Development and Implementation of a Reflective Journaling Method for Qualitative Research

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Abstract

The purpose of this research paper is to describe the development and implementation of a qualitative method used to study the transition experiences of recent mechanical engineering graduates. The school-to-work transition is a critical point on an engineer's career trajectory and involves substantial changes over a short period of time. To date, however, the experiences of newcomer engineers have been especially challenging to capture through systematic empirical approaches. To address noted limitations, we developed a data collection strategy that captures regular participant reflections during an ongoing experience. We sent weekly emails to 12 recent engineering graduates during the first 12 weeks of their jobs and asked them to recount a significant learning event. Each week, participants discussed a significant challenge, accomplishment, or realization, describing the activity itself, the role of facilitators, and their own beliefs about what they learned.

Findings suggest that weekly reflective prompts can be effectively used to capture the experiences and perceptions of recent engineering graduates as they move from school to work. Participants used the weekly reflections to provide rich descriptions of their experiences throughout the transition that offered unique insight into the conditions that prompt learning in practice. We argue that the reflective prompt methodology has promise for investigating the lived experiences of both recent engineering graduates and other populations of engineers that might be otherwise difficult to observe via traditional methods. We recommend further exploration of recent graduates' experiences as well as those of other difficult-to-access, perhaps underexplored, populations of engineers.

Introduction and Background

School-to-work transitions

Research on engineering practice has emerged as a major focus within the engineering education community (Korte, Brunhaver, & Sheppard, 2015; Lutz, 2017; Stevens, Johri, & O'Connor, 2014). And while engineering degree programs are designed to prepare graduates for the realities of modern practice, research suggests that a significant gap remains between what engineers are taught in school and what they do at work (Korte, 2011).

An important aspect of engineering practice, then, involves the school-to-work transition for recent engineering graduates. As newly minted engineers learn to navigate their organization, contextual differences across school and work pose a number of challenges. For example, engineering school and engineering work operate with different end goals. School is focused on achieving learning outcomes and demonstrating knowledge acquisition, while work is concerned with productivity, efficiency, profitability, and a range of aspects in which learning is not an explicit goal. These differences influence the role of knowledge and learning across organizations and require engineers to recognize and operate within a dramatically different system of goals and values (Paretti, 2008).

Further, the organizational structures and relationships within them can be substantially different across school and work. Recent graduates must learn to form collegial relationships with a range of individuals who might not resemble those common in university settings; in contrast to classrooms consisting of students within a relatively narrow age band, all at similar points in their education, with broadly shared goals around getting a degree, workplaces include colleagues of widely different generations, educational backgrounds, levels of expertise, and organizational roles. These differences are also manifest in perceptions of industry representatives of recent engineering graduates (Clough, 2004). Developing a coherent understanding of how new engineers experience

the school-to-work transition can inform both undergraduate education and organizational onboarding efforts. Such an understanding remains a goal and challenge for engineering education researchers as well as faculty and other stakeholders in student success.

Nevertheless, exploring the school-to-work transition has proven to be especially challenging (Stevens & Vinson, 2016). Researchers have studied engineering practice through in-depth observations and ethnographic methods (e.g., (Bucciarelli, 2001; Faulkner, 2007; Trevelyan, 2010), but these studies have primarily focused on experienced engineers. Recent engineering graduates leave universities to work in geographically dispersed locations throughout the country and perform a wide range of jobs (Brunhaver, Gilmartin, Grau, Sheppard, & Chen, 2013). Therefore, conducting observations of particular cohorts can quickly become too resource intensive in terms of both time and funding. At the same time, issues of organizational access have been noted (Stevens & Vinson, 2016) as another specific challenge of such research; not all organizations are willing to allow researchers to observe daily work practices and collect on-site data. And although periodic interviews with new graduates can provide the thick, rich description that is vital to qualitative research, those interviews are necessarily limited by their retrospective nature; we thus need additional methods to develop a more holistic picture of the phenomenon and triangulate empirical findings.

