Beyond the Interpretive: Finding Meaning in Qualitative Data

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Abstract

This theory paper compares two different qualitative analysis techniques for the same data: interpretive thematic analysis and deconstructive analysis. Recently qualitative methodologists have called for a move away from coding to what they call "post-qualitative" analysis and "thinking with theory". They argue that because interpretive coding is conducted without regard to theory and breaks the data into small pieces, it is inherently reductive, leading to a superficial and self-evident set of themes. In contrast, post-qualitative analysis begins by interpreting data in light of theory, resulting in deep interpretation. The analysis in this paper uses a single interview from a larger study on diversity and inclusion in engineering. The most striking difference in the two analyses is the tone. Thematic analysis results in a somewhat distant tone, treating the participant's views as received knowledge. The deconstructive analysis is richer in interpretation. Engineering education research would benefit from the deeper meanings obtained through post-qualitative analysis.

Introduction

Qualitative research has become increasingly used in engineering education over the last 15 years as evidenced by an increasing number of empirical papers that use qualitative methods and publication of various method and theory papers (Baillie & Douglas, 2014; Beddoes, 2013; Borrego, Douglas, & Amelink, 2009; Douglas, Koro-Ljungberg, & Borrego, 2010; Jordan, Adams, Pawley, & Radcliffe, 2009; Kellam, Boklage, & Coley, 2016; Koro-Ljungberg & Douglas, 2008; Walther, 2014; Walther, Sochacka, & Kellam, 2013). There are dangers, however, that as qualitative research becomes more common the ways in which it is used fail to reflect quality approaches. One early work critiqued inconsistencies between espoused and practiced epistemologies in qualitative papers (Koro-Ljungberg & Douglas, 2008). Other authors have critiqued interpretive methods, such as thematic analysis, for resulting in superficial descriptions of phenomena that do not provide meaningful insight (Jackson & Mazzei, 2012; St. Pierre, 2000; St. Pierre & Jackson, 2014) Another concern is that the qualitative approaches described in papers and textbooks can become seen as checklists that must be followed, rather than guidance that allows flexibility and adaptation of methods. One of the strengths of qualitative research is that methodologies and methods can be revised and adapted to fit a particular study, and even modified during a study when initial analysis shows that the methods chosen are not congruent with the collected data and research questions (for an example see Sochacka, Walther, Wilson, and Brewer, 2014).

Historically, interpretivist approaches were developed in contrast to positivist quantitative analyses. The intent was to understand the contextual factors that underlie phenomena and to understand how people make meaning from their experiences. While initially the "paradigm wars" placed interpretive qualitative analysis and positivist quantitative analysis in opposition to each other, there is now greater recognition that each approach has its own strengths and weaknesses, and that different approaches are needed for answering different kinds of questions(Baillie & Douglas, 2014). Mixed methods are becoming more common as a means to integrate the two approaches (Borrego et al., 2009).

Recently, some qualitative methodologists have pushed back on interpretive methods, arguing that they share important similarities with a positivist epistemology (Jackson & Mazzei, 2012; St. Pierre, 2000; St. Pierre & Jackson, 2014; also see volume 20, issue 6 (2014) of Qualitative Inquiry which was a special issue on qualitative analysis "post-coding"). For one, both positivist and interpretivist epistemologies call for removal of the researcher from the analysis process. In the positivist paradigm, researchers are supposed to be neutral because analysis is a search for Truth. Careful attention to interrater reliability is intended to ensure that researcher bias is not introduced. In interpretivist research, analysis is supposed to be done without reference to *a priori* theory, and researchers are advised to "bracket" their prior experiences such that the "voices of the participants" can be heard.

Another similarity is the fragmenting of data into small elements. In quantitative research numbers are used to represent the phenomena of interest. In interpretive qualitative research coding is used to fragment and reorganize data in order to identify themes that, while perhaps contextualized in the research setting, are decontextualized with regard to an individual's experience.

