

Synthesizing Indicators of Quality across Traditions of Narrative Research Methods

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Synthesizing Indicators of Quality across Traditions of Narrative Research Methods: A Procedural Framework and Demonstration of Smoothing Frames

Abstract

The purpose of this methods paper is to describe and discuss one of the main indicators of quality in narrative analysis, which is the process of narrative smoothing. Narrative analysis refers to a qualitative and highly interpretive research method that involves the creation of representative stories using data obtained from participants, usually in the form of interviews. Narrative analysis differs from other qualitative research methods in its indicators of quality as it does not seek to produce repeatable claims, because the goal is to capture participants' stories. The strength of a narrative analysis resides in the process of narrative smoothing for which there is limited specific guidance in the literature. Narrative smoothing refers to the process by which a researcher discerns what elements of a participant's experience to use when crafting the narrative. This paper seeks to supplement existing frameworks for assessing quality in educational research by discussing several ways in which research questions, theory, and priorities can influence the process of narrative smoothing. From this methodological discussion, this paper proposes a procedure for future researchers to use when narrative smoothing. Furthermore, and demonstrates how the selection of a smoothing frame should be influenced by research objectives and is essential for adhering to, communicating, and assessing the quality implementation of this interpretive technique.

Keywords: Narrative Analysis, Methods, Quality

Introduction

Narrative inquiry is a family of similar yet distinct methods of analyzing data in qualitative research and scholarly literature that is becoming increasingly common in engineering education research, in part because it has the advantage of collecting stories and giving voice to experiences that have perhaps been silenced in prior scholarship. For example, in recent engineering education literature, narrative methods have been used to explore subjects like how and why students choose to study engineering [1], the emotional trajectories of engineering students [2], learner agency in intercultural project based learning environments [3], and the influence of race and gender in engineering education in the US [4]. Narrative inquiry has two distinct advantages compared to other research techniques. First, it capitalizes on humans' natural inclination to think and share their experiences in the form of stories, thus making data collection relatively straightforward compared to other methods [5], leveraging assertions that all long-term human actions and sequences experienced are understood through narratives which are the primary means people use to navigate through time [6]. Second, narrative data collection lends itself to garnering thick descriptions and deep insight, given the tendency for participants to reflect on and derive meaning from their experiences by telling their stories [7].

While narrative inquiry can take various forms, there are two primary methods by which narratives can be analyzed: "analysis of narratives" and "narrative analysis." In an analysis of narratives, a researcher will collect prosaic data through interviews, text, or written statements and then examine the data for similar or corresponding elements grouped into themes [5].

Researchers may find analysis of narratives to be similar to thematic analysis, though the principle difference between the two is that an analysis of narratives requires that the data be in the form of a story, complete with a plot, setting, and a specific temporal sequence of events [5], [7]. In contrast, a thematic analysis does not require an emplotted story as its data type: For example, thematic analysis can be conducted on a collection of open responses to a series of survey questions without sequential or temporal relationships. In contrast, this type of data is incompatible with the analysis of narratives.

The primary focus of the present work, however, is narrative analysis, and in particular one specific part of narrative analysis that is very difficult: Narrative smoothing. In a narrative analysis, the researcher collects qualitative data that is collected through the telling of one or many stories, in one or more sittings with a participant, and often collected through interview methods. The output of a narrative analysis, though, is a singular emplotted story representing the participant's experience [5]. In a standard narrative analysis, a researcher will construct one narrative based on the lived experiences of one participant. As a variation, a composite narrative represents the combination of experiences from multiple individuals. They are typically constructed from participants sharing similar experiences or contexts and are often used to present real and accurate events and situations without identifying or exposing any individual.

Addressing Critiques of Narrative Analysis. Narrative analysis' strong embrace of a constructivist paradigm has incurred criticism from other researchers as narrative data is inherently interpretive, depending on the researcher as the instrument to not only collect the data and analyze the data, but to synthesize in sum the entire interview with a subject into a narrative that speaks accurately of the participant experience but communicates research findings to a scholarly community. In many research designs, analysis of the data and interpretation of the data are separate steps of the research process; however, in narrative analysis, data analysis and interpretation happen in an integrated way [8]. The interplay between these two concepts makes the findings—the resultant narratives—of the methods very dependent on the individual conducting the research. The researcher's choice of research question and context will inform the data collected from participants. The researcher's interpretation of the participant's responses influences how the researcher approaches the remainder of the interview. Naturally, researchers and research domains committed to positivist approaches may scrutinize the rigor and utility of narrative analysis [9]. Those unfamiliar with interpretive research might find this process “subjective” and in contrast with traditional positivist research methods which hold the forensically determined “objective” reality through controlled trials as the “gold standard.”

