Hybrid Spaces for Traditional Culture and Engineering:

A Narrative Exploration of Native American Women as Agents of Change

by

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ABSTRACT

This study sought the lived and told stories of Native American women working in

engineering and technology so that their voices may be heard in engineering education

scholarship and challenge assumptions surrounding universal understandings of what it

means to be a minority woman in science, technology, engineering, and mathematics

(STEM). The study was directed by two research questions: (1) What are the lived and

told stories of Native women in engineering and technology who are leading initiatives to

improve their Native communities and (2) How do Native women's understandings of

their identities influence their work and acts of leadership? The study employed narrative

inquiry as the methodological framework and was guided by theoretical frameworks of

identities as constructed, multiple, and intersectional (Crenshaw, 1989; Tajfel & Turner,

1979), hybridity, and "third spaces" (Bhabha, 2012). The inquiry was also informed by

feminist theories of Native scholars (Green, 1983; Kidwell, 1978) and engineering

education (Beddoes & Borrego, 2011; Riley, Pawley, Tucker, & Catalano, 2009). The

narrative analysis presented three narratives, based upon interviews, field notes,

observations, and documents: (1) the story of a Navajo woman working within a large

technical corporation (*Jaemie*); (2) the story of an Akimel O'odham-Mexican woman

working within a tribally-owned technical business (*Mia*); and (3) the story of a Navajo

woman growing her own technical business (*Catherine*). The narratives revealed a series

of impactful transitions that enabled Jaemie, Mia, and Catherine to work and lead in

engineering and technology. The transitions revolved around themes of becoming

professionals, encountering and overcoming hardship, seeking to connect and contribute

to Natives through work, leading change for their Native communities, and advancing

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their professional selves and their Native communities. Across the transitions, a transformation emerged from cultural navigation to leadership for the creation of new hybrid spaces that represented innovative sites of opportunity for Native communities. The strength of the Native spaces enabled Jaemie, Mia, and Catherine to leverage their identities as Native women within the global context of engineering and technology. The narratives denote the power of story by contributing the depth and richness of lived realities in engineering and technology.

For my mom, Laura

An enduring advocate for her children and all children pursuing their dreams

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PREFACE

I begin this thesis with a story of how I came to this inquiry, situating my personal story as a researcher as intrinsic to the narrative process. As the story unfolds, the curiosities that led me to direct an inquiry and the context for the need of an inquiry is established. Here are the narrative beginnings.

Part 1: Coming to Know Phoenix AISES and Native American Women's Roles

On April 17, 2013, I attended my first Phoenix American Indian Science and Engineering Society (AISES) meeting at Distrito, a Scottsdale-based hotel and restaurant. As a White woman, I was there to learn. Specifically, to learn from Native American professionals about how their cultures and worldviews influence their work in science, technology, engineering, and mathematics (STEM) fields. I was in my third year of the Engineering Education Ph.D. program within the Mary Lou Fulton Teachers College of Arizona State University, and had been studying how traditional knowledge, also referred to as "indigenous knowledge" or "local knowledge" (International Council for Science, 2002), might be integrated with K-12 engineering curriculum to support Native American students in their pathways to STEM careers. I was particularly interested in learning

about Navajo traditional knowledge and how the understandings, interpretations, and meanings of Navajo culture might inform culturally responsible schooling for K-12 engineering programs on the Navajo Nation. My draw to learn more about Navajo culture stemmed from an opportunity to teach a week-long summer camp for Navajo middle school girls at the Saint Michael Indian School near Window Rock, Arizona, the capital city of Navajo Nation. I intended for the engineering learning experiences to be developed based on design scenarios that were relevant to the community, such as sustainable housing, and integrated with Navajo traditional knowledge, such as resource use practices. Although I had lived in the greater Phoenix, Arizona area for most of my life, I was unaware of the richness of the Navajo cultural complex. With limited resources in engineering education literature on contextualizing learning experiences to Native American cultures (let alone Navajo culture), I had been reliant on science education literature for the development of the summer engineering camp (Aikenhead, 1997; Aikenhead & Jegede, 1999; Bang & Medin, 2010; Brandt, 2007; Brayboy & Castagno, 2008; McKinley, Stewart, & McRobbie, 2012; Kawagley, Norris-Tull, & Norris-Tull, 1998; Semken & Freeman, 2008; Snively & Corsiglia, 2000).

As I attended the Phoenix AISES meetings, I learned of the tremendous diversity across tribes. The majority of members in Phoenix AISES were Navajo, with other members representing several of the twenty-three tribes in Arizona (e.g., Hopi, San Carlos Apache, and enrolled members of the Gila River Indian Community) and tribes outside of Arizona (e.g., Mi'kmaq). The diversity of cultures and worldviews provided a unique opportunity to participate in conversations about Native American perspectives in

STEM and how to best support Native American students in their pathways to STEM

careers.
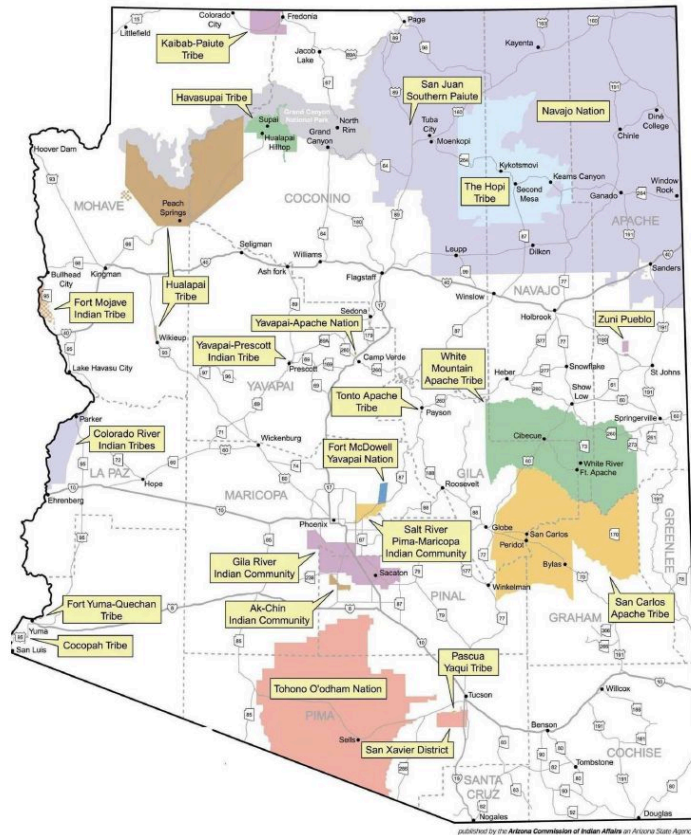
Figure 1. A map of Arizona tribal lands (Arizona Commission of Indian Affairs, 2016)

Following the summer engineering camp, I became a regular attendee of the

Phoenix AISES meetings. I learned something new from each meeting, whether from the

guest speakers (speaking on issues such as water rights on tribal lands) or conversations

with other members. The group was thriving; many of the members had long-term

friendships with one another and supported one another as they navigated STEM

pathways. Many members devoted much of their time to the Phoenix AISES group and to

other activities and organizations that supported Native American communities and their

peoples (e.g., The Phoenix Indian Center's Silver & Turquoise Ball, PFLAG Phoenix,

The Heard Museum of Native Cultures and Art, and The Hoop of Learning Program).

Mentoring local Native American university students was of particular interest to the

group in order to support the students in persisting through their STEM majors. As a

woman engineer, one characteristic of the society that stood out to me was the

prominence of Native American women in leadership roles. I had noted this characteristic

to one of my academic mentors:

> I have been going to the monthly Phoenix AISES meetings as well; this is the
> professional society for Native scientists and engineers. The meetings have been
> helpful in forming relationships with Native STEM professionals. I have learned
> so much from them, specifically regarding their extra-curricular activities. The
> members are very involved in the Native community, all while balancing a full
> work schedule and families. They serve on boards aimed at supporting Native
> community and youth, perform in pow wows, and so on. What is most surprising
> is that the women hold many of the leadership positions within the groups and
> within other Native-related groups. I would like to learn more about their
> participation in the group and their work. The women's roles seem unique
> compared to the broader participation of women in STEM work and co-ed groups.

At the time, the Phoenix AISES president was a woman, serving her second year as the

elected president. The monthly meetings had approximately twenty regular attendees,

half of which were Native American women for most meetings. Several of these Native

women were serving as chairs and members on committees (e.g., scholarship committee).

I wondered: how is it that Native American women have strong representation in Phoenix

AISES when the broader STEM community struggles with their recruitment and

retention of women? The representation of Native American women within Phoenix

AISES mirrored the landscape of participation for National AISES. As of June 2015,

approximately half of the thirteen chapter AISES presidents were women, 48 percent of

AISES members were women, and eight of the nine AISES student representatives were

women (L. Paz, Director of Membership and Communications for AISES, personal communication, June 23, 2015). Sarah Echohawk, a Pawnee woman, was named CEO of National AISES on May 1, 2013. She was taking over the position after Pamala Silas, a member of the Menominee Tribe, held the position for eight years (Landry, 2013). *The Native American women's leadership in the society was a prominent force and one that seemed to be a defining characteristic of the society.*

Part 2: Reconciling Native American Women's Participation in Phoenix AISES with Mainstream Narratives in STEM

I had come from an undergraduate program in bioengineering in the Ira A. Fulton School of Engineering at Arizona State University (ASU). Although many bioengineering programs, including the one at ASU, had women and men represented nearly equally, women were drastically underrepresented across all engineering majors combined. The mainstream narrative in engineering fields, in general, was (and is) one where women are underrepresented. To illuminate this underrepresentation, the National Center for Science and Engineering Statistics (2013) and the National Science Board (2012) reported that women comprise 50 percent of the population and earn 57 percent of bachelor's degrees across all degrees, yet only obtain 18 percent of bachelor's degrees in engineering and 18 percent of bachelor's degrees in the computer sciences. There are greater disparities for minority women (i.e., African Americans, Hispanics, and Native Americans/Alaska Natives), as they comprise 16 percent of the population yet only obtain three percent of bachelor's degrees in engineering and five percent of bachelor's degrees in the computer sciences (NSB, 2012; NSF-NCSES, 2013). Proportionally, minority women obtain half the rate of bachelor's degrees in engineering as compared to

the average for all women. The gender disparities in higher education continue as women enter the STEM workforce. Women hold nearly half of all jobs in the U.S., but only comprise 13 percent of the engineering workforce and 25 percent of the computer and mathematical sciences (NSB, 2012; NSF-NCSES, 2013). Minority women hold less than ten percent of science and engineering jobs (NSB, 2012; NSF-NCSES, 2013). As a result of the lack of women in STEM, recruiting women for STEM majors was a priority at ASU. This matched national agendas and corporate initiatives to increase women's retention rates and decrease attrition rates in the STEM workforce.

The participation of Native American women in engineering and technology, in specific, is a challenge to understand because, as Sarah Echohawk (the President of AISES) emphasized, "There is a lack of detailed data for Indian Country in general. We're often put in the 'other category'. We are a very small percentage of the population" (McKee Ranger, 2014). However, organizations such as The American Association of University Women (AAUW) and the National Action Council on Minorities in Engineering, Inc. (NACME) are working towards understanding the participation of underrepresented groups in STEM, including Native American women. Native Americans comprised 1.7 percent of the U.S. population in 2012 (NIEA, 2016), yet only hold a fraction of a percent of jobs in STEM (Corbett & Hill, 2015). From 2006 to 2010, Native women held fewer engineering and computing jobs than their Native male counterparts: 0.04 percent of engineering jobs and 0.1 percent of the computing jobs as compared to Native men's 0.2 percent of engineering jobs and 0.2 percent of the computing jobs (Corbett & Hill, 2015). According to these percentages, Native men held

five times more engineering jobs than do Native women and two times more computing jobs than Native women (Corbett & Hill, 2015).

Comparing Native American women's participation in science and engineering to other minority women, specifically African American women and Hispanic women, reveals something interesting. Native American women, in general, have comparable representation within their racial and ethnic group as compared to Hispanic and African American women. For example, from 2006 to 2010, Hispanic women held one percent of engineering jobs and one percent of the computing jobs as compared to Hispanic men's five percent of engineering jobs and four percent of the computing jobs (Corbett & Hill, 2015). According to these percentages, Hispanic men hold five times more engineering job than do Hispanic women (the same proportion as Native American women to men) and four times more computing jobs than Hispanic women (a greater discrepancy than Native American women to men) (Corbett & Hill, 2015). African American women held one percent of engineering jobs and three percent of the computing jobs as compared to African American men's four percent of engineering jobs and four percent of the computing jobs (Corbett & Hill, 2015). According to these percentages, African American men hold four times more engineering job than do African American women (a slightly improved proportion than Native American women to men) and one and one third times more computing jobs than African American women (an improved proportion than Native American women to men) (Corbett & Hill, 2015).

Across men and women within each racial and ethnic group, 23 percent of Native Americans (men and women) held science and engineering jobs in 2009 (19,000 jobs), which is higher than the 18 percent of African Americans who held science and

engineering jobs (197,000 jobs) and the 22 percent of Hispanics who held science and engineering jobs (230,000 jobs) (NACME, 2012). Within education, Native Americans (men and women) obtained 455 degrees in engineering in 2009, from bachelors to doctorates, as compared to 7,047 for Latino students and 4,206 for African American students (NACME, 2012). Proportional to their population, Native Americans have comparable rates of obtaining engineering bachelor's degrees, as do other minority groups and, in fact, exceed the national average for doctoral degrees awarded (NACME, 2012). However, minority groups are less likely to graduate from high school, to enroll in college, and graduate from college as compared to White groups; but if they make it to college, minority groups are just as likely to enroll in a STEM degree as their White counterparts (Corbett & Hill, 2015; NACME; 2012). Minority women still pursue fewer STEM bachelor's degrees than minority men. For example, although reports on Native American women are much more likely to participate in higher education and to earn bachelor's degrees than Native American men, they less likely to pursue STEM degrees (Babco, 2000, 2003; Lord et al., 2009). These statistics reveal that there is diminished participation in STEM when comparing men to women, White groups to minority groups and minority women to their minority men counterparts. Minority women face underrepresentation due to their status as both a minority and a woman.

Understanding the participation of minority women in STEM is complex and there is still much work to do. In regards to Native American women in particular, there is a need for more information to understand the wholeness of experiences in STEM. *Based on my personal experiences with Phoenix AISES, the statistics on the lack of Native women in STEM were not wholly representative of Native American women's*

participation in STEM, although they were representative of a diversity issue plaguing the nation.

Part 3: Growing Professional Relationships within Phoenix AISES

As I became involved in the Phoenix AISES group, my relationships with the other members grew. I learned that several of the Native American women were entrepreneurs and intrapreneurs in STEM fields. This furthered my curiosities about the participation of Native American women in the local Phoenix STEM community. Among the group of Native American women, two members had started businesses to aid Native communities with their renewable energy needs (e.g., installing solar energy systems on Native community lands) and others had started informal and non-profit outreach and diversity programs outside and within large technical corporations. Their academic backgrounds spanned fields of engineering, including electrical engineering, energy engineering, and computer systems engineering; technology, including electronics technology, manufacturing technology, computer information systems, mechanical design; and support fields for STEM, including diversity officer positions for human resources. To highlight their achievements and create positive role models for other Native Americans, these Native American women were frequently featured in online and printed publications (e.g., *Winds of Change*, an AISES publication) and awarded with honors at conferences and events. All of these Native American women volunteered their time to further the goals of Phoenix AISES: "giving back, community connectedness, and personal and professional growth" (Phoenix AISES, 2015). During my time with Phoenix AISES, I saw first-hand the dedication that it takes for Native American women to volunteer their time. They served on committees, raised scholarship funds for Native

American youth, and organized national conference activities and leadership summits. The stories of Native American women from the Phoenix AISES group contradicted the mainstream narratives of dismal rates of women, especially minority women, in STEM, and instead provided a counternarrative of Native American women who were taking on leadership roles in STEM work and initiatives.

The voices of Native American women in Phoenix AISES inspired me to direct an inquiry towards understanding Native American women's leadership in STEM as it was juxtaposed to their severe underrepresentation across STEM degrees and careers. This direction for an inquiry called for working towards an understanding of Native American women's experiences in the STEM workplace and the sense that they make of those experiences so that the dominant narrative could be countered with the richness and depth of personal experience.

Part 4: Beginning to Construct a Study

As I began to brainstorm what a dissertation study might look like that sought to learn from the personal experiences of Native American women in STEM, I was traveling to the Navajo Nation to gain access to the rich cultural literature base at the resource center of the Navajo Nation Library, judge at the Navajo Nation K-12 science fairs, and work with Dr. Shawn Jordan and the Office of Diné School Improvement to develop culturally-contextualized engineering curriculum for Navajo Nation middle schools. I was in need to learn more of Native American cultures and worldviews, and so I enrolled in a graduate research seminar taught by Dr. Donald Fixico (a scholar of Shawnee, Sac and Fox, Muscogee, and Seminole descent), called Indigenous People and the Natural Environment. This course focused on the works of public intellectuals

(Native American and non-Native American alike), such as Benedict Anderson, Keith Basso, Homi Bhabha, Vine Deloria, Donald Fixico, Michel Foucault, Clifford Geertz, Antonio Gramsci, Henri Lefebvre, Scott Momaday, Edward Said, Gayatri Spivak, and Jan Vansina, and challenged me to consider the relationships indigenous peoples might have with their environment. I also continued to participate in Phoenix AISES and was elected to serve on the board in the role of vice president. In the fall of 2014, I spent time in the Gila River Indian Community listening to stories of those working in engineering and technology and taking a cultural course through the Gila River Health Care taught by Ginger Sunbird Martin and Robert Pablo. In the three-day cultural course, I learned how the local hospital had difficulties with serving the needs of the community due to doctors and staff who were non-Native American and unfamiliar with Native American cultures and ways of knowing and doing. I also learned of the history of the Gila River land and of driving cultural values that have sustained their ways of life. In seven and half hours on each of the first and second days, Ginger and Robert overviewed significant differences between the dominant culture in the United States and the broader Native American culture (e.g., considerations for the group over the individual and the cultural ties to the natural environment) and the values and histories of the tribe (e.g., significance of language, resilience and rebuilding efforts, and the variations in traditionalism in the contemporary world). On the third day, we took a tour around the Gila River Indian Community to see the community first-hand and to begin to contextualize what we had learned.

Traveling to the reservation lands of Navajo Nation and Gila River Indian Community, working with Native American professionals, and taking a course

necessarily complicated my simplistic understandings of Native culture. Through first-hand accounts, I learned of the uniqueness and diversity of cultures and worldviews within and across tribes and also of the significance in sustaining their cultural vitality. As I moved forward with designing and implementing a dissertation study, I carried with me three main lessons.

Lesson 1: There is a need to decolonize practices and applications in STEM. STEM education and careers are rooted in Euro-American tradition and design. The Western framework for STEM has tensions with indigenous ways of knowing and doing as it marginalizes the contributions of indigenous peoples and their knowledge systems. There is a need to approach STEM through decolonizing practices and applications. A component of this is recognizing indigenous knowledge and practices as foundational to the development of STEM knowledge and applications as well as upholding the integrity of indigenous ways of knowing and doing, including cultural values.

Lesson 2: Place has meaning. The sense of place, including the meanings and attachments one has with a place, is a cultural value held within the traditional knowledge of a tribe (Barnhardt & Kawagley, 1999; Basso, 1996; Cajete, 1994; Deloria & Wildcat, 2001; Kelley & Francis, 1994; Semken, 2005). The sense of place has influence over the contemporary lives of Native Americans as each place, such as a plateau, mountain, or a river, has a history and a name to remind the people of the moral narratives of how to live life (Basso, 1996; Momaday, 1997). As I traveled to the Navajo Nation and the Gila River Indian Community, I became more familiar with what it means to be aware of the relationship that one has with places and to be mindful of the lessons that those places teach. The Southwest has considerable variability across the landscape, and with each

place there are lessons to be learned. The view of place as a source of wisdom (Basso, 1996) and as a living entity was a lesson that I carried with me.

Learning 3: Leadership extends beyond an engineering and technical position. Leadership within Native American communities, including from Native American women, is a cultural pillar that is rooted in the histories of tribes and consciously taught and learned from the elders to the youth (Warner & Grint, 2006; Wise-Erickson, 2003). As such, contemporary leadership within Native American communities is deeply intertwined with cultural frameworks for living, including upholding the needs of the tribe as a whole, having value for belonging and contributing to the group through a useful set of skills, and communicating in ways appropriate to the community. Based upon my conversations with Native American women professionals within engineering and technology contexts, the ways in they perceived their work and leadership certainly mattered, but their predominant focus was to improve the lives of their people and communities rather than to obtain a certain position in the workplace. The Native American women that I spoke with had embedded themselves as leaders in the larger social, cultural, and political frameworks of Native American communities. Leadership as it extends beyond an engineering and technology position to a larger cultural meaning was a lesson that I carried with me.

As I was shaped by experiences with Native American communities, individuals, and scholarship, I carried lessons learned with me. I approached the formation of this inquiry in this way, whereby I had many more lessons to learn and the inquiry process would be instrumental in shaping my own and others' understandings of what it means to be Native American women in STEM.

CHAPTER 1

INTRODUCTION TO THE INQUIRY
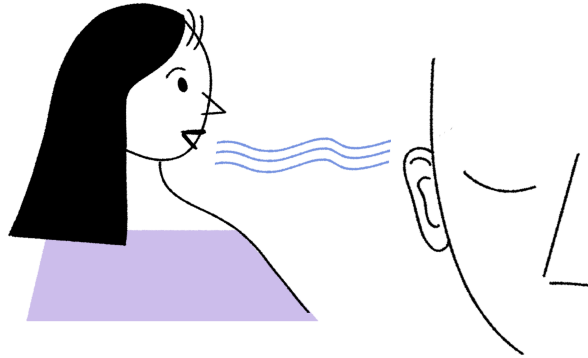
This study sought the lived and told stories of Native American women working in engineering and technology so their voices may be heard in engineering education scholarship and challenge the assumptions surrounding universal understandings of what it means to be a minority woman in the science, technology, engineering, and mathematics (STEM) workplace. The purpose of the study was to *access* the lived and told stories of Native American women working in engineering and technology, particularly those who were leading initiatives to improve their Native communities. Stories such as these were sought out because they have the opportunity to provide counternarratives that may add to or alter our understandings that derive from the dominant narrative of underrepresentation of minorities and women in STEM. Moreover, stories such as these offer an opportunity to explore the particularities and complexities of lived experiences, which can provide insight into a Native American woman's understandings of her work and leadership in engineering and technology and as it is

influenced by her identities as a Native American woman. The richness and depth offered by stories can challenge assumptions and unveil new meanings and understandings.

