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To cite this article: Audrey Boklage, Brooke Coley & Nadia Kellam (2018): Understanding engineering educators' pedagogical transformations through the Hero's Journey, European Journal of Engineering Education, DOI: [10.1080/03043797.2018.1500999](https://doi.org/10.1080/03043797.2018.1500999)

To link to this article: <https://doi.org/10.1080/03043797.2018.1500999>



Published online: 20 Jul 2018.



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Understanding engineering educators' pedagogical transformations through the Hero's Journey

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ABSTRACT

Many engineering education research faculty have put much effort into providing empirical evidence demonstrating the success of student-centred teaching strategies in the hopes that this evidence will result in widespread changes of engineering teaching practices. Unfortunately, these student-centred strategies have not been widely adopted as many engineering faculty still rely heavily on traditional lectures. In this study, we investigate three engineering faculty who have successfully made the transition to student-centred teaching strategies to uncover the complexities and nuances through their stories. This study uses Dewey's Theory of Experience as a theoretical framework and Joseph Campbell's Hero's Journey as a structural way to construct and analyse narratives of participant's journeys. These engineering faculty narratives shed light on the stages involved in the process of changing teaching practices and how individuals interact with the environment to evolve over time.

ARTICLE HISTORY

Received 30 December 2017

Accepted 11 July 2018

KEYWORDS

Higher education; active learning; faculty development; institutional culture; instructional change

Introduction

Research recognises the importance of universally incorporating student-centred teaching in all classrooms, ranging from pre-kindergarten to post-secondary institutions (Bransford, Brown, and Cocking 2000; McCombs and Miller 2007; Weimer 2013). For many years, engineering education researchers assumed that through continuing to add to the research base demonstrating that student-centred teaching was effective in engineering education, widespread change would be enacted (evidence summarised by (Pascarella and Terenzini 2005; Kuh et al. 2011; National Research Council 2012)). However, even as researchers continued to add to this corpus of research, systemic change never came to fruition (Seymour 2002; Fairweather 2008; Borrego, Froyd, and Hall 2010; National Research Council 2012).

A recent push in the literature and from funding agencies to focus on change strategies (Henderson, Beach, and Finkelstein 2011; Borrego and Henderson 2014; Finelli, Daly, and Richardson 2014; Hasanefendic et al. 2017) is a promising attempt to move towards a more systems-based approach that will result in more widespread change of teaching strategies. Henderson, Beach, and Finkelstein (2011) reviewed the literature exploring change strategies across undergraduate Science, Technology, Engineering, and Math (STEM) instructional practices and identified four theories of change strategies including: 'disseminating curriculum and pedagogy, developing reflective teachers, enacting policy, and developing a shared vision' (952). Unfortunately, the category that was aligned with developing research demonstrating the effectiveness of specific teaching strategies and curricular innovations was not effective in achieving change (Henderson, Beach, and Finkelstein 2011).

Previous research on trying to understand why widespread change has not happened has focused on why engineering faculty do not succeed in transitioning to student-centred strategies (Fairweather 2008; National Research Council 2012). Factors cited that contribute to this gap include faculty rewards, the perceived importance of teaching, and the institutional focus on research funding (Fairweather 2008). Additional factors cited in the Discipline-Based Education Research (DBER) report include the departmental culture, institutional priorities, reward systems, students, and faculty members' beliefs (National Research Council 2012).

More recently, researchers have begun to try to understand how to encourage faculty adoption of research-based, student-centred instructional strategies through studying faculty motivation (Maturovich et al. 2014), theories of change (Henderson, Beach, and Finkelstein 2011; Borrego and Henderson 2014; Finelli, Daly, and Richardson 2014), professional development programmes (Lattuca, Bergom, and Knight 2014), and endogenous, or internally motivated, characteristics of individuals (Hasanefendic et al. 2017). A recent study by Hasanefendic et al. (2017) explored the characteristics of six individuals who implemented a change in their departments and/or institutions. They found specific motivations needed to change institutionalised practices to include an interest in change, field experience, multi-embeddedness, authority to act, and strategic use of networks.

In this study, we are sharing and developing deeper understanding of the narratives of engineering faculty who have successfully experienced change in their teaching strategies, and through sharing these narratives, we expect that other engineering faculty will reflect on their own teaching stories and be inspired to pursue their own journey of change. We will also conduct a cross-case analysis to develop an understanding of the complexities and nuances within each of these narratives and gain insight into change as experienced and enacted by individual faculty. Through this work we hope to impact engineering faculty and administrators as they begin or continue to move towards more widespread use of student-centred teaching strategies within their departments and/or programmes. Through the shared narratives, we also hope to inspire faculty to embark on a journey of making changes to their teaching practices and to continue with these changes even after they meet some resistance from students, colleagues, or administrators, as will be seen in the narratives.

This narrative research project focuses on the journeys of exemplary engineering faculty who have experienced successful implementation of student-centred teaching strategies. From their narratives, we are able to begin identifying contextual and individual factors that contributed to their ability to implement student-centred pedagogies while also gaining understanding of barriers that made the process challenging. Additionally, we are able to identify endogenous (related to internal factors) and exogenous (related to external factors) factors that contribute to these shifts.

Purpose and research questions

The purpose of this study is to better understand the successful transition of engineering faculty from teacher-centred to student-centred strategies. The following research questions guided our project:

- In what ways do engineering faculty describe their personal journey of changing their teaching practices and pedagogies?
- In what ways, if any, do these successful change stories illuminate contextual and individual factors that contribute to this change?