Given the importance of the school-to-work transition and the challenges associated with investigating the phenomenon, there is a need for methods that can effectively capture the challenges, accomplishments, and realizations that recent engineering graduates experience as they move from student to professional.

Reflective journaling as data collection

One method that has potential for collecting qualitative data has been through the use of reflection. Here, reflective journaling means describing a recent experience and unpacking salient aspects (e.g., people, resources, activities) that affected learning, and doing so in an ongoing manner over time. Journals have been used in disciplines outside engineering education to promote reflection and deep learning (Boud, 2001; Carter & Francis, 2001; Clarke, 2004; Kessler & Lund, 2004). Boud (2001) reviewed the wide range of uses for journaling and the different kinds of reflection they might be able to prompt along with approaches for assessing the content of the journal entries themselves. They posit that journaling can be an effective mechanism to reinforce learning before (helping individuals clarify their expectations), during (responding appropriately to the current situation), and after (making sense of their experiences) educational activities. Further, Kessler & Lund (2004) implemented journals in an online nursing education program and found that journaling both leverages the strengths of reflective learning and provides a concrete record of learning outcomes demonstrated over time. But while the advantages of journaling have been noted for educational or assessment purposes, relatively less work has leveraged these reflections to conduct research that explores professional experiences.

Within engineering, journals have also been used to probe learning in various contexts and courses. For example, Babapour Chafi, Rahe, & Pedgley (2012) used journals to explore student decision making throughout long-term or design projects. Moreover, Wallin (2015) used weekly reflections to explore student development as undergraduate engineering researchers. More recently, Wallin & Adawi (2017) elaborated on this method as a formative assessment tool for self-regulated learning. Results suggest the use of reflective journals can effectively capture descriptions and explanations of individual experiences as they adapt to new organizational roles and settings.

Rationale for journaling approach

Journaling was selected for two primary reasons. First, lack of access to engineering organizations presents a number of challenges to observing newcomer engineers. Many engineers go on to work in defense industries, and access to meetings in which privileged information is communicated may not be possible (especially if one is carrying an audio recorder). Researchers have documented such challenges and have pointed out the pitfalls associated with such empirical approaches (e.g. Stevens & Vinson (2016)). Second, the journaling approach offered the potential to explore participants' learning experiences in detail while at the same time mitigating the intensive resource requirements of traditional observations.

Journals thus captured participants' micro-level (i.e., day-to-day) experiences without the costs required for observations. As will be discussed below, the approach was implemented with a sample of 12 engineers who worked in various locations throughout the United States (and who moved and traveled) during their journaling period, and captured a range of experiences that would have posed numerous challenges to researchers conducting observations. Journaling thus offered a parsimonious, efficient means to explore the experiences of this group of recent engineering graduates. And while the data collection approach is certainly different from observational methods, the focus and intent are similar (i.e., capturing experiential learning in context for specific organizational members).

In short, researchers and educators need to better understand experiences that comprise professional engineering practice, but do not have especially robust means of acquiring them. Capturing the experience of recent graduates in particular is important because 1) the school-to-work transition period has important impacts on more distal outcomes (Bauer & Erdogan, 2012) and 2) because engineering graduates are consistently described as underprepared for the realities of modern engineering practice (Collins, 2008; NAE, 2005). To that end, we pose the following question: *How can reflective journaling be used to inform our understanding of recently hired engineers' learning experiences during the school-to-work transition?*

Methods

To address this question, we present methods and data from a multiple case study focused on newcomer engineers' experiences during the school-to-work transition. In particular, for this study we were interested in what and how newcomers learn during their first three months of work, but we argue that the approach is extensible to a range of interests related to this transitional period. Our approach was inspired by the methods presented in Wallin (2015) and adapted to fit the current context of recent mechanical engineering graduates in their first 12 weeks of work. Because the focus of this paper is a particular empirical approach—and not necessarily the specific results of the approach—the next sections proceed in the following manner. First, we describe the rationale and background behind the approach. Next, we describe in detail the way the research was carried out, including questions asked, interactions with participants, and benefits and pitfalls.