The study was guided by two research questions – questions that were constructed from my time with Phoenix AISES and listening to stories of Native American women in STEM. The questions went through several evolutions as I developed relationships with Native American women in STEM, read literature on Native American cultures and histories as well as on STEM cultures and histories, and reflected. The cross-section between a Native American woman's world (grounded in Native American cultures and worldviews) and the world of engineers and technologists (prototypically Euro-American in design) presented many layers to consider. However, as a White woman, I decided it was not my place to determine the layer to consider, but rather to begin with the stories that Native American women choose to tell about their own work and leadership in engineering and technology and how their sense of self influenced their work and leadership. Therefore, the two guiding research questions were:

1. What are the lived and told stories of Native American women in engineering and technology who are leading initiatives to improve their Native communities?

2. How do Native American women's understandings of their identities influence their work and acts of leadership in the engineering and technology workplace?

Research Approach

To uphold storytelling as the primary mechanism for seeking a holistic understanding of what it means to be a Native American woman working and leading in engineering and technology, the study employed narrative inquiry as the methodological approach. Narrative inquiry is reliant upon individuals who are willing to share their lived

and told stories and spend considerable time with the researcher telling those stories. For this narrative inquiry, three Native American women willingly shared their lives with me and, over the course of the inquiry, the participants and I formed meaningful relationships grounded in a common goal for inspiring change in STEM and supporting Native women and girls in STEM.

The stories of the three Native American women are: (1) the story of Jaemie (pseudonym), a Navajo woman, as she navigated her career pathway to a research and development role within a large technical corporation and her leadership as a chapter president of the corporation's Native American support network; (2) the story of Mia (pseudonym), an Akimel O'odham-Mexican woman (and an enrolled member of the Gila River Indian Community) who works for a tribally-owned technical business and pursued a technical education while leading a new technical venture formed to serve the tribe; and (3) the story of Catherine (pseudonym), a Navajo woman who launched her own technical business off the reservation to serve the needs of Native nations.

The three Native American women's stories represent individual understandings of work and leadership in engineering and technology and influence of their constructed, multiple, and intersecting identities. Narrative inquiry embraces the relational qualities between the researcher and participant and acknowledges the place of the researcher on the landscape of storytelling. As such, the personal voice "I" was used within the narratives to navigate the stories as the research storyteller (Barone, 1992). Specifically, a personal voice was useful in discussing my emergent understandings of the Native American women's lived and told stories and to illuminate the reflexivity I used to approach the inquiry as a White woman.

Need for the Inquiry

The need for this inquiry is based upon a void in engineering education scholarship, as the voices of Native American women in engineering and technology are largely absent. Yet, their voices are needed to enrich the conversation surrounding minority experiences in STEM, and specifically to challenge dominant narratives and universal assumptions. The dominant narratives, as was narratively introduced in the preface, are ones that address the underrepresentation of minorities and women in STEM. Those dominant narratives often *speak of* minorities and women as cohesive groups, which can lead to assumptions that STEM experiences across individuals and within minority groups are similar or even the same. For example, quantitative studies, which have a strong tradition in STEM fields for answering questions surrounding teaching, learning, and careers in STEM (Wankat, Felder, Smith, & Oreovicz, 2002), are at risk for "bury[ing] the voices of underrepresented groups" through generalization by statistical analysis (Borrego et al., 2009, p. 57). Although quantitative studies have use (for example, for informing institutional perspectives on diversity in STEM), such approaches can adhere individuals from diverse backgrounds to a conglomerate of minorities and disregard the complexity of individuals' experiences and understandings. Native American women are at additional risk for: (1) being omitted from studies due to their statistical insignificance (Pawley, 2013) or (2) being written *about,* which has the tendency to ignore the complexity of their identities, cultures, and worldviews and its influence on their learning and pathways in STEM.

Rather, there is a need for narrative inquiry to "give voice to the silence" in the "thicket" of engineering education scholarship (Klein & Ackerman, 1995, p. 3-4).

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Through "thick" description of data within the context of a natural setting (Geertz, 1973), the emergent design of narrative inquiry allows for new questions and problems to be explored during the research process and is aimed at providing a holistic account of the problem or issue under study (Creswell, 2013; Denzin & Lincoln, 2005). As embedded within the qualitative research tradition, narrative inquiry is not bound by cause-and-effect relationships, but is concerned with addressing the complexity of interactions and factors within the phenomena and context under study. The inquiry process is concerned with "attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them," carried by the multiplicity of researchers' and participants' voices (Creswell, 2013, p. 44; Mazzei & Jackson, 2009).

Although great strides have been taken in engineering education scholarship to be inclusive of qualitative approaches and to ask different types of questions and explore existing questions in new ways (Borrego et al., 2009), there remains a void of studies seeking the particularities and complexities of experiences of Native American women in engineering and technology. Related studies include those that explore gendered systems in STEM and their affects on women across race and class (Gill, Sharp, Mills, & Franzway, 2008; Godfrey, 2003; Lord, Cashman, Eschenbach, & Waller, 2005; Pawley, 2004; Phipps, 2006) and the exploration of specific minority groups, such as the experiences of Hispanic women in engineering majors (Martin, Simmons, & Yu, 2013) and the motivation and persistence of first-generation Latinas (Verdin, Godwin, & Morazes, 2015). Although not focused on Native American women in particular, Yatchmeneff (2015) used a qualitative approach to understand the experiences of Alaska Native youth in the Alaska Native Science and Engineering Program (ANSEP). These

studies do not explore the experiences of Native American women, but they are theoretically linked by their intent to make sense of the experiences of minorities and women in engineering. As was discussed above, evidence of Native American voices in engineering education scholarship can be found embedded within broader participant samples, including a study aimed at understanding how institutional and program changes have affected minority groups (Shebab, Murphy, & Foor, 2012) and a mixed methods study exploring the experiences of female engineering students across ethnicity (Trenor, Yu, Waight, Zerda, & Sha, 2008). When seeking the voices of Native women, one must turn outside of the engineering education field to, for example, science education (e.g., Brandt, 2007), history (e.g., Denetdale, 2007; Pesantubbee, 2005; Roessel, 1981; Shoemaker, 1995), feminist studies (e.g., Albers & Medicine, 1983; Allen, 1992; Bataille & Sands, 1987; Brant, 1984; Donovan, 1998; Green, 1983; Hill Witt, 1974; Silko, 1977), and economics and politics (e.g., Prindeville, 2004). Literature, through autobiographies and biographies, also provide rich accounts of the lives of Native American women. Notable works include *The Scalpel and the Silver Bear: The First Navajo Woman Surgeon Combines Western Medicine and Traditional Healing* (Alvord & Van Pelt, 2009), *No Turning Back: A True Account of a Hopi Girl's Struggle to Bridge the Gap between the World of Her People and the World of the White Man* (Carlson, 1964), *The Ways of My Grandmothers* (Wolf, 1998), and *Papago Woman* (Underhill, 1979). Although this scholarship and literature is useful and necessary, these accounts do not provide contextual understanding for Native American women's experiences within the engineering and technology context.

There is a need for Native American women's voices in engineering education scholarship to contribute to understanding the wholeness and complexity of what it means to be a Native American woman in engineering and technology. This narrative inquiry provides a space in engineering education scholarship for the voices of Native American women, voices that are not often heard in engineering and technology. The voices of three Native American women included in this inquiry begin to fill the silence in the scholarship.

Significance of the Inquiry

The significance of this inquiry lies in the power of story. Of concern to this inquiry, the power of story can be identified through three interwoven strands: (1) the relevance of stories to indigenous peoples as a methodological approach, (2) the need for instructive stories in engineering education, and (3) the need for inspirational stories for Native nations.

The power of stories – relevance of the methodological approach.

Narrative is a theme throughout Indigenous scholarship. … Stories are bridges that connect our legends, our senses, our practices, our values, and, in essence, our sustainability as people. (Kenny & Fraser, 2012, p. 7)

Through the use of storytelling, narrative inquiry is compatible with the oral traditions of tribes that serve as a foundational element of Native life and a primary vehicle for sustaining it (Brayboy, 2005). By seeking the lived and told stories of Native American women, narrative inquiry honors "stories and oral knowledge as real and legitimate forms of data and ways of being," and in this way, "stories are not separate from theory; they make up theory" (Brayboy, 2005, p. 439).

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The methodological framework for narrative inquiry, grounded in a narrative view of experience, further supports the compatibility of narrative inquiry with indigenous ways of knowing and doing through the collaborative approach. Stories are "reflections on power" (Brayboy, 2005), and as such the reflexive research practices called for by narrative inquirers are critical to acknowledging the positioning and influence of the researcher and participant on the storytelling landscape. Within this view, the researcher and participant "both shape and are shaped by the landscape" (Clandinin, 2006, p. 47). Leslie Marmon Silko (1997), a renowned Laguna Pueblo poet and novelist, wrote of individuals and stories as entangled in her book *Yellow Woman and a Beauty of the Spirit*:

> 'A portion of territory the eye can comprehend in a single view' does not correctly describe the relationship between the human being and his or her surroundings. This assumes the viewer is somehow *outside* or *separate from* the territory she or he surveys. Viewers are as much a part of the landscape as the boulders they stand on. (p. 27)

As this study seeks Native American women's perspectives and experiences, the narrative inquiry approach seeks to "empower individuals to share their stories, hear their voices, and minimize the power relationships that often exist between a researcher and participants in a study" (Creswell, 2013, p. 48).

The power of stories – instructive stories for engineering education. The lived and told stories of Native American women who are situated in engineering and technology contexts are critical to understanding the complexity of experiences of underrepresented groups in STEM. Despite the need to hear the voices of Native American women in STEM, their lived and told stories have been marginalized or painted with a broad brush of what it means to be a minority in STEM (Lomawaima &

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McCarty, 2002). Native American women have their own unique experiences as a result of their constructed and intersecting identities; this uniqueness is compounded by the cultural diversity among tribes (Weaver, 2001; Yellow Bird, 2001) and the Native American women's lives as situated in engineering and technology fields, environments prototypically polarized to Native cultures and worldviews.

The lived and told stories of Native American women, through their own voices, are needed for its instructive purposes (Denzin & Giardina, 2009) – to provide direction for reform of STEM to be more supportive of Native American women and girls. The social significance of an inquiry that is inclusive of Native American women's voices is embedded in its potential to contribute research on practice to inform broadened participation and access to STEM education and workplace environments. The practical significance is embedded in the inquiry's potential to inspire new generations of Native American women to become leaders in STEM, as they see through these stories that others have come before them.

The power of stories – inspirational stories for Native nations. In the book entitled, *Living Indigenous Leadership: Native Narratives on Building Strong Communities*, Kenny and Fraser (2005) wrote, "Stories are a creative act of leadership through which we manifest our solidarity and strengthen our people to take their next steps in encouraging good and healthy lives" (p. 1). The lived and told stories of Native American women in STEM are direly needed to strengthen Native nations. It is likely that a Native American woman in STEM may not encounter another Native American woman in her field and that she may also be the only Native American person in her workplace – an unfortunate and unnecessary reality (Hill et al., 2010). The lived and told

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stories of Native American women in STEM, through their own voices, can be instructive and inspirational to Native nations and their peoples who are looking to strengthen their communities through STEM – representing both social and practical significance. Native nations and their peoples are seeking new reforms so that their children may be prepared for a "future steeped in science, technology, engineering, and mathematics and are truly prepared for higher education and good paying jobs" (Inter Tribal Council of Arizona, Inc. et al., 2013, p. 3). These reforms are "dependent on the preparation of their children to take control of their own future. For decades, Native Nations have participated in an education system that, historically, wasn't structured to build stronger Tribal Nations" (Inter Tribal Council of Arizona, Inc. et al., 2013, p. 4). Stories by and of Native American women in STEM will be critical to challenging the assumptions surrounding universal understandings of STEM education and minority participation in STEM education and the workplace. Additionally, stories of Native American women in STEM who are leading initiatives to improve their Native communities will provide direction and momentum for the change that is necessary for nation rebuilding and self-determination efforts in the context to STEM. The Native American women's stories will illuminate possibilities for better preparing Native American students for future career opportunities in STEM.

Weaving the three strands together. Together, the significance of the inquiry illuminates "the why" of the work. This is of utmost importance to narrative inquirers because they must think carefully of the stories they will tell and why.

As Thomas King (2003), a Cherokee and Greek man, wrote in *The Truth about Stories*:

> Once a story is told, it cannot be called back. Once told, it is loose in the world. So you have to be careful with the stories that you tell. And you have to watch out for the stories that you are told. (p. 10)

My experiences within Native communities, such as Phoenix AISES and with other research projects, the writings of Native American scholars and feminists, and my experiences within the engineering education field helped me to think about "the why" of my work. The stories that I sought to tell were rooted in social and practical significance (Curtis, 2013) as well as the significance of narrative inquiry as a methodological approach.

A Summary of the Narrative's Contributions

The narratives of this inquiry give voice to the silence in the engineering education scholarship, with each narrative contributing the depth and richness of the lived realities of a Native woman in engineering and technology and through a methodology compatible with Native ways of knowing. The narratives are structured around a series of impactful transitions that were represented within Jaemie, Mia, and Catherine's lived and told stories. The transitions revolved around the storied experiences of becoming professionals, encountering and overcoming hardship, seeking to connect and contribute to Natives through work, leading change for their Native communities, and advancing their professional selves and their Native communities. Across the transitions, a transformation emerged from cultural navigation of the local space (Native communities) and the global space (mainstream engineering and technology) to leadership for the creation of new hybrid spaces that represented innovative sites of opportunity for Native

communities. The strength of their local Native spaces enabled them to leverage their local identities as Native women within the dominant context of the global engineering and technology space. As Jaemie, Mia, and Catherine reflected on what it meant to be a Native woman, they told of being influenced by local narratives of the symbolic and behavioral power of Native women and the resilience and rebuilding of Native communities. The local narratives were set within the social, cultural, historical, and political contexts of Native communities. Jaemie, Mia, and Catherine learned lessons of what it meant to be a Native woman, and this enabled them to serve as agents of change for their Native communities by contributing their knowledge and skills in engineering and technology. Their roles as agents of change honored the Native women that came before them and looked towards a better future for Native communities.

The narratives are representative of counternarratives by adding to and challenging universal narratives and understandings of what it means to be a minority woman in STEM. The theoretical frameworks that guided the inquiry provided critical lenses for the interpretive analysis, and cumulatively provided new directions to contribute new perspectives for engineering education scholarship. Specifically, identities as constructed, multiple, and intersecting (Crenshaw, 1989; Tajfel & Turner, 1979) acknowledged the nature of identity as reflexive and as mutually shaping experiences in the social world. Hybridity and "third spaces" (Bhabha, 2012) were useful in directing considerations of how the Native women navigated local and global spaces and the meanings they attached to those spaces. Native feminist theories (Green, 1983; Kidwell, 1978) were useful because they drew particular attention to cultural and historical contexts and how those contexts differentiate the experiences of Native women as unique

to any other group due to the ways in which they arrived at their status and circumstance. Feminist theories in engineering education (Beddoes & Borrego, 2011; Riley, Pawley, Tucker, & Catalano, 2009) were also useful in validating the usefulness of an inquiry aimed at a broader, atypical approach to the experiences of Native women in engineering and technology. The narratives provided through this inquiry contribute new directions for exploring and discussing the lived experiences of Native women in engineering and technology. Moving forward with future research, there are opportunities to learn from and be inspired by the three narratives in this inquiry as well as to apply additional theoretical and conceptual frameworks to analyze them in new ways. There is also a need to continue research like this study to use narrative inquiry as a methodological framework in order to collect stories of diversity in STEM, including stories of diversity across Native nations in the STEM context. Stories have the power to disrupt dominant discourse and contribute to more whole understandings.

A Note on the Use of a Key Term

A former colleague and current professor at Diné College, Cynthia Benally, wrote in her dissertation entitled *Native American History Instruction in an Urban Context: An Exploration of Policy, Practice, and Native American Experience* (2014):

> I use the term Native American to mean the Indigenous peoples that first inhabited the land now claimed by the United States…. Some Indigenous peoples of the United States also refer to themselves as Natives, so that term will also be used. (p. 1)

As my dissertation concerns the narratives of three Native American women, I use the terms Native American, Native, and tribal synonymously. As I listened to the participants' lived and told stories, they referred to themselves as Native or by their

tribe's name (e.g., Diné or Navajo). When speaking of a specific tribe or a specific Native individual, I relied upon the use of the tribe's name (e.g., a Navajo woman). The three participants in my dissertation study grew up on reservations lands, but during the inquiry (or, in Mia's case, at some points in her adult life) lived off the reservation lands, and as such could be considered urban Indians or urban Natives (Benally, 2014, p. 1). Historians have studied the urban experience of Natives to better understand the forcible transition from reservation life to urban life and its impact on Native communities. A notable work by Donald Fixico (2000) includes the book, *The Urban Indian Experience in America*. Although my dissertation is limited in its scope by not seeking to contrast urban Natives with those who live on Native lands, the concepts relating to urban experiences are considered for the narrative analysis, specifically in terms of how they might relate to the participants' constructions of identities.

Organization of the Dissertation

I began the dissertation with how I came to this inquiry, specifically tracing how my relationships with Native individuals, including students and technical professionals, and Native groups, such as the American Indian Science and Engineering Society, coalesced and grew into this inquiry. My reasoning for beginning with my own story in the preface was rooted in the characteristics of narrative inquiry. Clandinin and Connelly (2000), two foremost scholars on narrative inquiry, wrote that research that claims to be narrative inquiry "characteristically begins with the researcher's autobiographically oriented narrative associated with the research puzzle (called by some the research problem or research question)" (p. 40). By doing this, the researcher's story is established as intrinsic to narrative inquiry, whereby the stories of the researcher and narrators (those

who tell their stories) are intertwined, and therefore influence how stories are perceived, understood, interpreted, and co-constructed (Mitchell, 2011).

The remainder of the dissertation is presented in six chapters. The introduction served as the first chapter – covering the purpose, need, and significance of the inquiry as well as some initial considerations for the inquiry. The second chapter presents the guiding theoretical frameworks for the inquiry – providing lenses for interpreting the identities and spaces that the participants navigated within their lived realities. The third chapter provides a detailed overview of the methodological framework, narrative inquiry – covering the ontological and epistemological groundings of narrative inquiry as well as the procedures carried out to conduct this inquiry. The fourth chapter presents the narrative analysis as comprised of three narratives, with each representing the storied experiences of a Native American woman in engineering and technology who is leading initiatives to improve her Native community. The fifth chapter provides a discussion of the narrative analysis in regards to the research questions posed for the inquiry – addressing what are the lived and told stories of Native American women in the engineering and technology workplace who are leading initiatives to improve their Native communities and how the participants' understandings of their constructed, multiple, and intersecting identities influence their acts of leadership in engineering and technology. Concluding the dissertation, the sixth chapter returns to the purpose and significance of the inquiry, presents the contributions made by the inquiry, and provides my reflections on the inquiry process as well as future visions of further research.

CHAPTER 2

LITERATURE REVIEW

Opportunities for "Third Space": Native American Women in STEM

As I have laid out in the introduction, the purpose of this inquiry was to seek the lived and told stories of Native American women working in engineering and technology and leading initiatives to improve their Native communities. Specifically, the inquiry aimed to access the particularities and complexities of lived experiences in order to gain insight of Native women's participation within engineering and technology spaces and how their behaviors and understandings within those spaces are informed by their identities. As the significance of the study is aimed at contributing findings of how we might better support Native women in engineering and technology in order to diversify STEM and strengthen Native communities, issues of how Native women construct their sense of self and the world around them and how these worldviews inform their actions and behaviors, particularly in Native spaces and engineering and technology spaces, are paramount to the inquiry. Therefore, the review of literature is focused on three relevant theoretical frameworks: identity, hybridity, and third spaces (see Figure 2). Following this, a review of two spaces, a Native American woman's space and an engineering and technology space, is provided.

Identity	Hybridity	Third Spaces
Stryker & Burke, 2000 Tajfel & Turner, 1979	Bhabha, 1996, 2012 Smith & Leavy, 2008	Bhabha, 1996, 2012
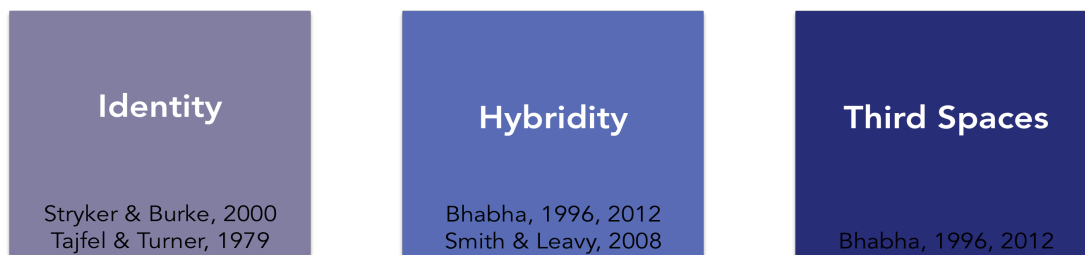
Figure 2. The literature review describes the theoretical frameworks

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Identities – constructed, multiple, and intersecting. Identity defines who one is. Identity is useful as it serves as an interpretive tool for the "multifaceted and dynamic self that mediates the relationship between social structure and individual behavior" (Hogg, Terry, & White, 1995, p. 255). Taken together, identities comprise the self-concept, with the self-concept representing the "cognitive structures that can include content, attitudes, and evaluative judgments" (Oyserman, Elmore, & Smith, 2012, p. 72). This enables individuals to make sense of themselves, the social world around them, and their orientation within the social world. Furthermore, identity enables an individual to position oneself within the social world and shape how they are understood and interpreted by others (Mishler, 1999), including who they are (present), who they want to be (future), and who they were (past) (Oyserman et al., 2012). Overall, identity is a meaning-making lens for participation in the social world (Oyserman et al., 2012).
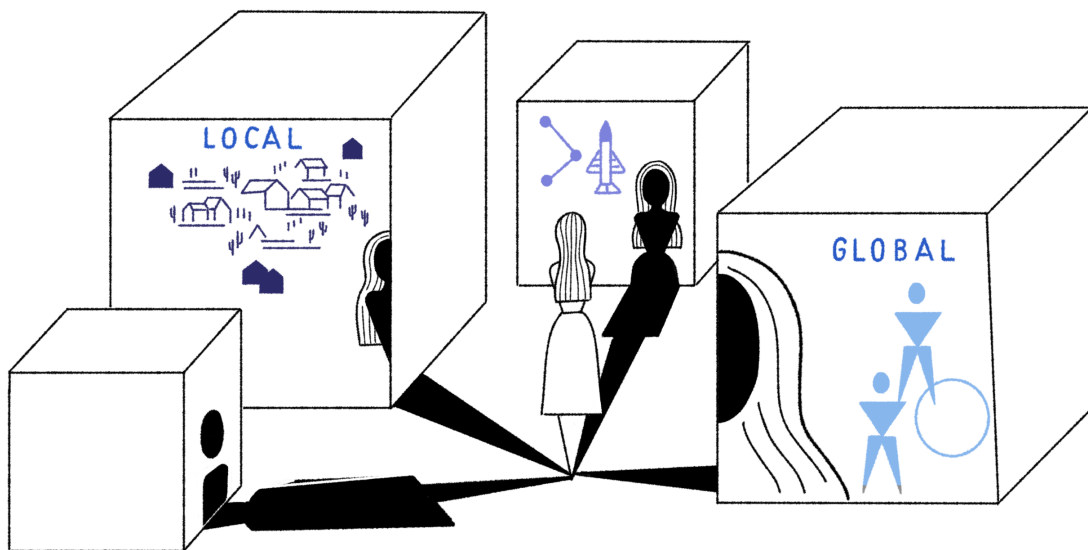
Figure 3. Identities are multifaceted and orient the self in the social world

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Theoretical perspectives on identity provide lenses for exploring both the complexity and usefulness of identity in seeking to understand aspects of the social world. Across the theoretical perspectives on identity, there is "considerable variability in both its conceptual meanings and theoretical roles" (Stryker & Burke, 2000, p. 284). Identity theory (Burke, 1980; Stryker, 1968) and social identity theory (Tajfel & Turner, 1979) are two leading theoretical perspectives on identity stemming from different academic traditions (microsociology and social psychology, respectively) that focus on the reciprocal links between the self and society. Both theories treat the self as "reflexive in that it can take itself as an object and can categorize, classify, or name itself in particular ways in relation to other social categories of classifications" (Stets & Burke, 2000, p. 224). As an object, the individual can categorize itself as a unique being through a personal identity; this represents the individual's perceived personality traits, goals, and desires on an individual level and as distinct from a social group (Stets & Burke, 2000). In relation to other social classifications, individuals categorize objects (e.g., ourselves and others) for their belongingness to the social group or category, representing their social identities. Both processes happen within the social sphere and represent an active, social construction of identity.