Theoretical framework

The theoretical framework guiding this work is Dewey's Theory of Experience (1938) which situates experience as consisting of the principle of continuity (past, present, and future) and the principle of interaction (between an individual and their environment). Dewey (1938, 130) explains that an experience has the potential to act as a 'moving force' and that through having an experience that 'arouses curiosity, strengthens initiative, and sets up desires and purposes' the experience can be an impetus for growth. An experience can only be fully understood if one considers not only the individual, but

also the environment in which the individual interacts. As it applies to this study, the faculty members' experience is represented in their journey as they interact with their environment, i.e. the institution, their classroom, in the process of executing change. The faculty member's process, from the onset of their desire for change to its actualisation, is the growth that Dewey describes. This theoretical framework also guided the choices for our methodology.

Methodology

We conducted narrative interviews with 15 engineering faculty specifically chosen from diverse disciplinary backgrounds within the engineering community. Next, based on the transcripts of these interviews, we then smoothed (Polkinghorne 1995) the narratives into stories, using Joseph Campbell's Hero's Journey as a coding and structuralising scheme (method is described in detail in (Cruz and Kellam 2017)). We selected the journeys of three faculty members to highlight in this paper with the purpose of demonstrating the range, in terms of their motivation for change, ideal impact and associated experiences, in the faculty journeys toward transforming their pedagogies.

Participants

Participant selection in the broader project consisted of a combination sampling strategy. We identified some participants using a criterion sampling strategy. This involved reviewing abstracts from two United States conferences to identify authors who are at the cutting edge of pedagogical innovations and who reported using a student-centred teaching strategy. We also recruited participants using snowball sampling (Biernacki and Waldorf 1981) to identify additional faculty members who have transitioned to incorporating student-centred teaching strategies. Initially, the snowball sampling strategy led us to have many participants from similar disciplines of engineering so we then transitioned to using a maximum variation sampling (Patton 2001) strategy to identify more participants (using the criterion sampling strategy). This also served to ensure that faculty used in our sample were diverse in their gender, race/ ethnicity, institution type, and engineering discipline affiliation. We initially planned to interview 10 faculty, but with snowball sampling (likely due to the strong social networks of some of our participants) 6 of our participants were from civil, environmental engineering, or construction management. Thus, we decided to modify our sampling strategy and to interview 5 more faculty from other engineering disciplines. There were a total of 15 participants (7 females; 8 males) in the study inclusive of racial and ethnic diversity.

We ultimately recruited and interviewed these 15 faculty members representing various engineering disciplines, from multiple institutions across the United States. We analysed (see data analysis section below) and constructed narratives for each of the interviews and then selected three for inclusion in this paper. First, we removed any narratives from the participant pool that did not have enough detail and, correspondingly, would not enable us to develop an in-depth understanding of their teaching stories. The brevity of some of the interviews – 2 interviews were less than 40 minutes – resulted in transcripts that did not have enough details to provide a rich narrative describing the transition from teacher-centred to student-centred pedagogies. Next, we read through the remaining 13 narratives and selected narratives that represented different paths towards the overall goal of student-centred pedagogy, including the scope of the teaching innovation. We also considered the diversity in the types of institutions with which they were affiliated during their transitions (private and public), department type (civil engineering, chemical engineering, and engineering education), gender, race, and ethnicity. The three participants for this study are Donna Riley, Charles Pierce, and Fernanda Leite. More details about their backgrounds, contexts, and experiences will be provided in the findings section when providing the participants' narratives.

In an effort to share the full spectrum of stories of the participants from this study, which is limited by manuscript constraints, authors of this article are preparing a book. This book will contain the

narratives of each of the participants as separate chapters of the book. Creating this book will enable us to share rich accounts of all participants in their own words to a broader audience.

Data collection

Narrative interviews were conducted in person and via Skype® with participants between the Fall of 2015 and Spring of 2017 and ranged from 29 to 84 minutes in duration. The purpose of these interviews was to elicit the narratives of participants. The interview questions aligned with the theoretical framework (Dewey 1938) in that they encouraged respondents to describe experiences from their past and present and to discuss how they were situated to move into the future (principle of continuity). The protocol also encouraged them to discuss their personal experiences and broader social experiences (principle of interaction). The initial prompt, 'I understand you are a [job title] of [discipline], can you walk me through how you have become the engineering educator that you are today,' was developed to encourage participants to enter the narration phase of the interview (Kim 2016) where they described their story. This part of the interview typically captured their first realisation of a need to change their teaching style from the way that they typically taught or from the way they were taught as a student. The interviewer then transitioned into the conversation phase (Kim 2016) of the interview and asked probing questions to encourage the participants to further elaborate on aspects of their story; these probing questions included questions such as, 'You mentioned _____, tell me more about that,' 'You mentioned _____, can you give me an example of that,' or 'You mentioned _____, what was that like for you?' Depending on when the participant started or ended their story, additional probing questions were asked to encourage them to describe early experiences teaching, recent experiences teaching, and/ or what served as resources for them in improving their teaching (e.g. from formal workshops, mentors, students). Additionally, the interviewer asked the participant to describe catalysts and barriers to changing their teaching practices. These questions, such as 'How have others in your unit responded to changes in your teaching?' helped uncover social and cultural aspects that may have supported or discouraged changes in teaching. In keeping in alignment with Dewey's principle of continuum, the final question looked to their future and focused on future plans for development as a teacher, 'How would you like to further develop as a teacher? How do you think you will go about doing that?' The interviews were audio-recorded, transcribed externally, and checked by a researcher for accuracy.

