

Women's Engineering Career Stories: Looking for a Pathway Back

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Abstract

Women remain underrepresented in engineering, leaving the profession at a rate double that of men. To address this inequity, change agents, such as engineering educators and industry professionals, must increase our understanding of women's engineering career pathways, including their decisions to leave the profession. Through narrative inquiry and a novel, boundary-spanning framework, we explore the career stories of women who have left engineering after having worked in industry. We make sense of the participants' career decisions by considering their career journeys through the lens of the unfolding model of turnover, a theory frequently used by organizational psychologists yet not fully applied to the study of women's engineering career decisions. In this paper, we describe the engineering career journey of Louise, one of three participants from our larger study [1]. We invite you to come alongside us as we explore Louise's engineering career story through the shocks (jarring events), scripts (plans of action), and image violations (violations of goals and values) of the unfolding model of turnover. By creating and reflecting on Louise's interpreted narrative and career journey map, we gain a deeper understanding of the tensions and difficult decisions Louise had to make along her engineering career journey. Without role models or career guidance, Louise experienced tension in balancing the needs of her work and growing family. She felt pressure to decide between her family and work. She chose to stay home with her family and pursue part-time, flexible engineering work; however, was unable to find a long-term position. Furthermore, she sought a re-entry path into engineering for years, yet has never found a pathway back. If she could have found a long-term, part-time engineering position she would likely still be practicing engineering today. Similar to Louise, Hewlett et al. [2] found that most women who left SET careers (science, engineering, and technology) sought re-entry paths. Findings such as these suggest if more employers would provide flexible work options and create pathways for returning engineers, more women would remain in or return to the engineering profession, thereby increasing the representation of women in the engineering workplace.

Keywords

Women in engineering, underrepresentation, career pathways, unfolding model of turnover, narrative inquiry.

Introduction

Women remain underrepresented in the engineering profession, leaving engineering careers at a rate double that of men. To address this inequity, we must increase our understanding of women's engineering career decisions across their lifespan, from their career interests during childhood, up through and including their decisions to remain in or leave the profession. While women are pursuing and persisting in engineering education programs at rates comparable to men, two thirds of women leave the engineering profession within fifteen years of obtaining their degree [3], [4]. This leaking pipeline is of great concern and thus our study focuses on understanding the career choices of women in the engineering workplace.

Understanding how individuals disengage and withdraw from the engineering profession is relevant to individuals as well as those who mentor, educate, and employ them. Awareness of common and potential engineering pathways can empower women by fostering proactive and

adaptive behaviors as they evaluate and navigate their career journeys [5]-[7]. Identifying ways to use their current career situation as a steppingstone for future opportunities, goals, and dreams may be enough to sustain some women on their engineering pathway, despite their challenges [7]. Also, the more keenly aware organizations (educators, mentors, supervisors, human resource managers) are of women heading down an exit ramp, the greater likelihood they can intervene.

Research Objectives

In this study, we address the career development of women engineers, an important and integral aspect of engineering education. Specifically we seek to understand the career pathways and decisions, particularly of women who have earned their degree in engineering yet are no longer working in the profession. It is important to understand the career decisions of this particular group of women, as gaining this knowledge will facilitate the development of new ideas to address the underrepresentation of women in engineering. Although career choice is known to accumulate, most studies of women's engineering career decisions have examined only one decision point (career and college major, persisting in engineering programs, staying/ leaving the profession). Our approach extends previous work by examining the participant's career journey from early childhood up to and including their decision to leave the engineering profession. We use a framework for this study that is developmental and integrates organizational psychology turnover theory [8]. Using narrative inquiry methodology and this novel framework, we seek to gain a rich understanding of women's engineering career journeys, including how and why some leave the profession. We address the research question: *What are the career stories of women who have left the engineering profession after having worked in industry?*

Methodology

We use a narrative mode of inquiry to gain a rich understanding of women's engineering career stories, including the processes and pathways by which women leave engineering after having worked in industry. As a methodology, narrative inquiry serves as a methods-level theory that guides our overarching study design, including data collection and analysis [9]. Previously researchers have utilized narrative inquiry methods in studies of engineers' education, career, and life experiences [10]-[19]. Narrative inquiry is instrumental in understanding the experiences of marginalized groups [11], [20]. These studies suggest narrative inquiry can provide a sound research methodology for studying the lived experiences of engineering students and professionals. However, few studies have used narrative inquiry to investigate women's engineering career decisions, in particular, their pathways in leaving the engineering profession [21].