Identity theory and social identity theory diverge in their explanations of social behaviors; both are useful for this inquiry as they explain different aspects of social behaviors. Specifically, identity theory is aimed at explaining role-related behaviors (organizing social behaviors in terms of roles), while social identity theory is aimed at explaining group processes and intergroup relations (organizing social behaviors in terms of norms, stereotypes, and prototypes) (Hogg et al., 1995). To elaborate, identity theory

explains that as individuals participate in the social world, they name themselves and others "as occupants of positions (roles)," whereby the "naming invokes meanings in the form of expectations with regard to others' and one's own behaviors" (Stets & Burke, 2000, p. 225). Therefore, the standards that derive from the roles individuals hold inform the behaviors that individuals are expected to carry out. Furthermore, identity theory has proposed that the identity salience (an assumption that role identities have hierarchical importance within the self-concept according to self-relevance) depends on the individual's commitment to the role (Stryker & Stratham, 1985). In other words, "a particular role identity is high if people perceive that many of their important social relationships are predicated on occupancy of that role" (Hogg et al., 1995, p. 258). Additionally, the role identity is high if the individual is likely to invoke the identity in diverse situations (Hogg et al., 1995). Identity salience explains why individuals who share role identities might invoke different behaviors depending on the social context (Hogg et al., 1995). Social identity theory, on the other hand, is focused on examining belongingness to social groups (or group membership) as determined by social identification and social comparison processes. Through social identification, the individual evaluates their compatibility with a social group (through, for example, norms and attitudes) and determines whether they belong to the group. As an example, an individual who is an engineering professional will likely adopt an identity of an engineer and will act like and behave like an engineer, as determined by the constructed and negotiated norms of the social group. As the individual determines they belong to a social group, they then use social comparison to evaluate other individuals and groups as similar to the group ("in-group") and different from the group ("out-group") (Burke, 2006).

Identity commitment of identity theory and social identification of social identity theory

have implications for the self-concept, in particular self-esteem (Burke, 2006). For

example, if an individual does not fulfill the expectation of a role identity, they may

experience the loss of the social group. Both identity theory and social identity theory,

through their respective role-based identities and group-based identities, inform the

evaluative judgments and comparisons that are made within the social world and explain

the meanings that individuals attach while within their role or group as embedded within

social contexts (Burke, 2006).

As individuals operate within the dynamic social world, they form multiple

identities within differentiated social contexts. In other words, across contexts of time,

place, and relations, individual are likely to seek belongingness to many different social

groups, resulting in multiple identities. The ability to hold multiple identities enables the

individual to "focus one's attention on some but not other features of the immediate

context" (Oyserman et al., 2012, p. 69). An individual's multiple identities span across

multiple social identities, multiple role identities, and multiple personal identities. Social

identities (also called collective identity) may include gender, racial, ethnic, cultural, and

class identities (Frable, 1997). In this case, the individual aligns oneself to a social group

and takes on the social group's identity, as explained by social identity theory. With a

social identity, the individual has knowledge that they are a member of the group, has

feelings about their membership within the group, and has knowledge of their status in

contrast to other members of the group (Oyserman et al., 2012, p. 69). Role identities are

diverse and are constructed from the context and informed by culture; examples might

include being a mother (in contrast to a father), an engineering manager (in contrast to an

engineering employee), or a student (in contrast to a professor). Personal identities, too, are diverse as it stems from the unique personal characteristics that an individual perceives herself or himself as having (e.g., "I was born a leader") (Burke, 2003). Depending on the context, an individual may feel and/or act in a certain way according to their multiple social, role, and personal identities. Oyserman, Elmore, and Smith (2012) wrote, "Choices that feel identity-congruent in one situation do not necessarily feel identity-congruent in another situation. This flexibility is part of what makes the self useful" (p. 70).

Studying issues of identity is complex because of its multiplicity and also ambiguous because multiple identities are in a "constant state of negotiation and interpretation: ever changing, always contested, sometimes contradictory, and continuously repositioned by the specificities" (Diggins, 2011, p. 1). Furthermore, multiple identities "simultaneously shape social issues and experiences" (Andersen & Collins, 2013, p. xi). As such, an individual's multiple identities cannot be detangled for singular analysis, but must be considered in their wholeness and for their *intersections* (Andersen & Collins, 2013). For example, for this inquiry, racial, gender, and professional identities are not examined in isolation of one another (a unitary approach used to place boundaries around an identity), nor are the racial, gender, and professional identities explored only in their multiplicity; more comprehensively, the racial, gender, and professional identities are explored for their intersections (e.g., how do the racial, gender, and professional identities interact with one another to influence meanings and behaviors) (Mitchell, 2011, p. 26). This approach to studying issues of identities is known as intersectionality or intersectional theory (Crenshaw, 1989, 1994). As identities operate

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together through intersectionality, they must be considered together as mutually

constructing and shaping experiences.
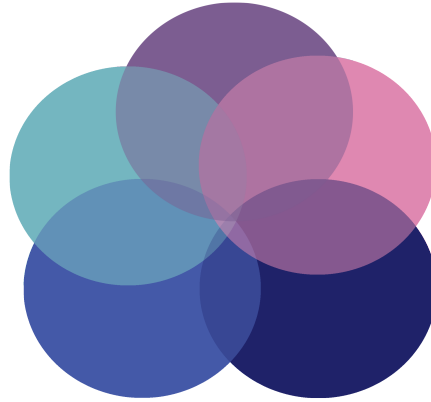
Figure 4. Identities are multiple and intersecting

As this inquiry approaches identity through holism, the participants' cultural,

ethnic, racial, gender, and professional identities are a source of focus as the inquiry

concerns the exploration of what it means to be a Native woman in engineering and

technology. Specifically, racial and gender identities are emphasized because they

"remain the foundations for systems of power and inequality that, despite our nation's

diversity, continue to be among the most significant social facts of people's lives"

(Andersen & Collins, 2013, p. 1); professional identities are emphasized because the

exploration of experiences is contextualized to engineering and technology environments

– environments which are struggling to diversify. Racial identities, however, are

recognized for its limits within this inquiry, as drawing boundaries around what it means

to be a Native is challenging. Racial identity refers to the "distinctions drawn from

physical appearance (skin color, eye shape, physiognomy)" (Frable, 1997, p. 145); it also

a "socially defined, politically oppressive categorization scheme that individuals must

negotiate while creating their identities" (p. 146). On a national level, racial groups are still labeled as: Asian, Black, White, and Native American, although these racial categories are heavily debated. This narrow approach to the Native identity might begin to be resolved by recognizing the confluence of ethnic and cultural identities with racial identities, and perhaps more importantly, "Indianness means different things to different people" (Peroff, 1997, p. 487). Examining cultural identity provides an example of the challenges with drawing boundaries around what it means to be Native. As cultural identity measures might include language, geographic location, and personal associations, such measures discount those who might not speak their tribal language or those urban Natives who live off the reservation land (a process with historical ties to forced relocation policies). Additionally, Native Nations have their own criteria for evaluating one's membership: "Some nations are matrilineal while others are patrilineal and others trace descent through either parent (Weaver & Yellow Horse Brave Heart, 1997, p. 24). Other Natives belong to tribes not recognized by the federal government, creating "difficulty being accepted as an Indian person by outside entities such as Indian Health Service" (Weaver & Yellow Horse Brave Heart, 1997, p. 25). To begin to resolve such challenges with drawing boundaries around identity categories, Native identity might be considered as "exist[ing] at the level of meaningful relations between parts of a living community" (Peroff, 1997, p. 488).

The individuals within this inquiry are recognized for their uniqueness and how their storied experiences may have "manifested differently" (Andersen & Collins, 2013, p. 5). Issues of context across time, space, and relations – in which the constructed, multiple, and intersecting identities are embedded within and influenced by – are

discussed according to the theoretical construct of hybridity, which extends the considerations of identity to its relationship with culture founded upon interactions within institutional, personal, and historical contexts.

  Hybridity and the third space. Home Bhabha's (1996, 2012) theoretical construct of hybridity, advanced from the study of cultural difference, is a useful consideration for this inquiry because it supports that identities are: (1) constructed, multiple, and intersecting and (2) embedded within the social world comprising experiences that take place across contexts of time, space, and relations. Extending the considerations of identity, the construct of hybridity brings attention to *identity as it interacts with culture* (Bhabha, 1996, 2012). Hybridity can be defined as the construction of a new identity from previously discrete and now overlapping identities as a result of interacting cultures (Smith & Leavy, 2008, p. 4). Hybridity has been a "master trope across many spheres of cultural research" (Kraidy, 2002, p. 316), but also has been scrutinized for it generality – because all peoples and cultures may be considered hybrids and all are in the process of hybridity (Rutherford, 1990, p. 211). The theoretical lens that hybridity provides, however, is useful in postcolonial discourse because it gives voice to the "complex negotiation of transcultural influence taking place at the local level in the lived realities of individuals' lives" (Smith & Leavy, 2008, p. 70). Within this transcultural negotiation, which is particularly relevant to our modern-day lives, individuals must negotiate between tradition and modernity, whereby tradition represents localized cultures and identities and modernity represents globalized cultures and identities. Individuals holding both local and global identities within a context may create a new identity for that given context. For example, Native American women within

engineering and technology may hold a local identity of what it means to be a Native American woman as well as a global identity of what it means to be a technician. In the engineering and technology context, which is contextualized to the specific space, time, and interactions, the individual may form a new identity of what it means to be a Native American woman technician. Within this example, the traditional cultures and identities of being Native American women are interacting with the global cultures and identities of what it means to be a technician with a mainstream field. Individuals, cultures, and social structures are not bound by "settled assumptions about [their] identity" (Kalua, 2009, p. 24), but are recognized for their transformation to a "future has not yet taken definite shape" (Turner, 1992, p. 133). Hybridity, therefore, has "emancipative and transformative power" for minority voices within the globalized world (Otsuji & Thompson, 2009, p. 13).

As hybrid identities are constructed through processes of interpretation and meaning-making, they are done so in personal, political, cultural, and historical contexts across dimensions of time, place, and relations. As new identities emerge, so do new spaces. Bhabha (1994, 1996) conceptualized these new spaces as the "third space" – representing an "ambivalent site where cultural meaning and representation 'have no primordial unity or fixity'," but rather have the possibility for new forms of identities and cultures (Meredith, 1998, p. 3). The third space represents the sites in which established conceptualizations of cultures and identities are called into question through on-going, complex negotiations (Meredith, 1998, p. 3). Bhabha (1994) warns that the point of third space is not to trace the exact moments of historical hybridization, but rather its use is to provide recognition of the "innovative sites of collaboration and contestation" that

"initiates new signs of identity" (Bhabha, 2012, p. 2). Third space is on the "cutting edge of translation and negotiation" (Bhabha, 2012, p. 56). Hybridity and third space operate together to demonstrate the value of a "multicultural society that is able to recognize and reconcile diversity" (Smith & Leavy, 2008, p. 5). Hybridity and third space encompass both real and imagined opportunity. Figure 5 shows a diagram of the third space, as a hybrid of the local and global spaces.
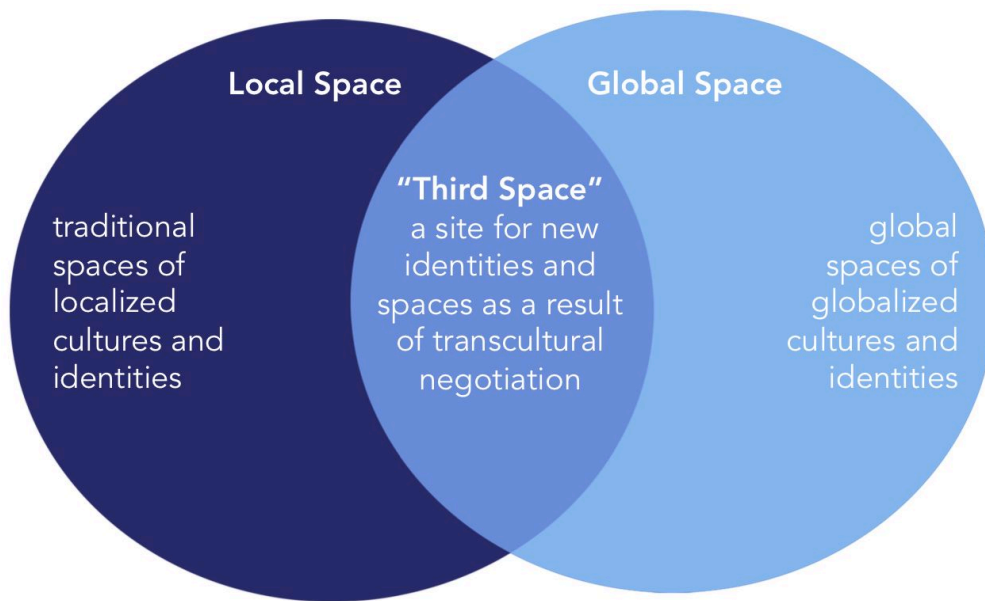
Figure 5. Third spaces can be constructed as a result of transcultural negotiation

Stories of hybridity in the third space. Narrative inquiry has been used as a way to "avoid the hazards of rigidifying aspects of identity into a misleading categorical entity" (e.g., race, gender, profession) by rather emphasizing the complexity of hybrid identities within the third space. Anzaldúa (1999) conceptualized identity as "clusters of stories we tell ourselves and others tell about us" to explain the complexity of identity in its dynamic construction (McCarthey & Moje, 2002, p. 231). Narrative inquiry brings the

cluster of stories to the forefront of research and encourages the researcher and readers to examine hybridity and the third space that are created by the negotiations that occur through interactions with others in context. Stories, therefore, are not diminished, but rather are upheld for their complexity, fluidity, and relational qualities. Figure 6 provides a conceptual illustration of listening to stories in the third space.
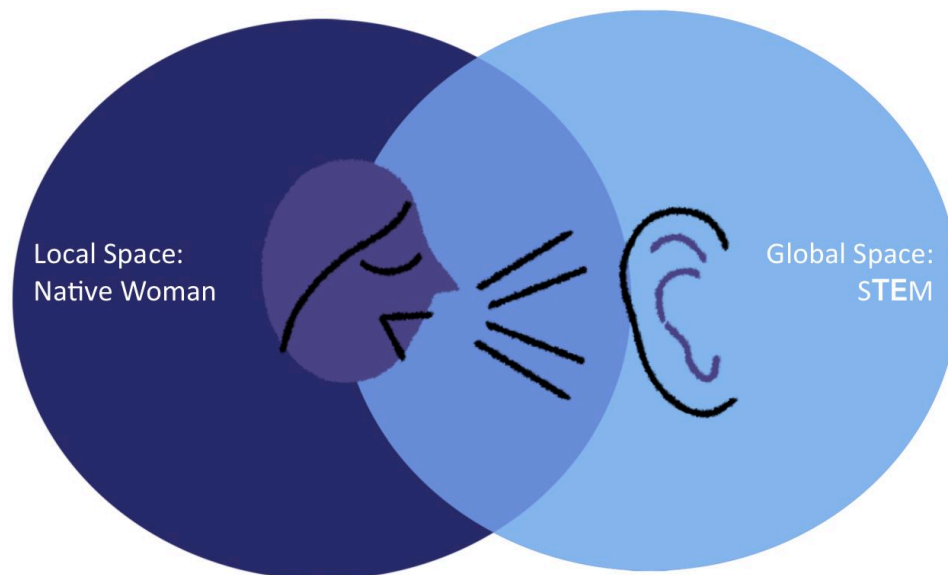
Figure 6. Narrative inquiry upholds listening to stories in the third space

Next steps in seeking to understand the stories. Moving forward in examining the storied experiences of Native American woman in engineering and technology required unpacking the possibilities of local (Native American women) and global (engineers and technologists) cultures and identities. As hybridity and third space are "consequences of historical process" (Huddart, 2007, p. 126), examining the spaces that localized and globalized processes exist within is relevant to this inquiry. Therefore, a

review is provided of the histories, cultures, and social structures that inform the distinct spaces under exploration within the inquiry – the Native American women's space (the localized space) and the engineering and technology space (the globalized space). Each of the spaces has complex histories, cultures, and social structures. As the participants hold identities as Native American women technical professionals, they must navigate these spaces, while actively interpreting and constructing their identities and forming possibilities of hybrid identities.

A Native American Woman's Space

      Native woman identities from Native feminist perspectives. Native American women, like all groups of people who share common identities, are complex, diverse, and in process. They have their own life experiences and perspectives, and come from diverse Native cultures and socio-economic backgrounds. Across their uniqueness, however, these Native American women share the common experience of being Native American *and* a woman, or a commonality of difference *(*Mihesuah, 1996). Native American women's experiences, as a result of their identities as being Native American and a woman, are different than that of both women's experiences (White or any other minority group) and Native American men's experiences (Anderson & Collins, 2001). Rayne Green, a renowned Cherokee woman activist who has dedicated scholarly efforts towards giving voice to the self-determination efforts of Native American women, asserts that feminist writings of Native American women "bears little resemblance" to feminist writings of non-Native American women due to differences in "status and circumstance" (Green, 1983, p. 264). Plainly speaking, a critical difference between feminist writings of Native American women and non-Native American women are in the dominant

narratives of "liberation" of women (propagated by non-Native American women) as compared to narratives of Native American women as "agents of change" (Kidwell, 1978). Addressing this discrepancy within feminist theory, Native American feminists have advanced a movement within scholarship termed "retraditionalization" – representing efforts to remove alien cultural models from the analysis of Native American women and rather recognize the power that Native American women have been assigned by their diverse Native cultures and are actively using to resolve the issues affecting their broader Native communities (Albers & Medicine, 1983; Bataille & Sands, 1984; Brant, 1984; Green, 1983).

The power within the Native American woman is grounded in her cultural dictates, as framed by the Native ethos. The Native ethos is the "way of seeing" that is dependent on cyclical, circular logic where all things are related, including the people of the earth, all the elements of the earth, and the metaphysical (Fixico, 2013a). Within the Native ethos, women have a powerful place as mothers, as mothers represent life-giving force (Allen, 1992; Cordova, 2007; Fixico, 2013a; Silko, 1977). Mothers and grandmothers of Native societies hold responsibilities as wisdom keepers and knowledge givers (Fixico, 2013a; Weaver, 2001). Fixico (2013a) wrote, "The mother defined Native people's lives, gave them lessons to live by, and shaped their cultures" (p. 150). Indeed, the value for women is evident in the abundant and prominent presence of women in the oral traditions of tribes and the cultural values they lived by as well as in the matriarchal, matrilineal, and/or matrilocal social structures of many Native societies (Klein & Ackerman, 1995). The Native ethos – grounded in cultural values, Native philosophies,

and carried forward to new generations through oral tradition – distinguishes the histories of Native American women as distinct from any other group.

The variegated hybrid identities across Native American women shows the complexity of the human experience, but across the differences, the experiences and identities of being a Native American and a woman is defining. The traditional Native ethos fundamentally contradicts with mainstream Euro-American ethos. Yet, contemporary experiences of Native American women require navigation through cultural boundaries and the persistent reinvention of self through processes of hybridization. In order to understand the storied experiences of today's Native American women in fields of engineering and technology who are leading initiatives to improve their Native communities, it is necessary to explore their traditional Native cultures and the roles and experiences of women within them. Modern-day experiences of Native American women stand on the generations of Native American women that came before them, as the oral traditions of their ancestors have been passed down from the elders to the youth. As such, this section, "A Native American Woman's Space", offers key aspects of Native American women's experiences and roles in Native life from three phases of history: traditional life, colonization, and modern-day. The histories offered within these phases are intended to inform how the experiences of Native American women might be unique to other groups. Examples are provided from historical studies of tribes across the Southwest, and whenever possible from first-hand accounts of Native American women collected through ethnohistories and/or histories written by Native American women scholars. The examples and first-hand accounts within the historical

overview are intended to emphasize experiences, rather than chronological time, to align with a Native ethos (Fixico, 2003, 2013).

The power of Native women in traditional life. In the traditional lives of Native societies of the Southwest, women were central to the social, political, economic, and spiritual structures of community. Women's power and prestige was established symbolically through the creation and emergence of narratives and realized through the behaviors and norms of everyday life, including their personal autonomy, economic control, and political clout within their Native communities (Allen, 1992; Bataille & Sands, 1984; Gridley, 1974; Klein & Ackerman, 1995; Sanday, 1981). Addressing questions of "Who are we?" and "Why are we?," the roles of woman and man were passed down through oral traditions spoken in Native languages, including ceremonies, songs, chants, prayers, storytelling, histories, folktales, lullabies, and jokes (Allen, 1992; Bataille & Sands, p. 1984, p. 2; Velarde Tiller, 2011, p. 44); yet Native values for personal autonomy provided opportunities for fluidity among women's and men's roles. Native American women were revered for being the "repositories of tradition and concern for spiritual ideals, upholding the stability of the tribe through both spiritual and generative power" (Bataille & Sands, p. 1984, p. 18). Although Native American tribes of the Southwest vary in their traditions, creation and emergence narratives, identities, worldviews, and cultures, the value for women as co-constructors, influencers, and guardians of Native life and culture is core to Native societies of the Southwest.