Data analysis

The data analysis followed an approach outlined by Cruz and Kellam (2017) that takes a structural approach to constructing and analysing participant narratives. This approach involves using Joseph Campbell's monomyth as a way of uncovering patterns that are common across narratives. The first phase of this approach involves the researchers becoming familiar with the transcripts through multiple passes of reading and identifying events within the transcripts. Events are separated from non-events within the interviews such as reflection, introspection, and theorising. In the next step, the events were coded according to Campbell's 16 monomythic codes (Campbell 2004) modified by Cruz and Kellam (2017).

These narratives were constructed and interpreted by the research team. Organisation of the narratives using this structural approach was completed by the researchers and was based on the transcripts of the interviews. The constructed narratives are a representation of our interpretation of an interview that was co-created with the researcher and the participant. In an attempt to mitigate some of the potential bias that comes from the researcher interpreting and applying this structure to the stories, we attempted to have the participants share their story in its entirety in the interview and only after that story was finished, did we follow up with probing questions around different parts of their story. In addition, when constructing the narratives, we used the participants' words verbatim as much as possible with connecting words added and denoted in the constructed narrative. In

addition, we engaged the participants in member checking prior to publication of any articles or books that included their story.

Each of the monomythic codes and our interpretation or description of that event as it relates to our data set is described below:

- The *call to adventure* occurs when the faculty member shares the impetus for their desire to change their teaching practice.
- The *refusal of the call* occurs when the faculty member considers not answering the call to adventure, and, in turn, not changing their teaching practice.
- *Supernatural aid* occurs when the faculty member receives unexpected aid from a person (e.g. mentor or colleague) or from media (e.g. a workshop, book or website) that helps prepare them for the journey on which they are about to embark.
- *The first threshold* is the first trial that the faculty member faces in their journey. This is a challenge that is generally expected by the faculty member and sets them on their journey into the unknown. In the context of this study, the faculty member leaves the ordinary world, their original world where they embraced teacher-centred teaching strategies, and transitions into the special world, where they experiment with and adopt student-centred teaching strategies.
- During the *belly of the whale* portion of the journey, the faculty member is 'swallowed into the unknown, and would have appeared to have died' (Campbell 2004). This is the lowest point in the faculty members' journey and becomes a transformative event.
- During the *road of trials*, the faculty member encounters many challenging and difficult barriers as they experiment with implementing changes in their course(s).
- The *meeting with the all-knower* event involves the faculty member meeting with a mentor or colleague who transforms their journey and is essential to the faculty member becoming a teacher who uses active-learning strategies in their classroom. This relationship is crucial for the faculty member to reach a resolution in their journey.
- The *meeting with temptation* portion of the journey involves the faculty member being tempted by something that would encourage them to go back to the way that they taught previously. The temptation could be a faculty member having less time and/or emphasis on teaching due to additional responsibilities.
- In the *atonement with parent* stage of the journey, the parent, here possibly represented by an administrator or a more senior faculty member, has influenced the faculty member until they realise their own power. In this stage of the journey, the faculty harnesses their power and becomes more autonomous and confident in following their own path.
- In the *apotheosis* stage, the faculty member reaches a stage of understanding and begins to take ownership of their new way of teaching, becoming comfortable in their new role as a teacher who has transformed their pedagogies.
- The *ultimate boon* occurs when the faculty member reaches resolution and feels as if they have mastered their new art of teaching and have reached a resolution of their journey.
- The *refusal of the return* phase occurs after the journey has reached a conclusion when the faculty member consciously refuses to return to the ordinary world, where they will need to re-integrate their new ways of teaching into the old environment that accepts and possibly values teacher-centred pedagogy. Instead, they may prefer to stay in the special world where they can continue to experiment with student-centred pedagogy.
- The *rescue from without* phase in the journey occurs if the faculty member is refusing the return. In this stage, there is some type of event helping bring the faculty member back to the ordinary world, thus resolving the journey.
- The *return threshold* occurs when the faculty member returns to the ordinary world and shares with colleagues and administrators what happened during their journey, thus reconciling their identity that was developed in the special world with their 'ordinary' faculty identity.

- The final phase, *master of both worlds and freedom to live*, enables the faculty member to move back and forth effortlessly between the ordinary world and the special world. The faculty member has reached a point of clarity where they can be an exemplary teacher embracing active learning strategies and can return to the ordinary world, that values teacher-centred pedagogy, and still thrive in this environment. The faculty member can also begin to encourage other faculty members to embark on their own journey to the special world where they can begin to experiment with student-centred pedagogy.

After coding these interviews, we used narrative smoothing (Polkinghorne 1995) to construct narratives of each participant. We first labelled each event in the interview transcripts and then constructed narratives by identifying the events that fit into one of the monomythic codes from Campbell and temporally ordering them into a coherent narrative. It is important to note that these interviews were conducted at a specific point in time, and the stories of these faculty are ongoing. For example, the interview with Donna Riley occurred in November of 2016 and since that time, she has moved to Purdue University to serve as the Kamyar Haghighi Head of the School of Engineering Education. Her story and the story of the other participants are ongoing and the monomyth is simply a way to structure their stories to develop a better understanding of their stories and a way to easily see patterns and commonalities or differences across different faculty member's stories. While the narratives provided in the results section, may seem complete they are certainly far from reaching any conclusion. After each story was structured using the monomyth and constructed, we selected three narratives to use in this paper (see participants section above for more details about the selection of three narratives), and then we compared the stages across these participant stories to identify themes related to pedagogical change.

