

Using Ethnography to Enhance Elementary Teachers' Readiness to Teach Engineering

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Introduction

Each classroom has its own culture that is constructed through the actions and interactions of its members, usually teachers and students. The diversity of the teacher workforce in the USA, however, does not reflect the diversity of the student population, resulting in most American students coming from different backgrounds than their teachers [1]. When teachers do not understand the different backgrounds of their students, learning can be inhibited. As Delpit [2] explains, “We educators set out to teach, but how can we reach the worlds of others when we don't even know they exist?” (pg. 14).

One way educators can learn more about the cultures of their students is through the use of ethnographic observation methods [3,4]. Through studying the communities and homes of their students, teachers can identify local and familial funds of knowledge that students bring with them to the classroom [5,6]. Ethnographic methods can be of particular importance to pre-service teachers, who often enter their field placement classrooms without taking part in the weeks or months of initial classroom culture development [7]. Engaging in ethnographic methods can give pre-service teachers unique insight into the school community and those funds of knowledge that are so crucial to understanding their students' backgrounds. When working with pre-service teachers, Frank and Uy [8] found that those who engaged in ethnographic observations of their field placement sites were better able to view the classroom from an insider's perspective and were less likely to make assumptions about students and their classroom behaviors.

Project Overview

The overall goal of this three year project is to increase awareness and preparedness of rural and indigenous youth to pursue engineering and engineering-related careers. To reach this goal, we are working with elementary pre and in-service teachers in rural and reservation communities to use ethnographic methods to connect local funds of knowledge with classroom curriculum. More specifically, the first phase (current phase) is on training participating teachers, whereas the second phase will be on supporting their implementation of the engineering curricula. This paper describes the first summer professional development, which focused on two items: (1) training elementary teachers and pre-service teachers in ethnographic methods and photo journal elicitation, and (2) introducing teachers to different ways to integrate engineering instruction into their teaching.

Summer professional development (PD) was presented in a blended manner, consisting of asynchronous Google Classroom work and synchronous Webex meetings. The Google Classroom work included modules on ethnography and qualitative coding, as well modules on technical training on photo journaling and the engineering curriculum itself. During the ethnography module, teachers completed a book study of *Ethnographic Eyes: A Teacher's Guide to Classroom Observation*, by Carolyn Frank [7]. As part of the book study experience, participants were provided with prompts to elicit reflections over the book chapters, participated in a group discussion about the book, practiced ethnographic notetaking while watching videos

of elementary classrooms engaged in engineering activities, and completed a neighborhood walk of the community where they taught. It is important to note that this PD occurred during the first few months of the COVID-19 pandemic. Participants were only asked to engage in the neighborhood walk activity if they felt safe doing so. One of the participants completed the full neighborhood walk activity and one participant completed a modified drive through of the neighborhoods where her students lived. For the ethnographic notetaking activity, participants were asked to create field notes in a similar manner as described by Frank [7] in *Ethnographic Eyes*. This consisted of dividing the paper into two columns. On the left side, participants were asked to write down observations of what they noticed in the video without making any inferences. On the right side, participants were asked to write down any thoughts, questions, or inferences about the observations on the left.

As part of the qualitative coding module, teachers were introduced to an Adobe Spark photo novella prompt that the research team previously developed and piloted [9]. Adobe Spark is a web-based multimedia authoring platform that allows for the generation of a variety of outputs, photo novellas included. A photo novella, or picture story, is a form of photo research in which participants take and share photographs with researchers and talk about what the photographs mean to them [10]. This grounding of participant created images in real life contexts allows researchers to learn from participants as they share and discuss examples of their lives as they see them. The Adobe Spark prompt was designed to identify what participants viewed as examples of engineering in their communities. Teachers were given example Adobe Spark photo projects, as well as an a priori codebook, and went through a series of guided and individual coding exercises. The goal of the activities was to prepare teachers to code their students' photo journal prompts to gain a better understanding of how those students view engineering around them.