Symbolic power: Native women in creation and emergence narratives. Leslie Marmon Silko (1996), the renowned Laguna Pueblo writer, once wrote, "Through the stories we hear who we are" (p. 267). Indeed, the power and influence of women in

Native societies of the Southwest was not born by happenstance, but is securely established through the creation and emergence narratives of Native societies of the Southwest, held in the collective memory of the tribes and retold over hundreds of generations through oral traditions. Across the diversity and complexity of creation and emergence narratives of Native societies of the Southwest, female deities are acknowledged as the creators of the people and all that is on the earth (Kidwell, Noley, & Tinker, 2001). In this way according to the Native ethos, all that is on earth is related (including the people) and earth is their mother. It is for this reason that the earth is known in motherly terms: Earth Mother, Mother Earth, Earth Woman, Mother Creator, Grandmother Earth, and so on (Erdoes & Ortiz, 1984; Fixico, 2013a). For tribes of the Southwest, the earth (as symbolic of mother or grandmother) is named by familiar terms that remind the peoples of specific narratives about their creation and emergence. For example, for the Navajos, she is Changing Woman, named for her ability to grow old and then young again, cycling like the seasons, and providing guidelines for all stages of life (Witherspoon, 1977). For the Apaches, she is also Changing Woman or White Painted Woman (Palmer, 2013; Stockel, 1991). For the Pueblos, she is Iyatiku or Earth Mother and Irriaku or Corn Mother, born from Tséitsínako or Thought Woman (Spider Woman) who "thought of everything that is" by "thinking of her sisters, and together with her sisters" (Silko, 1996, p. 159). For the Hopi, she is Kökyangwati or Spider Woman, who spun the matrix of society (Hazen-Hammond, 1999; Mullet, 1979; Patterson-Rudolph, 1997; Vecsey, 1983). For the Zuni, she is Awitelin Tsita or Earth Mother (Hicks, 2010). The female creator (earth as mother) is an active force in the narratives and lives of

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Native peoples of the Southwest, as she represents "life-giving, life-sustaining, and life-producing qualities" (Witherspoon, 1977, p. 141).

The narratives of earth as mother are complexly intertwined with the narratives of many deities and forces, including supernatural fathers, siblings, children, and creatures, each being known for defining characteristics, such as being a warrior, nurturer, or trickster. For example, within the Navajo creation and emergence narratives, Changing Woman had a sexual union with Father Sun, and as a result birthed a son named Monster Slayer (Locke, 2005). Later in the narrative, Monster Slayer and Father Sun worked together to rid the earth of monsters. Within some Apache narratives, the virgin White Painted Woman birthed a son, Child-of-the-Water, through the power of Ussen (male Giver of Life) (Stockel, 2000). In some Hopi narratives, Spider Woman is the grandmother to Twin War Gods, born of Sun and Water (Mullet, 1979). Within the creation and emergence narratives across and within the tribes, there is a vast array of forces and deities, and some are shared between the tribes (e.g., Spider Woman, Changing Woman) with variations of narratives unique to the tribe, clan, and people (Hazen-Hammond, 1999; Mullet, 1979; Patterson-Rudolph, 1997; Reichard, 1934; Vecsey, 1983). There is no hierarchy of authority among the deities according to gender; rather, they represent "balanced 'opposite' forces that combine as a dynamic whole to form the universe" (Tsosie, 1988, p. 1-2). Unlike the religious narratives of Euro-American traditions where there is one deity who is male (God), male and female deities of Native American creation and emergence narratives teach the people about "birth, regeneration, cyclicity, and the union of masculine and feminine elements" in order to sustain the natural system on earth (Tsosie, 1988, p. 1). Veronica E. Velarde Tiller, a

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notable Jicarilla Apache historian and author, spoke of the balance between female and male in an interview for the documentary, *A Thousand Voices* (Pierce, Martinez, Owingeh, Lucas, & Aubrey, 2015):

> In our origin stories, the female is as important as the male in terms of energy. So you have, for example, Father Sun and Mother Earth… those were created by two forces and not just one. Without man, there could not have been woman. Without woman, there could not have been man. It's an idea of equality and not seperation.

The narratives of tribes of the Southwest are all encompassing and complex. Emphasizing the vastness of the narratives, Silko (1996, p. 268) wrote, "The impulse was to leave nothing out. … Otherwise, the collective knowledge and beliefs comprising ancient Pueblo culture would have been incomplete." Indeed, this was true for tribes of the Southwest beyond the Pueblos; nothing was left out and everything was sacred, including female deities. Across the complexity of the narratives of tribes of the Southwest, women represented active forces, balanced by the forces of men. When this balance was disturbed, it created disharmony and disrupted cosmic order which could be stabilized by gender reciprocity and realizing the roles of man and woman (Zolbrod, 1984). Translating to the traditional lives of Native societies of the Southwest, women were enabled by the value of their gender, passed down from their symbolic power within creation and emergence narratives.

> 'I will tell you why,' she said to him.
> 'You are male and I am female.'
> 'You are of the sky and I am of the earth.'
> 'You are constant in your brightness, but I must change with the seasons. …
> 'Remember, as different as we are, you and I, we are of one spirit. As dissimilar as we are, you and I, we are of equal worth. … Unlike each other as you and I are, there can be no harmony in the universe as long as there is no harmony between us.'
> (Zolbrod, 1984, p. 275)

Behavioral power: traditional daily life. The symbolic power of women established in the creation and emergence narratives framed the identity of what it meant to be a Native American woman. These socially-constructed identities informed gender perceptions, and made it so Native American women of the Southwest could realize their power through the behaviors and norms of everyday life in social, economic, and political spheres. Paralleling the roles of the deities, women and men shared power and prestige, yet had distinct, complementary roles within each area of life to balance one another (which varied depending on the tribe). A man's power was said to come from visions, and a woman's power from children (Bataille & Sands, 1984, p. 37). Edmund Ladd, a Zuni and scholar, stated something similar about his tribe: "Men are responsible for the universe. Women are responsible for the family and the tribe" (Roscoe, 1991, p. 18). To maintain their balance on Mother Earth and within the universe, men and women passed down their cultural values (which importantly included roles for woman and man) through oral traditions spoken in Native languages (Bataille & Sands, p. 1984, p. 2; Velarde Tiller, 2011, p. 44; Allen, 1992). Through her "spiritual and generative power," women were the "repositories of tradition and concern for spiritual ideals, upholding the stability of the tribe" (Bataille & Sands, p. 1984, p. 18). As woman symbolized motherhood and the creator, Mother Earth, she had a central place in her Native society (Shoemaker, 1995). Symbols of motherhood ordered the lives within the tribes of the Southwest (Witherspoon, 1975).

The solidarity of mother and child, symbolized in patterns of giving life and sharing items that sustain life, is projected in Navajo culture as the ideal relationship between and among all people. All one's kinsmen are simply differentiated kinds of mothers … Moreover, this foundational bond of kinship is not limited to people, for the earth is called mother, the sheep herd is called mother, corn is called mother, and the sacred mountain soil bundle is called mother. The symbols of motherhood and the k'é solidarity which they symbolize pervade Navajo culture and provide the patterns and sentiments which order Navajo social life. (p. 125-126)

As the ideal woman of tribes of the Southwest was one that resembled the female deities, a woman gained status in her community by being a mother (biologically or sociologically) and, more importantly, grandmother (biologically or sociologically) (Tsosie, 1988, p. 7). Grandmother symbolized a respected woman who was mature, wise, and knowledgeable about the Native ways (Bataille & Sands, 1984). It was her responsibility to nurture and teach the young, counsel the community, and pass down cultural values and traditions through arts, oral traditions, and ceremonies (Schweitzer, 1999). Grandmothers were "the central characters in the daily and symbolic lives of Native women" (Schweitzer, 1999, p. ix).

A grandmother's understanding of Indian identity is an invaluable perspective that she is able to pass on to her grandchildren. Grandmother-as-cultural-transmitter may be one of her most significant contributions to the perpetuation of Indian communities (Schweitzer, 1999, p. 10)

Grandmothers were instrumental in shaping young women into the ideal woman. Paula Gunn Allen writes (1992, p. 7), "For many tribes, … the decisive, self-directing female is the ideal model to which girls aspire." Grandmothers modeled this and used intellectual thought and argument to teach the young women of the tribe (and all young people of the tribe, for that matter). As young women approached puberty, grandmothers and mothers took part in puberty rite ceremonies to celebrate Earth as mother and grandmother as well

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as the young woman's physical and spiritual transformation to womanhood. The young

women now had the potential and power to be a critical part in society, possessing the

ability to heal and renew her community, especially as she aged to grandmotherhood

(Basso, 1996; Begay, Clinton-Tullie, & Yellowhair, 1983; Frisbie, 1993; Palmer, 2013;

Stockel, 1991).

In many tribal societies, there was a compounded desire for grandmothers to be

the "strongest, most active and articulate" (Tsosie, 1988, p. 7). This made it such that

some grandmothers (biological or sociological) were set apart from others based upon

their achievements. This indicated the generative power bestowed to women was not

wholly representative of the sources of her power in daily life. Beverly Hungry Wolf

(1982) recorded the traditional ways of the women of her tribe (Blackfoot) in her book

entitled, *The Ways of My Grandmothers*. In the book, she wrote:

> All of my traditional grandmothers prayed a lot and believed in their religion. To
> me they were all holy women, living a sacred way of life. But there were special
> ones among them who were revered by the rest of the tribe as holy women. (p. 31)

Although Wolf is not from the Southwest, her statements about her grandmothers hold

true for those peoples of tribes of the Southwest. Notable grandmothers were honored

with becoming medicine women, trusted as healers and leaders. Annie Kahn, a Navajo

medicine woman named The Flower That Speaks in A Pollen Way for her ability to

explain ceremonies and teach, explained that medicine *is* spirituality. Her approach as a

medicine woman is documented in a chapter within *Medicine Women, Curanderas, and*

Women Doctors (Perrone, Krueger, & Stockel, 1989):

> 'Without exception, spirituality is inherent in healing. Spirituality is healing.
> Spirituality is power. No medicine woman will say that she has power because the
> power belongs to the Great Spirit. It is not hers! Everybody has a certain amount

of power. You have power. All of us have power. A medicine woman may use a particular object, such as corn pollen, to make things happen for her. My power is hidden in my prayers. I say 'hidden' because you can't see it. My prayers have names.' (p. 40)

Kahn went on to recall her grandmother's influence on her:

When Annie talked about her formal education, she talked about her grandmother. 'My grandmother was a medicine woman,' she said, 'a counseling medicine women, more, much more than a psychologist.' (Perrone et al., 1989, p. 40)

The social organization of many Native societies of the Southwest further reinforced the importance of women and the power that they held in daily life. Many Native societies of the Southwest were structured as gynocracies, or "women-centered Native societies [structured around] matrilocality, matrifocality, matrilinearity, maternal control of household goods and resources, and female deities of the magnitude of the Christian god" (Allen, 1992, p. 4). Matrilinearity established that the primary identity of children would be inherited from the mother's line. For those matrilineal tribes (e.g., Hopi, Pueblos, Navajo, Western Apache), a mother's clan was identified first, followed by the father's clan, reminding all members of the tribe of the "primary importance" of the female lines and "secondary importance" of the male lines (Klein & Ackerman, 1995, p. 159-160). For some matrilineal tribes, the basic clan unit was centered on the mother and grandmother, whereby grandmothers, mothers, their husbands, and their children would live as a unit (with men moving to their new wife's unit), creating matrilocal structures of living arrangements. Women were the heads of clans, or clan mothers, and this status afforded women with political, social, and economic decision-making powers. Ethnohistorian Richard Perry (1977) wrote of the considerable influence Western Apache women had over daily life through matrilocal structures.

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Women, in fact, did wield considerable influence in the matrilocal extended family unit, which often constituted the basic political unit as well, capable of functioning independently. This heightened female status was supported by the structure itself, since women remained surrounded by relatives, while men, initially at least, were outsiders in the unit. (p. 109)

Within the gynocracies of many Native societies, women controlled economic resources (e.g., managing food production, food storage, and dispersing food to the community) and made political decisions (e.g., whether to go to war). Their economic productivity and their reproductivity were perceived to be "expressions of fertility" (Shoemaker, 1995, p. 8). "Women's reproductivity was often metaphorically identified with food, nurturing, and life itself" (Shoemaker, 1995, p. 8). And so, women's economic roles and decision-making powers honored the symbols of motherhood. In the Hopi tribe, women's roles were passed down through oral stories of the teachings of Spider Woman.

The Spider Woman spoke to them thus: 'The woman of the clan shall build the house, and the family name shall descend through her. She shall be the house builder and homemaker. She shall mold the jars for the storing of food and water. She shall grind the grain for food and tenderly rear the young.' (Mullett, 1979, p. 5)

Memories of watching women of the tribe realize their power in daily life oftentimes stood out to young women of the tribe. In *Yellow Woman and a Beauty of the Spirit*, Silko (1996) wrote about watching the elder women of the tribe work:

One of my most vivid preschool memories is of the crew of Laguna women, in their forties and fifties, who came to cover our house with adobe plaster. They handled the ladders with great ease, and while two women ground the mud on stones and added straw, another woman loaded the hod with mud and passed it up to the two women on ladders, who were smoothing the plaster on the walls with their hands. *Since women owned the houses, they did the plastering* [emphasis added]. (p. 66)

Women's roles in traditional daily life were balanced by men's roles, and cooperation through egalitarian consensus-building was used to survive on Mother Earth and maintain balance within the universe. Spider woman's teachings to women were offered for men as well.

> The man of the clan shall build the kivas of stone under the ground where he shall pay homage to his gods. In these kivas the man shall make sand pictures which will be his alters. Of colored sand shall he make them and they shall be called 'ponya'. After council I shall whisper to him; he shall make prayers sticks or paho to place upon the ponya to bear his prayers.' (Mullett, 1979, p. 5)

The day-to-day tasks of the Zuni Pueblo also demonstrates this balance between woman and man.

> [M]en constructed the houses, but women plastered the outside walls. And while men were responsible for growing corn, women were responsible for storing and distributing it. Men were not even allowed to enter the granaries. Men and women also specialized in different arts and crafts. Men wove blankets, made jewelry, and manufactured their own tools. They even knitted their wives' wool leggings – a disturbing sight for the first Americans who visited the Pueblo. Pottery and ceramics, on the other hand, were made exclusivey by women. And while weaving was usually a male craft among the Pueblos, Zuni women also wove, usually with the smaller waist loom used to make belts and sashes. (Roscoe, 1991, p. 18)

While cooperation was key to creating harmony within the tribe and universe, Native values also upheld individuality and autonomy; the two ideas (cooperation and individuality/autonomy) were not dually opposed. Tribes of the Southwest supported autonomy and individuality through a person's "specific talents, abilities, and clan-sanctioned roles" (Tsosie, 1988, p. 6), which translated to fluidity between roles (e.g., women could do tasks typical of men, such as hunt, and vice versa) and expressions of sexuality (as evident in the third gender recognized by the tribes). Nonetheless, women's

roles were considered critical to survival, with women being considered to be capable of

living without men longer than men without women:

> [Apache] men were not thought able to survive for any extended time without the presence of women to provide the necessary functions of gathering and preserving. Women, however, were thought capable of living for extended time periods without the presence or assistance of men. (Stockel, 1991, p. 15)

Requesting a divorce was also indicative of individuality and autonomy of Native

members. Roscoe (1991) wrote that under the circumstance where a Zuni Pueblo woman

wanted a divorce, she would "simply set his possessions out on the doorstep" (p. 19-20).

> "When he comes home in the evening," Ruth Benedict [American Anthropologist] explained, "he sees the little bundle, picks it up and cries, and returns with it to his mother's house. He and his family weep and are regarded as unfortunate." (p. 19-20)

After the divorce, a woman would typically stay in her home and keep the children, with

the "next husband dot[ing] on them as if they were his own" (Roscoe, 1991). This

experience is similar to occurrences documented from the Navajo tribe.

> Divorce is easy for both men and women in the Navajo way. The woman 'puts the man's saddle outside the hogan' and he gets the message. If the man wishes a divorce, it is said, 'He went out to round up the horses and never came back.' A woman keeps the children with her extended family, and the man returns to his family of origin until he marries again and moves to his new wife's hogan. (Klein & Ackerman, 1995, p. 160)

The power of a woman was defining for Native life in the Southwest, even for

those tribes who were perceived by outsiders as having power differentials between

women and men (Lavender, 2006). As an example, Ruth Underhill (a renowned

American anthropologist who worked with the Tohono O'odham in the 1930s as a

recorder-editor documenting the life story of Maria Chona for *Papago Woman* (1979))

wrote about being corrected by Chona after misunderstanding women's place in the

Tohono O'odham tribal society.

> 'You see, we *have* power. Men have to dream to get power from the spirits and they think of everything they can – songs and speeches and marching around, hoping that the spirits will notice them and give them some power. But we *have* power.' When I looked a little surprised, the answer was 'Children. Can any warrior make a child, no matter how brave and wonderful he is?' They sniffed. 'A very small part. It's nothing compared to the months that a woman goes through to make a child. Don't you see that without us, there would be no men? Why should we envy the men? We *made* the men.' (Underhill, 1979, p. 92).

As a result of the work, Underhill coined the term "executive woman" to describe the

control Chona had over her own life and her self-directed accomplishments (Underhill,

1979). Although Chona was not representative of all Tohono O'odham women, her

strength as a woman grew out of her culture (this, according to Underhill's observations)

(Underhill, 1979). Chona's story, as it falls within a patriarchal social organization

(Lavender, 2006), represents an outlier case for tribes of the Southwest as many other

tribes were structured as matriarchies, with the exemplars being that of the Navajo and

Pueblo. Even in Chona's tribe, and across other tribes of the Southwest, women held

power that secured their position in life. Other works by Gladys Reichard (specifically

Dezba: A Woman of the Desert (1939) based off of the life of Navajo matriarch Maria

Antonia) and Elsie Clews Parsons (for example, *Pueblo Indian Religion* (1936) informed

by a Zuni governor's wife Margaret Lewis) represent works that made the "marginal

central" and broke through the scholarship with an understanding of the power women

held in traditional life (Kidwell & Velie, 2005, p. 6; Lavender, 2006). While these works

were transformational, early anthropologists who studied Native societies, yet were

foreign to Native cultures, were unable to interpret the meanings of the Native cultures

and imposed patriarchal ideological worldviews and values. These neglectful

interpretations of Native cultures led to misreports of Native life; these

misunderstandings persist today (Stockel, 1991, p. 10). For those reputable, early

anthropologists who have been validated by the Native societies (e.g., Brugge and

Benedict), the equality between men and women was evident.

> The women of this tribe seem to have equal rights with the men, managing their
> own business and trading as they see fit, saddling their own horses, and letting
> their husbands saddle theirs … (Roessel, 1981, p. 14)

The power of Native American women of the Southwest was established

symbolically through creation and emergence narratives, and realized through the

behaviors and norms of everyday life in social, economic, and political spheres. This way

of life informed what it meant to be a Native American woman. However, a formidable

phase in history was on the horizon with those peoples looking to colonize the Southwest.

Colonization: marginalizing the power of Native women.

> We saw a major violation of our way of life by societies foreign to our
> communities, ignorant to the preciousness and profoundness of the females in our
> societies. As a result of that we began to see the fractionalization of a way of life.
> (Pierce et al., 2015)

From the Spanish inquisition of the sixteenth century, Mexican-American

invasions of the nineteenth century, early reservation periods of the twentieth century to

present day, Native societies of the Southwest have endured long, traumatic histories of

oppression at the hands of colonizers who attempted to strip them of their cultures and

ways of life. The social, political, economic, and spiritual structures that were core to

Native societies were devastated. Colonizers forced a patriarchal system whereby race,

ethnicity, ancestry, sex, occupation, and ownership of land dictated status and authority

(Gutierrez, 1991; Prindeville, 2004). This corrupted the essence of Native societies that "generally valued knowledge, skill, and maturity – qualifications obtainable by both sexes" (Prindeville, 2004, p. 102).

Prior to confining Native Americans to reservations, patriarchal ideologies were forced upon Native societies with mandated conversions to Christianity by priests and missionaries. By the late 1800s, Native Americans of the Southwest were forcibly placed on reservations or assimilated, and the focus shifted to children under the economic rationale that it is "cheaper to educate Indians than to kill them" (words spoken by Indian Commissioner, Thomas Morgan, at the establishment of the Phoenix Indian School in 1891 and propagated by the U.S. Secretary of Interior, Henry Teller, and Commissioner of Indian Affairs, Carl Schurz) (Lindauer, 1998, pp. 1). The "Kill the Indian in order to save the Man" boarding school era was used as an attempt to terminate any resemblance of Native culture, which profoundly impacted the value of women (Adams, 1995; Barton, 2004). During this time, Native American children were "forcibly abducted" from their homes, and stripped of their identities, cultures, and values (Lajimodiere & Carmen, 2013, pp. 3). Children endured a horrific "civilization process" whereby they were forbidden from embodying any Native cultural value or traditions, including speaking their language, expressing their spirituality, referencing kinship, speaking of "the way you make a living," and "the way you express emotion" (Bear, 2008). Beatings, starvation, military regimes, and manual labor were part of daily life at the early reservation schools (Giago, 2006). Rather than send the children home for the summer, they were "leased out to white homes for menial labor" (Smith, p. 7, 2009, p. 5). The school administrators targeted young girls and structured their education so that they

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would learn their proper place as subservient housewives (Smith, 2009, p. 5). The motivation was to "inculcate patriarchal norms and desires into Native communities so that women would lose their places of leadership in Native communities" (Smith, 2009, p. 5). Native American girls were affected through direct abuse at the boarding schools and Native American women were affected through the indoctrination that they were no longer of any value to society.

By the beginning of the twentieth century, over 100,000 young Native Americans had been raised without their families, in some cases for years (Native American Public Telecommunications, 2006). With the absence of their Native communities and oral traditions, the children's identities and cultures, including the foundational value for women, had been desecrated. The abuses of the boarding school era set a history of abuse and terror that has lived on in Native societies today through violence against women and substance abuse (Yellow Horse Brave Heart, Chase, Elkins, & Altschul, 2011). Generations of young Native Americans were raised to be "terrified of being Indian," which began cycles of intergenerational trauma and loss of culture for some (Lynch, 2012, pp. 17)

> I don't know how to speak Indian. When I was little, my mother and father didn't speak it to us because they were brought up in boarding schools and when they went to boarding schools they were forced to go. They were beaten for speaking their native language at boarding school. So they thought that we would be taken from home and forced to go to boarding school too. So they didn't want us to be brought up speaking our language and beaten if we talked our language. So they didn't teach it to us. (Whitbeck, Adams, Hoyt, & Chen, 2004, p. 122).