One of the most significant critiques of narrative analysis is the relative opacity surrounding how narratives are created through a process called *narrative smoothing*, which is the process by which a researcher will examine the gathered data, discern which data elements to exclude and include, decide how to arrange them to create the final narrative, adding in transitions, emotive words, and showing accurate connections in themes while also relying heavily on participant quotes and phrasings to replicate tone, voice, and mannerisms [10]. Critics of narrative analysis question the ability of the method to produce intellectually rigorous findings, contending that the method lacks utility due to its inability to produce generalizable claims that can apply to a

broader population, and asserting that some of the data it generates amounts to little more than personal “fiction” [11]. Additional criticism of narrative analysis focuses on the role and influence of the researcher within the smoothing process. Connelly and Clandinin [12] address a potential concern in narrative creation which they describe as the temptation for researchers to produce “Hollywood plots.” These are the products of analyses in which potentially significant context or details were censored or diluted to create a cleaner and more coherent narrative.

In answer to these criticisms, we can borrow some arguments in defense of qualitative research in general. Qualitative researchers can debate whether the notion of “conventional generalizability” should even exist in qualitative research, given that all observations are inextricably linked to their specific context [13], moving the community toward conversations around transferability and the value from studying small sample sizes. Proponents of research dealing with small samples argue that the knowledge generated from a rich understanding of individual cases can have important implications for larger populations [14], [15]. According to Bassey, transferability does not reside with the capacity for a knowledge claim to apply to a large population; instead it resides in the ability of the author to provide sufficient framing surrounding the research and participant jointly referred to as the “sending context” [16]. It is then the responsibility of the reader to discern the appropriateness of the findings for other situations (i.e., the “receiving context” [16]).

Specifically for narrative analysis, Connelly & Clandinin [12] propose that a good researcher will walk the reader along with their decision-making and does not obscure potential counternarratives in the data. Often, when data collection is conducted through interviews, participants will share information that is not immediately relevant to the research aims, however insightful it may be to the interviewer. For example, if a participant was asked to describe their experience in a work environment, they may choose to describe the family life of their co-worker or employer as part of their answer. This background information benefits the interviewer as it will help frame the context and dynamics the participant had to contend with. However, this information would be omitted from the final narrative as this background is unnecessary for the reader. It is important to remember that although this information would not be included in the final constructed narrative, its influence persists through the remainder of the data collection and interpretation.

Smoothing is inherently an iterative and reflective process that researchers often refine through experience [11]. Most literature on narrative methods typically discusses the philosophical underpinnings of narrative analysis and what attributes high-quality narrative smoothing demonstrate [5], [7], [17]. However, in our practice, most texts and papers lack a strong articulation and demonstration of various ways to smooth narratives, and do not offer descriptions of the exact procedure through which narrative smoothing occurs. We therefore have designed this paper with two ends in mind: First, to promote the credibility and viability of narrative analysis for engineering education researchers, there must be greater transparency regarding how researchers go from a raw interview transcript to a publishable narrative. Second, researchers considering using narrative analysis methods will be more equipped to employ and defend their methodological decisions in using narrative methods.

To this end, this paper will articulate the process of narrative smoothing, starting seemingly before the analysis and data handling process even starts: In considering the role of the researcher, their point of view, and their positionality. Then, we present a synthesis conversation on quality in qualitative research with explicit eyes on those factors affecting narrative analysis, and some elements of quality that uniquely affect narrative analysis. Last, we demonstrate the four main “flavors” of narrative synthesis and crafting, but rather than simply defining the categories as has been done in other literature, we will demonstrate the application of these methods crafting the same participants’ data into four similar-but-different narratives to show how the research question and the lens on which we intend to answer the research question will influence how the smoothing process occurs, which details we retain, which we exclude, and how we have woven the narrative.

Positionality & Role of the Researcher is Critical to Establishing Credibility

Narrative researchers must always remain cognizant of their potential to influence the data. As narrative techniques rely heavily on the researcher's interpretations, great care must be taken to avoid threats to the contextual validity of the analysis. The provision of a strong statement of positionality establishes the honesty of the researcher and allows the reader to be aware of any potential influences on the analysis [18], as has been well-established in emergent conversations in the qualitative methods and engineering education research community. A researcher’s positionality represent the ways in which different dimensions of their identity can have an influence on the research they are conducting [19]. In engineering education, statements of positionality usually amount to little more than a description of the author’s perspective regarding the research [20]. Secules et al. suggest that this is an underuse of positionality and argue that positionality provides “an opportunity for researchers to interrogate their own motivations, worldviews, beliefs, and embodied components of the research process” [18].