Executing the reflective journaling approach

First, to recruit participants for the study, we conducted interviews prior to graduation, while potential participants were still in school and thus still readily accessible. These anticipatory interviews afforded several advantages: they allowed in person recruitment for a large population (through emails forwarded by course instructors and visits to class); they provided a mechanism to gather rich qualitative data regarding participants' expectations and concerns about their upcoming transition to work; and, perhaps most importantly, they allowed the researcher to establish a rapport with each participant in a face-to-face setting prior to shifting to electronic data collection. The initial interview also included questions about when individuals planned to begin work and what email address they preferred that the researcher use for post-graduation contact. Using this approach, we recruited 13

participants from a single major at one institution; of these 13, 12 actually participated in the study once they began work. Once each participant began work, they received a set of reflection prompts via email each week for twelve weeks. These prompts were sent each Thursday at 3:30 pm; via an automated system for sending the emails; Boomerang was used in this study, but a range of similar products are readily available.

As noted, the prompts were derived from Wallin (2015) and modified to more appropriately fit the school-to-work context. Where Wallin (2015) used reflective journaling to explore learning in a research-based undergraduate course, we modified our language to account for the different activities and people our participants would engage with. Because our study focused on learning, we defined a "significant learning event" as a meaningful accomplishment, significant challenge, or important realization. Participants were prompted to reflect on and unpack one event each week through a series of open-ended questions. The prompts also asked participants to consider the role of facilitators or other individuals as well as how the experience related to their undergraduate learning and preparation. For example, our significant challenge prompt was presented as follows:

> *Think about your experiences over the past week. Your answers to do not necessarily need to be related to events that occurred during official work hours, but should be related to your experience transitioning from school to work.*
>
> 1. *What was your biggest challenge this week?*
> 2. *What made it so challenging?*
> 3. *How did you approach this challenge?*
> 4. *Did anyone else play a role or help you with this challenge?*
> 5. *What would you do differently next time?*
> 6. *How do you see this relating to your undergraduate experiences?*

For variety, question prompts were slightly modified each week to ask about important accomplishments and realizations as well. Despite the variations in prompts, we noted that participants tended to use the space to talk about an event they considered important regardless of the specific nature of the prompt (e.g., sometimes an accomplishment was framed as overcoming a significant challenge and vice versa).

The use of email was particularly important here because it allowed the interviewer to quickly and easily clarify any confusing responses, though we were careful to avoid too many requests for clarification to respect the time of both the participant and the researcher.

Because the prompts themselves are relatively short, we then concluded the study with a final interview at the end of three months. This final interview provided the opportunity to probe specific events mentioned in the reflective responses in more detail, and while this probing was necessarily retrospective, participants' weekly responses often provided a concrete memory trigger that facilitated recall. In doing so, it also allowed participants to describe experiences and perceptions that they may have omitted from the weekly responses. These interviews provided space for participants to elaborate on specific experiences and offered triangulation of reflective journal findings.

Incentives and Participation

To maintain participation and keep individuals engaged, we implemented a number of strategies. First, to incentivize participation, we developed a raffle system in which responding to a reflective prompt entered participants into a weekly drawing among participants. Each week, a $50 Amazon gift card was raffled based on a random number generator assigned to each participant. This strategy was chosen over prorating or distributing a smaller amount across all participants each

week because the authors believed that, given the relatively small participant pool, the potential for winning $50 was more enticing than being guaranteed $10. However, research is needed to better understand the psychological factors behind incentivizing this type of research and data collection.