Like the effects of boarding schools, new political mandates under patriarchal infrastructures instituted discrimination against Native American women of the Southwest. For those adult women that were left on the reservation, their rights, including

rights to their property, were severely affected during the early reservation years. In traditional life, Native American women and men did not own land, but rather owned rights to anything they made, including their homes (Shoemaker, 1995), Upon the passing of the Dawes Act in 1887 by Congress, reservation lands were divided into small plots, managed by the federal government through the Office of Indian Affairs, and assigned to Native American heads of the family, "ideally the husband and father" (Shoemaker, 1995, p. 160, Stremlau, 2005) An Euro-American ideological framework dictated the "'proper status' of women and sought to teach the Indians 'suitable' sex roles," one where women were dependent on their husbands as a 'helpless helpmate'" (Christofferson, 1991, p. 178). Native women, who were divorced, widowed, or single could serve as heads of households, but many struggled with realizing these rights (Stremlau, 2005). Women of the Native societies experienced a grave loss of their socio-economic and political powers and identity.

> In the process of allotting lands to Native Americans, wives were relegated to a dependent position with regard to property. The allotting commission assigned land to husbands. Wives' rights to that land in cases of divorce were contingent upon the legality of their marriages. This was a significant change from pre-reservation pattern in which women's rights to divorce and property were not restricted by men. … Government dictates concerning marital property, however, created a new male-dominated social and economic system. (Shoemaker, 1995, p. 170)

In the early 1900s, the federal government passed a series of mandates to gain additional control over Native Americans and their reservation lands. In 1924, American citizenship was forced upon Native Americans, whether it was wanted or not, through The Indian Citizenship Act (Jaimes, 1992). Prior to this, geologists working for the Standard Oil Corporation located possibilities of oil and natural gas deposits on the

Navajo reservation (Jaimes, 1992, p. 94). Navajo (male) elders declined to authorize the drilling of test holes, and subsequently the federal government stripped any resemblance of traditional leadership under the guise of a "better administration." The new leadership was comprised of young, male, Anglo-educated Native Americans hand selected by government officials to conform to the federal governments' quest for oil, gas, and minerals. The Meriam Report, published in 1928 by the Institute for Government Research, reported that drilling for oil and natural gas would "recover the costs associated with its support [of Native Americans and the reservation lands]," and as such the native governments (and specifically the Navajo government) should be governed by corporate boards and the Secretary of Interior (Jaimes, 1992, p. 94). The Indian Reorganization Act (IRA or Wheeler-Howard Act) of 1934 enacted that Native governments be converted to a council model, like that of corporate boards, and absorbed into the polity for the "'beneficial' management of Indian land and resources" (Jaimes, 1992, p. 95). The government structure was meant to "undercut the unity marking traditional native societies," including the "consensual form of decision making and selection of leadership integral to indigenous traditions," and rather established constitutions and charters managed by departments of the U.S. government (Jaimes, 1992, p. 95). By 1938, 108 Native nations reorganized and 77 rejected the act, including the Navajos (Olson & Wilson, 1986, p. 124; Prindevelle, 2002). The 1940s and 1950s brought additional rulings to assert control over Native Americans, including the House Concurrent Resolution 108 that led to the termination of 109 Native nations, Public Law 280 that stripped Native nations of legal authority rights, The Relocation Act of 1956 that displaced Native Americans and families to places foreign to them, and The Indian Civil Rights Act of

1968 that restructured Native governments to be more regulated by the federal government.

Colonization demolished Native life and left Native American women and men disenfranchised. Women suffered additional devaluation and displacement from their status in life based solely on their gender. While men were assigned to be the chiefs, council board members, and representatives for government, women no longer shared political or economic power with the men of their tribes. The patriarchal society fueled discrimination against women. The effects of this are apparent in all aspects of life – political, economic, social, and spiritual. This is all too apparent in one particular case in the Southwest. In 1978, the traditionally matriarchal Pueblo society was supported in enforcing a gender-based membership system, created from effects of colonization, which "treated female members in a disabling and different way than male members" (Valencia-Weber, 2004, p. 49). Children of women who had married outside the tribe were denied membership, but were given to the children of men who had married outside the tribe. Women were left "virtually paralyzed within a system that subordinates women" and without federal Indian benefits, such as annuities from the tribe, access to education and health programs, and housing, suffered financially and psychologically (Christofferson, 1991, p. 170). Women in this circumstance suffered from a loss of cultural identity from tribes that were tarnished by societies foreign to their cultures, traditions, and more importantly their value of women.

> My only crime is being born a female. I want the same rights as the men – the right to vote for a chief and the right to live on the reservation. (Christofferson, 1991, p. 170)

Cultural genocide desecrated the Native ways of life, and Euro-American-based social, economic, educational, and political systems continue to reinforce ideas that women have a subordinate position to men. However, throughout colonization periods as well as through postcolonial time periods, Native Americans have demonstrated resilience to protect Native cultures and traditions.

Resilience and rebuilding: Native women in transition.

> "Resilience is required of anyone who wishes to survive. Whether bonds of prison or bonds in our own mind, resilience offers hope to a dismal future. … this is an essential step to rebuilding." (Fixico, 2013b, p. 15).

Through generations of cultural genocide, the women and men of Native societies of the Southwest remained steadfast in their dedication to protecting their cultures and traditions. Narratives of resilience throughout colonization periods in Native American history – including reservation life, land allotments, boarding schools, Native government restructures, deals with the federal government, and relocations (Fixico, 2013b) – are proof of the determination to preserve the sacredness of Native lives and values. The self-determination of the Native societies of the Southwest enabled them to reinvent their lives, as they were now embedded within mainstream White society. The 1960s and 1970s was a time in which the rebuilding of Native societies began to gain speed, but certainly the generations beforehand contributed to reaching this milestone (e.g., the formation of the Society of American Indians in 1911 which "advocated the abolishment of the Bureau of Indian Affairs (BIA) for its paternalism and pressed for the protection of Indian legal and cultural rights") (Fixico, 2013b, p. 122). Activism by upcoming Native American leadership paved the way to protect the rights of Native societies and restore balance to their ways of life. Fixico (2013b) wrote of Native American leadership during

this time in his book *Indian Resilience and Rebuilding: Indigenous Nations in the Modern American West*. Groups that were formed in order to advocate on behalf of their Native communities included the National Indian Youth Council (formed in 1961), National Indian Education Association (formed in 1970), National Tribal Chairman's Association (formed in 1972), and the Council of Energy Resource Tribes (formed in 1975) (Fixico, 2013b). Documents like the Declaration of Indian Purpose: The Voice of the American Indian (1961) and movements like "Red Power" and American Indian Movement (AIM) were grassroots efforts to "push back" against the "unwanted cultural transition" (Fixico, 2013b, p. 124-126).

Native American women had a critical role in the resilience efforts of Native societies. As an example, several women were among the main leaders of the National Indian Youth Council. In a book about the NIYC, *Red Power Rising: The National Indian Youth Council and the Origins of Native Activism* (2011), Shreve wrote:

> The founding of the National Indian Youth Council was also a part of the growing politicization of young people in the United States. There were, however, some significant differences between the NIYC and its contemporaries. Women, for example, played a much greater role within the NIYC than they did in other student organizations. Joan Noble, Shirley Hill Witt, Karen Rickard, and others not only helped create the NIYC but also assumed positions of leadership. They often directed policy, planned meetings, edited the council's publications, and greatly contributed to the overall ideological evolution of the NIYC. (p. 7)

As changed occurred, activism within Native societies was not always united or homogenized. There were generational differences in how Native issues should be dealt with and how solutions should be conceptualized (Fixico, 2013b). Nonetheless, activism on the behalf of Native American women and men created a "new prototype warrior" (Fixico, 2013b, p. 124). New legislation was established to protect Native Americans.

Examples included The Indian Self-Determination and Education Assistance Act (1975),

requiring that Native Americans have representation in the programs directed by federal

government; The Indian Child Welfare Act (1978), whereby the boarding school system

was renounced and adoption procedures put in place for Native American children; and

The American Indian Religious Freedom Act (1978) which gave Native Americans the

rights to express their spiritual beliefs (Fixico, 2013b; Jaimes, 1992).

Women were, and remain to this day, critical throughout the resilience and

rebuilding of Native life. Women as keepers and bearers of culture, identity, and

traditions have sustained the cultural vitality of Native societies of the Southwest

(Kidwell, 1978, p. 120; Medicine & Jacobs, 2001). Despite being stripped of power,

Native women remained steadfast to protecting their Native cultures and traditions and

grew their economic and political power. Native American women feminists have written

that the traditional roots of Native societies have supported Native American women in

their resilience as they were confronted with colonizers who sought to strip them of their

power. For example, Clara Sue Kidwell (1976), a scholar and member of the White Earth

Chippewa and Choctaw tribes, wrote of the strength and persistence of Native American

woman:

> The persistence of their biological function and role in society has provided a
> sense of security and stability in the changing Indian world, and their flexibility in
> adapting to other roles has been a survival factor in processes of acculturation. …
> The role of wife and mother persists (to note the higher Indian birth rate), and it is
> still respected in Indian communities. The positive actions of her children still
> reflect on her credit as wife and mother. She is still in a position to influence
> decisions because she is a respected member of the community. If she has been
> forced into the job market of the dominant society to help support her family, she
> still plays an active important role within her own society. She is still a bearer of
> culture and identity of her people, and in this role there is still power. (p. 120)

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This excerpt demonstrates the concept of "retraditionalization," whereby Native American women are able to "integrate traditional and contemporary demands in a positive, culturally consistent manner" because their "traditional base" empowers them as cultural transmitters through their behavioral and spiritual powers (Royster & Simpkins, 2005, p. 51). Traditions of Native cultures, evident through artistry, ceremonies, and storytelling, keep alive women's status in Native societies (Medicine, 2001). The transmission of cultural values through traditional teachings has enabled contemporary Native American women in contributing to the resilience and rebuilding efforts to preserve Native societies and push back against being engulfed by dominant society. Medicine (2001) recognized that the status and position of contemporary Native American women are being supported through artistic efforts, educational efforts, economic enterprises, and rituals. Native American women, across their diverse worldviews, experiences, and Native cultures and traditions, are navigating new pathways and re-constructing what it means to be a Native American woman in the contemporary world. Although there are great differences between different Native cultures and individuals and no such thing as a monolithic Native American woman (Mihesuah, 1996, p. 15), "traditional narratives have stood the test of time, demonstrating a vitality and resilience to speak to contemporary issues and problems" (Denetdale, 2007, p. 134).

Contemporary leadership of Native women. Examples of today's Native American women leadership are evident in all social, economic, and political aspects of life. The National Center for American Indian Enterprise Development (2016) annually honors forty Natives under forty years old. In 2014 and 2015, nearly half of the recipients

were women. Beyond these awards, Native American women are making an impact in national-level politics, including Jodi Archambault Gillette (Standing Rock Sioux) who served as the Deputy Associate Director of the President's Office of Intergovernmental Affairs and Diane Humetewa (Hopi) who is the first Native American women to appointed as a federal judge for the U.S. District Court of Arizona. Within education, Native American women have earned bachelor's and master's degrees at faster rates than their Native American male counterparts over the past ten years (Knapp et al., 2005). Within the social aspects of life, Native American grandparents have a strong role in their grandchildren's lives, with seven percent of grandparents living with their grandchildren in 2004 (more than twice the rate of the total U.S. population) (Ellis & Simmons, 2014; Pérez & Luquis, 2008). Nearly sixty percent of those Native grandparents were partially responsible for their grandchildren's care (this speaks to the importance of grandparents in Native American life, but also the issues of poverty within Native communities as result of decades of trauma) (Pérez & Luquis, 2008).

Some Native American women are choosing to rebuild their Native communities through entrepreneurship and innovation. Businesses owned by Native American and Alaska Native women have grown 124 percent and revenues increased 48 percent from 1997 to 2014 (American Express OPEN, 2015). As of 2014, Native American and Alaska Native women owned 119,000 businesses and employed 40,600 workers, generating over ten billion dollars in revenue (American Express OPEN, 2015). Among the Native population in the U.S., women own 47 percent of all Native American and Alaska Native-owned businesses, employ 33 percent of the workers, and contribute 29 percent of the revenue (American Express OPEN, 2015). This represents a large contribution to the

Native community on behalf of Native American women's efforts. Most Native American and Alaska Native women-owned businesses are concentrated in the Southwest – Oklahoma, New Mexico, and Arizona.

Within the social, economic, and political structures of dominant society, many Native American women are forging new paths and reinventing what it means to be a contemporary woman, standing upon the strength of the generations of Native American women that came before them. As Native American women use their voices to advocate for their Native communities, they are honoring their Native cultures and traditions and ensuring their path toward a sustainable and culturally vibrant future.

Summary. By offering key aspects of Native American women's experiences and roles in Native life from three phases of history – traditional life, colonization, and modern-day, the section "A Native American Woman's Space" provides evidence of the value for Native American during periods of Native history. Furthermore, across these histories, the strength of Native American women is evident. Native histories, cultures, and social structures inform what is means to be a Native American woman. As Native American women share the common experience of being Native American *and* a woman, the constructions of their identities have stood upon identities as agents of change rather than those that needed liberation. Today's Native American women must navigate localized spaces of Native traditions, cultures, and identities as they are confronted with contrasting spaces – such as engineering and technology spaces.

An Engineering and Technology Space

Under the theoretical framework of hybridity and third space, the second space under consideration is the global (mainstream) space – for this inquiry, the engineering and technology space. Considerations for this space include examining the distinct identities, cultures, and histories of the space – or, more specifically, the beliefs of what it means to be a professional in the space, common sets of knowledge and practices that define the space, and the histories that informed the creation of the space. This review of an engineering and technology space is intended to inform how the participants navigate being a Native American women working in engineering and technology.

Professional identities from feminist theories. STEM fields, particularly engineering and technology, are struggling to be inclusive of women, more drastically minority women, and even more drastically Native American women. Select scholars within engineering education have turned to feminist theory to address the diversity issues plaguing STEM, particularly engineering and technology (Beddoes & Borrego, 2011; Riley, Pawley, Tucker, & Catalano, 2009; Riley, 2008). Beddoes and Borrego (2011) wrote: "Deeper engagement with feminist theory would help explain the complex problem of underrepresentation and suggest a promising path forward" (p. 281). Moreover, the authors argued that "explicitly feminist theories are also needed to illuminate deep-rooted gender issues in engineering education" and to address "the goals of increasing gender diversity and equity in engineering" (Beddoes & Borrego, 2011, p. 282). Riley, Pawley, Tucker, and Catalano (2009), too, echoed this point in their article, *Feminisms in Engineering Education: Transformative Possibilities* and posed the question of where a "broader approach to feminism in engineering education and practice

[might] take us" (p. 24). Beddoes and Borrego's (2011) literature review of feminist

theory in engineering education journals for the time period 1995-2008 synthesized

distinct branches of feminist theory that have been represented in engineering education

to address the experiences of women, including women minorities, in engineering and in

some cases, more broadly, STEM. Intersectional feminism, through intersectional gender

theories and multicultural theories, is one branch of feminism that has been applied to

engineering education to address "gender in relation to other identities or hierarchies such

as race, class, ethnicity, sexual orientation, and nationality that form a complex

intertwining of identity and oppression of marginalized groups," assuming that "gender

alone is neither a total identity nor universally experienced" (Beddoes & Borrego, 2011,

p. 286). The intersectionality framework was discussed in previous sections of this

chapter to illuminate the need to recognize individuals as having complex, evolving,

constructed identities and, because of this, a singular dimension of their identity (e.g.,

gender) cannot be examined as isolated from other dimensions of social identities and

contexts of time, space, and interaction. As Beddoes and Borrego have pointed out

(2011), intersectional approaches have drawn from scholarship within Black feminism

and Chicana feminism. This narrative inquiry extends the application of the intersectional

approach within engineering education by turning to Native American feminism to

explore the lived and told stories of Native American women in engineering and

technology to reveal the complexities and particularities of their experiences in the field.

Donna Riley's book *Engineering and Social Justice* (2008, p. 84-85) overviewed the role

of stereotypes in engineering education. Within this overview, Riley highlighted

landmark studies that are grounded in intersectional feminist theories. Speaking to their

importance, Riley (2008) wrote, "Consideration of the intersectionality of race and gender in engineering reveals an even more complex story," and the complex stories reveal challenges that "can be glossed over when they are lumped into larger categories of analysis" (p. 84). Specifically, Riley overviewed studies by education scholar Pauline Chinn (2002) and education and counseling scholar James Moore (Moore III, Madison-Colmore, & Smith, 2003). Chinn (2002) conducted a narrative analysis to explore the experiences of female Asian and Pacific Islander engineers and scientists, specifically as it related to racial stereotypes of "model minorities," or those populations who were perceived as stereotypically excelling in STEM. The intersections of race and gender were explored and contributed to understandings of the development of professional identities in STEM. For example, Chinn (2002) wrote that the findings "suggest K-12 gender equity science practices encouraged development of the women's interests and abilities but did not affect parental beliefs," with those parental beliefs potentially affecting participation in STEM and the development of professional identities being that "parents expected daughters to be compliant, feminine, and educated enough to be marriageable" (p. 302). Moore III, Madison-Colmore, and Smith (2003) conducted a grounded theory study to explore the perceptions, attitudes, and experiences of African American males enrolled in engineering school at a predominantly White institution. He found that African American males "work harder to counter negative stereotypes" (Riley, 2008, p. 84), and contextualized his findings to literature on, for example, stereotype threat and persistence in engineering.

Professional identities are of importance to engineering education because they illuminate questions surrounding an individual's educational and professional persistence

and retention and the factors that may contribute to their sense of belongingness to the engineering and technical community (Meyers et al., 2012) and how they engage with and make sense of professional knowledge and skills (Ibarra, 2004). An engineering identity, in specific, frames how an individual sees herself or himself as an engineer and the sense they make of their work and responsibilities as an engineer and the skills and relationships they need to perform their work (Murphy, Chance, & Conlon, 2015). In the words of McIlwee and Robinson (1992, pp. 20–21), "To be taken as an engineer is to look like an engineer, talk like an engineer, and act like an engineer." Scholars who have studied engineering identities have examined the development of the professional identities among pre-adolescent learners (Capobianco, French, & Diefes-Dux, 2012) and engineering students (Dukan, 2008; Elliot & Turns, 2011; Loui, 2005; Yun, 2006) as well as the professional identities of practicing engineers and engineering technologists (Downey & Lucena, 2004; Jorgenson, 2002; Seron, 2015). From a qualitative study on the gendered perspectives of engineering identities (Hatmaker, 2013; Jorgenson, 2002), it was found that: women engineers have qualified themselves as engineers through their intellectual engagement in the work (in other words, their technical competency), emphasized strategies that have allowed for their success in technology environments, positioned themselves from a stance where gender is irrelevant to their experience in technology and they are an individual and not part of a homogenous group of women engineers, and tensions exist between the responsibilities of family (e.g., motherhood) and work. In another qualitative study on the gendered perspectives of engineering identities (Hatmaker, 2013), it was found that women engineers navigate their engineering identities through "impression management tactics" (essentially, proving

oneself and presenting a professional image and status) and "coping strategies" (essentially, those tactics, such as rationalizing, that are inward focused). In a qualitative intersectional study of race, gender, and class (Seron, 2015), it was found that the class identity was impactful in that underrepresented minority women from upper middle class had the "cultural capital" to negotiate tensions stemming from race and sex.

As this narrative inquiry concerns those in engineering and technology work, it is useful to broaden the exploration of professional identities to those including technologists' identities. Murphy, Chance, and Conlon (2015) explored engineering and engineering technologist students' identities from a technical institute. They found, paradoxically, that engineering students saw their developing professional identities as closely linked with design activity and different than those of engineering technologists, whereas the engineering technologist students saw their developing professional identities as being that of engineers (even though they did not do design work); the engineering technologists also viewed the activity of engineering as broad and with many job roles (Murphy et al., 2015). Land (2012) found that for a "very broad range of engineering companies operating across the full spectrum of engineering services and products, baccalaureate engineering technology graduates are engineers" (p. 38). In other words, engineering technologists share identities as engineers and view the differences in their work versus those with engineering degrees as differences in academic orientation (theory-based versus application-oriented) (Land, 2012).

Like all identities that an individual may hold, professional identities are dynamic and shaped by context (Clarke, Hyde, & Drennan, 2013, p. 8). Forming a professional identity within a given profession (of concern in this inquiry, engineering) "is a process

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involving many knowledge sources, such as knowledge of affect, human relations, and subject matter" (Clarke et al., 2013, p. 8). "As people acquire discourses they form the social self in new ways" (Clarke et al., p. 8). Professional identities represent a "complex interweaving of values, social forms, linguistic forms, [and] beliefs" (Lundell & Higbee, 2001, p. 58).

On an institutional level, the profession and academic discipline of engineering work together to form the cultural frame, or the cultural landscape, of engineering (Godfrey & Parker, 2010). As the engineering community actively works towards defining what we are and what we are capable of becoming (Rover, 2008, p. 389), its cultures and identities are in flux. As engineering educators, the conversations that we have, the research that we do, and the steps that we take to improve the teaching and learning of engineering constructs the "culture of engineering practice, research, and education" (Rover, 2008, p. 389). *Engineering for a Changing World: A Roadmap to the Future of Engineering Practice, Research, and Education* (2008) speaks to the complexity of engineering in the contemporary world and how its identities and cultures are changing rapidly. This section offers an overview into the institutional norms and distinguishing factors of the knowledge domain of an engineering and technology space, including defining engineering and technology, the types of problems engineering solves, the methodology for solving engineering problems, the attributes required of engineering work, and the ontology of engineering. These sections are intended to inform how individuals in engineering and technology might make sense of their work.

Placing boundaries around the engineering and technology space. The word engineering was constructed from the words engine and ingenious which, when taken

together, derive from the Latin word *ingenium*, meaning *a clever invention*. The inventions, or products that derive from engineering, are the technologies. Engineering and the technologies derived from engineering have existed since the beginning of humankind as people changed their environment to suit their needs and developed products to improve their lifestyle (e.g. the wheel or the pulley). Classic engineering achievements are evident in the pyramids from the Ancient era and advances in electrical and mechanical engineering of the Renaissance era. Engineering as a profession was born in the 19th century out of societal and economic demand (Noble, 1979). Throughout time and context, the essence of engineering has remained the same: to create change. Koen (1985) wrote: "To identify a situation calling for the engineer, we must look for one in which not just any change, but the best change is desired." (p. 10). The changes that engineers seek to make and the ways in which they carry out change can be examined by the types of problems engineers solve, the methodology engineers employ to solve problems, the knowledge they use to carry out the method, the values and attributes of engineers, and the reality and identity of engineering.