For the larger study, we recruited three female participants who had previously practiced engineering in industry for two to seven years before leaving the profession. We specifically focused on this subpopulation to carve out a narrower range of experiences to research and analyze. We gathered participants via snowball sampling of the corresponding author's former engineering co-workers. Snowball sampling is a strategy commonly used by qualitative researchers when seeking a small information rich sample [22], [23]. We screened potential participants via an email questionnaire and determined that all three met the requirements for inclusion in the study (identified as female, held a bachelor's degree in engineering, previously worked in a position normally afforded to those with a bachelor's in engineering).

Consistent with the narrative inquiry traditions, interviews provided our primary source of data [9, p. 157]. We also used documents and artifacts as secondary data sources [24]. We conducted three ninety-minute interviews, and utilized a background questionnaire, a workplace artifact, and a life experience timeline to elicit participant narratives. We interviewed all participants online via Zoom. Based on narrative inquiry guidelines recommended by Kim [9], each interview was semi-structured, containing a maximum of 6 – 10 questions (p. 163), and included both narrative and conversation phases (pp. 167-170). During the narrative phase, we prompted participants to share their career stories (journeys) in a primarily uninterrupted presentation, as suggested by Kim [9, p. 168] and Polkinghorne [25, p. 13], thus allowing the participant freedom to narrate their story. Following this phase, we led a more semi-structured phase, in which we asked additional clarifying questions, and provided prompts to dig deeper to evoke additional career stories from participants [9, pp. 169-170], [26, p. 85]. While the expanded study includes three participants, in this paper, we describe findings regarding the engineering career story of one participant, Louise, a fifty-five-year-old, married, white woman with two children, who left the engineering profession after having worked as a chemical engineer for seven years.

Narrative inquiry has two different modes of analysis based on two kinds of thinking – narrative and paradigmatic [9], [25, p. 12], [27]. While narrative thinking connects diverse elements into a unified whole, paradigmatic thinking reduces general ideas into categories and themes. Polkinghorne [25] uses “narrative analysis” for narrative reasoning and “analysis of narratives” for paradigmatic thinking. We adopt a similar designation except we use “summative analysis” to describe the paradigmatic mode. We analyzed our data using both narrative and summative modes.

Narrative analysis involves gathering descriptions of events and synthesizing them into a story [9], [25, p. 12]. For this mode of analysis, we collaborated with participants to create first-person narratives of their career stories through a multi-step process, following the guidance of Polkinghorne [25] and Kim [9]. Participants first presented their career stories by answering the prompt “*Tell me how you got where you are today*”. The presenting story is the one participants feel most comfortable sharing, the one that they have told many times before. When prompted further, most participants add details or new events to their story. As researchers (and career counselors) we can use various tools to help participants review and reflect on parts to their story that they haven’t previously considered. After generating the interview data alongside participants, we transcribed the data, immersed ourselves in the data, and constructed draft narratives according to a process outlined by Page [28] in their narrative analysis of mothers’ life histories. We also used Kellam et al. [29] to guide construction of these narratives. For this mode of analysis, we constructed first-person narratives with quotes directly from the interviewee’s responses, similar to the methodology described by Kellam et al. [29]. For each participant, we wrote detailed process and analytic memos after each interview. Each process memo contained procedural details, whereas analytical memos contained a self-reflection and a written response to the question, *What do I know so far about (RQ): What is the career story of this woman (participant x) who has left engineering after having worked in industry?* After creating the first-person narratives, we verified their accuracy with each participant. Louise verified the accuracy of her narrative with a short email indicating that everything looked accurate as is. At this time, she also provided her preferred pseudonym. She commented about her use of ancillary words such as “you know” and “like”. I assured her that this was a normal response and explained why

leaving some of the extemporaneous text was useful. I made only minor adjustments in response to this feedback, as leaving the text as intact as possible adds to the credibility of the account. In Pantoja [1], first-person narratives are included for all participants, including Louise, whose story is the focus of this current paper.