This paper focuses on the book study data to explore the following research question: How can engaging in ethnographic practices support teachers' readiness to teach engineering that is situated within locally relevant contexts?

Participants

Participants included three elementary teachers and two undergraduate students who were enrolled in an elementary education certification program. Each participant was assigned a pseudonym and detailed information for each is provided below

Courtney. Courtney is a white female with 29 years of classroom teaching experience. She currently teaches 5th grade at a rural school located on a Native American Reservation, approximately an hour drive from the small city where she lives. Courtney is bilingual in English and Spanish and taught at a school with a large number of native Spanish speaking students prior to teaching at the reservation school. Courtney holds National Board Certification in the area of Early Childhood Generalist and reported prior experience teaching engineering to her students.

Kerri. Kerri is a white female with 19 years of classroom teaching experience. She currently teaches 3rd grade in a small rural school located in a large western state, and lives within the district boundary of the school where she teaches. Kerri reported prior experience using a makerspace with her students.

Holly. Holly is a white female with 14 years of classroom teaching experience. She holds National Board Certification in the area of Literacy: Reading-Language Arts/Early and Middle Childhood and currently teaches 4th grade in a small town. She lives in a large town about 25 minutes away from the school where she teaches. Holly has a Master's degree in Education Technology and reported prior experience teaching technology enhanced engineering activities (i.e. Lego WeDo) to her students.

Kristina. Kristina is a white female and senior at a large, public university where she is enrolled in an elementary education bachelor's degree program with a science education option. As part of her degree program, Kristina has completed an 80 hour field placement experience where she was assigned to a 5th grade classroom. Kristina also teaches at a summer outdoor science education program for children and hopes to teach upper elementary or middle school science upon graduation.

Jennifer. Jennifer is a white female and junior in the same program as Kristina. Jennifer was a mechanical engineering major her freshman year but switched her major to education due to a strong desire to work with children. She is completing an elementary education bachelor's degree program with options in both science and mathematics education. Jennifer has not completed a field placement experience yet. She hopes to teach middle school math or science upon graduation.

Data Collection and Analysis

For this first phase of the larger study, multiple pieces of data were collected from participants, including demographic information, written Google Classroom assignments, and reflections. All synchronous professional development sessions were video recorded and transcribed for analysis. First, the authors conducted an initial read through of each assignment, response, or transcript and compiled a list of initial codes. Next, researchers used the initial code list to complete a round of descriptive coding as described by Saldana [11]. Next, a round of focused coding [11] was conducted to determine prominent categories that emerged during the coding process. Finally, codes were compared across data sources and merged to allow for triangulation [12].

Findings

When answering our research question, "How can engaging in ethnographic practices support teachers' readiness to teach engineering that is situated within locally relevant contexts?", we chose to divide the findings into two sections. The first section focuses on the themes that emerged from the qualitative analysis of book study reflections and group discussions and the second section summarizes what we learned through participants' responses to the ethnographic notetaking activity.

Book Study. Findings are presented based on emergent themes.

Improving learning. All of the participants emphasized the value that knowing more about students has on their abilities to meet the unique needs of their students and provide better instruction.

“Knowing about my students’ communities helps me guide the instruction at the very core. It tells me more about the depth of background knowledge they will have going into my lessons. It helps me determine how much and what kind of frontloading is necessary to successfully complete an activity.” (Kerri, *Ethnographic Eyes* Chapter 2 reflection)

“Knowing a students’ community can help you plan and deliver instruction because you will know more about a students’ background knowledge and what experiences they may or may not have had. It is also important to teach from the students' culture/view so they are able to apply what they learn in school, to what they learn at home (like how a student can connect the water sensor activity with farming/ranching at home).” (Jennifer, *Ethnographic Eyes* Chapter 2 reflection)

“It is so important for me to understand different learning needs and to be able to provide instruction that will allow students to show me what they know in a way paper pencil often doesn’t. The Crow are an oral culture so expecting them to organize their thoughts into a paper when they do not speak that way makes it a struggle unless you can understand how they structure stories and build on that.” (Courtney, *Ethnographic Eyes* Chapter 2 reflection)

“Getting to know our students and where they’re coming from, what their experiences have been like, it just tells you so much more about why they may behave the way they do, why they struggle in one area or another. And I don’t think we give it enough attention in schools.” (Kerri, group book discussion)

Different ways of knowing. Some participants indicated there was a connection between culture and different ways of experiencing the world, which impact learning. It is important for teachers to understand and value these cultural differences to ensure they do not try to force their perspectives and ways of knowing on their students.