   The types of problems engineers solve. The changes engineers make have a distinct function: they are intended to create an optimal solution for a human or societal need (Koen, 2003). Engineering's purpose to create solutions is often conceptualized as problem solving. For example, the National Academy of Engineering (NAE) and National Research Council (NRC) (2009) wrote that engineering is "a process for solving problems"; and The U.S. Department of Labor specified that engineers develop "economical solutions to technical problems*"* (Carnegie Foundation for the Advancement of Teaching & Sheppard, 2009). The types of problems that engineers deal

with are *design problems* and are characteristically practical, achievable, ill-structured, context-specific, and have no definitive solution (Cross, 2008; McKenna, Kremer, Plumb, Ro, & Yin, 2011). Visser (2006) contested that there are limitations to conceptualizing engineering as problem solving due to the nature of a *problem* being one that is a difficulty and deficiency and the nature of *solution* being one that is rigid. Rather, the situations that engineers seek to change – labeled as engineering design problems – must be actively constructed and structured by engineers and those that they interact with during the engineering process. Lending to the active construction of an engineering design problem, engineers will often re-evaluate and re-frame the problem throughout the engineering process (Vincenti, 1990). Like engineering problems, their outcomes (engineering design solutions) are not rigid. An engineering solution is the "best change within available resources" (Koen, 2003) and can take many forms, including systems, processes, artifacts, and so on. As Koen (1985) challenged, "Look around the room in which you are now sitting. What do you find that was not developed, produced or delivered by the engineer?" (p. 7). Consider the number of engineering professions that exist today (16 according to the U.S. Department of Labor) and the engineered products they produce and this task takes on another order of magnitude. Engineering design problems and their solutions span an insurmountable breadth and diversity and are actively constructed.

   The methodology engineers employ to solve problems. Engineering design is the methodology that engineers use to produce their outcome (an optimal solution to the engineering design problem) through the use of heuristics (Koen, 2003). Engineering design is the common denominator across all engineered products and is what can be

used to identify the presence of engineering activity (Koen, 1985). Like the diversity among engineered artifacts, the engineering design process is complexly varied in the ways it is performed. Bucciarelli (1996) showed in *Designing Engineers* that the engineering design process does not take one singular form. De Figueiredo (2008) supported this by presenting a systems view of design, whereby design processes are structured in different ways to achieve different functions. Reinforcing the complexity of engineering design processes, Pahl, Beitz, Feldhusen, and Grote (2007), authors of *Engineering Design: A Systematic Approach*, wrote that the engineering design process, or design methodology as they call it, is a complex landscape of approaches, stages, principles, purposes, and traditions. Furthermore, Pahl, Beitz, Feldhusen, and Grote (2007) argued that the engineering profession is currently within a systems theory of design with socio-economic-technical processes, procedures, and methods being used "for the analysis, planning, selection, and optimum design of complex systems." Bucciarelli (2003) supported this view whereby socio-economic-technical factors affect the engineering design processes. Design is not stagnant, absolute, guaranteed or deterministic. Rather, it is dynamic, complex process that is a part of a greater feedback loop used by the engineer to know engineering and construct new engineering knowledge. However, across any variation of the engineering design process, the characterization remains the same. Engineering design is systematic, iterative, purposeful, creative, and social (ABET, 2012; Bucciarelli, 2003; Cross, 2008; Dym et al., 2005; NAE, 2009).

   Knowledge used to carry out the engineering design methodology. Engineering knowledge is a distinct body of knowledge and guides engineers in using judgment,

making decisions, and building consensus with the community (Bucciarelli, 2003; CFAT & Sheppard, 2009; Koen, 1985; Koen, 2003; Polya, 2014; Vincenti, 1990). De Figueiredo (2008) conceptualized engineering knowledge as a four-dimensional transdisciplinary model. The categories of engineering knowledge in this model include knowledge of the basic sciences, design, social science, and learning from doing. In this model, the engineer must converge and internalize the knowledge found within these four dimensions in order to carry out engineering design methods. De Figueiredo's (2008) four dimensions of knowledge are apparent in case studies of engineering (Vincenti, 1990), discussion of engineering methods (Koen, 2003), and in the explication of philosophies of engineering (Heywood, Carberry, & Grimson, 2011; McGrann, 2008; Smith & Korte, 2008). In the basic sciences, knowledge is produced through experimentation and analysis, and represents the theoretical knowledge of the sciences and mathematics. For instance, engineers must know how to use physical properties and quantities to assess an engineering device's performance. In the social sciences, the social nature of the world must be realized, including the social complexity of the engineering teams, the needs of the end user (customer), and the social and economic values. Included in the social science knowledge is knowledge of cultural values and norms, including what are acceptable and expected behaviors. In the design knowledge dimension, the art of design is key. De Figueiredo (2008) wrote about the design dimension:

> It values systems thinking much more than the analytical thinking that characterizes traditional science. Its practice is founded on holistic, contextual, and integrated visions of the world, rather than on partial visions. Typical values of this dimension include exploring alternatives and compromising. In this dimension, which resorts frequently to non-scientific forms of thinking, the key decisions are often based on incomplete knowledge and intuition, as well as on personal and collective experiences. (p. 94)

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Knowledge constructed by the engineering community through consensus is also pertinent to design knowledge, which includes operational principles to interpret and explain how a device functions as well as considerations for determining what is state-of-the-art. Within learning by doing, the engineer uses "the ability to tuck up one's sleeves and get down to the nitty-gritty" (De Figueiredo, 2008, p. 94), and typically acquires this knowledge on the job (CFAT & Sheppard, 2009). Sources of knowledge for learning by doing are rules of thumb and design considerations.

Throughout the processes of converging knowledge, engineers must make judgments, decisions, and build consensus during the design process. To do this, engineers rely upon reasoning through heuristics. Polya (2014) wrote, "Heuristic reasoning is reasoning not regarded as final and strict but as provisional and plausible only, whose purpose is to discover the solution to the present problem" (p. 113). Heuristic reasoning enables engineers to utilize the flexibility needed for determining the most logically compelling argument for the context. Acceptance of a heuristic depends on whether it works and is useful in a specific context. For example, an engineer may be required to optimize a solution according to particular factors. Through heuristic-based reasoning, engineers might rely upon heuristics of operational principles and normal configurations to assess how a solution is performing and how it needs to be optimized. As engineers create and use heuristics to guide their work, they gain expertise that informs their work. The expertise that engineers learn contributes to an engineer's ability to build consensus with their community and determine best practices (Koen, 1985). Best practices, as they are a function of time and other contextual factors, are the building

blocks to determining what is state-of-the-art (Koen, 1985). Determining what is state of the art through heuristic reasoning guides engineering practice to its goal – to develop an optimum solution for the design problem at hand.

Desired attributes of engineers. To guide the work of engineers, the engineering profession has designed codes of conduct. These codes "acknowledge the overall mission of the profession as contributing to human welfare" and that engineers must be competent (CFAT & Sheppard, 2009, p. 8). The attributes that engineers must possess to do their work have been categorized by the National Academy of Engineering and Accreditation Board for Engineering and Technology, Inc., an accreditation program that guides the ways in which aspiring engineers are educated. The attributes have been assigned as: practical ingenuity, strong analytical skills, discovery and design, creativity, communication, accountability, mastery of principles of business and management, professionalism, and life-long learning (ABET, 2012; NAE, 2005). As the engineering and technology space is actively constructed, so too are the desired attributes of engineers. This is reflected in the active changes that are made to the attributes put out by National Academy of Engineering and ABET.

An ontology of engineering. As is informed by the practice of engineering, an engineering ontology can be defined by the limitless nature of engineering. Von Karman stated, "Scientists discover the world that exists; engineers create the world that never was" (Bucciarelli, 2003, p. 1). Engineering is not bounded by an absolute value system like in the theoretical sciences and mathematics where a theoretical ideal exists and all works are approximations to this ideal. Rather, engineering reality is bounded by those practical design solutions that can be actualized, with the assumption that what may or

may not exist in the present and future is both uncertain and provisional. "What is truth?," as conceptualized by the theoretical sciences and mathematics, does not ground the work of engineers. Rather, engineers strive to build from previous technologies to develop new technologies, new knowledge, and new ways of knowing and doing (Lande, 2012). Engineering practice operates within a context- and function-dependent state, whose functions include, among others, socio-cultural factors (e.g. societal needs), time, and resources, and is subject to constant change. Experience and consensus are critical the identity and realities of engineering practice.

Back to Opportunities for "Third Space": A Summary

The aim of this inquiry was to listen to the stories of Native women who are working in engineering and technology and leading initiatives to improve their Native communities. As such, the ways in which the Native women navigated local and global spaces and challenged assumptions through their leadership acts were paramount to this inquiry. Additionally, the ways in which the Native women actively constructed their sense of self and how this influenced their behaviors was critical to the inquiry. Therefore, this chapter provided a review of three driving theoretical frameworks for the study: identity (Stryker & Burke, 2000; Tajfel & Turner, 1979), hybridity (Bhabha 1996, 2012; Smith & Leavy, 2008), and third space (Bhabha, 1996, 2012). Hybridity and third space were useful frameworks in bringing attention to the transcultural negotiation that occurs as individuals navigate spaces and identities. To delve further into the relevant local and global spaces and illuminate cultural differences, the chapter provided a review of: (1) a local space representing possibilities for Native women's identities and cultures, and (2) a global space representing possibilities for engineering and technology cultures

and identities. As the subsequent chapters unfold, the Native women's leadership to leverage opportunities for the construction of third spaces will be explored. The crux of the inquiry is focused on the lived realities of Native American women in order to bring their voices to the forefront of engineering education scholarship and to understand how to better support Native women in engineering and technology spaces, including the possibilities for new third spaces.

CHAPTER 3

METHODOLOGY
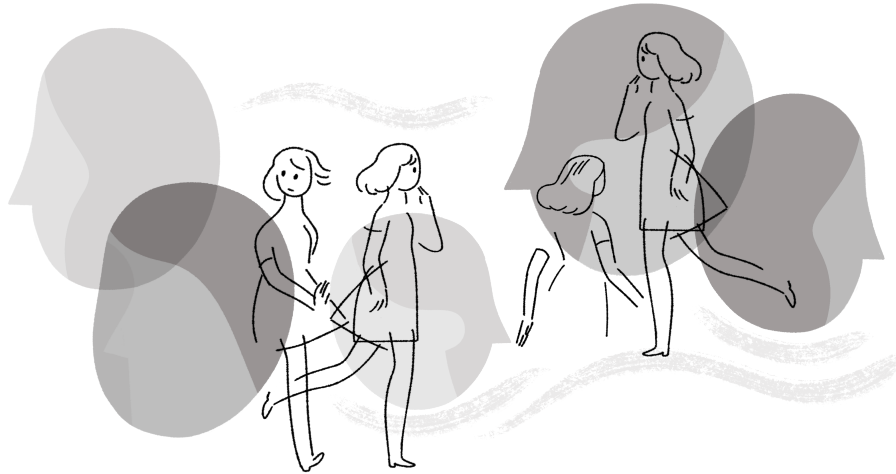
     I selected narrative inquiry as the methodology for this study under the desire to understand the complexities of experiences of Native American women in engineering and technology who were leading initiatives to improve their Native communities within engineering and technology contexts. Therefore, the focus of the inquiry was on accessing the meanings the Native women participants attach to experiences, including the initiatives they were leading improve their Native communities in relation to their constructed and intersecting identities. By acknowledging that individuals have their own social construction of reality (Trahar, 2009), the narrative inquiry examined "issues in depth through exploratory, open-ended conversations, prioritzing holistic understanding situated in lived experience" (pp. 5), much like the approach advocated for intercultural research through narrative inquiry. As I conducted the inquiry, I intended to situate myself, the researcher, as a research storyteller (Barone, 1992) in order to challenge

assumptions surrounding universal understandings of what it means to be a minority in

STEM. Barone, a foremost scholar on narrative inquiry and arts-based approaches, stated

this in an article about the research methodology:

> One of the reasons for doing narrative research is not to come up with final versions of the truth about educational phenomena or prevailing policies and practices, but rather to have people think skeptically about various dimensions of prevailing policies and practices. … To ask questions that hopefully enrich an ongoing conversation. (Arizona State University, 2009, pp. 16)

This chapter describes the narrative inquiry approach, including the ontological and

epistemological underpinnings, as well as the process that was taken to conduct this

narrative inquiry and analysis.

The Narrative Paradigm

> [The narrative] is present at all times, in all places, in all societies; indeed narrative starts with the very history of [hu]mankind; there is not, there has never been anywhere, any people without narrative; all classes, all human groups, have their stories, and very often those stories are enjoyed by men of different and even opposite cultural backgrounds. (Barthes & Duisit, 1975, p. 237)

> Narrative, as an expression of the human experience, can be found everywhere

(e.g., myths, legends, tales, short stories, histories, dramas, paintings, and cinemas) and is

carried by language, pictures, and gestures (Barthes & Duisit, 1975). The construction of

narratives is fundamental to being human and has existed since the first chants and

drawings, and "like life itself, it is there, international, transhistorical, and transcultural"

(Barthes & Duisit, 1975, p. 237). Within scholarship, narratives can serve as both the

phenomena of human experience to be studied and the methodology for studying the

human experience, with the methodology being known as narrative inquiry (Clandinin &

Connelly, 2000). Connelly and Clandinin (1990) distinguish between calling the

phenomena "story" and the methodology or inquiry "narrative," whereby "people by

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nature lead storied lives and tell stories of those lives" and narrative researchers "describe such lives, collect and tell stories of them, and write narratives of experience" (p. 2).

Methodological beginnings. Historically, narrative inquiry has been traced as a 20th century development, representing a turn away from positivism and upholding narrative ways of knowing (Reissman & Speedy, 2007). Sandelowski (1991) wrote this of the value of narratives:

> Mourning the devaluation of narratives as sources of knowledge, and emphasizing the moral force, healing power, and emancipatory thrust of stories, scholars across disciplines have (re) discovered the narrative nature of human beings. (p. 161)

The rise of narrative inquiry (labeled "narrative revolution" by Leiblich, Tuval-Mashiach, and Zilber (1998, p. 1)) is distinguished by several key pivots in the history of research on the human experience, establishing fundamental themes for the methodology (Clandinin, 2006). These turns include: (1) a turn away from the objectivist view of the relationship between the person conducting the research and the person serving as the participant and towards a relational view, whereby the interpretations of data are influenced by the researcher and participant; (2) a turn towards words as a reliable source of data; (3) a turn away from the general and universal, including the generalized grand narrative, towards the local and specific, emphasizing the "power of the particular"; and (4) a turn to accept alternative epistemologies and ways of knowing (counteracting positivist views), whereby findings are established through authenticity, resonance, and trustworthiness (Clandinin, 2006). As narrative inquiry contributed to the exploration of the human experience within an interpretivist paradigm, it grew its roots in intellectual traditions such as phenomenology, hermeneutics, cultural studies, feminist studies, ethnomethodology, and symbolic interactionism (Sandelowski, 1991), orienting

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philosophies such as social constructivism and post-modernism (Clandinin, 2006). As such, narrative inquiry secured its place within the social sciences, in part by the works of: psychologist Donald Polkinghorne (1988) who focused on the perspective of an individual's psychology over time and contributed the view of narrative "as a mode of ordering complex events and human actions so we can see them as part of the whole"; psychologist Jerome Bruner (1986) who contributed the idea that narrative is "the primary way in which humans think, a primary way that human beings make meaning of experience, and a primary way that human beings communicate understanding of experience"; anthropologist Clifford Geertz (1995) who contributed the idea that "narrative is the way we make meaning as we reflect on the past, form accounts of change over time and place, and weave fact and interpretation to craft coherent accounts of complex experiences"; anthropologist Catherine Bateson (1994) who contributed the idea that narrative is "a means of capturing the complexity of changing life experience, of sharing and learning from reflection on experience, and of improvising new ways of living that savor the ambiguity of life experience"; and ethnographer Norman Denzin (1997) who contributed the idea that meaning of experiences are made by the researcher and participant (Phillion, He, & Huber-Warring, 2010, p. 249).

Within the social science field of educational research, narrative inquiry as a term was introduced by Connelly and Clandinin (1990) in the article "Stories of Experience and Narrative Inquiry" for the journal *Educational Researcher*, building from cases of educational research that had narrative qualities or informed the use of narrative for educational research (e.g., Eisner (1988) and Noddings (1986)) (Clandinin, Pushor, & Orr, 2007). Their claim for the need of narrative inquiry in educational research was that

"humans are storytelling organisms who, individually and socially, lead storied lives," and as such stories of lived lives provides an opportunity to understand experiences of individuals intertwined with issues related to education (Connelly & Clandinin, 1990, p. 2). With this claim, Connelly and Clandinin (2000) placed boundaries around narrative inquiry as a research methodology:

> People shape their daily lives by stories who they and others are as they interpret their past in terms of these stories. Story, in the current idiom, is a portal through which a person enters the world and by which their experience of the world is interpreted and made personally meaningful. Viewed in this way, narrative in the phenomenon studied in inquiry. Narrative inquiry as a methodology entails a view of the phenomenon. To use narrative inquiry methodology is to adopt a particular narrative view of experience as phenomena under study. (p. 447)

Today, narrative inquiry is widely used as a methodology in education research to gain a deeper understanding of phenomena, including understand students' experiences (Rice, 2011), teachers' experiences (Craig, 2013; Kissling, 2014), students' and teachers' experiences as they intertwine (Barone, 2001), and gender and cultural issues (Mitchell, 2011). Within STEM education, narrative inquiry has been applied within contexts of science education (Hwang, 2011), engineering and technology education (Kellam, Gerow, & Walther, 2015), and mathematics teacher education (Lutovac & Kaasila, 2009). Narrative inquiry has profound use within intercultural research (Trahar, 2009) and within indigenous research (Dunbar, 2001; Kenny & Fraser, 2012; Vaz, 1997).

Ontological and epistemological underpinnings. "Narrative inquirers work from different assumptions" – with differences existing within views of "reality, knowledge developed from an inquiry, the relationship between experience and context, and the relationship between researchers and participants" (Clandinin & Huber, 2010, p. 14). Although not all narrative inquirers hold the same ontological and epistemolgoical

commitments (a point that is discussed by Clandinin and Rosiek (2007)), narrative

inquiry offers new perspectives for narrative as a mode of knowing and thinking about

experiences.

Like the work that has come before this in the education scholarship, this inquiry

is situated upon the philosophical foundation of the Deweyan theory of experience

(Dewey, 1938) – which frames the ontological and epistemoligical underpinnings of

narrative inquiry. Clandinin and Rosiek (2007) outline two important aspects of Deweyan

theory of experience that frame the ontology and epistemology of narrative inquiry. The

first is that Dewey's notion of experience is pragmatic, whereby "our representations

arise from experience and must return to that experience for their validation" (Clandinin

& Rosiek, 2007).

> [Dewey's conception of experience] does not refer to some precognitive,
> precultural ground on which our conceptions of the world rest. Instead, it is a
> changing stream that is characterized by continuous interaction of human thought
> with our personal, social, and material environment. (p. 39)

In the words of Clandinin and Rosiek (2007), the ontology of narrative inquiry is "not

transcendantal, it is transactional" (p. 8), whereby all experiences take place between the

"self and its world" (Dewey, 1981, p. 251). This frames the nature of reality as not

"merely mental nor merely physical," but rather that reality can only be understood if it

"take[s] into account the total normal experience" and recognize that experiences are

"transformed through the human context they enter" (Dewey, 1981, p. 251). Secondly,

experience is continuous, and so "what you see (and hear, feel, think, love, taste, despise,

fear, etc.) is what you get" – it is a continuous reality (Clandinin & Rosiek, 2007, p. 10).

There is no "unchanging transcendent reality" (God's eye or pure view of reality), but

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rather inquiry "is an act within a stream of experience that generates new relations that then become a part of future experience" (Clandinin & Rosiek, 2007, p. 10). Clandinin and Connelly (2000) wrote:

> The idea that experiences grow out of other experiences, and experiences lead to further experiences. Wherever one positions oneself in that continuum – the imagined now, some imagined past, or some imagined future – each point has a past experiental base and leads to an experiental future. (p. 2)

Within the ontology of experience, grounded in the Deweyan theory of experience, the epistemology of narrative inquiry is relational between the person and the world; it is never independent of the knower. In this way, they are considered "espistemic constructions" and "ontological artifacts of our own making and doing" (Sorrell, 2004, p. 75).

There are practical implications of a narrative view of experience that stands upon the foundation of the ontological and epistemological stance of narrative inquiry. Specifically, the elements of situation, continuity, and interaction within the narrative view of experience frames the methodological approach and directs it towards elements of place (the situational dimension), time in the form of past, present, and future (the temporal or continuity dimension), and personal and social relations (the sociality dimension) (Clandinin & Connelly, 2000; Clandinin, Pushor, & Orr, 2007). Clandinin and Connelly (2000) call this methodological framework for narrative inquiry "a metaphorical *three-dimensional narrative inquiry space*" (p. 50), whereby such a framework "allows our inquiries to travel – inward, outward, backward, forward, and situated within place" (Clandinin & Connelly, 2000, p. 49). To conduct research on experience is to "*experience an experience*" and all directions must be considered during

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a narrative inquiry – that is, "in*ward and outward, backward and forward,*" (Clandinin & Connelly, 2000, p. 50, italics in the original). The inward direction is the internal conditions of self (e.g., feelings); the outward direction is the environment; and backward and forward direction is time – past, present, and future (Clandinin & Connelly, 2000). Figure 7 presents a conceptual illustration of the three dimensions within a narrative inquiry space.