Summative analysis involves collecting stories and then analyzing them using a paradigmatic process that results in themes within and across multiple stories [9], [25, p. 12]. For this paper we describe the process and themes we identified for just one participant, Louise. In a subsequent work, we will describe the analysis and themes across all three participants. To complete the summative analysis of Louise's engineering career story, we analyzed and interpreted her first person narrative (full narrative included in the author's previous dissertation work [1]) by reviewing this narrative and related analytical memos. We then created a third-person interpreted narrative for Louise by following the guidance of Page [28] and Kellam et al. [29]. Text for this narrative came primarily from our analytical memos completed after each interview, and one final memo after all three interviews were conducted. Louise's interpreted narrative provides her career story in the form of a shortened core of less than 3,000 words. The concise nature of these narratives allowed us to relate aspects of Louise's career story to our theoretical framework based on aspects of the Unfolding Model of Turnover (UMT) and Career Construction Theory (CCT). Here we include highlights of this framework to assist readers in placing our findings in context. Readers who want to gain a more in depth understanding of our initial theoretical framework and subsequent iterations to it can refer to our previous works [1], [8]. After digressing to describe the elements of this framework next, we will return to describe how we used this framework to gain a better understanding Louise's engineering career journey.

Career Construction Theory (CCT) is a refashioned form of the developmental self-concept theory, subsuming most of its propositions, differing mainly from an epistemological standpoint. Like the self-concept theory, Career Construction Theory focuses on the hypothetical construct of career maturity and the idea that career maturity progresses along a continuum of developmental tasks expected at a particular chronological age [30]. According to both theories, women in engineering progress through growth, exploration, and establishment stages as they develop and modify their career plans from birth through entry into the engineering profession [5], [30], [31]. Progression through these stages involves developing and implementing one's vocational self-concept by translating one's view of self into occupational terms and then preparing for and performing that occupation [32]. Vocational self-concept, the self-perceived qualities that an individual considers relevant to work roles, develops through the interaction of inherited abilities, physical make-up, opportunities to observe and play various roles, and evaluation of the extent to which role-playing receives approval from others [30], [32].

The Unfolding Model of Turnover [33] considers multiple pathways to turnover, described by shocks (jarring events), scripts (plans of action that may be self-authored or guided by the expectations of others), and image violations (violation of goals and values). This model differs from more traditional turnover models [34]-[37] based on job satisfaction as the primary antecedent to turnover [38]. While the unfolding model is primarily used to describe organizational turnover (exit from a company or corporation), the concepts of shocks, scripts, and image violations also, more broadly, help describe vocational turnover (exit from a

profession). Constructs within the theory were adapted to use the model for our purpose in this study, to describe vocational turnover.

After creating the shortened third-person narrative, we made sense of Louise's decisions to leave the engineering profession by examining her career journey using critical components of the UMT and CCT, including shocks, scripts, and image violations (UMT) and the developmental stages (CCT). To analyze and interpret her engineering career story, we prepared a graphical representation of her story, or a career journey map. We created this map by reviewing Louise's draft narrative and all rounds of analytical memos. We then used this map to make sense of her engineering career decisions by considering the shocks, scripts, and image violations she encountered throughout her journey. Through this analysis and our extensive immersion into her story, we identified key shocks, scripts, and image violations she encountered throughout her journey. We then categorized and labelled these shocks, scripts, and image violations by developmental stage. While describing Louise's career story in terms of shocks, scripts, and image violations helps us make sense of her career decisions, sequencing these aspects was challenging. Therefore, we created bundled groups of shocks, scripts, and image violations to facilitate this process. For example, we bundled shocks with other shocks that occurred during a similar time window. Similarly, we bundled scripts with other scripts (and image violations with other image violations). We then created a roadmap by placing bundled groups in chronological order from left to right across the map. While there is overlap between the career decisions and the shocks, scripts, and image violations, these items are distinct. Thus, to provide context to assist in making sense of the shocks, scripts, and image violations, we inserted a timeline of career events across the top of the career journey map. We provide Louise's career journey map and then tell her career story, or interpreted narrative, in third-person, from our perspectives as the researchers, beginning with details surrounding her decision to leave the profession, and then filling in more details from the backstory. Louise's career journey map and interpreted narrative are including in the following section.