“It is important to explore students’ neighborhoods so you can understand their homelife, culture, and the community that they grew up in. All of these factors contribute to who the student is as a person and how they learn.” (Jennifer, *Ethnographic Eyes* Chapter 2 reflection)

“My past life experiences are very different from the rural community my students come from, not to mention the Native Culture and the Culture of Poverty they come from. If I don’t go into the community and meet my students where they are at, I will have many misunderstandings about how I ‘think’ they should be doing things.” (Courtney, *Ethnographic Eyes*, Chapter 2 reflection)

“The idea of there isn't really a right, or a correct way of thinking, I think. And, you know, growing up in an all-white High School, everyone was the same as me. And I

thought, yeah, what I learned that's right, I'm learning the correct way. But then I think if you have students coming from different backgrounds and different religions, right could mean so many different things and I think teaching our right way to students could be detrimental in some ways, and take away from their identities.” (Kristina, group book discussion)

“I need to design my lessons with them [students] in mind. Instead of always with the curriculum in mind. In the homes that we are in right now, we really need to take into consideration who the kids are beyond the walls of our classroom and fit our classroom to their needs and not force them into what we see as a classroom.” (Courtney, group book)

Building Trust. When reflecting on the importance of learning about students’ cultures, some participants pointed to the critical nature of building trust with families.

“Although I think it is important in all teaching experiences to understand where students come from, I especially think it is important when a different culture is present. Many of my students’ grandparents attended Boarding Schools. The perspective of school for the family is one of mistrust and harm. I need to be able to find this out, understand, and then do what I can to help build the bridge from home to school...In my experiences with teaching bilingual students as well as Native students, I found that once the families see the effort you are putting forth, they embrace you and work with you instead of against you.” (Courtney, *Ethnographic Eyes* Chapter 2 reflection)

“I had spent three quarters of a year with my students before we went to remote learning [due to COVID-19], but I got to know them on such a better level when I was seeing their houses, bedrooms, pets, etc. (both in drive bys to say hi and during our online meetings). Not only that, but they got a glimpse into my home and life as well. I had so many good conversations with my students about art I saw on their bedroom wall or a pet they would show me that I don’t think I would have had otherwise which led to a feeling of mutual trust and respect. I think it also helped my relationship with parents as well.” (Holly, *Ethnographic Eyes* Chapter 2 reflection)

Learning to “speak” the same language. Multiple participants referred to the importance of teachers, students, and community members speaking the same language. Courtney describe her time teaching in a Spanish bilingual program and her ability to successfully teach students to read and do math in Spanish. However, she described her struggles to communicate with families at community events such as a basketball game because she did not know the dialect that was used outside of the school. She then focused her response to her current teaching on the reservation where many of her students are also English language learners.

“The students refer to clothing with different words than I do. I know what they are referring to but they had no idea what I was asking them. I would ask them to get their shorts for swimming and they were confused because they wouldn’t want to wear their basketball shorts to swim in, they would want to wear their trunks. It is the same way with parents, I think, even if they speak English. How many of us conference with

parents and think ‘geesh they don’t care’ when really they are coming from a place of confusion, or deep respect and won’t question you, or even a chip on their shoulder because of past experiences. Even my students will sit politely and listen to me go on and on and then I will stop and ask them, ‘Do you know what that means?’” (Courtney, *Ethnographic Eyes*, Chapter 8 reflection)

Courtney’s experience highlights the importance of teachers being aware of the language they use in their classrooms and how much of that might be foreign to their students who do not have the same life experiences or culture. Kristina made a similar point during the professional development discussion noting about the second nature of the language teachers use while teaching.