The final step of the data analysis was member checking. A draft of the manuscript was shared with the participants for their input regarding the findings, and their feedback was integrated into the findings. In the interest of the word limitations of this manuscript, we will present abbreviated narratives in the researcher's voice for each participant's narrative, inclusive of some participant quotes. These constructed narratives are considered the findings in this narrative analysis project. In the discussion section, we will discuss themes that emerged from the cross-case analysis of these narratives.

Researcher positionality

Peshkin (1988) emphasises the importance of the qualitative researcher's positionality, a way in which qualitative researchers treat their understanding of knowing, epistemology, as a strength in grounding their ability to interpret the data.

The first author of this paper, Audrey Boklage, approached this research from the perspective of a STEM educator. She spent seven years teaching high school science and had experienced her own road of trials towards creating a student-centred classroom. She approached this research with an understanding of the challenges of changing pedagogy in environments often resistant to change and, because of her background, she found that she related well to the participants during the interviews.

The second author, Brooke Coley, has a bioengineering background and has recently transitioned into being a faculty member and an engineering education researcher. During the data collection phase of this study, Brooke was in a postdoctoral position applying to faculty positions in engineering. Interviewing these participants served as a form of mentorship, guidance and encouragement regarding how to embrace student-centred teaching strategies. Through these stories, she believed others would also value and learn from these faculty and similarly be inspired for change, even knowing the process would be challenging. The participants in this study made it seem worth the investment of self and resources. Her interest in these faculty stories influenced her follow-up and

probing questions during the interviews, likely influenced the stories that she constructed based on these interviews, and influenced her interpretations of these narratives.

The third author, Nadia Kellam, has a background in mechanical engineering and has been a faculty member who conducts engineering education research for over 10 years. She believes in the power of stories and, in this work, is interested in learning from the success stories of faculty who have transitioned their teaching practices. She understands that the lived experiences of faculty are complex and nuanced and is interested in bringing stories of these faculty to light to, hopefully, help empower other faculty to make changes in their teaching. While this interest motivated her initial interest in this project, Nadia's background influenced the research design, including the interview protocol, the theoretical framework, the choice to use narrative research methods in this study, and the approach to understanding faculty change through studying successful stories of change.

Limitations

This study contains limitations that should be recognised. In our case, the focus on each participant's lived experiences, thoughts, feelings, beliefs, and values necessitated the need for an in-depth exploration through the use of qualitative methods (Marshall and Rossman 2006). However, the findings of this study are purposefully limited by the context of each participant and respective institution(s) and therefore, the results should not be generalised to other individuals or institutions (Firestone 1993) without careful consideration of the individual and context. While these results are not generalisable to all faculty (and that was never the goal of this research), there are lessons that can be learned through these stories that could lead to insights when either attempting to change one's own teaching strategies or when encouraging others to embark on changes (Maxwell 2013). Additionally, each researcher's perspective was acknowledged through positionality statements and constructed narratives were conferred with members of the research team to ensure the credibility (Lincoln and Guba 1985) and sincerity (Tracey 2010) of the data.

Results

We chose three faculty's narratives to illustrate pathways of faculty incorporating student-centred pedagogy in their classrooms as well as their strategies for implementing this pedagogical change. These findings will first focus on Dewey's principle of continuity and conclude with a discussion of the principle of interaction. The findings will also highlight the structural analysis that was conducted using Joseph Campbell's monomyth. Each participant's story was unique and did not necessarily use all of the codes from Campbell's monomythic journey. Aside from highlighting the contextual and individual factors that contributed to the successful transitioning of faculty to student-centred teaching strategies, these findings also inform an analytic construction of a theory of change (Henderson, Beach, and Finkelstein 2011) towards student-centred pedagogy. We are using the names of the participants in this section as these are their stories and the participants gave consent to use their names in dissemination efforts.

Case 1: Donna Riley

Dr. Donna Riley was a Professor of Engineering Education and Science and Technology in Society at Virginia Tech at the time of the interview. Her journey to adopting student-centred pedagogies evolved over a '10-year period of experimentation' with her thermodynamics course.

As an undergraduate, Donna described her professor norm in engineering as the 'Cambridge and Oxford educated' that lectured and presented notes fostering very little engagement for the students. Their pedagogies forced students to have to work together to gain an understanding of the material beyond information presented during lectures. The outlier in this group consisted of a

professor that used transparencies projected onto a screen rather than the typical chalkboard approach. However, in her other courses, those in the humanities and social science, Donna had a very different experience. Particularly, the professor of her Religious Studies course would engage students in critical conversations related to readings and reflections that would create a space where everyone felt connected. Donna recalled, 'What always surprised me was that I felt like I belonged in the room.' This level of engagement stimulated her interest in the subject despite it being a challenge for her. For example, she did not read ancient Greek, and had not taken the suggested prerequisites for the course, but she still felt a sense of belonging in the class based solely on the professor's facilitation. This triggered her to start thinking critically about the way engineering was taught and why similar approaches had not been adopted in such environments. She explained,

I became curious, about that time, about why engineering couldn't be taught in the same way that my religion classes were being taught. I didn't really get to pursue that question, [it] just rested in the back of my mind for a while.