Careful consideration of positionality is especially important in narrative analysis given the researcher’s role as the “instrument” of analysis [21]. Just as in technical engineering wherein students are taught to consider how their instrumentation might affect the system they are trying to measure; narrative researchers must consider how their identities influence not just the analysis of the data but also its collection. For example, in a study focused on gathering the experiences of graduate students, a researcher should consider that students are more likely to share their authentic thoughts and experiences when interviewed by a peer as opposed to a faculty member around whom their communications are likely to be more restrained. Thus, even before the interview, the difference in status between the interviewer and interviewee will influence the potential data collection. Researchers must consider their capacity to influence the words and sentiments shared by their participants. Participants, rather than being sources of static information, often respond and react in accordance with their perceived relationship with the interviewer. In studies that involve the researcher interacting with the participant, and especially in narrative studies where the voice of the participant is intended to be retained, the researcher must remain conscious of their own language when communicating. How a specific thought or question is phrased can alter the response garnered from the participant. The researcher must be wary of artificially generating responses by implanting specific verbiage or sentiments into the

minds of their participant when asking a question or following up on a comment. While the participant acts as the chief source of information and context, the researcher helps ground the data into a theoretical understanding to address the motivating research questions.

This collaborative relationship persists even in the physical absence of the participant during post-data collection analysis as their words preserved in the interview transcripts continue to offer new information to be interpreted. The researcher is tasked with discerning which data elements fit together and form a coherent story that accurately characterizes the phenomenon being studied in the context of the circumstances and individuals from which the data was derived. How well this process is conducted is the primary focus of quality in narrative research.

Indicators of Quality in Narrative Smoothing

Recent work has sought to establish frameworks capable of assessing the quality of qualitative research methods. In line with Walther et al.'s work, we define quality interpretative research as research that is "idiographic in nature, in that it emerges from the unique perspective of individuals or groups but is transferrable to and meaningful for other contexts" [22]. We find great utility in tools such as Walther & Sochacka's Q3 framework, which provides a versatile guide for implementing quality across various qualitative methods[23]. Tools such as this help researchers assess how they produce and manage qualitative data according to how well their theoretical framework maps to the context under study (theoretical validity), the applicability of the research design for answering the research questions (procedural validity), appropriateness of interpretations to the population being studied (communicative validity), how well knowledge claims correspond to the reality under investigation (pragmatic validity), and how resistant are the research techniques to unforeseen influence (process validity) [22].

However, many constructs appropriate for establishing the quality of other research methods are incompatible with narrative analysis. For example, triangulation (or crystallization) is an oft-used technique to incorporate procedural validation during data generation. Triangulation is the use of multiple sources of data that each point to the same conclusion [24]. Lather critiques the concept of triangulation in research contexts where there is not one single "truth" to arrive at but a multiplicity of truths pertaining to different individuals and perspectives [25]. Furthermore, given that narrative inquiry is concerned with how individuals relay the story of their experiences and not with pinpointing an exact objective state of affairs, triangulation is an ill-suited technique for adding validity [26]. As such, narrative analysis' inherent subjectivity and focus on the individual's experience warrant a modified set of criteria to judge research quality.

There is broad agreement among narrative research practitioners that narrative analysis may have slightly different criteria than other qualitative research methods [17], especially because the quality of a narrative analysis rests on the strength and integrity of the researchers' narrative smoothing. Quality in narrative analysis still centers around the constructs of reliability (dependability of the data) and validity (strength of the analysis) as in all research [7], [17]. However, reliability and validity must be reframed from their traditionally positivist paradigms, and qualitative researchers have been reframing the conversation away from concepts like 'reliability', 'generalizability', and 'repeatability' into standards like 'trustworthiness' and

‘transferability’. As it applies to narrative research methods, we have compiled phrases and notes about standards of quality in narrative smoothing compiled from the literature, shown in Table 1. Note that these words are different from the other types of validity often justified in engineering education research: Because they are less-employed and method-specific, it is plausible that newer researchers may not be able to see these aspects in action.

Table 1: Concepts of Validity & Reliability in Narrative Smoothing

Concept	Definition
Access	“Availability of the research notes, transcripts, data and the process of construction of knowledge between the researcher and participants of the study on which the researcher has based their findings” [17].
Familiarity	The capacity of a narrative to capture seemingly mundane events or thoughts and represent them in a way that reveals their significant emotional and psychological underpinnings [27], [28].
Transferability	When sufficient information has been provided to the reader, they can judge the application of the research findings and outcomes to other contexts [16], [29].
Authenticity	The researcher can provide sufficient information so that the reader is convinced the narrative is being presented in a serious and coherent manner [30]
Honesty	The demonstrated trustworthiness of the “human instrument” (the researcher) in accurately representing the experiences of the participants [21].
Verisimilitude	The plausibility of narrative and its ability to be believed as a realistic and viable story experienced by a real person given the same context [31].

The Narrative Smoothing Process is Inherently Governed by the Research Questions, Theory, and the Types of Stories being Captured.