As a result of these two characteristics, interpretive analysis can lead to a fragmented, decontextualized, superficial explanation of the phenomena being studied. Themes are often self-evident and do not provide a deep, meaningful interpretation. As an alternate approach, authors have described "post-qualitative" analysis as "thinking with theory" (Jackson & Mazzei, 2012; St. Pierre, 2000; St. Pierre & Jackson, 2014). The data is read through the lens of a particular theory such that meaning is interpreted simultaneously with analysis. To demonstrate the benefits of such an approach, I analyzed qualitative data using both traditional interpretive coding and post-qualitative analysis. Data came from a single interview transcript obtained as part of a project on faculty attitudes on diversity and inclusion. I used only a single interview because the intent of this paper is not to reach conclusions about faculty attitudes, but to illustrate the different results obtained from the two analyses. No claim is made that the analysis in this paper represents a complete analysis of faculty attitudes. Rather, comparison of the two analyses will show how deeper meaning can be obtained through a post-qualitative analysis

Epistemological Commitments

Thematic Analysis

Constructivism describes knowledge as being created through interactions of individuals with the world (Crotty, 2003). There is no meaning outside of a person's perception. We construct our understanding of the world through our own realities: "*[K]nowledge* refers to conceptual structures that epistemic agents, given the range of present experience within their tradition of thought and language, consider *viable*" (Von Glasersfeld, 1989, p. 124; italics in original). Thus, knowledge is contextual, contingent, and subject to interpretation. Constructivism informs the thematic analysis of this study by considering the statements of the research participant to be their own construction of what diversity means and how it impacts education. During the analysis I made efforts to ensure the authentic voice of the participant.

Constructivism also has implications for data analysis and interpretation. Von Glaserfeld (1989) points out that the physical aspects of communication (sounds, letters on a page) do not themselves contain meaning. Rather, they are symbols that trigger interpretations in the listener's or reader's mind. The implications for data analysis are provided by Charmaz, (2006) who states that,

We may think our codes capture the empirical reality. Yet it is our *view: we choose the words that constitute our codes. Thus we define what we see as significant in the data and describe what we think is happening (p.47, emphasis in original).*

Deconstructive Analysis

The deconstructive approach of Derrida is a process of critically interrogating meaning and how it is produced (Caputo, 1997; Derrida, 1976; Jackson & Mazzei, 2012). Deconstruction acts to reconsider what is taken for granted. It "is not about tearing down but about rebuilding ; it is not about pointing out an error but about looking at how a structure has been constructed, what holds it together, and what it produces. It is not a destructive, negative, or nihilistic practice, but an affirmative one" (St. Pierre, 2000, p. 482). Deconstruction can be applied to both language and larger institutional structures, and I use it both ways in my analysis. Deconstruction makes evident that language does not have intrinsic meaning. Language is used to construct ideas. "We have constructed the world as it is through language and cultural practice, and we can also deconstruct and reconstruct it" (St. Pierre, 2000, p. 482). Deconstruction discloses the way we have constructed the world and questions that construction.

Some of the analytic cues that are used for a deconstructive analysis are (Jackson & Mazzei, 2012, p. 17-19):

- Signifier/signified: Signifiers are the words and symbols used to designate something, which is the signified. The relationships between signifiers and signified are constructed through a mutual interaction. Signifiers are constructed to correspond to the signified, but the signified itself is constructed through the way we use the signifiers.
- Absent presence/trace: The absent presence is that which has been left unsaid but which is still present through the way it impacts meaning. The trace is "the absent presence of imprints on our words and their meanings before we speak or write them" (Jackson & Mazzei, 2012, p. 19).
- Erasure: Erasure is the process of troubling signifiers to reveal what they hide. Erasure results in an opening of meaning that questions how signifiers are used while at the same time maintains the necessity of using them.
- Différance: Différance results from the absent presence. It is the contradictions in the signifier that make it troubled, but which are continually deferred. Through différance the signifier contains both the exposed and the absent presence.

Methodology

Source of Data

Data for this paper came from a single interview that is part of a larger study on faculty and administrator attitudes towards diversity. I interviewed faculty and administrators at a

single university prior to attending a diversity training workshop. Semi-structured interviews took place either in person in their offices or over Skype. The interviews were intended to understand their views on diversity and inclusion. The interview guide included questions such as "What does diversity mean to you?", "Provide an example of when you had to deal with an issue related to diversity, inclusion, or social justice," and "How would you characterize the climate in your department for racial minorities? For LGBTQ individuals?" All participants signed an IRB-approved consent form before the interview. Interviews were audio-recorded and transcribed verbatim. The interview analyzed in this paper was from an administrator.