“Okay, this is just teacher says this, you know, and so, filming yourself, like while you teach and then really looking to see what’s the language. How am I saying things? You know, the patterns I think are really powerful because it’s hard to pick up on, if you’ve experienced that your whole life.” (Kristina, group book discussion)

Holly also talked about the language that teachers use and how it could lead to a breakdown in communication that might occur when teachers try to explain the reasons for specific practices to family members who do not use the same professional language that the teachers do.

“I sometimes find it hard to talk about what we do as educators in a way that makes sense to outsiders. I can see how this practice of turning it back into a language people can understand would help.” (Holly, *Ethnographic Eyes*, Chapter 8 reflection)

Self-Reflection. Courtney and Holly’s responses around the benefits of teachers videoing their classrooms were robust and mentioned the value of their previous experiences videotaping their classes as a part of the National Board Certification process.

“When I was completing my National Boards, I videotaped myself several times...I learned a lot about myself and my students through this process. There were times where I thought that I was giving clear explanations, but when I would watch the recording back I could see that wasn’t always the case. I think watching myself in this way helped me to develop better verbal scaffolding. I also learned a lot about my students that year and how they would respond if I wasn’t immediately present with them or their group. It helped me to pinpoint who might need more instruction and scaffolding and who I might have overlooked as a potential leader. When I had the time to watch and listen to what unfolded in the classroom I had the time to really analyze and determine how to best help students as well as grow as a teacher.” (Holly, *Ethnographic Eyes*, Chapter 8 reflection)

“When I did my National Boards I had to video myself. It was awesome. I was supposed to watch the students and not myself and I could see when my ‘teacher’ language was not understood. Student observations showed students off task or misbehaving. It gave me an opportunity to infer what was causing that and then to see if I needed to adjust my language. I needed to see the class from the student perspective and video is a great way to do that. Reflection is one of the most powerful things in education and having a

recording of what you taught is a really good way to help see things you probably missed.” (Courtney, *Ethnographic Eyes*, Chapter 8 reflection)

“It just gives you a chance to see yourself through a different lens and I think that’s very important...what you need to look at is what are the kids doing while you’re talking? Are they paying attention? Did you lose them?...It’s not so much staring at yourself but what are they doing? I can use it to help my teaching.” (Courtney, group book discussion)

Ethnographic Notetaking. We explored the field notes participants created when watching a video of an elementary teacher implementing an engineering design challenge in a 5th grade classroom. All participants were able to successfully limit their left side notes to direct observations and included inferences and wonderings on the right hand side. When comparing the items included in each participant’s notes, there were some similarities, yet notable differences based on level of classroom experience. All participants noted the level of student engagement and made inferences about classroom management. All participants except Jennifer mentioned at least one instance of the teachers using formative assessment to gauge student understanding. Further, Jennifer was the only participant who did not ask any additional questions about student behavior or why the teacher chose to employ a specific strategy. One possible explanation for this is that Jennifer had not yet completed a formal field placement experience and her lack of experience in a classroom setting limited her ability to fully reflect over what she observed. Another notable difference was that Courtney and Holly included much more information on their right side (reflective) column than the other participants. This could be linked to their prior experiences engaging in deep video reflection during the National Board certification process. Despite these differences, all participants indicated that they valued going through the ethnographic notetaking exercise and recognized the value of engaging in the process in their own classrooms.

Conclusion and Future Plans

While the COVID-19 pandemic prevented us from implementing the summer professional development as originally planned, we were able to provide our participants with experiences using ethnographic practices and provide space for them to engage in dialogue around the connections between culture, community, and school. The next phase of this project involves having the participants utilize ethnographic practices during the next academic year to learn more about the students in their classrooms and use that information to guide engineering curriculum development.

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