How a researcher guides their narrative smoothing is primarily influenced by what characteristics of the narrative best serve the intended research objectives. Narrative smoothing should be closely aligned with the research questions motivating the study and the theoretical framework orienting the study. The research questions should guide the researcher as they discern which elements of a participant’s experience are to be represented in the final narrative. Similar-sounding research questions can produce dramatically different narratives even given the same interview data depending on the objective of the narrative. Consider the four generic research question templates below and how each might warrant a different narrative smoothing process.

1. How does participant X experience/phenomenon Y?
2. Which experiences caused participant X to question/consider phenomenon Y?
3. How does participant X conceptualize phenomenon Y, considering their experiences?
4. How does participant X characterize Y experience/phenomenon?

While these questions may seem similar, their underlying goals and intentions for the research will (and should) impact the way that a given participant’s narrative is crafted. The first question aims to situate the participant’s lived experience in the context it occurred. This type of question would aim to produce a *diachronic narrative* with a clear setting and a coherent chronological, or diachronic, sequencing of events experienced by the participant, often emphasizing the temporal

relationship between the events in the participant's life to demonstrate to the reader and scholarly community how the precise sequence of events influenced their trajectory [5].

In contrast, question two is less concerned about a linear storyline and more about describing critical events in the participant's story. Critical event analysis as a special sub-type of narrative analysis identifies critical events -- critical event is a specific occurrence that significantly impacts the worldview or perspective of the individual experiencing it [17]. These events are unplanned, have life-changing consequences, and can only be identified retrospectively [32], while also identifying "like" and "other" events retrospectively that led to the critical event itself. Narrative smoothing conducted from a critical event focus will concentrate on identifying for the reader the most significant events in the participant's experience and showing how these critical events forever changed their perspective or experiences after the fact. Question three emphasizes the goal of capturing the participant's internal reflections on their experience more than their experience. In this framing, the narrative is the mechanism through which the participant makes sense of and ascribes meaning to their experiences. Narrative smoothing in this fashion has phenomenological attributes, as the emphasis of the analysis is focused on the participants' interpretations of the events discussed [31].

The fourth question proposed lends itself to a more linguistic analytical lens, leading the researcher to examine the dialogic process that occurred between the participant and interviewer. Riessman describes this "interactional analysis" as one in which, "Attention to thematic content and narrative structure are not abandoned in the interactional approach, but interest shifts to storytelling as a process of co-construction, where teller and listener create meaning collaboratively." The approach requires transcripts that include all participants in the conversation and is strengthened when paralinguistic features of interaction are included as well." [33]. Regardless of the type of smoothing employed, the connection between the source data and the emplotted narrative should be made clear to the reader [34].

The Process of Narrative Smoothing Shares Elements with other Qualitative Methods while Organizing Information through the Narrative Frame

The process of narrative smoothing is highly iterative and interpretive, which is one reason it is difficult to find step-by-step instructions for conducting narrative smoothing. There is a form of art in narrative smoothing that is refined through experience, but to add transparency to the narrative smoothing process and provide a guide to newer scholars considering looking employing narrative analysis methods, we share our ten-step process for narrative smoothing in Table 2, and then demonstrate using our own research team's data how this process and the four types of narrative frames lead to different crafted narratives offering different values for scholarship.

Table 2: A Stepwise Approach to Narrative Smoothing

1. Develop refined research questions that will home in on the construct(s) under investigation
2. Select a theoretical framework through which the data will be analyzed
3. Identify contextual details necessary for the readers' comprehension of the participant's experience, (e.g., setting and circumstances)
4. Use open and axial coding in a manner like an analysis of narratives or thematic analysis, coding for recurring thematic patterns in the data using the theoretical framing
5. Identify which type(s) of narrative smoothing best answers the research question. If, through reading the literature, it is decided that a different approach would capture a new, novel, and meaningful perspective, consider tweaking research question and smoothing frame
6. Code the transcript again using the desired frame of smoothing (e.g., code for critical events or occasions in which the participant retrospectively makes sense of their experiences)
7. Pull all quotes coded from the chosen mode of smoothing and determine how well they represent the recurring patterns identified previously;
8. Assemble the pulled quotes into a narrative using contextual details (from Step 3) to help bridge the gaps (smooth) between quotes; Researcher's interpretation, synthesis, and summary of other supporting events may be useful if justified by the data. Researcher may decide to leave in linguistic indicators of uncertainty ("Like, umm, ...)
9. Assess the crafted narrative for readability and coherence as if unfamiliar with the interview transcript. If used in a journal article, there may continue to be small iterations to be made as the discussion and conclusions are formed to ensure that claims made by the author are justified by the narratives
10. Member check with research participants to ensure that the narrative accurately captures and represents their story; adjust narrative and manuscript where needed