Second, the lead author maintained frequent contact with the participants each week. By confirming receipt of the reflections each week and providing short, individualized comments about the entries (e.g. “Thanks!” “Sounds like you had a rough week! Hope next week is better.” “Congratulations – sounds like that was a big deal!”), we personalized the experience for participants in ways that kept them more motivated to respond. Finally, as noted above, the anticipatory interviews allowed the lead author to meet each participant in person and establish rapport in ways that seemed to prevent attrition. Again, further research is needed to investigate the role of researcher-participant rapport, but similar studies point to the importance of having the follow up emails sent by the same researcher conducting the initial interviews (Gewirtz et al., 2018; Paretti et al., 2017).

We also opted to allow participants to remain in the study even if they missed a given week’s response. Recognizing that working professionals often have a variety of competing demands, including work travel, life events (buying a house, getting married, etc.), and project deadlines that might prevent them from responding in a given week, we determined that the value of keeping participants in the study over the full three-month period outweighed the limitations imposed by having incomplete data sets (i.e. less than 12 responses) for one or more individuals. Moreover, because the responses were weekly, participants would sometimes capture experiences from the past two weeks if they missed a week. Thus, unless a participant explicitly withdrew from the study and requested that we not contact them (which did not happen in this case), we sent them an email each week regardless of whether they had responded the previous week.

Potential issues or limitations

This method also has some limitations. First, reflective prompts only asked participants to discuss a single event each week. The initial phases of the school-to-work transition is accompanied by rapid learning and intensive changes over a relatively short period of time, and the format for data collection might have overlooked additional significant events within a given week. Triangulation using multiple interviews or different types of prompts might help corroborate some of the findings from journal entries while also capturing additional learning events that participants did not report in a given week.

Second, this particular approach hinged, at least in part, on the rapport established in the initial interviews between the first author and the research participants. It seemed important that there was consistency in the researcher the interview and sending the follow-up email to maintain participation and engagement in the study. As a result, scaling this approach up to study more than 12 participants at once might present significant logistical and methodological challenges. Future work should explore the importance of researcher-participant relationships and their influence on sustained participation at larger scales.

Third, as noted above, our choice to retain participants even if they missed a given week meant that the final data set had gaps for different individuals (for details, see the discussion section below). This limitation means that we cannot do a direct week by week comparison across all the participants because not everyone provided data each week. However, the approach did allow us to retain all of the participants for the full course of the study, and all participated in the final interview. Given the goals of this study, the high retention rate proved to be sufficiently valuable to compensate for the missing data. Notably, the final interview then also provided a key mechanism to more fully probe participants’ experiences and uncovering key incidents missing from the data set.

Results

As reflective prompts were answered each week, responses were compiled in participant-specific files. Each participant had their own document in which their responses were recorded. The data produced from this data collection approach resembled narratives of the first 12 weeks of one's new job, starting from the first day. The following sections will offer data on retention and persistence in the study, provide an overview of the structure of the results (e.g., length, richness, detail), and discuss the range of response types and content articulated by participants. (For a full discussion of the coding and analysis applied to these journal responses, see (Lutz, 2017))

Response rate and retention

As noted, an important component of this data collection was establishing rapport between participants and the researcher leading the study. By making efforts to build trust and respect, we were able to maintain a strong response rate and sustain participation throughout the duration of the study. For example, time was dedicated during initial interviews specifically for light conversation and discussion led by participants (e.g., How are your classes going right now? Do you have any exciting plans for this weekend?). Overall, 129 reflective prompts were submitted out of a possible 144. Most participants responded to all 12 reflective journal prompts, with all but one responding to at least nine out of twelve. The response rate is critical here because it helps provide a consistent view of the trajectory of an individual's school-to-work transition.

Structure of responses

In terms of reflective responses, participants differed with respect to the length and richness provided. In some cases, participants provided short, one-sentence answers to questions. For example, the following passage demonstrates a relatively brief set of responses.

1. What was your biggest challenge this week?

    Continued issues with HR. My computer account keeps getting disabled.

2. What made it so challenging?

    The people responsible for the issues are in Europe, so it's difficult to get in contact and get things fixed.