Louise's Engineering Career Story

Louise is a white woman in her mid-fifties, married with two children. She last worked full-time as an engineer about twenty-five years ago when she decided to stay at home after her children were born. After leaving engineering, Louise worked part-time as an engineering consultant several times. She then taught middle school science for about nine years after earning her master's in education. Recently Louise held a part-time engineering consulting position. That position ended when the business slowed due to COVID, and she is currently not working for pay. She is seeking to get involved and give back but is also okay with staying at home. She holds a BS in chemical engineering, an MS in education, an MBA, and seven years of engineering experience. About her family background, she states,

My parents were both college-educated. My mother taught elementary school up until I was born, and my father was a physician. I am the oldest of five siblings, and all are college graduates. My husband is an engineer. My two children are both college graduates and young professionals.

Louise describes her career journey as a “group ride on a bicycle.” She further elaborates about her pathway, “Sometimes you're riding uphill, and it is really, really, really hard. And sometimes you're riding downhill, and you can...coast and...let the wind blow your hair”. The career map

below describes the portion of Louise’s career journey, beginning with her early ideas about engineering careers up through her ultimate decision to leave the engineering profession. At times, we include the pieces of her career journey after leaving the engineering profession for context. Still, these parts of the story are outside the scope of this current study, and we will cover them in more detail in a future work. The focus of this career journey map is for use as a tool to make sense of Louise’s engineering career journey through the lens of our theoretical framework, including aspects of the Unfolding Model of Turnover (shocks, scripts, and image violations) and Career Construction Theory (career developmental stages). Across the top of the figure, we have included key events or decisions along her career development timeline. The events are not meant to be mutually exclusive or even necessarily the most meaningful events. Instead, we have selected a representative number of events to provide a context for understanding the shocks, scripts, and image violations Louise experienced along her journey. In the remaining paragraphs of this section we describe Louise’s engineering career story in terms of the of shocks, scripts, and image violations she experienced along the way.