Working Example. In previous and current work, our research team is conducting a five year, multiphase mixed methods [35], [36] nationwide study on doctoral attrition and master's-level departure from the engineering doctorate. While the full methods detail for this study can be found in prior work [32], [37], [38]. In summary, following IRB approval, we recruited doctoral engineering student participants across the U.S. by sending a recruitment email with a screening survey to graduate coordinators of the fifty highest engineering doctoral degree-conferring universities in the U.S. [39]. From over 600 interested respondents, we selected 42 respondents to participate in semi-structured interviews, employing maximum variation sampling [40] on gender, race, and how often they considered leaving their programs, and whether they completed the survey. Additionally, we omitted international students from our interview selection due to the diverse and distinct challenges they face compared to domestic students. Interviews were conducted with each participant via Zoom with two graduate student members of the research team. The resulting interview audio files were professionally transcribed and de-identified, and all participants were compensated via a \$10 Amazon gift card. We interviewed all forty-two participants who met our interview selection criteria (see full study for further details) and examined the transcripts for insights and storylines pertaining to graduate attrition. In

examination of the transcripts, the experiences of five participants stood out from the others because of severe threats to their well-being coupled with a strong determination not to depart from their programs. These experiences of these students were characterized by extreme circumstances such as emotional abuse from advisors and for one participant sexual abuse from a lab mate. Therefore, in an instance of extreme case sampling [41], we conducted follow-up interviews with these five to investigate the tension between persistence and well-being embodied by their stories. Prior to the follow-up interview we selected Seligman's Well-Being Theory as our theoretical framework. According to Seligman's model, well-being is a multi-dimensional construct comprised of six constituents: positive emotion, engagement, relationship, meaning, achievement, and vitality [42]. These six components of well-being theory formed the foundation for the follow-up interview protocol and an initial coding schema for transcripts. Of these five, four of them were women who shared several elements in their respective narratives, including the role of gender in influencing their experiences. The narratives of these four women have been crafted with gender as an influential theme, and a resultant publication is in review.

The fifth participant, a White man in the fifth year of his program given the pseudonym Alice, differed from the other members of the sample because of his gender that his narratives, though valuable, were extraneous to the goals of that prior publication. However, it is Alice and his experience that are presented here as our walkthrough of the utility of various narrative framings.

We developed four example narratives crafted from different sections of the same interview following our nine-step process summarized in Table 2. First, we identified the research question we sought to answer using the data. In the four example narratives below, we have crafted a narrative to meet a question that is an adaptation of one of the four generic research questions described previously. Each narrative employed Well-Being Theory as the theoretical model and had the same contextual features surrounding Alice's status as a fifth-year doctoral student at prominent U.S. institution. All codes generated from the transcript corresponded to one or more of the tenets of Well-Being Theory namely: positive emotion, engagement, relationship, meaning, achievement, and vitality. After coding in accordance with the four modes of smoothing discussed previously, we smoothed each narrative using contextual details with a focus on producing narratives that display Alice's well-being (or lack thereof) resulting from his experiences. As the final form of trustworthiness, we member checked these narratives with Alice, who confirmed that they did all indeed accurately represent his experiences and feelings. (As a note, although Alice had strongly questioned during his PhD., at the time of the member checking for this paper, he reported that he successfully graduated.)

Positionality of the Researchers:

First author: In accordance with the earlier discussion regarding the importance of positionality, I now disclose my motivation and positionality. My motivation for this study was to unpack why some engineering graduate students, in the case Alice specifically, continued to persist in their programs despite a substantial decline in their quality of life. Alice's intriguing story prompted the subsequent follow-up interviews and member checks. To avoid underusing this opportunity to promote this transparency in the research, I will avoid merely listing identities and only focus on positionalities and dynamics relevant to the study [20]. The only salient identity I shared with

Alice relevant to this study was my status as an engineering doctoral student. In this capacity, I was able to leverage my own understanding of graduate education when interpreting his responses during and after the interview. Furthermore, Alice likely felt more comfortable divulging his thoughts and feelings to a fellow graduate student than compared to a faculty member with whom there would be a felt power differential. However, I refrained from imposing my own thoughts and experiences regarding graduate education from the interview and have remained cognizant of my point of view throughout the analysis. Leveraging the thoughts and interpretations from the rest of the research team helped ensure that no personal bias influenced the data analysis and that all claims made maintained fidelity with Alice's words and sentiments.