Donna's experiences prompted her to enter the Ph.D. programme in the Centre for Teaching and Learning at Carnegie Mellon where she could focus on teaching as a part of a community in engineering who were also interested in such topics. Having had such engaging learning experiences in other studies compared to engineering served to be Donna's *Call to Adventure*. Early on in her graduate education, she established a desire to challenge the existing approaches to teaching engineering in hopes of developing pedagogical innovations. The first test of her journey occurred when she received her first faculty appointment at Smith College.

Smith College is a women's, liberal arts college. After teaching a team-taught Introduction to Engineering class in the fall semester, Donna's first solo taught course was Thermodynamics the following spring semester. It was the first time everything was up to her – the syllabus, curriculum, and deliverables. As a new faculty member and first time independently teaching a course, she was noticing familiar outcomes of her teaching despite being more proactive and engaging. This was the *First Threshold* and she recalled it in this way,

I noticed that I was repeating some of the very same problematic relationships that existed in my prior experience with Thermodynamics. This was true even though I wasn't doing this passive lecture thing. I was doing active learning. I was doing the stuff I was taught to do, but I could tell there were students in front of the class that were engaged, and the students in the back of the class weren't engaged. I could just see it all unfolding in those same ways that I had been taught.

In efforts to understand how she could further improve her teaching, she reached out to a trusted colleague for advice. Her colleague served to provide one of what would become several sources of *Supernatural Aid* along her journey. This colleague recommended a particular text, *Teaching to Transgress* by bell hooks (1994), that enlightened Donna's understanding of classroom dynamics and would ultimately prove to be a critical input into the unfolding of her journey. Upon reading the book, Donna experienced a shift in how she perceived the dynamics of her classroom. It gave her a deeper understanding of the knowledge that her Religious Studies professor had held regarding power relationships in the classroom and viewing students in a holistic way. *Teaching to Transgress* provided knowledge regarding valuing the authority of experience as well as what students bring into the classroom. These elements had been integrated into her Religious Studies course, but had been lacking in her engineering related courses.

Donna continued to innovate the Thermodynamics course, but she wanted to secure a sustainable source of funding to support her research. She entered the *Belly of the Whale* phase of her journey when she found there was no home for her interdisciplinary research at the National Science Foundation (NSF). Her Ph.D. had been received in Engineering and Public Policy and her research was interdisciplinary. Her specific work was in the areas of risk-assessment and risk-communication. As a proactive faculty member, she routinely went to NSF to meet with Programme Officers to discuss funding opportunities. She was especially interested in applying for a grant in the faculty

early career development programme, CAREER, as it was expected that she apply to this programme as an early career faculty member at Smith College. The Programme Officers in Environmental Engineering, and Social, Behavioural, and Economic Sciences informed Donna that there was no fit for her research in either of their Directorates. She was encouraged not to waste her time writing a CAREER award around her research interests.

This upset Donna because it left her uncertain of how to proceed. She was expected to apply for a CAREER award prior to applying for tenure, but here she was being told that her research had no place in the competition. As *Supernatural Aid* would have it, Donna serendipitously encountered an Engineering Education colleague who was known to be a mentor to everyone, while in the faculty office of another colleague at Smith, a few months after receiving the discouraging news. When asked how she was doing she shared her frustration with the news she had received. Unbeknownst to her, the mentor described a unique opportunity for her to apply her pedagogy-related research for a CAREER award in Engineering Education, which was a new venue for similar work at the time. Donna remembered the time crunch and fulfilment of that exchange, 'I had two weeks to write the thing. I wrote it. I submitted it. It wasn't the best grant proposal ever written, but they funded it.' Although she described funding it as a potential risk for the NSF Programme Officer, through this award, Donna now had a five-year funded research project to explore what it would mean to adopt bell hooks-like pedagogies in Engineering Education.

This was a turning point in Donna's journey. She would face several challenges on the *Road of Trials*, such as receiving push back from the students and other faculty or challenging critical assumptions in the classroom. Nonetheless, she continued to make modifications to her teaching to create a critical and reflective way of thinking among her students. Donna exceeded a desire to simply engage students in the classroom; she was attempting to create a transformational change in the way things were done and the degree of development that it fostered for the students. She experienced *Apotheosis* after enduring the 10-year experiment with Thermodynamics at Smith College. She describes her sentiment,

Some of it certainly was that I did grow frustrated with the amount of push back I was getting at Smith College having gone there to be a change-maker and getting to a place where people didn't really understand what I was doing. The students didn't, my colleagues didn't. While I had a great cadre of folks that I could start to step up with, it became, I started thinking more about the bigger picture of what was I doing in the field of Engineering Education and how I could have an impact outside of my institution. As the Smith College experiment wore on, people paid less and less attention to what was going on there, and kept saying 'Well, you can do that because you're at Smith College. You're a special case.' Doing something at Virginia Tech would obviously directly impact a large number of engineers right away, and have more influence in the rest of the enterprise of Engineering Education, so that made the move make a lot of sense.

After serving in the policy domain at the NSF as Programme Officer in Engineering Education, Donna transitioned back to Academia and became a *master of both worlds* at Virginia Tech, where she aspired to have a more widespread influence on the enterprise of Engineering Education. She continues to innovate new pedagogies for transforming the realm of Engineering Education from several vantage points. Her current work involves iterative development and delivery of a course for non-Engineering majors on Citizen Engineering. This course explores the meanings of engineering in society and how members of the public can influence large engineering projects as well as undertake their own engineering projects in their communities, redefining what engineering can and should be.