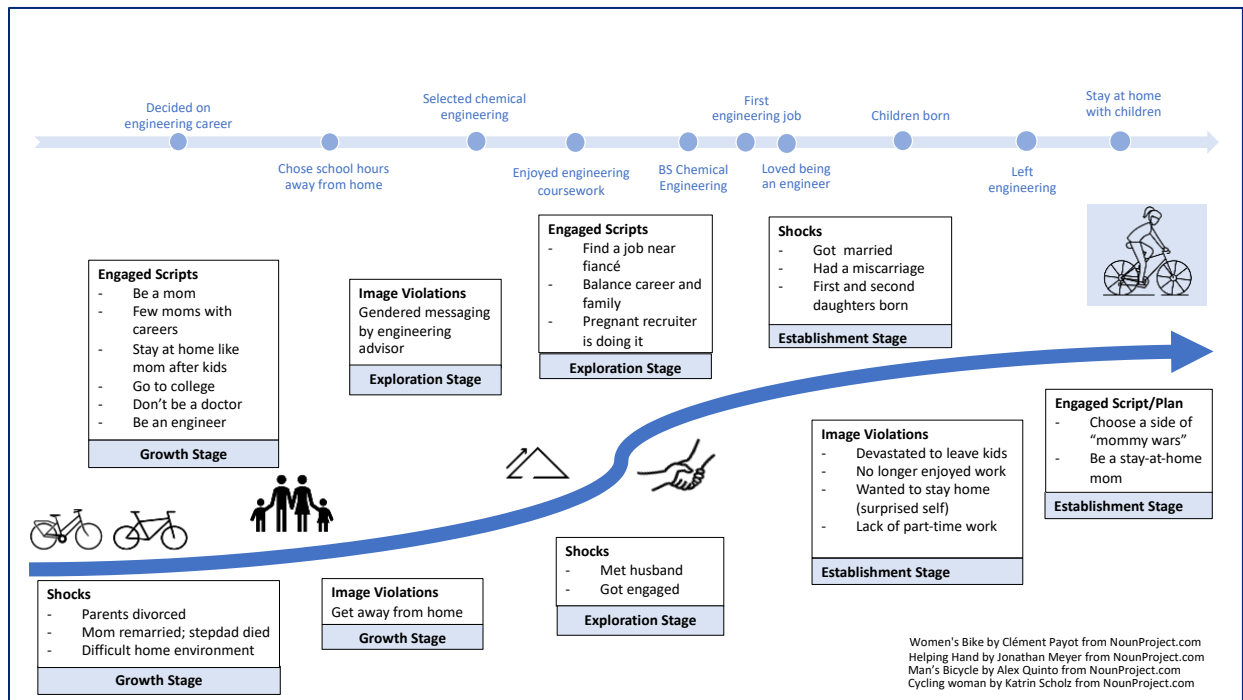


Figure 1. Louise’s Career Journey Map

Louise had several jobs offered to her upon graduation. She was able to secure a position in the geographical location where her soon-to-be-husband lived, who was also an engineer. Louise loved being an engineer and found it very rewarding. She liked the intellectual stimulation and the financial benefits and felt proud to be an engineer. Louise experienced a smooth transition to the workplace. She built great relationships with her supervisor and co-workers, including the other three engineering new hires and two other women in her department. One miscarriage and seven years later, she became pregnant with her first child (*shock*). The maximum maternity leave allotted was four months. Louise took that entire time.

When it was time to return to work, Louise struggled intensely. She did not feel good about leaving her daughter with others (*image violation*). She says, “Every day I was crying, crying...on my way to work, you know, like it was just hard for me to leave my daughter.” She states, “I just was heartbroken. I just was really heartbroken, and I just didn’t feel good about leaving her”. One day she saw her daughter crying through a two-way window at the daycare. She imagined the worst; that her daughter missed her and cried all day. She became very distracted at work and did not enjoy it like she did before her child was born (*image violation*). Her employer allowed her to flex her hours to start and end earlier, which helped some. However, she and her husband continued to discuss their options, as she desired to be home with her child (*script*). She felt isolated from her peers because she was allowed this flexible schedule alternative, and they continued working regular business hours. While deciding what to do about her desire to stay home with her first child, she became pregnant with her second (*shock*). When home with both children on maternity leave, she decided that she could not go back. Her husband agreed with her decision. Reflecting on this decision, she states,

I was very surprised. I did not anticipate that [staying home with the children] was going to be what I was going to want to do. I thought that I was going to want to work, and I thought that I was going to want to keep on my career path. So, I did not anticipate that. And my husband and I didn’t really talk about it [before then]. In fact, when I did finally bring it up with him, he was really, he was on the same page, and he was very glad and supportive of me (image violation).

When she left her job to take care of her children, she thought it was temporary and that she would return to engineering in about five years. Looking back, she feels sadness, and some regret, about leaving the profession and wishes that she could have worked part-time in the field (*image violation*). When her children were in pre-school, she was able to do some engineering consulting for about a year, but that ended unexpectedly for no apparent reason. After that, she invested her time volunteering at her children’s school and caring for her family. When she reflects, she remembers the “mommy wars” happening in society. About this era, she states,

So it was kind of the height of the Mommy Wars. You know, like, ‘Well, I’m staying home’ and ‘Well, I’m working.’ And... ‘Why would you do that?’. You know, like ‘Oh, you’re gonna be so bored’ and ‘Oh, how can you leave your kids?’ And you know, it was just like a kind of a constant [thing]. At least it seemed like it to me...and maybe I was hyper-aware of it because I was trying to make that decision.

She shared how this experience made her feel that she had to choose a side, either stay home or work (*script*). She didn’t see any examples or models of women who balanced work and family. Regarding career planning, she didn’t have a roadmap or plan for re-entering the workplace. In retrospect, she wishes there was a way she could’ve been a working mom with a flexible, hybrid option to balance work and time to care for her family. However, given that she was unaware of these options, she stands by her decision to put her family first by staying home with them.

The shock of having two children in a short timeframe led to several image violations (*devastated to leave kids; no longer enjoyed engineering work*). During this time, Louise also experienced an image violation or incongruity between her value for work-life balance and her perception that her options were limited (*lack of part-time engineering work*). These shocks and

image violations resulted in her leaving engineering to pursue previously identified scripts (*chose a side of the mommy wars; stay at home with children*).

