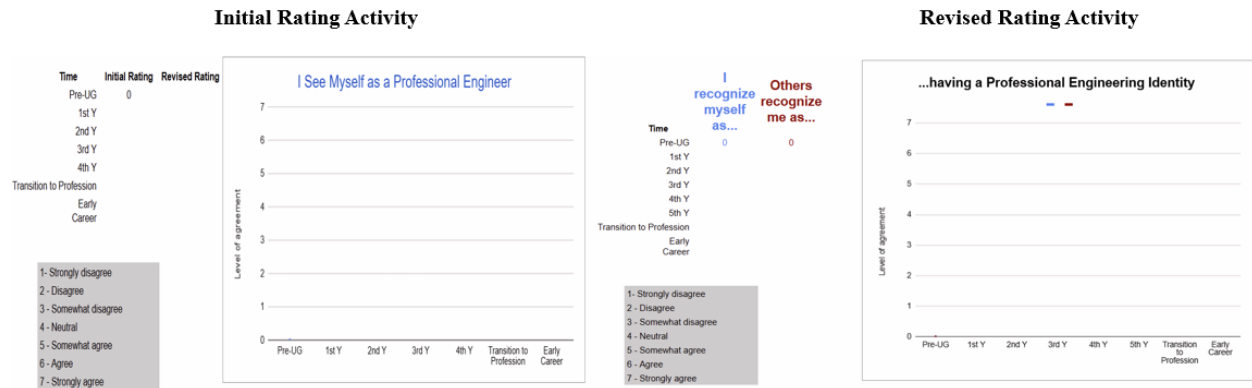


Fig 1. Initial and revised rating activity

Discussion and Implications

This theory/method paper contributes to ongoing conversations about the role of narrative research in engineering education by making visible the theoretical commitments, methodological reasoning, and design decisions involved in conducting narrative inquiry. Rather than presenting empirical findings, this paper intentionally focuses on what is often left implicit, the “black box” of how narrative inquiry is designed and enacted in practice. As narrative research requires sustained philosophical, theoretical, and methodological alignment, articulating these decisions is essential for ethically and rigorously representing human experience.

A central implication of this work is the need for explicit methodological transparency in narrative inquiry. Designing narrative research is not a procedural task that can be reduced to interview protocols alone; it requires ongoing reflexive engagement with epistemological assumptions about experience, meaning making, and relationality. By detailing the design and development of a two-interview narrative inquiry approach, this paper demonstrates how methodological rigor in narrative research emerges through intentional alignment between theory (e.g., Dewey’s theory of experience), narrative epistemology, and interview practice.

This work also responds to calls for expanding the methodological imagination of engineering education research [9]. Narrative inquiry has often been positioned as a niche approach, frequently associated with studies of underrepresented groups or discrete interventions. While such work remains essential, this paper advances narrative inquiry as a foundational methodological approach for understanding engineers’ experiences within the profession more broadly. From this perspective, narrative inquiry offers a powerful means of examining how engineers construct meaning, navigate tensions between education and practice, and engage in reflection as part of their professional formation.

Kim's notion of "*flirting*" with narrative inquiry is particularly useful for conceptualizing this methodological stance [18]. Rather than adhering rigidly to prescriptive procedures, narrative researchers engage in a dialogic and responsive process, one that remains grounded in narrative traditions while remaining open to adaptation, creativity, and contextual sensitivity. This orientation is especially valuable in engineering education, where methodological innovation is needed to capture the complexity of professional learning and identity development without reducing experience to static categories.

Finally, this paper highlights the potential of narrative inquiry to support reflection and PEI development, not only as outcomes of research, but as processes embedded within research design. By treating interviews as relational and reflective spaces, narrative inquiry can foster the kinds of meaning-making processes through which engineers reinterpret experience and re-story their professional identities. In this way, narrative research aligns closely with broader goals of engineering education research to better understand the lived, evolving, and reflective dimensions of engineering practice.

Future work will extend this methodological contribution through its continued empirical application. The first phase of data collection, consisting of narrative interviews, has already been conducted. Building on this foundation, the next steps involve constructing participant narratives using established practices of narrative analysis, followed by systematic analysis of these narratives to examine patterns in participants' professional engineering trajectories and the development of their PEI. In addition, the constructed narratives will be used in conjunction with the second, reflective interview to support participants in revisiting and further interpreting their experiences, thereby fostering deeper reflection on their evolving identities. Findings from this ongoing work will inform the refinement of the proposed two-interview design and contribute to the development of actionable guidelines for implementing narrative inquiry both as a rigorous research methodology and as a structured practice for reflection and identity development in engineering education contexts.