3. How did you approach this challenge?

    Went and talked to the plant HR (again) to try to get the issues remedied for good.

4. Did anyone else play a role or help you with this challenge?

    All of the local HR people, they're becoming very familiar with me.

5. What would you do differently next time?

    Everything is out of my hands, not sure if there's anything I could to change any of it.

6. How do you see this relating to your undergraduate experiences?

    I learned about condition-based maintenance (my intended expertise) on control panels in a meeting about some unresolved issues we were having with some robot cells. [John, Week 2]

In other cases, participants elaborated on and contextualized their experiences. The following passage is an example of a thick, rich description offered by a participant. Important to note here is that this participant was responding to a similar set of questions as the above quote.

1. What was your biggest challenge this week?

My biggest challenge this week was understanding the context of the problems I had been assigned to work on. My company is over 100 years old and they have a lot of history dealing with the kinds of problems I'm working on now. I have spent all week trying to assess the situation and understand the scope of the problem.

2. What made it so challenging?

The first hurdle is that the person who knows the most about my assigned project is on vacation until Monday, and I'll be out next Monday-Friday for training. Not much will get done over that time. Other obstacles include tracing through old email chains, trying to remember or figure out who said what about what and when they said it. My manager is on vacation and isn't available to approve some software that I need to understand the history of the problem. Figuring out who could help me was difficult. I emailed one guy a nice email asking for his help and got back a "[Employee] will help you with this,,,"

3. How did you approach this challenge?

I've just been asking questions relentlessly. My girlfriend's dad, who is high up in engineering at another company, has a favorite saying that "the best time to ask questions is immediately". I've realized that I've been given little guidance a.k.a. lots of freedom, so I'm trying to use it as an opportunity to show what I can do. I've tried to make all of my emails to people who might be able to help me clear and courteous. I've been thinking about ways to solve the problem that haven't been thought of yet to inject some new life into the problem and get out of our current confusing and ambiguous rut. One of the people who put me on the project said to me that the current employees are "limited because they know what they know, while you know pretty much nothing yet. Use that to your advantage."

4. Did anyone else play a role or help you with this challenge?

Yes, the manager and my girlfriend (and her dad) (see above) and their quotes have helped me. I've also adopted the two guys who sit on either side of me in our group as mentors. They've been doing a great job of answering my questions and just telling the story of their work. A lot of times I don't even know what I don't know, so their narratives help fill in gaps I was unaware that I had.

5. What would you do differently next time?

Honestly I think I have a pretty good approach - I'm learning really fast. However, it might be good to establish a relationship with the people I'm emailing with questions more deeply before I send them a bunch of emails that require them to look through files on their computer or do some other work for me. I want to foster the kinds of relationships where people want to help me (but I think that starts with me - I have to eagerly and capably help them first).

6. Are there any additional new experiences you'd like to discuss or that you believe contributed to your learning?

Yes! I had a great conversation with the man whose cubicle I "stole" when I was hired. He is the VP of Systems Engineering for [my employer] and has a cube in my office even though his real office is in North Carolina. He introduced himself one day this week and invited me to pick his brain later in the week. I did that today. He encouraged me to stay to true to my ideals, saying "you'll go farther if you're suspended from above rather than trying to build your way up from the ground." Meaning, focus on developing technology that improves

people's lives, influencing the next generation of engineers, and doing your absolute best work on every problem you work on. He said to treat every person you interact with as your customer, and your job is to make customers happy.

I started to embrace my work a bit more this week too. I had my first time where I was writing this document and got so into it that I forgot I was at work. It's getting better every week. [Eddie, Week 3]

Length of response (measured by word count) was variable across participants, but less so across weeks with a single participant. That is, different participants provided different length responses, but those who initially wrote longer responses continued to do so throughout the study. In any case, if clarification was needed on a given response, the email format used for data collection provided a convenient mechanism for following up and asking for more detail. In such instances, participants often responded with clarification within a few days.