Second author: As PI of the research team conducting the larger research project, I bring to the study my underlying commitments to the study of graduate engineering education, positioned as a tenure-line faculty member housed in a traditional engineering discipline, but holding a PhD in engineering education. I have been studying facets of graduate-level engineering education for over ten years, and in that time have had several funded research projects focused on graduate student development. I align with the values of constructivism and therefore often gravitate toward qualitative research methods. I find power in stories, especially from graduate student perspectives that are often silenced, especially those narratives from people considering (often to themselves) whether to persist in their PhD. As a methodologist, I care that these stories are taken seriously by the disciplinary communities that need to hear them, and it is from that point of view that I have overseen the narrative analysis methods for this project and have worked with my PhD student (the first author) to craft narratives from these various smoothing frames, and asked him to synthesize his processes of narrative smoothing to better explain the method to others hoping to use the method as well as to justify its procedures and quality to traditional engineering faculty. While we use theory and literature to help guide our procedures, I also acknowledge that I am the product of the engineering graduate school system, both in a traditional engineering degree field and in a department of engineering education, and those two programs, in conjunction with my research, shaped my commitments to identifying ways to improve graduate engineering education.

Narrative Smoothing in Action: Four Examples

Example 1: Diachronic Narrative. First, we present Alice's diachronic narrative emphasizing the chronological sequence of events. This narrative provides a first-person perspective in which the reader can understand the context in which the participant acted. In Alice's diachronic narrative, we develop a general understanding of his experience by unpacking the sequence of events that led him to the interview.

RQ1: How do engineering students experience graduate education?

I started doing research in a lab my sophomore year, so I felt like I, I understood what it meant to like, you know, have to like grind in a lab... That's like what I thought grad school would be. I joined a lab that relates to my field but doesn't match up with the work I used to do in undergrad. I think the biggest surprise was kind of what I already mentioned, is that there's like, there's no standardization or rules or like expectations. But anyway, I worked in the lab over the three years on projects that my advisor wanted me to do. I did not enjoy working on them and we had issues

communicating with each other over expectations and goals. I definitely felt some favoritism of other students some of whom shared all my frustration and ultimately left. This is when I really started doubting whether to remain in grad school. I mean, so, so the first three years in grad school, I was like, it was the transition between me being really excited about research and then all of the sudden becoming, not excited about research. The first few years I was very sad that I was not... doing these, these things that I thought I was capable of doing and so that was like very depressing for me. I would wake up sad and go to bed, right.... Recently, I'm able to wake up and I'm not sad, which is awesome. But again, the only way I was able to do that was to just stop caring or stop being invested in it at all. I think that I should have left three years ago, um, or even earlier, maybe even within my first year or my second year. Right. Like, I think I should have just gotten, I should have realized that this is messed up and not good. And even if it's somewhat normal, like, that's not okay and I just need to get out of here. Honestly, I wish I had never even applied, but I don't think that that's something that I would necessarily advise people to do. I think the one thing that I tell anybody that's considering applying to grad school is that it's kind of like a wild West.

Note that in the narrative smoothing process, we decided to keep in the words that showed Alice's construction of knowledge (e.g., "Right." "Like," and re-starts on thoughts, to indicate his process and his voice rather than our scholarly stylings.) If we were using this narrative in a scholarly paper or in a workshop on graduate student well-being, we would highlight the aspects of the PERMA-V well-being framework employed, showing and articulating how the sequence of events that is common in graduate school, including milestones and transitions that are common elements of engineering doctoral programs, led to stressors, loss of well-being, and led him to begin questioning departure from the doctorate. In the discussion, then, it would be expected that this temporal, chronological dimension of the narrative would be most salient to how we expected this hypothetical resultant work to add value to the current literature on graduate engineering education; perhaps the development of disenchantment or detachment that seems to be resulting in the later stages of Alice's career, which has not been well-explored in literature.

Example 2: Critical Event Narrative. A critical event narrative analysis would be most appropriate for research question two as it aims to identify and depict critical events in the parts of Alice's life salient to how he began to question leaving his Ph.D., following Mertova and Webster's critical events methods [32]. This critical event smoothing highlights the episode that permanently altered Alice's opinion of his advisor, upon his realization that his advisor would not advocate for him or his well-being causing him to view academia as a hostile environment. The sequence of events presented in the narrative is not necessarily in the order in which they happened, but together they show how "like", and "other" events (using the terminology of critical events analysis) built toward a critical event. By sacrificing the temporal continuity, the reader is now aware of how even seemingly disparate things (tiffs between lab group members, advisor issues, brewing resentment, expectations for graduate school, all came to a head during one critical meeting which changed his worldview.

RQ2: How do engineering graduate students' experiences cause them to begin to question their persistence in the PhD?