SITUATIONAL

SOCIALITY

TEMPORAL
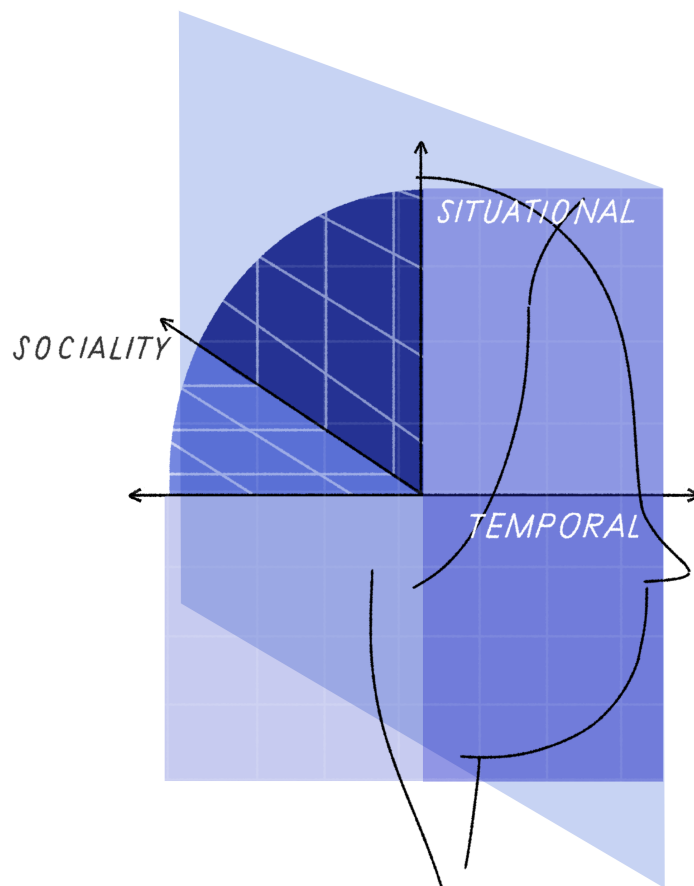
Figure 7. The narrative view of experience and the three-dimensional space

Approaching the Inquiry

Clandinin and Connelly (2000) wrote that approaching an inquiry is "walking into the midst of stories" (p. 63). Within this midst, researchers are located in the three-dimensional narrative inquiry space, situating themselves in a "nested set of stories – ours and theirs" (Clandinin & Connelly, 2000, p. 63). Deciding to use a narrative approach meant considering my own story (inward reflection) and how my story related to stories of Native American women in engineering and technology (outward reflection) as well as considering the particular personal, social, cultural, and historical contexts in which the stories were situated (Creswell, 2006). This reflection was provided as the preface to the dissertation overviewing how I came to this inquiry. These considerations required awareness, or "wakefulness," due to "the situated complexities" specific to narrative inquiry (Clandinin, Pushor, & Orr, 2007, p. 21). The experience of approaching a narrative inquiry study, therefore, depends upon a "process of interpretation and making sense of the phenomenon under study" (Brown, 2008, p. 2). I participated in the three-dimensional narrative inquiry space by: (1) engaging with Native community organizations (e.g., Phoenix AISES), (2) speaking to Native American engineers, technologists, and scholars about my research interests, including sharing how the research was evolving, reflecting on the goals of the study and the future visions for the study, and (3) once the inquiry was formalized, interacting in the field with participants, including sharing and discussing field texts with participants. It was through this process that I approached the inquiry and how my research as narrative inquiry took shape.

Moreover, the nature of narrative inquiry is founded upon "moving into close relationships with participants" (Clandinin & Connelly, 2000, p. 82). The relational

quality of narrative inquiry required that I become "fully involved" with participants

while also stepping back and seeing my own story in the inquiry (Clandinin & Connelly,

2000, p. 81). I approached the inquiry in this way: trying to manage the tensions of

"moving back and forth between full involvement [via conversations and interviews over

coffee, lunches, and dinner; serving on the Phoenix AISES board with one participant;

and spending time at work with two participants] and distance" to see the stories within

our co-constructed reality that was situated in a certain context (Clandinin & Connelly,

2000, p. 81). After each meeting with a participant, I documented my reactions from the

interviews as well as tensions I was having with understanding aspects of the lived and

told stories through voice memos and handwritten field notes in a journal. These

reflections allowed me to reflect inwardly.

As a White woman, I was not a member of the Native community, and so it was

especially critical for me to be mindful of how I approached the inquiry. I came from a

place of not knowing while also attempting to make meaning from the research

experiences. This required me to be ethical, respectful, reflexive, and critical (Smith,

2012). The quality of my interactions was pertinent to building trust; and humility was

pertinent to maintaining good relationships with each of the participants. I will discuss

the specific ethical considerations and process for building trust for this inquiry further in

the subsequent section entitled "Research Quality."

I approached the inquiry by a desire to tell culturally-relevant stories within the

engineering and technology context. I committed to narrative inquiry based upon its

usefulness to bring Native American women's perspectives and experiences to the

forefront within engineering education scholarship, including the complexities and

particularities that influence their perspectives and experiences. The narrative inquiry had

the potential to move from "telling of stories in the field as opposed to telling … stories

of the field" (Denzin & Lincoln, 2008, p. 96). So often "Indigenous people have been

scripted by colonists, imperialists, and voyeurs, whose vision is tainted by their sense of

superiority and their belief that they are the creators of knowledge" (Denzin & Lincoln,

2008, p. 96). The STEM education literature is no exception, where some researchers

situate themselves "in the middle of what there is to know" (Denzin & Lincoln, 2008, p.

96). By committing to narrative inquiry, this study rejected an objectivist, one-truth lens

and sought to tell the stories of Native American women in engineering and technology

and support "stories and oral knowledge as real and legitimate forms of data and ways of

being" (Brayboy, 2005, p. 439).

Procedures of the Inquiry

This section serves to provide a description of the procedures of the inquiry, the

participants who consented to the inquiry, the data collection process, and the context for

the inquiry. The narrative inquiry did not take a "linear path," but rather it was an

"engaging, one-step-forward, two-steps-back kind of journey" (Maple & Edwards, 2000,

p. 33).

Participants. Narrative inquiry is reliant upon individuals who are willing to

share their lived and told stories and spend considerable time with the researcher telling

those stories. For this inquiry, three Native women participated; they each assigned their

own pseudonym as Jaemie, Mia, and Catherine. I came to know Jaemie, Mia, and

Catherine in different contexts and at different times, but each expressed their desire to

share their stories for this narrative inquiry in hopes that it would inspire other young

Native women and girls to take paths of leadership within engineering and technology. Additionally, Phoenix AISES served as a critical platform which initiated a snowball effect of coming to know each of the participants. Specifically, Jaemie and I made contact through a Phoenix AISES meeting. As I interviewed Jaemie for another study, she expressed her willingness to share her stories for this narrative inquiry. Mia and I were introduced by her manager, Mark (psuedonym), at her workplace, Gila River Tech (pseudonym). I had been listening to the stories of those that worked at Gila River Tech after becoming familiar with the business through a Phoenix AISES meeting. Catherine and I, too, met through my time at Gila River Tech.
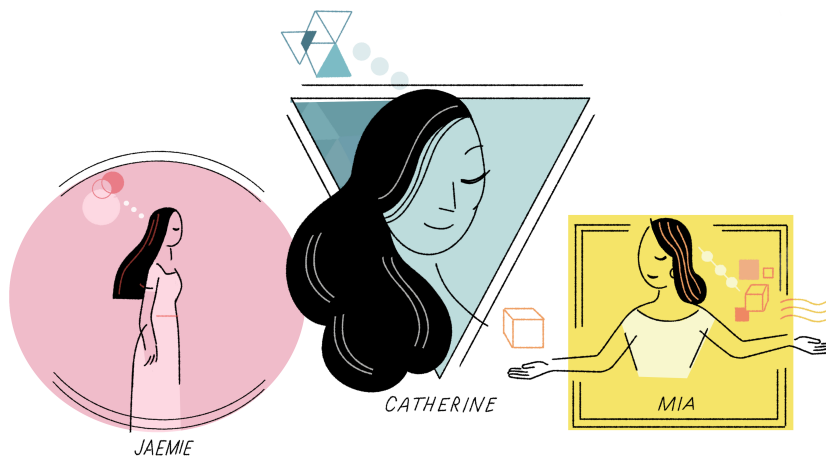
Figure 8. Jaemie, Mia, and Catherine: Participants of the inquiry

Three participants is an appropriate number for narrative inquiry as the methodology is dependent upon seeking richness and depth through the particularities and complexities of stories, or, as Pawley (2013) wrote, stories are useful because we can "learn from small numbers." As individuals, the three participats brought forth different perspectives and life experiences informed by numerous dimensions of their lives, such

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as their tribal identity, age, contexts for work, involvement with leadership, family structures, and whether they were raised and lived on or off reservation land (see Table 1). Over the course of the past year and a half, the participants and I have formed meaningful relationships, whereby we shared (1) common goals for inspiring change in STEM and to support Native women and girls seeking to make change happen through STEM work and (2) interest and concern for each other's lives. These meaningful relationships sustained this inquiry.

Table 1

Demographics of Participants

Participant	Tribe	Raised on/off res	Live on/off res	Work on/off res	Profession	Age
Jaemie	Navajo	On	Off	Off	Engineer	40 years
Mia	Akimel O'odham-Mexican	On	Off and On	On and off	Technical Service Provider	34 years
Catherine	Navajo	On	Off	On and off	Technical Service Provider	54 years

Participant summaries. Jaemie is a forty-year-old Navajo woman who works in a development engineering role (a component of research and development) at a large technical corporation. She advanced to this position after nearly thirteen years in the field as first a technical representative and then a manufacturing technician. Jaemie also leads a chapter of the technical corporation's Native American support network in the role of chapter president and is developing and implementing a comprehensive STEM outreach program for the Navajo community in cooperation with a state science foundation and her technical corporation. In addition to her volunteer work with the Native American

support network, Jaemie served on the board for a local chapter of the American Indian Science and Engineering Society. Jaemie grew up on the Navajo reservation in Chinle, Arizona and moved off reservation to pursue a STEM education and career. She has a Bachelor's of Applied Science in Electronics Engineering. Jaemie is also a single mother of four children, aged twenty, eighteen, sixteen, and fourteen.

Mia is a thirty-four-year-old Akimel O'odham-Mexican woman who works as a technician for Gila River Tech (pseudonym), a tribally-owned technical business. She is also working with Gila River Tech to develop a new venture: a broadcasting and television department aimed to provide local, culturally-relevant television for community members. Mia grew up on the reservation in Gila River Indian Community, moved away from home, and then back home again. She has an Associate's Degree in Computer Networking and is currently pursuing an Associate's Degree in Radio and Television Broadcasting Technology with the support of Gila River Tech. Mia also volunteers her time as the secretary for a Gila River business association as well as for a cultural foundation that strives to encourage education among Native students. With her volunteer work, Mia collaborates with the Four Sister Tribes: Ak-chin Indian Community, Gila River Indian Community, Salt River Pima-Maricopa Indian Community, and the Tohono O'odham Nation to "help preserve culture and traditions of the communities." Mia is "auntie" to her siblings' and friends' children calls herself "a Native who is trying to make a difference."

Catherine is a fifty-four-year-old Navajo woman. She founded and operates her own Native-owned business to "build electronic Native communties" by providing business development and technology services to tribal nations in a "culturally-sensitive

way." She grew up on the Navajo reservation in Chinle, Arizona and moved off the reservation shortly after high school with her husband for opportunity and education. Catherine has a degree in Computer Information Systems. Catherine is a widowed mother of three children and grandmother to three children.

Data collection. Data for narrative inquiry begins with the assumption that all data is situated within the three-dimensional narrative inquiry space (with temporal, situational, and sociality dimensions) and that the data collected is imbued with interpretation because it is a researcher's experience of an experience with the participant. The experiences between researcher and participant within the narrative inquiry methodology is dependent upon participants reflecting upon their life and explaining their stories to the researcher (Clandinin & Connelly, 2005). The words spoken by participants and between participant and researcher form the storied experiences and provide the empirical evidence for the empirical narrative. Words as data are referred to in narrative inquiry as "field texts" and are used for ongoing reflection, interpretation, and analysis throughout the data collection (and data analysis) periods. Field texts are used to bridge the researcher's experience of an experience with the participant to the final empirical narrative, called the "research text" (Clandinin & Connelly, 2000, p. 93). Neither the field text or research text are objective with neither being free from interpretation. The data collection process is founded upon a reconstruction of experience, grounded within the Deweyan theory of experience.

Within narrative inquiry, there is a range of types of field texts used by researchers and participants to tell their storied experiences (Trahar, 2011). In this narrative inquiry, I relied upon research interview conversations, memos to myself, field

notes, observation time, and reviews of public documents. The processes for collecting each form of field text for this study are discussed below. I also spent considerable time with the participants outside of formal data collection, which will also be discussed. Table 2 summarizes the physical data collected with the participants as well as the time periods for the inquiry.

Table 2

Physical Data Collected with Participants

Participant Pseudonym	Time Period of Inquiry	Research Interviews	Voice Memos to Self	Field Notes	Documents
Jaemie	February 2015 to January 2016	6 interviews (156 minutes)	6 voice memos (30 minutes)	14 pages	3 media articles
Mia	November 2014 to January 2016	2 interviews (161 minutes)	2 voice memos (16 minutes)	31 pages	2 media articles
Catherine	January 2015 to January 2016	3 interviews (68 minutes)	2 voice memos (11 minutes)	27 pages	1 media article

Research interview as field text. A total of six semi-structured interviews were conducted with Jaemie (for a total of two hours and thirty-six minutes), two semi-structured interviews with Mia (for a total of two hours and forty-one minutes), and three semi-structured interviews with Catherine (for a total of one hour and eight minutes). The form of the semi-structured interviews was organized by the themes to be covered along with a list of suggested questions to be asked during the interview (Kvale, 1996). In this way, the semi-structured interviews served as interview conversations (Kvale, 1996; Mishler, 1986). Throughout the interview conversations, I maintained an "openness to changes of sequence and forms of questions in order to follow up the answers given and

the stories told by the [participants]" (Kvale, 1996, p. 124). This enabled new stories and themes to emerge. The purpose of the interview conversations was to gain new insights into the each of the participants' lived worlds and understand the meaning of their experiences (Kvale, 1996). Throughout the interview conversations "knowledge [was being] created inter the points of views of the interviewer [myself] and interviewee [participant]," whereby "knowledge evolves through a dialogue" (Kvale, 1996, p. 124-125).

Prior to the first interview, it was critical that a location and atmosphere be determined where each participant would feel "safe enough to talk freely about his or her experiences and feelings" (Kvale, 1996, p. 125). To do this, I reminded each participant of the intent of the first interview and asked each participant where they felt most comfortable meeting. By the time of scheduling the first interview with each participant (which occurred at different times), I had established a rapport with each participant. I had known Jaemie for nearly five months. We first exchanged emails to one another on September 17, 2014, met in person on October 9, 2014, and conducted the first interview on February 3, 2015. I had known Mia for nearly two months. We met briefly for the first time on October 27, 2014 and the first interview was conducted on December 17, 2014. I had known Catherine for nearly three months. We had met in person for the first time on November 5, 2014 and the first interview was conducted on January 27, 2015. By the time the first research interview was being scheduled, I had numerous conversations with each participant about my research study and each participant had previously given their consent to participate in the study. For Jaemie, I had interviewed her for another research project and was volunteering with her for Phoenix AISES; for Mia, I had previously

spent three days with her at her workplace; and for Catherine, I had previously spent one

work day with her. I asked each participant where they would prefer to meet to have the

initial interview conversation. For Jamie, it was nearby her office; for Catherine, it was a

local public library near her home; and for Mia, it was a restaurant near her home.

Subsequent interviews with Catherine and Mia took place at either a library or restaurant,

depending on the time of day and their work schedules.

Despite the rapport I had established with each of the participants, I was aware

that research interviews often create inequality between the research and participant

because the interview is governed by the researcher. I attempted to minimize this

inequality by encouraging a participatory relationship where participants could shape the

interview by providing accounts of their experiences that were relevant to their lived

experiences. Nonetheless, I as a researcher chose the introductory topics, and the format

of the interview was one where each person (whether researcher or participant) took turns

"taking the floor" to speak (Clandinin & Connelly, 2000, p. 111).

When I met each participant for their first interview conversation, I reminded the

participant of the aim of the interview – to better understand their experiences in

engineering and technology and the initiatives they are leading to improve their Native

communities. Specifically, I adopted a revised form of Spradley's (1979) interview

protocol to introduce the first interview:

> Hello, [insert name of participant]. Thank you for meeting with me. As you know,
> the goal of this project is to understand the experiences you have had in the
> engineering and technology workplace as well as the initiatives you are leading in
> those environments. I want to understand the world from your point of view and
> understand the meaning of your experiences. I have a list of questions I would
> like to ask, but the goal of this interview is to be conversational. I will ask you

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questions so that I can arrive at a deeper understanding. Do you have any questions for me?

The remainder of the first interview conversation and the subsequent interview conversations were designed to prompt discussion through what and how questions (Kvale, 1996). The interviews included questions of various types: introducing questions (e.g., Can you tell me about the work that you do at your workplace?), follow-up questions (e.g., Can you tell me more about that?), probing questions (e.g., Do you have an example of that?), specifying questions (e.g., How did they react to that?), interpreting questions (e.g., Is it correct that [this] then happened?), and reflection on meaning questions (e.g., How has that changed you?). When the topic was changed, I used a structured transition by telling the participant, "I would like to hear about this [other topic]." The major introducing questions for the interview conversations were asked within the following areas to understand: the participant's engineering and technology work (e.g., Can you tell me about the work that you do?), the initiatives the participant was leading (e.g., Can you tell about [initiative] you lead?), their life history (e.g., How did you come to do these things in the engineering and technology field?), and their interpretations of their identities (e.g., How does your identity as a Native American woman influence the aims of your work?). The goal of the interview conversations was to keep the overarching outline in mind, while aiming for detail. The follow-up, specifying, interpreting, and reflection on meaning questions were aimed at gaining the "richness, nuance, and complexity" of the landscape (Clandinin & Connelly, 2000, p. 83).

   Voice memos to self as field text. Following the research interviews conversations, I had informal conversations with each participant lasting anywhere from

ten minutes to one hour. During these informal conversations, the participant would continue to reflect on their stories and how they relate to their life now, their goals, the state of their Native community, and so on. These follow-up conversations provided more equality than the research interview, in that participants had the flexibility to speak about the topics of specific interest to them. As I listened, I built additional mutual trust and care for each other with each participant. The conversations were situated in the three-dimensional inquiry space, grounded in narrative truth and relativism. As such, we were co-constructing knowledge and realities as we spoke. I, as a researcher, gained new insights into the ambiguities of the narrative work and the experiences of the participants. These conversations following the interview conversations served, in part, as the basis for the memos to myself. I would also reflect upon the recorded interview during the voice memos. I recorded the memos in the car and reflected on the topics that each of the participants and I discussed. The memos to myself continued to serves as an ongoing reflection of the lived and told stories of the Native American women participants throughout the inquiry process.

Field notes as field text. Clandinin and Connelly (2000) wrote that, "field notes are the most important way we have of recording the ongoing bits on nothingness" (p. 104). For this narrative inquiry, field texts were critical to keeping ongoing notes for myself throughout the narrative process as well as for recording the observations of work days of Catherine and Mia. The purpose of the field notes taken during Catherine and Mia's work days were to record the type of work that Catherine and Mia did, who they interacted with, and the conversations that we had during the day. I would also use field notes to sketch the work environment and work process. The field notes varied in their

detail, interpretive content (at times, I would write notes of possible interpretations or notes for analysis), and style (at times, I would write as if I were an outsider looking onto the work and other times, during conversations with participants, I would write as if I were a participant in the work day). Clandinin and Connelly (2000) wrote that narrative inquirers may try to record "all of experience," but inherently the field texts are "constructed representations" and so the wholeness of the experience is not there to be obtained (p. 106). My aim was to record enough data to be able to reflect upon the experience during the transition from field text to research text; although this intent was difficult to monitor.

Documents as field text. Within narrative inquiry, documents are often "selectively decided" upon to contextualize the work (Clandinin & Connelly, 2000, p. 113). The three participants worked in the engineering and technology field and leading initiatives to improve their Native communities in the engineering and technology contexts. As such, each of the participants had been featured in Native news outlets, which highlighted their achievements and goals. As each of the participants shared with me that they had been featured in the news, I used the public documents to gain new insights into how the Native communities viewed the efforts of each of the participants and the statements that the participants had given their communities.

Summary. The purpose of data collection through the creation of field texts, in the forms of research interviews, memos to self, field notes, observations, and document reviews, was to "discover and construct meaning" from representations of storied experiences (Clandinin & Connelly, 1994, p. 423). The field texts represent "reconstructions of field experience and therefore embody an interpretive process" as

situated in the three-dimensional inquiry space of temporal, situational, and sociality

elements (Clandinin & Connelly, 2000). The data collection process represented a

transition from the being in an environment with participants (the field) to field texts. The

next phase in the narrative inquiry process was transitioning to the data analysis and

interpretation phase, whereby field texts were used to make meaning of the storied

experiences and represented by the final product – the research texts (represented within

the narrative analysis or narrative construction).

Context, as Defined by the Three-Dimensional Narrative Inquiry Space

In an opening discussion of this chapter on the ontological and epistemelogical

underpinnings of narrative inquiry, I wrote that narrative inquiry is "an act within a

stream of experience that generates new relations that then become a part of future

experience" (Clandinin & Rosiek, 2007). This is critcial to the discussion of context

because it is the consideration of the "stream of experience" that sets boundaries around

the context of the inquiry. The narrative view of experience directs the considerations of

the context of the inquiry toward the elements of place (situational), time in the form of

past, present, and future (temporal), and personal and social relations (sociality)

(Clandinin & Connelly, 2000; Clandinin, Pushor, & Orr, 2007).

The situational dimension. The situational dimension, or the place, is the "the

specific concrete, physical and topological boundaries of place where the inquiry and

events take place" (Connelly & Clandinin, 2006, p. 480). However, the physical elements

of place "may change as the inquiry delves into temporality" (Connelly & Clandinin,

2006, p. 481); for example, when I asked each participant to describe how they grew up, I

had to consider the participant's past experiences as nested within a specific place of their

childhood home environment. As a narrative inquirer, it was of upmost importance to think through the "impact of each place on the experience" (Clandinin, Schaefer, & Downey, p. 46). Considerations of those places that were important to the participants (e.g., Navajo Nation, Gila River Indian community, and the participants' workplaces) were crucial to this inquiry and reflected in the narrative analysis.

The temporal dimension. "Events under study are in temporal transition, that is people and events always have a past, present, and possible futures" (Clandinin, Schaefer, & Downey, p. 45). As I was conducting the narrative inquiry, it was required that I consider the participants (and others that I encountered within the narrative process), places, and events under study as "in process, as always in transition" (Connelly & Clandinin, 2006, p. 480). There was no singular reality to be discovered or realized. The stories of the three Native American women represented a co-construction of reality for a specific "stream of experience," representing an experience of an experience. The temporal element is reflected in the narrative analysis through reflections on the past, present experiences, and asking participants to imagine their future.