Case 2: Charles Pierce

Dr. Charles Pierce is an Associate Professor of Civil and Environmental Engineering at the University of South Carolina. Charles's father was a Civil Engineer and is also who he credits with his early exposure to the professional practice of engineering, 'I had a pretty good idea I wanted to go into engineering from high school into college ... I was well aware of what my dad did and I seemed to have those interests.' It was not until after his undergraduate experience that Charles experienced the first

step of his journey, *the Call to Adventure*, earning a PhD with the purpose of eventually teaching engineering. At this point in his life he had a 'better sense' of what a PhD entailed and recognised that although he was a good researcher, he felt his true strength was in teaching.

I was intrigued by the idea of getting a PhD. This is what's most important, because at that point, I now had a better sense of what a PhD was which I don't think I did as an undergraduate and could see what I could do with it which was to go into academia. I enjoy doing research, but never thought that was my strength, I really did like teaching.

After teaching a variety of Civil Engineering courses during graduate school and eventually as a professor, Charles's *Call to Adventure* evolved from teaching with a teacher-centred approach to a more student-centred approach, mentoring and 'help[ing] students in this whole process of being an engineering student' and to use their engineering education to accomplish their dreams.

As a result of embarking on the journey of purposeful, student-centred teaching, Charles encountered the *Road of Trials* along the way. Many of his trials were related to his determination to teach in a way that engaged students with the materials and forced them to think critically. In his interview, he reflected on his experiences as an engineering student and the challenges he faced with regard to being engaged in his courses. He expressed fond remembrance for instructors and courses that were 'engaging and entertaining'. Ultimately this served as a motivation for him to make his classes engaging for his students.

Charles shared an anecdote about his efforts early in his teaching career to compile notes for his lecture, something he spent a significant amount of time on; however, once he began teaching he realised that good teaching was not about covering all the content, but rather about students truly understanding the concepts of the course.

I remember assembling just this beautiful, what I thought was a beautiful set of notes where I extracted information from here and from there. I was learning too, so that was very useful for me, but then I realized I just had all these great notes that were just too much, and so I started trimming ... I very quickly realized that I can't cover everything I have in these notes. I just can't do it ... I do feel like much of what I cut was that extra stuff I had gone to find that I felt was very important, but I guess maybe as I developed, I considered, 'Yeah, I can leave that off, that's okay.' I also think part of that was I came to realize that I wanted students to know everything. I wanted to be that good professor that taught them everything.

Realising the importance of conceptual understanding rather than covering everything as part of his student-centred pedagogy was Charles's *Ultimate Boone*. Throughout his interview he referenced the importance of 'students understand[ing] the most basic principles' and 'critical thinking.' He credits teaching students in their first year of engineering courses with forcing him to focus on fundamental understanding of principles. 'Trying to introduce to them what Civil Engineering is' was of utmost importance to Charles.

As a result of his trials and realisation of his *Ultimate Boone*, Charles decided to permanently change his teaching towards an active-learning student approach, his *Apotheosis*. He realised that worksheets and grading answers as either right or wrong did not contribute towards his vision of student learning. Charles became more focused on the process of how students learned and grasped a concept. This encouragement of students to work towards finding the correct answer and explaining their thinking became a core tenet of his classes, a process he described as 'active learning, worksheets to document, [and] in-class problem solving.'

As Charles's journey culminated, he experienced the sense of being a *master of both worlds and freedom to live* as a professor who is still focused on prioritising and encouraging student's conceptual understanding of engineering in his classroom while inspiring others in their teaching endeavours. He credits earning tenure with allowing him this freedom to write grants and collaborate with other faculty members to implement innovative pedagogies, such as a flipped classroom, in engineering courses at his university.

That makes a huge difference for me personally to know that there's a decent sized group of faculty that I brought into writing these kinds of proposals, to doing this kind of work, to knowing that it has meaning and potential impact.

Case 3: Fernanda Leite

Dr. Fernanda Leite is an Associate Professor in the Department of Civil, Architectural and Environmental Engineering at University of Texas at Austin. Her first exposure to teaching was during her undergraduate experience in Brazil. There she taught English as a foreign language in an after-school programme and, ‘fell in love with teaching.’ It was at that point that she ‘knew she wanted to teach, but didn’t want to be an English teacher in an after-school programme as a full time career.’ Her father was an Agricultural Engineering Professor in Brazil and later in the United States and through this experience she ‘knew what it was like to live the academic life from the observation of [her] father.’ Fernanda credits her grandfather for her knowledge and eventual passion for the construction industry, as he was a commercial and residential developer in Brazil. Through her father and grandfather Fernanda was able to ‘put all these little pieces together’ and recognise her *Call to Adventure* to become an engineering professor. She credits teaching with ‘igniting’ her passion.

Aside from providing her with the academic lifestyle as a child, Fernanda’s father served as *Supernatural Aid* in guiding her towards setting her goals of combining her passions for the teaching and the construction industry. She openly credits her father’s guidance in her decision to pursue advanced degrees, ‘My father really helped me shape of how I got there. That’s where I traced out my plan of what do I need to be this person, in terms of getting the right degrees.’ During her Master’s programme in Brazil, Fernanda continued in the *Call to Adventure* stage when a professor from Carnegie Mellon University in the United States taught a short course in the summer. The professor invited her and her husband to pursue their PhDs at Carnegie Mellon University. During her time as a PhD student, she served as a teaching assistant and was frustrated by her lack of freedom in deciding what to teach, thus entering the *First Threshold*,

I was supposed to teach the lab, and teach them how to press the buttons. That just frustrated me. But you only had one hour a week, and it was not connected to the lecture slides. You really couldn’t do a lot more than that anyway. That’s the first thing that I said, ‘If I’m going to do this, I’m going to do it right, the way that I really believe how this should be done.’