Louise experienced tension throughout her career journey in deciding if she should stay at home with her children or work full-time. We can make sense of this tension by exploring the scripts she held throughout her life and career (see Figure 4). Louise knew from a young age that she would attend college (*script, growth stage*). Her parent's whole family went to college, so this was never a question. As a young child, she doesn't recall career role-playing. Instead, she played house, where she was the mom (*script, growth stage*). She knew very few women professionals (*script, growth stage*). Her mom was a teacher but left her career to stay at home with her when she was born (*script, growth stage*). Her mom had a friend who was a lawyer and ran for office. She recalls her mom sometimes questioning her friend's decisions, but other times she was very proud of her. Even though her mom left teaching to stay home, Louise thought she would continue working once she had children (*script, exploration stage*). However, she didn't have any role models or examples to guide her in how this could work. When graduating from college, a pregnant woman interviewed her for a job. She vividly remembers thinking it was good that this woman could balance working and being a mom (*script, exploration stage*). Once she started working in industry, there were two other women, Lisa and Tammy, in her department. Around this time, Louise got married and started thinking about having children. Reflecting on her observations of Lisa's experience after she had a baby, Louise states,

I can remember when...Lisa...had a baby. You know she had the baby; she was off for a while. She came back and I kind of observed her through that process.... And I kind of remember thinking, 'Wow, that is gonna be really hard for me. I don't know how that's gonna go kind of thing' (script, establishment stage).

Before having children, Louise never anticipated she would leave her engineering career to stay at home with them. Having her first daughter and then having her second daughter shortly afterward was a shock that caused her to evaluate her life and career. This shock led to image violations that she hadn't anticipated (*devastated to leave her kids, no longer enjoyed her work, and wanted to stay home with her children*). Despite societal "mommy wars" and her mom's decision to stay home after Louise was born, she didn't feel pressure from anyone. Instead, something within her (*shock followed by image violation*) told her she was making the right choice (*to follow her initial childhood script*). That shock and image violations described above caused her to evaluate her situation and ultimately pursue her childhood dream of being a mom and staying at home. She felt she had to choose a side of the "mommy wars," so she decided to stay home and follow her initial "internal script" of becoming a mom.

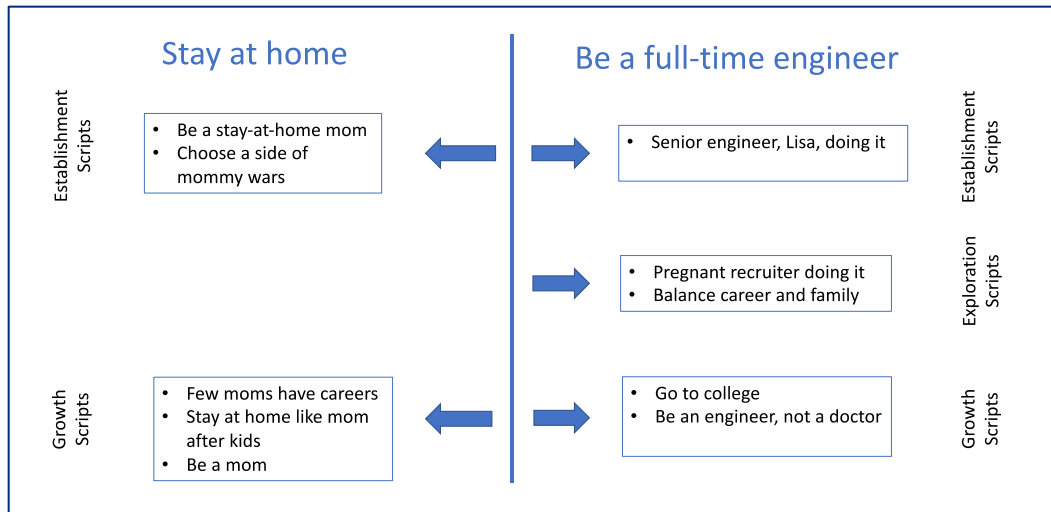


Figure 2. Louise’s Tension Explored Through Scripts

Louise’s tension between her desire to be at home with her children and her love of engineering continued even after she left the profession. She had a few part-time engineering positions, but nothing lasted very long. When her children were in high school, Louise entered into a two-year transition to teaching program. She earned her MS in Education and then taught science in a local middle school. When teaching, she found ways to incorporate engineering concepts. She describes her work as a teacher as highly exhausting. She didn’t want to miss any aspects of parenting, so she got up late at night to do her prep work (script to “*be-a-stay-at-home mom*”). After eight years, she taught part-time, and after the ninth year, she left teaching. Her caregiving responsibilities for extended family members increased during her last two years as a teacher. She helped care for her aging mother, father-in-law, and chronically ill sister. After leaving teaching, she lost her dad and the family members mentioned above. She took some time off to travel and then began to look for work again.