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Appendices

A.1. Sample Interview Quality Reflection Tool (IQRT) Analysis of Narrative Interview Questions

Question	Goal of question	Aligned?	Understood?	Detracting?	New Concept?	Concept introduced	Question type	Open/ Closed	Comment
Okay. So, so, can you, introduce yourself? And as part of that, can you tell us about your educational background and your current professional role? what year did you graduate, what degree, and what is your current or most recent professional role? So this is just sort of a basic introduction of who you are.	To establish participant context and initiate narrative entry	Yes	Yes	No	No	NA	Descriptive	Open	The question functioned effectively as an entry point, allowing the participant to situate themselves within their educational and professional trajectory. While the response was primarily descriptive rather than deeply reflective, it established a coherent baseline narrative that supported subsequent elaboration and meaning-making.
Okay, so what we want to ask you about first is sort of your	To elicit a detailed, temporally structured narrative about the	Yes	Yes	No	Yes	Pathway to engineering	Narrative	Open	While the question explicitly invited a “story” and encouraged

path into engineering in the first place, so... Can you tell us the story of how you decided to go to school for engineering? And be as detailed as possible?	participant's entry into engineering and the early experiences, influences, people, and decisions that shaped that pathway								elaboration, it also framed the participant's experience as a coherent "path" into engineering, which may have implicitly encouraged a linear, retrospective reconstruction rather than a more fragmented or uncertain account.
Were there any, like, people or experiences or anything else that influenced, like, that decision?	To prompt elaboration on influences shaping the participant's decision to pursue engineering and extend the initial narrative	Yes	Yes	Potentially	Yes	External "influences" (people, experiences)	Probing	Open	While the question aimed to deepen the participant's account, it introduced a specific interpretive frame by foregrounding "influences" (e.g., people, experiences) as explanatory factors. This may have shifted the participant from a more participant-driven narrative toward a response structured around externally attributable causes. Additionally, the follow-up risks interrupting the participant's natural

									narrative trajectory by redirecting attention to predefined categories of influence
So if you go back to being a high school student for a minute. Like, did you... did you have any idea of what it might mean to be a professional engineer? Like, I understand you maybe didn't... Think about it at that point, but did you... Did you ever think about it? Like, did you have any, like, exceptions of it?	To elicit participant's early conceptualization of engineering and their pre-entry understanding of the profession	Yes	Yes	Yes	Yes	"Professional engineer"	Structural	Open	This question introduces several competing moves that may disrupt narrative flow and constrain participant response. The framing requires the participant to shift temporally (back to high school) while simultaneously engaging in abstract reflection on the meaning of "professional engineer," which may not have been salient to them at that time. Additionally, the interviewer pre-emptively suggests that the participant "maybe didn't think about it," which introduces an assumption and may steer the response toward absence rather than exploration. The fragmented phrasing and

									multiple restarts (“did you...”) further risk interrupting cognitive processing and narrative coherence. As a result, the question may lead to hesitant, surface-level, or confirmatory responses rather than rich narrative or reflective meaning-making.
so let, let's, Keep talking, then, about the undergraduate side of things. Like, first, we want to know about your experience, like, moving from high school to college. So can you tell us the story about that transition from being a high school student to being a college student?	To elicit a temporally structured narrative of the participant's transition into undergraduate education	Yes	Yes	No	Yes	Transition	Narrative	Open	The question effectively invites a narrative response by explicitly asking for “the story” of a transition, supporting temporal organization and participant-led elaboration.

What... yeah, what about... what about, like, socially?	To prompt elaboration on the curricular experience	Partia lly	Most ly Yes	Yes	Yes	“Social ” dimens ion as a distinct analyti c categor y	Probing	Open	This question was intended to encourage more details from interviewee about their transition period but it may narrow the participant’s narrative by isolating the “social” dimension as a specific area of interest, thereby shifting from participant led meaning- making to interviewer- imposed categorization.
So, can... Can you tell us the story about your experience with the engineering curriculum, sort of year by year?	To elicit a detailed narrative of the participant’s undergradu ate experience with the engineering curriculum across time	Yes	Yes	No	No	NA	Narrative	Open	The question effectively invites an extended narrative by asking for “the story” of the participant’s experience, supporting temporal organization and elaboration. However, the directive to describe the experience “year by year” may impose a rigid chronological structure that may not align with how the participant naturally organizes or

									recalls their experiences.
Was there, like... Any relationships with, like, faculty and staff that you remember, or what were those like? And what about, like, relationship with your peers?	To elicit reflections on relational experiences within the participant's undergraduate context	Partially	Yes	Yes	Yes	Relationships as segmented categories (faculty/staff vs. peers)	Probing/Comparative	Open	This question probes for more details on interviewee's undergraduate curricular experience but introduces multiple analytical moves simultaneously by segmenting relationships into predefined categories (faculty/staff vs. peers) and prompting comparison within a single turn. While it may generate breadth of information, it fragments the participant's narrative by shifting from a continuous account to discrete relational domains. The bundling of multiple questions in one prompt may also reduce depth, as participants may respond briefly to each part rather than elaborating on any single relational experience.