I don't think graduate school is a very rewarding process, or like in terms of like scholarly pursuit, right like you think of grad school as like a scholarly pursuit, I don't really think that the amount of my time I'm spending is contributing to me intellectually, and that, combined with issues with my advisor, have caused me to consider leaving. I guess it has always been brewing... My advisor was very like, uh, like interested and like excited about that stuff my lab mate was working on, whereas my work was not that. So that kind of led to some resentment in terms of professional space. Lots of people had the same issues, and ended up leaving their graduate programs. Um, and then towards the end, the one person who did graduate from our lab, we did have, like, a minor conflict towards the end of her graduate experience 'cause basically my advisor, similar to what I'm experiencing now, wanted her to do "one more project." And this person basically tried to, um, get me to do that project. And I was just like, "Uh, no. I've got, I got some other stuff I'm working on." And so, she really didn't like that, 'cause that kind of meant that she might have to stay a little longer. She didn't end up having to do that, but that definitely led to some conflict between us even though we were really good friends for like three years. And then towards the end of that, it's kind of, I wouldn't say it fell apart. There was this meeting with the three of us, and, and then this person kind of called me out in front of our advisor and was just, it was like, yeah, well we're all busy, like you need to step up. And my advisor just kind of sat there and didn't say anything and so to me, that kind of like, I expected her to like step in and be like, "Look, he's busy." But she just said nothing. To me that was a sign that... she's not going to advocate for me. I also like to try to have conversations with my advisor, not necessarily about the research topics, but just about anything, right. Like, I tried to talk to her about my feelings as a graduate student, right? And so, all these things, so like, my experience has not been the experience that I had in undergrad...even in terms of collecting a lot of data. So that was a big expectation that I would say has not been met, and it all makes me wonder if I should stay in grad school.

This kind of narrative focuses on the critical events that consolidated Alice's stance on higher education. Note how the events Alice described were not necessarily big flashy occurrences. While the episodes he describes are most certainly discouraging to an observer, they do not necessarily appear to huge dramatic events when compared to the circumstances encountered by others such as overt racism or sexism. This demonstrates how critical events are specific to the context and person experiencing them with the meetings Alice described being the biggest catalysts in his story motivating him to question remaining in his program. Furthermore, note that this narrative smoothing would emphasize different aspects of the PERMA-V framework. Only those aspects of PERMA-V directly impacted by the event are likely to be included in this smoothing. For example, Alice's sense of engagement and meaning were negatively impacted upon witnessing that his advisor did not exhibit the regard for his time and work that he wanted her to. In contrast, no claims regarding Alice's vitality or physical health could have been made based on this mode of smoothing from this portion of the interview. Discussion of this interview would highlight how seemingly mundane or unremarkable negative experiences can have long lasting and deleterious effects on students and their thoughts surrounding academia and their well-being.

Example 3: Interpretative Narrative. Question three orients the study to examine how Alice made sense of his experiences and how that influenced his view of higher education. The third mode of narrative smoothing carries a phenomenological influence as the emphasis is placed on the participant's reflections on the described events at the time of the interview. This mode of

smoothing concentrated on how he reflected on the experiences recounted in his story more so than the actual events themselves. We see how Alice's hindsight and interpretations of how he felt in the lab drive the creation of the narrative. Looking back, he can describe his resentment and sense of futility towards his work and how his complaining might have perpetuated his lack of well-being.

RQ3: How do engineering graduate students conceptualize academia, considering their experiences?

The resentment I had towards my peers or like the favoritism culture, I would say that like really sucked, right. Cause I was coming into grad school really excited about doing some cool research and the feeling that I was the lowest person in the hierarchy... you know, the lowest form of research in our lab. It definitely made me question like, why am I here? Why am I doing this? It just like made the experience suck, right? Cause like, you know, whenever I published my first paper, I thought like... I didn't even... I was not even happy. Like I didn't feel any sense of accomplishment for anything. This is like, almost like 'this is beneath me.' And I think that that was mostly because like, relative to the other people in our lab, felt that way. I don't think I could have had a conversation with my advisor. She kind of does spin on stuff like where if you come to her with like a problem she like, or a grievance or something like that she like tries to spin it into like, 'Oh, this isn't so bad' or whatever. Um, and I definitely complained a lot to my lab mates and they hated that. I think it was my second year, 'cause I was complaining so much and my lab mate kind of just was like, "Look. If you hate this, just leave, right, 'cause like we can't stand it anymore. Like, you can't just keep complaining all the time to us at work.... This is, this is making work suck for us now. Right. You're just constantly complaining." And I mean that really hit home, right. I took that to heart pretty much and I, and I'm glad she said that, 'cause it was, she was totally right.

This narrative focuses on Alice's thoughts regarding his mental and emotional state during his time in graduate school. While all narratives have the benefit of hindsight, this mode of smoothing emphasizes the evolution of his opinions both over time and in situ as he was still in his program at the time of interview. Note how his interpretations of his thoughts and how different events influenced his thinking produce the most important elements of this narrative and feed directly into the claims made using the PERMA-V framework. Alice functions almost like a co-analyst explicitly stating that he "was not even happy" and that he "didn't feel any sense of accomplishment" following the publication of his first paper. Discussion of this narrative would unpack how Alice's disenchantment with academia grew over time. Leveraging his own commentary we would witness how each experience Alice recalled contributed to the steady deterioration of his sense of well-being and his growing sense of disenchantment with academia.