Thematic Analysis

I conducted thematic analysis using standard coding and the constant comparison method. Coding was conducted in three stages. During initial coding I created labels to identify the meaning of each segment of the transcript. As recommended by Charmaz (2006) these codes mostly began with a gerund (e.g. avoiding, creating) to emphasize the action that was occurring. As is common in interpretive research I created the codes without reference to previous codes in order to identify the meaning of each data segment. The coded data segments ranged from 5 to 194 words in length. A total of 87 codes initial codes were created. I then grouped initial codes into focused codes, and then combined focused codes into themes. Throughout this process I compared codes at different levels to other codes and the original data. I continually regrouped and rearranged codes until a consistent set of codes and themes emerged. Throughout this process I attempted to set aside any preconceived notions in order to allow the meaning to be developed from the words of the interviewee, consistent with interpretive research practices.

Deconstructive Analysis

Deconstructive analysis followed the approach described by Mazzei (2004). I read the transcript multiple times. As I read the transcripts I considered the following questions, connected to concepts in deconstruction:

- Signifier/signified: What words are used to represent things, and what are the things being represented?
- Absent present/trace: What is absent or left not signified? What has been ignored to maintain a self-contained and self-sufficient truth?
- Erasure: How is the signifier uncertain? In what ways it is inaccurate yet necessary?
- Différance: What are the contradictions in the use of the signifier that produce the trace?

I then compiled these annotations into a single document and wrote additional text to fully explicate connections, contradictions, and hidden meanings. I reviewed and revised this text multiple times until a consistent narrative was developed.

Analytic Findings

Thematic Analysis

Harvel (self-selected pseudonym) is an administrator in the college of engineering at the university where the study took place. Three themes emerged from his interview: being aware of diversity and inclusion issues; approaches to creating a more diverse and

inclusive college; and the impacts of not being diverse and inclusive. Each theme is discussed briefly below.

Being aware of diversity and inclusion issues

Harvel began the interview by discussing the importance of being aware of diversity. He primarily supported the need for diversity by pointing to literature showing that diverse teams are more creative than homogeneous teams. He felt that this was a "politically correct" way to make faculty aware of the importance of diversity. It was clear that he felt the need personally to learn more about issues occurring in his college. In fact, he was very surprised to hear that the students had concerns, stating that "it was kind of a shock to hear these students talk about feeling a little bit uncomfortable because I haven't personally seen it." He attributed this lack of awareness on his part to the diversity and openness of his own research group. He thought that perhaps other research groups were not as close-knit as his.

Despite the growing awareness of diversity and inclusion issues in the college of engineering, he recognized that change can be difficult. He noted that some departments, particularly electrical and mechanical engineering, have difficulty recruiting women. Overall, he attributed lack of change to inertia and tradition, stating that "people don't want to change."

Approaches to creating a more diverse and inclusive college

Harvel described five primary means he saw for the college of engineering to become more diverse and inclusive: administrative approaches, diversity in faculty hiring, increasing pipelines, supports for faculty, and supports for students. The administrative approach he discussed was creation of a diversity officer in the college, modeled after both industry and the existing safety officer position.

Most of the interview focused on diversity in faculty hiring, as might be expected from an administrator. Twenty five initial codes (out of 87 total initial codes) were related to this topic. Harvel described a number of issues and potential solutions for faculty hiring. One of his concerns was the lack of diversity in the pipeline for potential faculty hires. While he suggested that "we can go after very bright people and diversify with faculty at the same time", he also believed it would be difficult to hire diverse faculty while maintaining appropriate standards for new faculty hires. Throughout the interview he returned to this topic, stating for example,

…we need to be color blind and gender blind, at some stage. So for example you set your criteria for your search and you do your search and you pick people that exceed your criteria. And let's say you get to the final three, they're all equally valid candidates. They're all equally, you would just love to have any of them. At that point you would maybe take a peek at diversity.

The desire to pay careful attention to standards was largely driven by the college's plan to increase its ranking. Thus, "every hire has to actually, in some respects, move the needle in terms of ranking. So it's tough. It's tough to do that and keep an eye on diversity."

He did describe some solutions to this dilemma. One was simply working to get a critical mass, as the college did several years previously with a cluster hire of Black faculty. He also

proposed ways to increase the pipeline. For example, he has been considering creating a program whereby promising undergraduates from his college would be mentored to enter graduate school somewhere else and then have preferred consideration for later hiring. He also suggested a consortium model whereby schools would agree to hire each other's PhD graduates.