A.2. Narrative Interview Protocol

Introduce the Purpose:

- We are interviewing early career engineers, like you, to understand how you came to engineering, and to learn about your experiences as undergrads and early career professionals
- We're doing this work to understand how early career engineers make sense of their varied experiences in the process of becoming a professional engineer and how you reflect on that process
- The goal is to develop a model for this process that leads to the development of reflection interventions to better support engineering students in navigating this process for themselves

We will conduct two interviews with you, each lasting 60-90 minutes.

- This first interview has two parts:
 - The first part is focused on establishing your story (a narrative of your experience). So, for the first 40 minutes or so, think of this as less like an interview and more like *a chance for you to tell us your story of becoming a professional engineer* as you want it to be understood.
 - The second part of the interview will try to gather your perceptions about a professional engineer as a particular identity.
- The second interview will be a follow-up that allows us to explore some things in greater detail (informed by analysis and interviews with other early career engineers).

Based on the interviews, we will develop a written narrative for you that will be shared for review and editing.

Any questions about the process? Any other questions?

This is part of ongoing research and data from this interview will be used in presentations and publications. Your identity will be kept confidential and no identifiable information will be shared with anyone outside of the research team. You can ask to be removed from the study at any time. Do you consent to participate in this research?

PART 1: Establishing Narrative Core

Introductions

Researchers -- We want to establish rapport with participants, so when we introduce ourselves, we should take a minute to tell our story about how we got to where we are today. In this way, we can model in a small way, the level of detail we want.

Q1: Please introduce yourself. Tell us about your educational background and your current professional role. What year did you graduate? What degree did you complete? What is your current or most recent professional role?

Path Into Engineering

Q2: Can you tell us the story of how you decided to go to school for engineering? Be as detailed as possible.

- Q2A: What people or circumstances influenced your decision to study engineering?
- Q2B: Are there any experiences that you had leading up to that decision?

Q3: When you think back to your time as a high school student, what did you think it would mean to be a (professional) engineer? Why?

Undergraduate

Q4: Now we want to know about your experience moving from HS to college. Can you tell us the story about that transition from being a high school student to being a college student?

- Q4A: What was it like for you emotionally, intellectually, and socially?
- Q4B: Is there a significant event, moment, or interaction that really stands out in this transition?

Q5: When (what years) were you an undergraduate student?

Q6: Tell us the story about your **experience with the engineering curriculum** year-by-year.

- Q6A: What were courses like? Do any courses really stand out? Why?
- Q6B: What were your relationships and interactions with faculty/staff around course like? Do any of those relationships or interactions stand out? Why?
- Q6C: What were your relationships and interactions with your peers like? Do any of those relationships or interactions stand out? Why?
- Q6D: How did your course experiences make you feel about yourself as an engineer? What courses/experiences do you think of explicitly for this?

Q7: What was the influence of your curricular experience (your course work) on your professional preparation?

- Q7A: In what ways, if any, did your courses prepare you for the profession? In what ways, if any, did it fail to prepare you for the profession?_
- Q7B: What stands out as significant from your experiences with the curriculum – positive or negative?

Q8: Tell us the story about your **experiences with co- and extra-curriculars** year-by-year.

- Q8A: What were those experiences like? Do any of them really stand out? Why?
- Q8B: What were your relationships and interactions with managers/mentors/leaders like?
- Q8C: What were your relationships and interactions with your peers like?
- Q8D: How did your co- and extra-curricular experiences make you feel about yourself as an engineer? What co- and extra-curricular experiences do you think of explicitly for this?

Q9: What was the influence of your co- and extra-curricular experiences on your professional preparation?

- Q9A: In what ways, if any, did your co- and extra-curricular experiences prepare you for the profession? In what ways, if any, did those experiences fail to prepare you for the profession?
- Q9B: What stands out as significant from your experiences with co- and extra-curriculars – positive or negative?

Q10: What stands out as the most challenging part of your UG experience? What was most rewarding?

Q11: When you think back to your time as an undergrad, what did you think it would mean to be a (professional) engineer? Did this change over your undergraduate career? How? Why?

Early Career

Q12: Now we want to know about your experience going from college to the profession. Can you tell us the story about your transition from being a college student to entering professional practice?

- **Q12A:** How did you cope with adjusting to your new role? What was it like for you emotionally, intellectually, and socially?
- **Q12B:** Is there a significant event, moment, or interaction that really stands out in this transition?
- **Q12C:** What was most surprising when you first started working?