After earning her PhD, Fernanda began her job at the University of Texas at Austin. Fernanda’s strong vision for her connected teaching translated quickly to her classroom practice. She had strong relationships with the construction industry and engineering firms in and around Austin, Texas and frequently incorporated guest speakers and real world problems in her classroom. Although she acknowledged that the work required extra effort on the part of the instructors, she recognised the contributions of support staff in assisting her pedagogy.

Aside from her pedagogy, Fernanda recognised the importance of research in her career as well. She did not view research and pedagogy as separate.

I’m just one person. I can’t separate my teaching person from my research person. I’m one person. My experiences are all combined experiences. That’s what’s important. I have to put in the same dedication that I do for teaching in research. That’s the only way to keep teaching cutting edge as well. Especially teaching something that’s technology oriented ... You really, really have to be connected to research to keep students engaged, and what’s the most innovative piece of it? Keep them ahead of the curve ... Just always maintaining the connection between research and teaching.

This drive to stay current was a *trial* for Fernanda; however, she recognised its importance and overcame this challenge in order to maintain her student-centred pedagogy. She found these challenges ‘stimulating’ and recognised the need to change.

In addition to these challenges, Fernanda sought out opportunities to continue learning, even topics for which she was a novice. Through her learning process she discovered ways to structure her class in a way that was engaging for her students. For example, rather than relying solely on lecture for teaching, she incorporated hands-on learning experiences.

Like others in this research, Fernanda’s *Ultimate Boone* was successfully adopting student-centred pedagogy. However, her ideal *Ultimate Boone* for the future, was for her class not to exist.

My hope is that a class like the one I teach, the BIM [Building Information Modeling] class, is not going to be needed in the future, because it's just going to be industry practice. That's what I tell my students. My ultimate goal, my dream, is that I'm not going to be teaching this class in 10 years, because this is just industry practice, there's not going to be a need.

Always ambitious, Fernanda exhibits both the *Freedom to Live and Master of Two Worlds*. She recognised this privilege and her identity as a professor focused on teaching and research,

I have my niche, which is I'm very much connected to industry, even from my research as well. My department supports me. I can be productive, and can build these connections

Discussion

This study applied Dewey's Theory of Experience to understand the journeys of faculty as they made transitions to incorporating student-centred pedagogies in their teaching using the structure of Campbell's Hero's Journey. As explained in Dewey's framework, all three participants experienced change that was largely impacted by the interaction between the individual and their institutional environment as they navigated a path well aligned with the progressive stages of the Hero's Journey.

The three participants all felt the motivation and interest to change the traditional, institutionalised practices and incorporate student-centred pedagogy, which was coded as their *Call to Adventure*. Interestingly, although Donna, Charles, and Fernanda were striving to answer a similar *Call to Adventure*, their overarching pedagogical goals or *Ultimate Boones* were different. Specifically, Donna wanted to transform the realm of Engineering Education; Charles wanted to promote conceptual understanding for his students; and Fernanda wanted to keep her students engaged through sharing her research and current innovations in the field.

The path to student-centred pedagogy was not necessarily simple and straightforward for these participants and they each encountered *trials* or barriers, which is often the case for individuals attempting to change the status quo of their pedagogy. Innovation at the level of higher education institutions requires certain internal, or endogenous, characteristics of individuals to institute change (Hasanefendic et al. 2017). One of these characteristics, strategic use of social networks was an important part of all three participants' journeys. In the case of Donna, her social networks manifested in the form of *Supernatural Aid*. She had significant encounters with colleagues that influenced the path of her journey and helped her challenge the status quo of engineering pedagogy. Charles's social networks included faculty members he could collaborate with on innovative pedagogies as a result of grant funding. Finally, Fernanda's social networks included individuals from industry whose experience she integrated into her classroom case studies. These social networks resulted from the participants' experiences in different settings, sometimes external to the current institute in which they were trying to implement change. These field experiences aided their vision and implementation of pedagogical change. For example, Donna's experience as an undergraduate exposed her to a different type of pedagogy she looked to incorporate in her teaching as a professor, while both Charles and Fernanda's graduate school experiences influenced their desire to adopt a student-centred pedagogy.

The Belly of the Whale for Donna and Charles differed as well and highlighted Dewey's interaction between the individual and their environment. Donna's *Belly of the Whale* stage involved external forces that held influence over her ability to develop a research programme to support her learning of how to create and implement innovative pedagogies. Charles's *Belly of the Whale* stage involved internal tensions between his perception and practice of teaching.

Each participant experienced the *Master of Two Worlds* phase of the hero's journey as they successfully embraced active learning strategies and were exemplary faculty members. It is important to note that Donna, Charles, and Fernanda, in their duality, each sustained commitment towards their *Call to Adventure* and *Ultimate Boones*. In both Donna and Charles's cases, they were able to focus on their pedagogy in conjunction with externally funded research projects, a contributing factor (Fairweather 2002) to their mastering both the research and teaching missions of Academia. While Fernanda, on

the other hand, credits her social networks in industry as a way to support her research and pedagogy.