Example 4: Interactional Narrative. The fourth research question lent itself to a more interactionally focused narrative analysis that sought to capture the language and tone conveyed by Alice. In this fourth mode of smoothing, the emphasis is placed on the verbal construction of the narrative. The exact language used by Alice in describing his experience aids the researcher and reader in understanding these events' impact. For example, throughout the interview, Alice used powerful quotes and emotive expressions when depicting events in his story and offering his reflections on them. His visceral descriptions of his sense of "resignation" and his view of a

career in academia as "terrible" and as a "trap" convey and contextualize his tumultuous and emotional graduate experience.

RQ4: How do engineering graduate students characterize their graduate experiences?

I was definitely going through depression and that was super rough. It's hard for me to specifically characterize what mental health problems I was having, but like, I know I was having some, like, something was not right. Like people should not be feeling the way that I felt in terms of just miserable all the time. And yeah, I mean like I definitely like I kind of like isolated myself a little bit more at those times... during that time period. Like I had a big group of friends, I hung out with a ton of my first year and I didn't really see much my second or third year, not because they weren't still my friends but because I kind of just like chose to not be around them. I was just like so bummed out that like, I didn't want to be around people and then because I was bummed out bum them out, you know? I don't really care about any of that stuff at all anymore. Um, I'm kind of resigned. Like I don't really care about the work I do. And so, I just want, I just want to be happy doing the work that I do and the way I, the way I do that now is I just don't care about it. And I feel like that would be like a trap almost to me, deciding to become a faculty member, which would be terrible. But at the same time, I do think I would develop technical skills in a postdoc that I did not develop as a graduate student. I wish I had never even applied... because I think that would be much like, I think just like holistically as a person, that would be a lot better. I think it would be physically healthier, mentally better. Like I think that I would be in a very, I feel like I'd be in a much more positive spot in my life if I had spent the last five years working in industry, doing a career, um, that kind of thing.

This last mode of smoothing captures the emotional impact of these events on Alice. The first three narratives sought to create a summarized but holistic representation of the events that characterized Alice's experience and his reflections with the benefit of hindsight. This fourth narrative communicates to the reader the magnitude of the emotional toll these experiences had on him. Here we see clearly how to map Alice's experiences to his decline in positive emotion, relationship, and vitality. In discussion of this narrative, we would examine the discrepancy between the raw and honest expression of lack of well-being and Alice's perceived value of his graduate experience. This narrative would be the best choice for highlighting the tension between persistence in engineering graduate and the well-being of students suggesting that graduate programs should consider other means of evaluating the health and efficacy of their programs.

Discussion and Conclusion

At the heart of narrative inquiry is the process of narrative smoothing in which the researcher crafts the narrative out of the data gathered from the participant. A narrative analysis's strength lies in the quality of its smoothing. In this paper, we presented a stepwise approach to narrative smoothing that systematizes the process of narrative smoothing, and then demonstrated how the same data set, dependent on the research questions and theoretical framing involved, could be crafted in four different ways in accordance with the four different types of narrative smoothing presented. These four narratives presented here contain overlapping information but incorporate elements from different parts of the interview and are framed to best answer research questions that are salient to the research community. Their depiction of different aspects of the narrative with varying levels of resolution reveals different things to the reader according to the purview of the researcher.

We observe four advantages to following this procedure for narrative smoothing. First, following this procedure allows the researcher to have a coherent and articulated order of operations rather than attempting to create a narrative from an entire interview all at once. Second, following this procedure ensures that the researcher has every aspect of their study in alignment, ensuring that the final narrative and interpretations are drawn to complement one another. Third, it promotes constant engagement with data and mitigates the possibility of the analysis making claims that are not merited on the participant's lived experience. Lastly, the researcher is encouraged to remain aware of what kind of narrative best suits their project and how to “show” the reader what happened to the participant in a believable way: Unless readers are given full access to the interview transcripts, they will be unaware of how much and which information is being omitted from the final narratives. By disclosing which mode of narrative smoothing the researcher discerned would best fulfil the research objectives, readers will have a stronger understanding of why the details they can see in the finalized narrative were included.

Narrative analysis is an invaluable for investigating people’s lived experiences and is becoming more widely employed as a research method in the engineering education research space, especially as a way to capture stories from groups who have historically been disenfranchised in some way. We situated this work in the context of our field of engineering education as it was largely born out of the study discussed in our working example. However, we see this stepwise framework for narrative smoothing as having broader implications for research in various fields that use narrative inquiry. By leveraging our narrative smoothing technique, those employing narrative analysis will be able to articulate their process more clearly as they document their research. Further, we hope that an articulated procedure for narrative smoothing can help work toward continued standardization of quality in narrative smoothing methods.

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