Content of responses

Beyond response length, participants also decided to focus on a wide range of experiences and learning events within their reflective prompts. As was expected, participants used the prompts to discuss events that took place at work and the associated challenges, accomplishments, and realizations. For example, in the following passage, Doc described the initial process of getting used to the dynamics of his office and the job itself.

1. What was your biggest challenge this week?
   My biggest challenge this week was getting used to the dynamic of being a consultant. In my office, we worked with billable hours, so your value is measure in how many hours you can bill to the client. Therefore, everything I do during the day has to be measure and record (every hour). The problem was that I didn't get many billable hours because I didn't have the knowledge to help with the projects my office has. Moreover, people were hesitant to give me things to do (projects-wise) because I did not know the regulations for different air permits.
2. What made it so challenging?
   This was challenging because I need people to give me projects so I can develop and grow as an engineer. However, as I said before, people do not want to give my projects since we have a lot of work as an office and it will take more time to explain the project than just doing themselves.
3. How did you approach this challenge?
   I approach this challenge by finding the projects people were working on, learning about the air permits, regulations and equipment that applied to it. Thus, when I offer my help, I did not just say "hey do you need help?" instead I said "I understand that you need to do a permit V that requires this, this and that, I could do it for you so you can focus in a more important task.
4. Did anyone else play a role or help you with this challenge?
   The main issue was that my supervisor (who gives me projects) was out of the office fore three out of my fours days, so he had a big role in me not having specific projects. However, my coworkers are trying to explain stuff whenever they have time.
5. What would you do differently next time?
   I will recommend for future consultants to read before hand the topics and regulations related to their field. This will help a lot once they start working.
6. How do you see this relating to your undergraduate experiences?
   This was the opposite of what I was used to in college. In college everything is structure. They give homework, test and projects, you always know what you need to do. However, in

my job, if you want to be valuable, you have to get contracts with new clients, reach out for projects, be more proactive. [Doc, Week 1]

Responses such as these were most common and also what were expected by the research team. At the same time, however, participants also used the space to discuss personal or professional development that took place beyond the immediate context of their office or specific job. In the quote below, Eric described a social gathering at a local water park that helped him form relationships with other peers and colleagues at his office.

1. What was the most significant thing you learned/realized this week?
   The most significant thing I did last week was Saturday when the Emerging Professionals group at work held an event at a local water/adventure park.
2. What made it significant?
   This was significant because I realized how many of the people attending I knew or had become close to over the past couple of months.
3. Did anyone help you in achieving this accomplishment?
   The friends who attended and the group who organized the event.
4. How did they help?
   These individuals helped because they were friends to me and we're welcoming from the start. The organizing group helped by putting all of us in the same place for this and previous events.
5. How does this compare to accomplishments you've achieved in school?
   In school it was definitely much easier making friends as there was much more interaction outside of "work" hours. The nature of being in school is more conducive to meeting and engaging with new people in a less formal space.
6. Is there anything new or unexpected you learned/experienced that you'd like to share in addition to the above responses?
   Last week I started to learn more about different types of quality non conformance and how to address those issues. Part of that was consulting with the vibrations group. I took that opportunity to go speak to our contact there and try to get to know him better, as well as the way his team helps ours. It was clear from our conversation that there can sometimes be some tension, but this is just an opportunity to take his suggestions and turn them into actions in order to improve the relationship between our groups.
   [Eric, Week 9]

Such experiences were not necessarily expected, but the exploratory nature of the study and data collection instruments allowed participants the freedom to describe any event they believed contributed to their learning during the school-to-work transition.

Further, some participants chose to describe events that were generally unrelated to their school-to-work transition. For example, Sheryl described the process of buying a car as an important learning event.

1. What was the most important thing you learned/realized this week?
   Don't tell car dealers you plan on buying a car in a year.
2. Why do you believe it is important?
   They feel like you're wasting their time, become rude, and not very helpful
3. Did anyone help you learn/realize this?
   The car dealer and my dad
4. How did they help?