Louise’s desire to return to her original script (“*be an engineer*”) continued well into the establishment stage of her career. She contacted a previous engineering peer/ mentor a couple of years ago. This woman had started her own business, and Louise was able to do part-time engineering consulting work again. Interestingly, Louise chose to return to engineering work instead of education. When I asked her about this, she mentioned that she had already done part-time education work and that nothing about that work was part-time. She was ready for something less emotionally exhausting, so she pursued part-time engineering work. Even more than that, she mentions that she finds engineering work more exciting and identifies more with engineers than educators. She states, “*When I was teaching, I always liked when I could talk to my kids about engineering...And so I think I see myself more as an engineer than as a teacher.*” She loved the flexibility and technical nature of the engineering consulting work. Then COVID hit. She continued working in this role for about a year, but business slowed, and the project ended. After that, she has not worked for the last year or two. She is currently looking for opportunities to get involved and give back but is okay with staying at home. She and her husband are moving from the establishment stage towards the maintenance and disengagement career stages, characterized by sustaining their current activities and making retirement plans.

Discussion

Through the construction of Louise's career narrative and subsequent analysis using shocks, scripts, and image violations as a framework, we gain insight into how and why she decided to leave the engineering profession. While narrative studies such as ours are not generalizable, the findings are transferrable, meaning that they can provide insight to help us understand how and why other women like Louise may decide to leave the engineering profession after having worked in industry. In this way, the constructing and sharing of these stories contributes toward addressing the underrepresentation of women in engineering and STEM.

One interesting aspect of Louise's career story is that Louise didn't realize she was leaving the engineering profession when she resigned from her last engineering job. In other words, she didn't consciously decide to leave the profession. Instead, her decision to leave happened over time and was only visible to her in retrospect. Louise believed she would eventually return to engineering work. She stated, "*I don't have this memory of being like, ok, well this is over...this part of my life is over*". She continues, "*I do remember that at the time, my husband Mike, and I thought...this will be for...five or whatever years and then I would go back.... I would return to full-time work*". Louise's delayed awareness of her decision to leave the engineering profession provides evidence that supports the process-oriented nature of career decisions as suggested by our theoretical framework. Further, it affirms the importance of studies such as this one, that consider women's engineering career decisions over time. The idea that Louise didn't make a deliberate decision to leave engineering raises some important philosophical questions. Specifically, "What is the best way for researchers to define 'leaving the engineering profession' for study?". For this study, we considered "leaving" as "voluntary cessation of employment in engineering work by an individual who previously worked as an engineer". Louise's affirmative response to our screening survey and subsequent conversations with her confirmed that she had left the engineering profession according to this definition. Additionally, through this survey and later discussions, it was clear that Louise considered herself to have left the profession. However, it is not clear at what point she came to that realization. Perhaps, for some time she, like participants in other studies, considered leaving their engineering job as a pause until they could locate another opportunity for re-entry into engineering work [2].

This finding about career decision making over time raises a related philosophical question: "Should we consider participants' part-time engineering work as returning to the engineering profession?". For this study, we did not consider Louise's part-time work as returning to the profession because she only held those positions briefly. Similarly, other researchers consider transitioning to part-time work as a pathway to exiting the profession [39]. With the awareness we gained from this current study, we suggest further studies consider women working in ongoing part-time engineering roles as having remained in the profession. Part-time engineering work constitutes an essential and valuable contribution of women to the engineering profession, and thus in our opinion it should be normalized as engineering work.

Another question of significance raised by this study is, "Why didn't Louise return to engineering?". Gaining an awareness of what kept Louise from returning to engineering work after taking a pause provides insight into the cognitive aspects of her career decision-making process. While each case is unique, understanding what kept Louise from returning may provide insight into other women's engineering career stories. Louise wanted to stay in the engineering

profession after having children. It is plausible that she would still be working in engineering if she had secured ongoing part-time engineering work. Because she could not secure this type of opportunity, she was not able to stay engaged with the engineering profession. Without an established network, she faced challenges with re-entering the workforce. Louise's story suggests that for some women, finding ongoing flexible part-time engineering work is challenging. Some companies have developed initiatives to create more flexible opportunities for women in SET careers [2]. However, STEM professionals with caregiving responsibilities, including women engineers, who wish to work part-time, may be viewed by colleagues and supervisors as less valuable or less committed to their work [39]. Future studies should examine women's access and experiences in part-time engineering work.