Harvel's discussion of the pipeline issue largely overlapped his specific comments about faculty hiring. He noted the need to increase the number of students going to graduate school, citing a statistic that 22% of the undergraduates in the engineering college are Hispanic, but only 5% of the graduate students. The suggestions he made for increasing the pipeline were the same as noted above for faculty.

The supports for faculty and students also overlapped. His focus for faculty was on training the faculty to support students. For example, he stated the need to develop resources for "helping faculty identify when a student looks like…they need some help." For students he expressed the desire to provide spaces for students to talk to people about issues they may be facing. One of his concerns was that students may think it shows some kind of weakness if they do seek support, saying,

Just not sucking it in. Actually saying it's okay if I go see Dr. [Smith]. It's okay if I go see Dr. [Jones]. It's okay if I go see Chairman [Doe]. So that's what I hope. Just putting the word out that we're here for you, we're here for the students

<u>Impacts of not being diverse and inclusive</u>

Harvels's discussion of the impacts of not being diverse and inclusive focused on how it is affecting students. He noted that there are a number of impacts on students, including isolation and emotional issues. He related the story of one female student in his department who was the only female in her class.

I had an undergraduate…female...working in my lab. And she came into her senior year and she was the only female…engineer in her senior class and she felt really isolated, you know. The guys kind of picked on her and things and she left. She went to [another department].

He also heard at a student meeting that events happening outside of school could have a significant impact on minority students in ways not recognized by others.

There was no discussion, there was no recognition from faculty or even student colleagues that hey, this is, you know, this is in the news and this is consuming me and emotionally I'm tied up and yet it's just another day at the office. And that really bothered a couple of the students.

Deconstructive Analysis

As was described above, Harvel's interview covered a number of different topics related to diversity and inclusion with the majority of the interview related to faculty hiring. Thus, I focus the description of the deconstructive analysis on that topic.

The following excerpt comes from a portion of the interview in which he is describing what happens after a meeting with students. The students asked for meeting to discuss diversity issues. Harvel was surprised that they wanted to talk about their desire for a more diverse faculty (as opposed to student body). He responded by talking about the limited number of

potential minority faculty in the pipeline. After the meeting he talked to one of the students individually.

A And then one student challenged me. Came up to me afterwards and said I got your point but I don't think, I think there's many potential candidates coming from historically Black universities. And that got me thinking. And that's true but how many of them have Ph.D. programs and would they be competitive being hired at [this university]. And then our bar is, I don't know if [this university] would hire me again (laughing). I mean seriously. Seriously. The bar is so high now, you know, we're looking for super stars right off the bat and I didn't tell this to the student but I'm thinking in the back of my mind, yeah, that's true but it's not an area or a pipeline as the student may think it would be.

Q But do you know that?

A I don't know that or not. You know, I'm just, no …

Q … So does that …

A … So we value a student from Michigan or Georgia Tech or Stanford …

Q … Right …

A … right? And those are not historically Black …

Q … No …

A … but if they produce you know, a Black or a Hispanic teacher ….

Q … But if you don't know that an HBCU does not produce such a student, why, I guess my question is why do you, why is the reaction the same? ….

A … Yeah, so was that an inherent bias on my part? Maybe. Because I just, I haven't explored that, that space yet.

Much of his discussion of recruiting focused on standards. Earlier in the interview he said about faculty searches,

…we need to be color blind and gender blind, at some stage. So for example you set your criteria for your search and you do your search and you pick people that exceed your criteria. And let's say you get to the final three, they're all equally valid candidates. They're all equally, you would just love to have any of them. At that point you would maybe take a peek at diversity.

We see here tensions in the desires to increase diversity and maintain the "standards" expected for new hires. At one point he said "we can go after very bright people and diversify with faculty at the same time," yet later he said "every hire has to actually, in some respects, move the needle in terms of ranking. So it's tough. It's tough to do that and keep an eye on diversity." From these statements I deconstructed his tensions between standards and diversity. He seems to be taking two opposing stances: 1) We can be race- and gender-blind because the educational system is a meritocracy. There is at least adequate opportunity for anyone to meet whatever standards are set. Diversity is not a major issue because you can "take a peek" at it at the end of the process; 2) There is no meritocracy. Meeting our standards and diversifying is "tough" because we can't hire from anywhere. Only those schools that have the same prestige as us (Michigan, Georgia Tech,

Stanford) are worth even considering. Although he recognizes that this statement does not have a basis in data he brushes off the concern by saying, "Maybe…I haven't explored that…space yet."