The Hero's Journey was effective in capturing the evolution of these faculty as they strived to accomplish what they had envisioned with their specific student populations. Critical to the process is having a faculty member willing to invest in the process of adopting innovative pedagogy in their classes. Each of the faculty in this study described their impetus for doing so and endured the road of trials involved to see their vision through. Each faculty also acknowledged the criticality of having a community of support, or faculty learning community, whether it be like-minded colleagues or administrative buy-in, where a culture that values the student-centred approach to learning is developed over time. Through these strategies, the ambiguity of the change process is minimised, the community of faculty is strengthened and more faculty are drawn in as individuals begin their own journeys to transform their teaching practices.

Implications

This study yields insight into the larger social systems that should be considered as faculty take the initiative to adopt alternative pedagogies and a change strategy in their institutions. Specifically, the barriers (i.e. *trials* in the hero's journey) experienced on the journey seem to be correlated with the degree of disruption of the innovation. When analysing these constructed narratives, in the corpus of the entire set of narratives, the degree of disruption emerged as salient in understanding faculty change. Future work could look more explicitly at the degree of disruption and how that impacts faculty adoption of new pedagogy and the acceptance of the pedagogy with others in the broader context. Donna's vision was to transform a way of doing by incorporating the value of students' experiences into the classroom and viewing them in a holistic way, an atypical approach for most engineering courses. This effort was met with greater push back from the surrounding community of other faculty and colleagues because it challenged an accepted norm. As much as colleagues were a challenge to her, certain colleagues at key points in her career helped spur her journey towards transforming Engineering Education. Charles had a more local vision, involving optimisation of students' conceptual understanding of the material through fostered engagement in the course. The barriers in achieving this vision rested internally to the actual faculty member and his classroom. Fernanda's vision for her pedagogy was one of empowerment for her students and integrating their knowledge in the real world. Her largest barrier was resources in the form of human capital and time. Like Charles, Fernanda's largest barrier was internal rather than external (the institution). This work suggests a correlation between the degree of change envisioned through the student-centred approach and the resulting resistance of the external institutional context. For faculty wishing to make changes in their teaching, having a clear vision of the impact they want their innovations to have can better prepare them for the types and scales of barriers they will face on their journeys.

Another implication of this work is the paramount importance of having a community of support, or social networks, to implement this vision (these primarily appeared in the *supernatural aid, meeting with the all knower*, and *atonement with parent* structures within the monomyth). The three faculty cases in this work shared the sentiment that the presence of people encouraging their ideas made all of the difference in their decision to pursue their individual goals. True impact came from a social network with the mindset to create change rather than just one person in a silo trying to make a difference. This could have implications for managers of academics (e.g. department heads or deans), in their initiatives to encourage faculty to make changes to their teaching practices. These initiatives could involve developing local social networks and communities of faculty who can support one another in their initiatives to change their teaching practices.

All faculty members were able to become a *Master of Two Worlds* of academia in their research and pedagogy as they achieved a student-centred classroom. The three participants in this study would not have been able to challenge the engineering academic norm without the authority to act and implement this change. Receiving tenure, grant funding and social

network supports were key components in the participants ultimate success of their pedagogical innovations. It is important to also note that we do not mean to imply that the faculty in these narratives are at the end of their journey, simply that they reached a level of mastery in their journeys at the time that they were interviewed. It is likely that they are all continuously making changes to their teaching practices as they continue in their academic careers, in other words, their journeys are continuously evolving.

In all three journeys, the impetus for change was an internal desire of the participants. Henderson, Beach, and Finkelstein (2011) recognise this process of pedagogical reflection and decision to change classroom pedagogy as a successful characteristic of facilitating change. It could be helpful for us to consider ways of encouraging individual engineering faculty to embark on their own journeys of change. At an institutional level, institutional barriers can be removed and incentives can be put into place to create an environment conducive to individual change within engineering classrooms.

For the engineering educator who is interested in improving their teaching and learning, we hope this paper serves as an inspiration to embark on a journey to make a change to your teaching practices. Moreover, we hope that as you face difficulties when changing your teaching practices (e.g. your *road of trials*), that you remember that making changes such as this are not straightforward and often involve many difficulties along the way, as was exemplified in these faculty narratives. As was shown with the three narratives in this paper, changing your teaching from the status quo can be a difficult goal, but can payoff through increasing student learning and helping you obtain more meaning from your role as a teacher.

Conclusion

This article is a first attempt at using the Hero's Journey to better understand change towards student-centred pedagogy of engineering faculty members. Implementing change represents a challenge within academia as individuals must navigate both systemic and individual factors. Although the paths of these faculty were distinct, they each demonstrated continuity and growth in their journeys while structurally aligning to the Hero's Journey. Even though each participant did not experience every stage of the Hero's Journey, it served well as a structural model and in its applicability across a range of faculty journeys. These journeys illuminated pedagogical change as an individual and personal process that may align with or have misalignment with the department and institution's conceptions of change and innovation. This individual process first relies on an endogenous characteristic (desire to change their pedagogy) as a result of previous experiences both in and out of academia (Hasanefendic et al. 2017). These participants used this motivation in conjunction with their social networks and authority to act to implement a student-centred pedagogy in their classrooms.

Acknowledgement

We wish to thank our fellow research team members, Joachim Walther, Stephan Durham, Sandy Bird, and Kathleen DeMarrais at the University of Georgia for support during the early stages of this project, the participants of this research project who shared their stories, and the reviewers of this manuscript for their support and thoughtful suggestions.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the National Science Foundation under grant numbers 1329300 and 1542531.

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