My dad hinted to the dealer that we might spontaneously buy a car. Where he would buy it and I would pay him back.

5. What could you do to create more learning experiences like this?

   Continue my car search in different areas and look up dealer's car stock.

6. How do you see this relating to your undergraduate experiences?

   In Mechanical engineering I knew a bit about cars, but nothing about sales. I knew what I wanted in a car and figured out which model and makes I wanted.

   [Sheryl, Week 2]

While these events are not related to the school-to-work transition per se, they were nonetheless perceived as significant by participants in this study. It seems important that researchers work to better characterize the boundaries of the school-to-work transition and the relevant learning experiences that accompany it.

Discussion and Implications

Research on engineering practice comes with a range of logistical and methodological challenges, and reflective journaling offers a useful mechanism to explore this phenomenon. In general, the reflective journaling approach appears to offer unique insight into the experiences of recent mechanical engineering graduates as they learn to engage in engineering practice.

Journaling for reflection and self-regulation skills

Journaling and reflective activities have been successfully implemented in other disciplines and findings in this research suggest that these approaches can be effective in exploring learning for recent engineering graduates. Boud (2001) noted the benefits of journals and reflections, and the present findings echo these claims. For instance, participants in this study described not only significant learning experiences, but also elaborated on what made the experience significant for them, how that learning related to their past experiences, and what they might do in a similar situation in the future. The prompts helped participants unpack complex events in ways that might promote more effective learning as they move through the school-to-work transition and experience new challenges. Future work should explore the varying degrees to which participants engage in reflective thinking and how views about knowledge develop (e.g., (King & Kitchener, 1994)) as they navigate the school-to-work transition.

Further, journaling might help newcomer engineers develop self-regulated learning skills needed to continue growing and adapting to their workplace. Wallin (2017) demonstrated the efficacy of reflective journals for students in undergraduate research activities, noting in particular the ways journals can offer assessment points for complex learning. In the present work, participants offered rich descriptions of their learning experiences and also noted the impact that journaling activities had on their awareness of learning at work. Specifically, some participants noted that the process of unpacking a significant event each week kept them “on the lookout” for experiences that might qualify as an important accomplishment, challenge, or realization. By being aware of and prepared for these significant learning events, participants might develop skills needed to anticipate, respond to, and make sense of challenges as they arise in new contexts.

Practical considerations

Given that this method is relatively underexplored in engineering education, it is important to discuss practical considerations for implementing this approach. In the following, we note lessons learned, benefits, and potential pitfalls of executing the reflective journal approach for studying recent engineering graduates.

First, in terms of duration of the journaling period, 12 weeks seemed to be an adequate length of time to capture significant experiences. During the first 12 weeks of the school-to-work transition, learning is rapid and variable from one week to the next. However, after about nine weeks, participant responses began to convey a sense of stability and predictability in terms of learning and seemed to have settled in to their jobs to a large extent. While participants continued to reflect and elaborate on significant events, those events were not explicitly related to the school-to-work transition, and instead echoed themes related to workplace learning more generally. For example, within the first month of work, participants described learning related to onboarding experiences or challenges related to learning about their organization—by the end of the 12 weeks, participants began to describe challenges related to the specific projects they had been assigned to. While more research is needed regarding the temporal boundaries of the school-to-work transition, twelve weeks appears to be a useful point at which the nature of learning shifts from organizational to specific project topics. However, some participants were in training courses for the majority of the 12-week period, and for these participants, the time frame did not adequately capture their initial experiences with the work itself.