The absent presence in his discussion is what the standards are that drive faculty hires at this university and who has set those standards. His focus for who meets the standards are students at institutions such as Michigan, Georgia Tech, and Stanford, which he contrasted with HBCU students who do not meet the standards. Although he didn't identify specific standards, we can speculate that they include things such as attending a highly ranked school, having an advisor who is well-known in the field, presentations at prestigious conferences, and publication in prestigious journals.

Left unsaid are alternate standards. What other ways might we identify potential for success? In a previous paper I suggested that a Research Experience for Undergraduates summer program, which are highly competitive and typically require a grade point average (GPA) of greater than 3.2 (out of 4) to attend, could require that students have a GPA ***less*** than 3.0 (Douglas, 2015). This upper limit on GPAs would then force REU program directors to consider other ways to define students' potential. What if we did the same with faculty hires? What other "measures" might we develop?

Discussion

This section will discuss the differences in the analyses rather than the actual content of the interviews. The most striking difference in the analyses is their tone, which results from the different kinds of research questions appropriate for each approach. Thematic analysis would be used to answer a research question such as, "What do faculty and administrators believe are the key elements to diversity in academia?", while a deconstructive research question would be "What are the institutional and societal norms that impact faculty's and administrator's beliefs about diversity in academia?"

In keeping with the assumptions of interpretive qualitative research, the thematic analysis maintains a somewhat distant tone, reporting what Harvel said with little commentary. This approach is consistent with the desire in interpretive research to privilege the voice of the participants. As noted by Charmaz (2006) the voice of the researcher appears in the choices made as to how the data is coded. The resulting themes may not be exactly the same as those identified by another researcher, but the constant comparison process helps them to be internally consistent. Thus, there is a tension in interpretive research between maintaining the voice of the participant and interpreting what they are saying. As described by Charmaz (2006),

As we define our codes and perhaps later refine them, we try to understand participants' views and actions from their perspectives. These perspectives usually assume much more than what is immediately apparent (p. 47).

Nevertheless, the primary focus of the thematic analysis is on describing what Harvel believes.

The tone of the deconstructive analysis is very different. It moves deeper into the meaning of what he said. It is less concerned with describing diversity and inclusion from his perspective, and more with understanding what meanings lie beneath what he has said.

This is the role of deconstruction. It does not take Harvel's statements for granted, but queries what is not said (the absent presence) that creates the meaning behind his statements. There is clearly much more of my interpretation present compared to the thematic analysis. I would argue that the deconstructive analysis is richer and more meaningful precisely because it does not take his words at face value. Rather than simply describing what he said, it explains what his statements mean. Harvel is not aware of these meanings, and may actually reject them if provided the analysis for confirmation. This is one of the key features of deconstruction, understanding the contradictions and hidden meanings that are not visible.

Readers may respond that I have set up a straw man argument because I have left theory out of the thematic analysis. As one reviewer of the initial abstract for this paper asked, "Are not all research results, qualitative or quantitative, viewed through the lens of some…theoretical basis?" A fair question, because quality interpretive research does utilize theory to frame and give depth to the findings. The difference is in the way theory is used. In interpretive research theory is left to after the analysis. We are instructed to "bracket" what we know so that our analysis is not influenced by theory. In this way we can hear the authentic voices of our participants and then overlay theory on top of the analysis. In post-qualitative analysis the theory becomes part of the analysis. We do not hear the authentic voices of the participants because we do not intend to. We intend to understand what they say from a particular theoretical perspective in order to lay bare meaning in a particular way. Another way to think about it is the following: If I could conduct another interpretive analysis without regard to my previous analysis, I would expect to end up with similar codes and themes. If I conducted another post-qualitative analysis based on a different theory I would learn something completely new. Even applying a different theory to the interpretive analysis is limited in how much new insight can be gained, because the underlying analysis remains the same. Similarly, while inter-coder reliability may be a consideration in some forms of thematic analysis, inter-coder reliability has no meaning in deconstructive analysis because the analysis is conducted through the lens of my interpretation.