- **Q12D:** Can you describe a particular moment when you felt you were unprepared?
- **Q12E:** Can you describe a particular moment when you felt well prepared?
- **Q12F:** What advice would you give to a student about that transition?

Q13: Did your understanding of what it means to be an engineer change in transition from undergrad student to starting to work as a practicing engineer? If so in what ways?

- **Q13A:** Are there any significant events, moments, or interactions from the transition that really stand out?

Q14: Can you tell us the story of your professional career so far?

- **Q14A:** How many jobs/roles/titles? How many/what companies?
- **Q14B:** When did you start working in the profession? What was your first professional position?

Q15: Have your perceptions of what it means to be a professional engineer continued to evolve since you started working? How? Why?

PART 2: CONVERSATION PHASE

Professional Engineering Identity Definition: Identity means the extent to which you are recognized as a ‘certain kind of person.’ In this case we are interested in the extent to which you are recognized as a professional engineer.

This means that we want to know in what ways you recognize yourself as a professional engineer and in what ways others recognize you as a professional engineer.

Q17: When you think about what it means to be a professional engineer, what things come to mind? How would you describe being a professional engineer to a first-year engineering student?

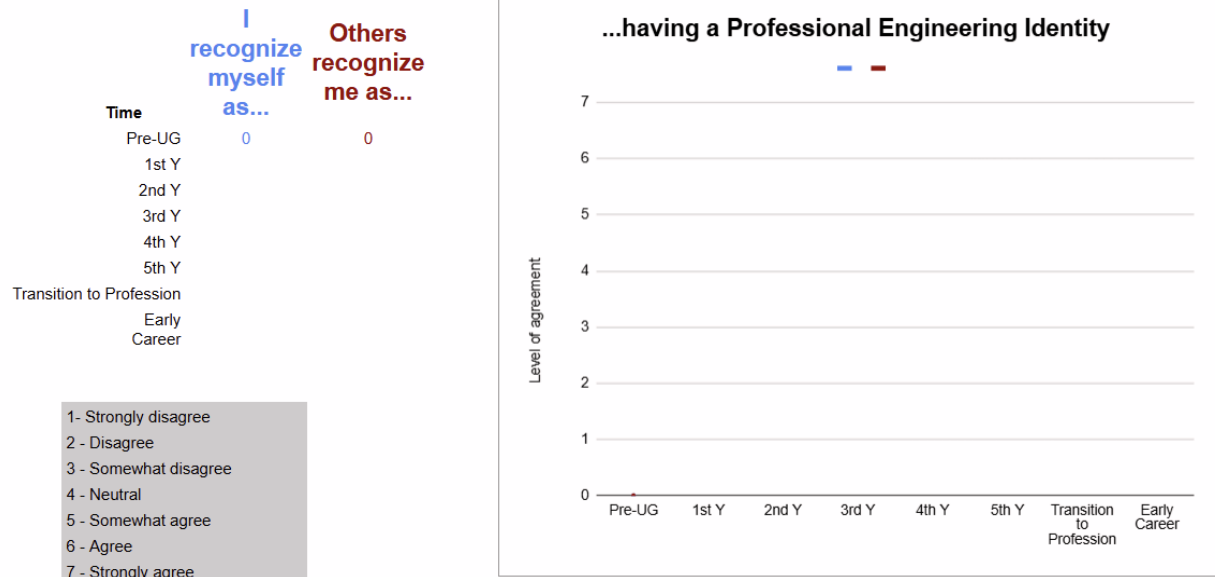
- **Q17A:** In what ways do you recognize yourself as professional engineer?
- **Q17B:** In your current role, what moments make you feel most like a professional engineer? Why?
- **Q17C:** Do others around you – colleagues, supervisors, friends, family – see you as a professional engineer? How do you know?

Q18: Who comes to mind from your professional life that makes you think “yeah, that person is a good engineer”? Why? What makes them a good professional engineer?

Q19: How would you describe the process of becoming a professional engineer?

- **Q19A:** If you think about who you were as a student, do you see yourself differently now? In what ways? How did those changes happen?

Q20: Share screen with **PEI Rating scale** and ask them to Rate their level of agreement with the following statement at each point in time:



- I recognize myself as having a professional engineering identity.
- Others recognize me as having a professional engineering identity.

Talk us through each point in time and talk us through your reasoning for the rating? How do you know? What experiences come to mind at each point in time? Is there a specific experience or interaction or event that comes to mind for each of these time-points?

Q21: When you picture yourself 5-10 years from now, what does it look like? What kinds of roles or responsibilities do you imagine taking on? What actions or plans do you think you should be doing now/or doing to make that future possible/easier to transition?