Second, attending to the researcher-participant relationship was a critical component of the approach used here. Specifically, it was important to conduct initial interviews with participants to build rapport before they began work. During the initial interviews, significant time was devoted to building trust with participants and making sure they were comfortable with the research and sustained communication following graduation. In addition, using email to collect data was a strategic decision to make communication more seamless and reminiscent of an organic dialogue, as opposed to say an online survey form with short answer text boxes. The use of email let the research team follow up for clarification (e.g., when participants used ambiguous or confusing language) and also allowed the lead author to give personalized responses to each participant as they answered the reflective prompts. More research is needed, but other research outside of engineering education has noted the importance trust and rapport in sustaining participation in longitudinal studies and it appears that such aspects should also be considered when implementing the methods described here (Mactavish, Mahon, & Lutfiyya, 2000).

In the future, researchers should more fully explore the benefits, drawbacks, and limits of the approach described herein. For example, our research design explored the first twelve weeks of the school-to-work transition, but the boundaries on this period are not well defined or understood. Future work should investigate the efficacy of reflective journals beyond the 12-week mark to better understand the points at engineers shift from newcomers to experienced members. Moreover, the journals used in the present study asked about a single event each week, effectively limiting participant responses to only one experience. Given the rapid learning that takes place in the school-to-work transition, it is possible that our approach overlooked additional significant events. While this was done to minimize the burden on the participants, future research should expand to probe for additional significant events or “a-ha” moments throughout a given week.

One potential concern is the extensibility of the approach here–that is, how many graduates could successfully be followed in this way. Author 2 has successfully employed the same approach in a larger study involving graduates from four institutions (Gewirtz et al., 2018) to explore new graduates’ transition experiences more broadly. Following the approach described here, this larger study recruited and interviewed students prior to graduation; given the number of institutions and the common semester end times, we used teams of researchers, with one to three people conducting interviews at each institution. We recruited 59 participants in the first cohort (May 2017) and 72 participants in the second cohort (May 2018). Following the initial interviews, we used two researchers to manage the weekly reflective prompts (each researcher was responsible for two

universities). Notably, we added a second quantitative weekly survey to this larger study to elicit lists of activities participants engaged in and perceptions of preparedness on a 10-point scale. This larger study, funded by a grant [details withheld], also included interviews with each participant at the end of the 3-month period, but added interviews at 6 months and 12 months. The same researcher who managed a given participant's weekly responses conducted the follow-up interviews. For the first cohort, of the original 59 participants, 57 responded once they started work, 46 completed the 3-month interviews, 41 completed the 6-month interviews, and 31 completed the 12-month interviews. Data collection for the second cohort is ongoing.

In the larger study, each participant was paid per survey response, and as in the study describe in this paper, we kept participants in the study even if they missed one or more responses. While this approach leads to an incomplete data set, as noted, it did yield a relatively high retention rate, and during the first 12 weeks, on average participants responded to 9 of the 12 quantitative surveys and 9 of 12 reflective prompts. To better explore patterns in the data given this limitation, we aggregated responses by month rather than by week–an approach that proved successful and yielded key insights regarding the challenges participants experienced in their transition from school to work (Gewirtz et al., 2018).

Conclusions

Studying engineering practice, and recent engineering graduates in particular, remains a challenge for a number of reasons. Organizational access as well as resource limitations can hinder researchers' abilities to gain a deeper understanding of how learning takes place at work and how individuals move from students to professionals. However, a reflective journaling approach to data collection offers an opportunity to explore significant experiences in ways that mitigate some of these noted challenges. The authors developed and implemented an approach which used weekly emails to investigate the learning experiences of recent mechanical engineering graduates during the school-to-work transition. In general, the approach provided detailed descriptions of meaningful learning experiences, while also building context around the event in terms of the setting, the role of others, and the ways in which their undergraduate experiences prepared them for those experiences. By unpacking an event each week, participants provided an overview of their development and learning that offers insight into personal and professional development that has been difficult to capture thus far. While the approach has some limitations, we argue that reflective journals can be an effective means to probe the experiences of populations that might be otherwise difficult to access. With a better understanding of the learning and experiences that characterize the school-to-work transition, engineering educators can better prepare students for the realities modern engineering practice, and future work should explore the potential for this method in studying other populations and critical time periods.

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