One particular limitation of this paper is that it is based on a single interview. However, I would argue that the distinction between the two approaches would be even greater with multiple participants. In that case the interpretive analysis would comingle the codes and themes from all the interviews, and each individual's voice would be lost. The post-qualitative analysis would maintain each participant as an individual, examining the different ways that each participant spoke in the context of the chosen theory (for an example see the various analyses in (Jackson & Mazzei, 2012)). The richness of the post-qualitative analysis would be enhanced, while the richness of the interpretive analysis would be reduced.

Conclusion

In this paper I have compared two different analyses of the same interview to show the limitations of interpretive qualitative research. Interpretive analysis results in an uncritical description of the participants' beliefs. Post-qualitative research results in a richer examination of what the participants' statements mean. Most engineering education researchers are now familiar with coding as an analysis technique and it is used frequently.

However, there is also an increasing use of it that results in shallow, self-evident, and ultimately not useful analyses. I encourage the engineering education research community to move towards post-qualitative analysis as a way to bring deeper insights to our work.

References

Baillie, C., & Douglas, E. P. (2014). Confusions and conventions: Qualitative research in engineering education. *Journal of Engineering Education, 103*(1), 1-7.

Beddoes, K. (2013). Feminist methodologies and engineering education research. *European Journal of Engineering Education, 38*(1), 107-118.

Borrego, M., Douglas, E. P., & Amelink, C. T. (2009). Quantitative, qualitative, and mixed methods research in engineering education. *Journal of Engineering Education, 98*(1), 53-66.

Caputo, J. D. (Ed.) (1997). *Deconstruction in a nutshell: A conversation with Jacques Derrida*. New York: Fordham University Press.

Charmaz, K. (2006). *Constructing grounded theory*. Thousand Oaks, CA: Sage Publications.

Crotty, M. (2003). *The foundations of social research*. Thousand Oaks, CA: Sage Publications.

Derrida, J. (1976). *Of grammatology*. Baltimore: Johns Hopkins University Press.

Douglas, E. P. (2015). Engineering as a space of white privilege. *Understanding & Dismantling Privilege, V*(1), 36-44.

Douglas, E. P., Koro-Ljungberg, M., & Borrego, M. (2010). Challenges and promises of overcoming epistemological partiality: Advancing engineering education through diverse ways of knowing. *European Journal of Engineering Education, 35*(3), 247-257.

Jackson, A. Y., & Mazzei, L. A. (2012). *Thinking with theory in qualitative research*. New York: Routledge.

Jordan, S., Adams, R., Pawley, A., & Radcliffe, D. (2009). *Work in progress - The affordances of photo elicitation as a research and pedagogical method.* Paper presented at the ASEE/IEEE Frontiers in Education Conference, San Antonio, TX.

Kellam, N., Boklage, A., & Coley, B. (2016). *A narrative inquiry approach to understand engineering students' identity formation*. Paper presented at the American Society for Engineering Education, New Orleans, LA.

Koro-Ljungberg, M., & Douglas, E. P. (2008). State of qualitative research in engineering education: Meta-analysis of JEE articles, 2005-2006. *Journal of Engineering Education, 97*, 163-175.

Mazzei, L. A. (2004). Silent listenings: Deconstructive practices in discourse-based research. *Educational Researcher, 33*(2), 26-34.

Sochacka, N. W., Walther, J., Wilson, J., & Brewer, M. (2014). *Stories 'told' about engineering in the media: Implications for attracting diverse groups to the profession*. Paper presented at the Frontiers in Education Conference, Madrid, Spain.

St. Pierre, E. A. (2000). Poststructural feminism in education: An overview. *Qualitative Studies in Education, 13*(5), 477-515.

St. Pierre, E. A., & Jackson, A. Y. (2014). Qualitative data analysis after coding. *Qualitative Inquiry, 20*(6), 715-719.

Von Glasersfeld, E. (1989). Cognition, construction of knowledge, and teaching. *Synthese, 80*(1), 121-140.

Walther, J. (2014). Understanding interpretive research through the lens of a cultural verfremdungseffekt. *Journal of Engineering Education, 103*(3), 450-462.
Walther, J., Sochacka, N. W., & Kellam, N. N. (2013). Quality in interpretive engineering education research: Reflections on an example study. *Journal of Engineering Education, 102*(4), 626-659.