Louise's engineering career story suggests the importance of employers providing flexible work options and creating pathways for women to return to the engineering profession after exiting the workforce to have children or otherwise. After having children, Louise wanted a flexible engineering-related work option for a higher degree of work-life balance. She returned to her engineering work full-time after her maternity leave with her first child ended. She talked with her employer and, with expressed reservation, he allowed her to adjust her work hours to provide more opportunity for her to care for her daughter. When her second child was born, she struggled to return to work due to the tensions we described in the previous section. She wanted to follow her plans to be an engineer but she felt torn about being away from her children. After her second child she decided to stay home full-time and work part-time. Like Louise, 17% of new mothers in one study transitioned into part-time STEM work after having children [39].

Louise sought part-time engineering opportunities but was unsuccessful at securing long-term positions. She did engineering consulting work part-time on a few occasions but could never find a position that lasted longer than a year. When her children were in pre-school, she worked as a consultant for a former peer/ mentor until the job ended unexpectedly. A couple of other times, she did some short-term consulting as well. Her last engineering consulting position ended because the business slowed due to COVID, but the other positions had no apparent reason for ending. Because Louise couldn't find consistent part-time engineering work, she eventually pursued a science education when her children were in high school.

Similar to Louise's story, Hewlett et al. [2] found that most women (64%) who left SET careers sought re-entry paths. Several companies, such as General Electric and Johnson & Johnson, have started programs to re-introduce women who have exited SET careers [2]. While it is encouraging to see companies stepping up to create these programs, studies suggest additional work is needed in this area. For example, Cech & Blair-Loy [39] call for more well-regarded part-time opportunities and re-entry pathways for women in STEM careers. Findings from our study support their call. Post-COVID, more companies now know they can operate with employees working online and in flexible work arrangements. The question is no longer *can* they, but *will* they offer flexible work options to those who need it?

Conclusions & Implications

In conclusion, if Louise could have found a long-term, part-time engineering position it is very likely she would still be practicing engineering today. She loved engineering and misses working in the profession. She also loves her family and felt drawn to spend more time caring for them.

At the time she left engineering, Louise did not have strong mentors or role models to advise and guide her in the process of being a mother with an engineering career. She felt she had to decide one or the other (her career or her children). She chose her family and doesn't regret that decision. In conclusion, I hypothetically ask, *What options and support can we put in place so that other mothers don't feel like they have to choose between work and family?*

One change we can make is to adjust the way we view and describe part-time engineering work. Instead of viewing part-time engineers as less committed and less valuable in their roles we should consider their dedication and sacrifice, as caregivers and employees. If an employee works part-time in an engineering role, that work should be normalized by researchers and employers for what it is - professional, engineering work. Given that a high percentage of STEM workers desire to transition to part-time work after having children, educators and employers should work together to create more opportunities like this for women in engineering and STEM. Future studies should examine women's access and experiences in part-time engineering work.

Another area to explore further is why more women don't return to the engineering profession after taking a pause for childrearing, or otherwise. In other words, what makes a pause turn into an ultimate decision to leave. In this study, we see that Louise could not find a suitable pathway back into engineering after having her children. She tried several options in engineering and STEM and could not find what she needed. Researching the career decisions and pathways of women engineers, particularly over the lifespan, can help us gain new insight so that we can help women stay or find a pathway back into the engineering profession if that's where they want to be. A full assessment of existing re-entry pathways for women engineers would benefit all involved – the profession, industry, academia, and the women themselves.

This narrative study across all of the career developmental stages has allowed us to explore the deep, rich engineering career story of one woman, Louise. We dove deep into her life and career and uncovered some very interesting insights and ideas from her story. We identified some areas of change and topics to explore further regarding the engineering profession and our views on what constitutes engineering work. As we collaborate across disciplinary boundaries, work sectors, and other dividing lines we will continue to identify new ways to address the underrepresentation of women in engineering and STEM. No woman should have to choose between work and family. We can't change the past, but as educators, employers, advocates, and friends, we can impact the future, one career story at a time. Let's partner together to help women like Louise find a pathway back to engineering.

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