The sociality dimension. The sociality dimension calls for considerations of the personal and social conditions. Personal conditions represent the "feelings, hopes, desires, aesthetic reactions, and moral dispositions of both the inquirer and participant" (Clandinin & Connelly, 2006, p. 480). The social conditions represent the "existential conditions, the environment, surrounding factors and forces, people and otherwise, that form the individual's context (Clandinin & Connelly, 2006, p. 480). The sociality element brings to the forefront the interactions between the participant and researcher, whereby the researcher, or narrative inquirer, is in an "inquiry relationship with the

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participants' lives" (p. 480). As I was conducting the narrative inquiry and interacting with the participants and their stories, I could not "subtract" myself from their lives or their stories (p. 480). This is reflected in the narrative analysis by recognizing that each narrative is a co-construction that is co-composed and through acknowledging both the narrative inquirer's voice and participant's voice.

Summary. Context is of critical importance to narrative inquirers. Throughout the research process, narrative inquirers must be "thinking narratively, attending to the temporal, social, and place dimensions of our stories of experience" in order to "stay acutely attentive to lives for 'narrative inquiry is about life and living'" (Connelly & Clandinin, 2006, p. 478). Narrative inquiry requires "simultaneous exploration of all three" dimensions of the lived and told stories (Connelly & Clandinin, 2006, p. 479). As I worked with each of the participants, I needed to be "open to the myriad of imaginative possibilities for composing field texts" through attentiveness "to situating field texts within the three-dimensional narrative inquiry space, that is, positioning field texts with attention to the temporal, the personal and social, and place" (Chan, Keyes, & Ross, 2012, p. 58). As I concluded the fieldwork for the inquiry and co-constructing field texts, I endeavored into the next phase of the narrative inquiry: analysis and interpretive acts.

Data Analysis and Interpretation

The data analysis and interpretation phase, otherwise known as the narrative analysis or narrative construction, of narrative inquiry brings to the forefront the questions that arised from the beginning of the study, such as "Who cares?" and "So what?" (Clandinin & Connelly, 2000). These questions address the purpose, significance, and meaning of the inquiry, which have to be attended to during data analysis and

interpretation. Additional questions such as "For whom will I write," "Who are the characters of the study?," "Why am I writing?," "What am I trying to convey?," "What personal, practical, and theoretical context give meaning to the inquiry and to its outcomes?," and "What forms could out final research texts take?" also need to be addressed in the data analysis (Clandinin & Connelly, 2000). To navigate these questions, I used three sets of considerations to move from field text to research text: (1) theoretical considerations, (2) practical considerations regarding the field texts themselves, and (3) interpretive-analytic considerations (Curtis, 2013). My purpose in moving from field text to research text was to uncover the "figure under the carpet" (Edel, 1984), while being cognizant of the "myriad of imaginative possibilites" (Chan et al., 2012) that could arise through considerations of the three-dimensional narrative inquiry space. During analysis and interpretation, I was mindful that the research text would be created in a certain relational and temporal context that represents the "lived immediacy of that experience" (Clandinin & Rosiek, 2007, p. 44).

Theoretical considerations. The theoretical considerations involved in narrative inquiry call for focusing on the phenomena under study through a narrative view of experience, with the phenomena under study shifting as the researcher reflects on meaning both through the lived and told experiences by the participants and the researcher's experience with the experience. From the earliest moments of moving from field text to research text, I considered how I might go about writing about the narrative ways of knowing and my role as research in the storied landscape. I documented reflections on meanings in notes and used these later in the process to construct the narratives.

Practical considerations. The practical considerations of the narrative inquiry required that I, as the researcher, transition from being in the field and making field notes to creating the research texts. This meant that I move away from "close contact, the daily conversations, the frequent meetings" so that I could shift my focus to "reading and re-reading the field texts and composing the research texts" (Clandinin & Connelly, 2000, p. 129). I found that my experience with moving from field text to research text was similar to how Clandinin and Connelly described (2000, p. 130); I missed spending time with the participant, listening to their stories, and asking new questions. Additionally, when I first began to create the research texts, I had an urge to let the field texts speak for themselves because they were compelling in its original form; however, practical considerations of data analysis brought me back to the purpose of narrative inquiry, which was to construct meaning in the field texts as it might inform the scholarship, which relied upon the interpretation and analysis.

Interpretive-analytic considerations. The interpretive-analytic considerations required that I "ask questions of meaning and social significance" in the midst of a complex landscape (Clandinin & Connelly, 2000, p. 130). To begin to ask such questions, I organized the data (electronically and physically) to determine what I had. After organizing the data, I spent hours over the reading and re-reading the data. From this, I made a brief summary of what was contained in the set of data for each participant to have an understanding of the data that I had. The summary illuminated what had been attended to in the inquiry, but equally what had not been attended to in the inquiry.

Strategies for composing the interim research texts. By addressing the theoretical considerations, practical considerations, and interpretive-analytic

considerations, I was moving from field text to interim research texts. I used strategies specific to narrative inquiry to further implement the move from field text to writing interim research texts (Connelly & Clandinin, 1990; Curtis, 2013). These strategies included broadening, burrowing, storying and restorying, fictionalization, debriefing, and identifying resonant threads (Clandinin & Connelly; Curtis, 2013, p. 79).

Broadening. Broadening involved "stepping back" to consider each participant's story "in relation to the grand narrative" of what it means to be a Native American woman in environments of engineering and technology and their Native communities (Curtis, 2013, p. 80). Through the process of broadening, I began to position each participant's lived and told stories within scholarship and its relevance for illuminating how the STEM community could better support Native American women in persisting in STEM (Clandinin & Connelly, 1994; Curtis, 2013).

Burrowing. Burrowing involved "meaning-making" by "illuminating emergent threads within the participant's stories (Curtis, 2013, p. 80). The intent of burrowing was to unpack the situated particularities and complexities of the storied experiences (Clandinin & Connelly, 1994; Curtis, 2013). The stories told by Jaemie, Mia, and Catherine were each considered for their individuality and specific complexities. The specific complexities and individual emergent threads were documented and crafted in the forms of the early versions of research texts. Each of the participants and I discussed these emergent threads to further unpack meaning.

Storying and restorying. Storying and restorying required that I attend to the metaphorical three-dimensional narrative inquiry space by considering the temporal, sociality, and situational dimensions of the storied experiences. Indeed, the

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three‑dimensional narrative inquiry space served as a "scaffold" for the narrative inquiry, and as a strategy for the analysis and interpretation (Murray Orr & Olson, 2007, p. 821). By attending to the three‑dimensional narrative inquiry space and "retelling and reliving of stories, that is, to inquiry into stories" (Clandinin, Pushor, & Orr, 2007, p. 33), I was able to consider the lived and told stories of the three Native American women as they were embedded in engineering and technology and Native communities from "varied perspectives" and to explore the "possibilities for seeing differently" (Orr & Olson, 2007, p. 821).

Fictionalization. I used "fictionalization" through the use of pseudonyms to create anonymity and "decrease the likelihood" that the participants and their places of work would be identified (Curtis, 2013, p. 80). The intent of fictionalization through pseudonyms was to support the ethical considerations of this narrative inquiry, which will be discussed further under the section entitled "Ethical Considerations."

Debriefing. I used the strategy of debriefing to uphold quality research, as discussed below, and to "negotiate meaning" and enhance the "reflective processes" (Curtis, 2013, p. 81). Specifically, debriefing involved verbally speaking about the interim narratives with the respective participant and, once the research texts were more complete, sharing the interim research texts with the participants.

Resonant threads. Identifying the threads of resonance required that I scope out the lived and told stories of all three participants. I considered: How might the three participants' stories be connected to one another? What commonalities might they share? How might the commonalities be layered to all three narratives to say something of their significance? Documenting the resonant threads throughout the narrative analysis process

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was crucial in discussing and positioning the three narratives as a collection of storied experiences.

Using strategies to move to the final research text. As I employed the strategies described above, I was intentionally moving from writing interim research texts to deciding upon and writing the final research text, that is, the narrative analysis presented in this dissertation. My narrative inquiry process was filled with uncertainty and tensions at every stage. As I was confronted with the "discursive, fragmented, filled with halting moments" process, I had to reconcile seemingly endless questions over meaning-making, quality of the work, audience, voice, and signature, to name a few, or what Clandinin and Connelly (2000, p. 144) call "writing research texts in the midst of uncertainty." I documented the tensions I encountered during the narrative construction process, serving as another strategy for reflective, relational inquiry and also providing a basis for identifying my struggles with narrative inquiry (to be discussed more in depth later). I relied on the skills required of narrative work: "imagination, innovation, creativity," "aversion to technicism," "blend of independence and empathy," "comfort amidst ambiguity, complexity, and contradiction," and "acceptance of the necessity that each narrative journey be, in important ways, a fresh start" (Barrett & Stauffer, 2009, p. 221), along with the trust, openness, ethical engagement, and collaboration.

Co-constructing the research texts. As I moved from the interim research texts to the final research text, I strived to uphold narrative ideals while also making decisions concerning the form that the narratives would take. I structured the final research texts around the importance of upholding: the particularity and complexity, resonance,

common elements of narrative form, and considerations of voice, signature, and audience.

Particularity and complexity. Throughout the narrative analysis, I remained committed to the narrative ideal of upholding the particularity and complexity of the lived and told stories of the participants. To do this, I relied upon representing the participants' experiences in its depth, messiness, richness and texture and by using the actual words spoken (Etherington, 2004). My goal was to show the participants' "deep embeddedness in a particular milieu" (Dunne, 2005, p. 386) with the intent that their narratives might:

> Disclose an exemplary significance … that proves capable of illuminating other settings – without the need for re-routing through abstract generalities and, indeed, with greatest potential effect for those most deeply in the throes of the very particularity of another setting. (p. 386)

To uphold the integrity of my role in the reconstruction of knowledge, I relied upon representing my part in the particularity and complexity of the stories lived and told. I included some conversations that took place between the participants and myself. I aimed to be transparent, highlighting the relational element of the work, and show the ways in which the lived and told stories were shaped by my interactions with the participants. This aspect of the narrative form speaks to the researcher's positioning within the work and the reflexivity that narratives require to show the particulars and complexity of experiences. However, questions over which conversations to include and omit created tensions in the process.

Resonance. I also aimed to uphold resonance through the narrative analysis. In a

chapter entitled "Charting Narrative Territory" (Barrett & Stauffer, 2009), Bowman

wrote of resonance:

> We think of narrative's capacity to engage us deeply and concretely as a kind of
> "resonance": the power of narrative to which I have been alluding here, the power
> of narrative work done well, is, perhaps, a function of its capacity to set in motion
> some kind of sympathetic vibration. Narrative that fails to resonate is just so much
> talk. (p. 217)

Furthermore, Bowman wrote that narrative analysis "done well" is linked to its "appeals

to particularity" (p. 218).

> It is cliché, almost, to maintain that narrative work does not seek to generalize: it
> seeks only to confront us with something unique and particular …. For something
> to resonate or have meaning or value requires a relationship or a connection to
> something else. Meanings are connections. And what a particular connections
> means is a function of the uses it serves. Meanings are uses. Resonance…
> operates in the middle ground between two untenable extremes: the utterly
> abstract and the utterly concrete. (p. 218)

As I broadened, burrowed, storied and re-storied, and looked across the three

participants' stories for resonant threads, I aimed for my narrative to take the form of

something that would resonate with my audience.

Narrative form: elements of the research texts. To co-construct narratives that

uphold particularity, complexity, and resonance, I strived to use the "kind of interpretive

skill that can bring out the complex weaving of plot and characters, the dense meshing of

insights and oversights, of convergent and contrary motivations and interests, of

anticipated and unanticipated responses" (Dunne, 2005, p. 386), realizing that

"interpretive skill" required bottom-up and top-down considerations for writing the final

research text. Bottom-up considerations meant thinking of the research text in terms of its

linguistic structure, or its words, sentences, and cohesiveness (Bamberg, 2012). Top-

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down considerations meant thinking about the research text in terms of its cognitive

structure, or its plots, themes, and coherence (Bamberg, 2012).

To elaborate upon the bottom-up considerations, I used the spatial and temporal

markers recommended by Bamberg (2012) to: (1) build the characters (through the

"temporal contiguity of what happened") and position them in relation to one another and

(2) "build and sequence small thematic units, those that resemble paragraphs… into

larger units that ultimately surmount to the narrative and what it is about" (p. 12). I also

used lexical and syntactic indices to "signal" where I was, as the narrator, in the

"construction of the overarching unit" (p. 13). For example, "shifts between lexical

devices that seemingly refer to the same character also can be significant." As I refer to

each of the participants as a Native American woman, I am assigning each of them to a

membership category and marking their position (Bamberg, 2012).

To elaborate upon the top-down considerations, I relied upon narrative cohesion

building to "ultimately result in some structural whole" – the structural whole being the

narrative analysis – whereby "the emergent whole is more than its linguistic components"

(Bamberg, 2012, p. 90). Specifically, I structured the narrative analysis with an

orientation (to describe the exposition or, in other words, to take "the listener into the

there-and-then where actions take place"), complication(s) (to describe the problems that

the participants have encountered), action orientations (to describe the actions taken to

move toward a resolution), the resolutions and/or failures that occurred due to the

resolution actions, and, finally, the closure of the narrative (to take "the audience back

into the here-and-now of the telling situation") (Bamberg, 2012, p. 90).

While co-constructing the narrative analysis, I was mindful of the power of "story" among Native communities. Fixico (2003) wrote about characteristics of story in his book entitled *American Indian Mind in a Linear World*:

> "Story" among American Indians consists of at least five parts: time, place, characters, event, and purpose. Together, they are the sum of an "experience." Each part connects the other parts for the storyteller to weave his or her story in the art of storytelling that is poetry and fine entertainment and knowledge sharing in Indian communities. (p. 22)

Fixico's statements on the Native traditions of story paralleled the elements of the metaphorical three-dimensional narrative inquiry space, while providing a perspective from a Native lens. For example, Fixico described the element of time as:

> Time as a part of the story of when it happened becomes less relevant as the story continues to be told. Time becomes less important as the characters come to life and relive the experience. The storyteller breathes life into the story by describing the characters involves and vividly describing the event. (p. 25)

Fixico's conceptualization of time within Native traditions of storytelling maps to the temporal dimension of the three-dimensional narrative inquiry space, and provided me with an opportunity to consider how to construct the narrative along the temporal dimension while emphasizing experience (rather than the chronological time). This was relevant to the narratives because each of the participants situated themselves along a continuous stream of experience through time, reflecting back on their past to situate their current experience (e.g., how they were raised on the reservation and how that relates to why they are conducting themselves a certain way in the present time) and looking toward the future (e.g., describing their future goals and how that relates to why they are conducting themselves a certain way in the present time). I attempted to vividly describe

these experiences through the participants' own statements to situate the lived and told stories along a continuum of time, or the temporal dimension.

On the element of place, Fixico wrote:

> Place plays a prominent role in the story to give it texture, so that the listeners can relate to the origin of the story. Place becomes a reference point that is needed in life so that we know where we come from and who our relatives are. Reference points of experience become landmarks and even sacred places or special sites where they remind travelers of certain paths, rivers, trees, valleys, and mountains that have become touchstones for memory. In this way, every place has a story relating to human experience. (p. 25)

Fixico's conceptualization of place within Native traditions of storytelling maps to the spatial dimension of the three-dimensional narrative inquiry space, and provided me with an opportunity to consider how to present the "reference points of experience" with the narrative. For example, the lived and told stories marked by descriptions of the participant's home was crucial to the participants' identities as Native American women (all three participants were raised on the reservation). Their experiences with home was linked to time, or the temporal dimension, as the participants reflected back, situated their present, and envisioned a future around their stories of home.

On the element of characters, Fixico wrote: "Characters carry the story, thus allowing the listeners to relate to them and to form opinions" (p. 26). This maps to the relational dimension of the three-dimensional narrative inquiry space, whereby the characters of the narrative (e.g., myself as the researcher and the participants) served the purpose of creating intentionality for the actions that take place, or the reason for the narrative to exist.

Overall, Fixico wrote that "'experience' is the heart of the oral tradition for Native peoples," whereby "listening and interpretation is imperative for understanding" (p. 26).

"When story is told effectively, it becomes powerful" (Fixico, 2003, p. 26). Indeed, this was the objective for the narrative analysis: to uphold integrity of the work while constructing narratives that had significance and an impact to extend broadly into the communities of listeners. Fixico's descriptions of traditional Native storytelling were pertinent to my narrative analysis, as they provided guidance for interpreting the lived and told stories of the Native American women participants and co-constructing their stories into narratives.

Voice, signature, and audience. Voice, signature, and audience are three major considerations for narrative inquiry work (Clandinin & Connelly, 2000). Considerations of "voice" calls for determining how much of the participant's voices should be heard in the research text. Considerations of "signature" calls for determining how much of the researcher's voices (my voice) should be heard in the research text. Considerations of "audience" calls for determining how to best communicate the narrative inquiry process and narrative analysis to others. Concerning voice, my intent was to give the participants a "primary position" in the narrative, and so I chose to frequently quote the participants directly (Luton, 2010, p. 73). The lived and told stories of the three Native American women give "voice" to an underrepresented group in STEM, and as such their voices were pertinent to the narrative analysis. As for "signature," I chose to include my signature, or my voice, to uphold transparency, knowing that my interactions with the participants affected the narrative inquiry. I especially included my signature when I encountered tensions or when my reflections resulted in transforming my understanding of an event. I found it difficult to consider the audience. I wanted the narrative inquiry to reach both STEM and Native communities alike, but decided that it was engineering

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education that needed the contributions of the narratives the most. Qualitative research traditions are becoming more popular within engineering education, but narrative inquiry has not yet accelerated within the field as compared to other fields with strong social science traditions due to the strong positivist traditions in STEM fields (Chism, Douglas, & Hilson, 2008). This meant that I had to be mindful of the narrative analysis and how the audience may interpret the narratives of lived and told stories.

Boundaries. Writing research texts is a tension-filled time as the narrative inquirer must "rub up against" boundaries (Clandinin & Connelly, 2000). Specifically, tensions arise throughout the process of situating the work in theory (through the strategy of broadening) and understanding the complexities of the lived and told stories (through the strategy of burrowing). The first represents formalistic boundaries, or negotiating the inquiry process within frameworks set by theory. The latter represents reductionist boundaries that arise from reducing the field text to a final form in the research text as if it were "exactly so" (Clandinin & Connelly, 2000, p. 142), recognizing that "memory is selective, shaped, and retold in the continuum of one's experiences," and this continuum falls along the three dimensions of the narrative inquiry space (Clandinin & Connelly, 2000, p. 142).

Formalistic boundaries. Considerations of formalistic boundaries were set in motion from the beginning of writing this dissertation. Beginning with the structure of the dissertation, I had to consider how to place theory within the thesis. Formalistic research traditions call for theory to be placed within a distinct chapter, such as a literature review chapter as was done in this dissertation. However, many narrative inquirers weave theory throughout the dissertation or publication, representing the back-and-forthness of

narrative inquiry (Clandinin & Connelly, 2000). While rubbing up against the formalistic boundaries, I had to consider my audience, engineering education – a field more formalistic in tradition. Therefore, I represented the research process in a form that may be more familiar to the audience.

Turning to the composition and interpretations of the research texts, I experienced tensions as I rubbed up against formalistic boundaries set within the theoretical frameworks of the study. I used a theoretical framework that recognized the dynamic and varied nature of individuals (i.e., individuals as holding constructed, multiple, and intersecting identities and as dynamically creating new hybrid identities), which was useful in representing the three participants' "highly personalized stories" (Clandinin & Connelly, 2000, p. 55) and exploring new, illuminate threads. Additionally, the examination of the spaces set in motion by the theoretical framework (i.e., the Native woman's space and an engineering and technology space) was useful in drawing attention to and exploring particular elements of the lived and told stories (e.g., recognizing the influence of motherhood within Native cultures). However, I was challenged by the need to broaden my focus across the three narratives, setting aside the individual explorations of the participants' storied experiences, to examine what contributions or claims might be made about the understandings of the three participants' identities on their acts on leadership (see RQ2). This tension-filled process represented the need to explore the broader socio-cultural grounds of meaning production (Mishler, 1986, p. 26). For example, a tension arised from the varied spaces that the three participants operated within their daily work lives. As the participants worked within diverse engineering and technology environments, I was challenged to consider the storied experiences and

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categorize experiences according to formalistic themes, ideas, and theories. The participants' active involvement throughout the inquiry, including the interpretations, resolved these tensions by allowing their voices to be a part of the meaning production. Throughout the inquiry, the participants and I spoke openly about tensions and sought to resolve them through co-constructed interpretations. Additionally, I experienced tensions from formalistic boundaries as I explored new theoretical contributions that the narratives might provide. Specifically, I began to think of historical power networks (Foucault, 1983) as they are embedded within engineering and technology spaces and within Native communties. However, a different approach, with different formalistic boundaries, would have been required. Formalistic tensions within narrative inquiry must balance both the need to explore new emergent threads and new possibilities with the theoretical frameworks of the inquiry. Within narrative inquiry, there are unlimited possibilties of what a narrative could be and as it is situated within a changin stream of experience, and so there is aways a need for more stories. Therefore, the understanding that narrative inquiry embraces the assumption that individual stories and narratives do not comprise the "fundamental unit that accounts for human experience" (Clandinin, 2006, p. 5) was useful in resolving tensions from rubbing up against formalistic boundaries.

   Reductionistic boundaries. Considerations of reductionistic boundaries typically arise from being overwhelmed by the amount of data and relying upon memory of the field and field text (Clandinin & Connelly, 2000). Within my experiences within this inquiry, I experienced tensions with representing the depth of the data that I had collected within the research texts while also feeling the need for additional data. As I delved into the lived and told stories, I sought more stories to explain why phases in the participants'

life or reasons for actions they took. However, the formalistic boundaries aided in resolving these tenions – specifically, by reminding myself that the inquiry was not intended to be a life history, but rather the inquiry was intended to produce narratives aimed at illuminating the storied of experiences of Native American women in engineering and technology who are leading initiatives to improve their Native communities. I also experienced tensions with coming to know and then representing aspects of Native communities – specifically, in understanding the complexity across tribes, between the participants' urban lives and upbringings on reservations, and between scholarship and individual participants' understandings. As I came into the inquiry, I had some experiences within Native communities and a developing theoretical notion of Native cultures and traditions; however, conducting the narrative inquiry with the participants confronted my notions and grew my awareness of the complexities and particularities across and within Native communities, including the participants' lives. As I sought to reconcile this tension of needing to represent aspects of Native communities, I relied upon the intent of narrative inquiry, which is to share individual participants' storied experiences. This could not have been done without the participants' willingness to share their understandings and answer my questions, as this is what the inquiry was founded upon. As I thought narratively about the three women's narratives, I rubbed up against the reductionistic boundaries, and sought to resolve them with the understanding that narrative inquiry represents "living life at the boundaries" (Clandinin & Connelly, 2000, p. 140).

Struggles. Throughout the inquiry process, I had to learn to think like a narrative inquirer (Connelly & Clandinin, 2006). Clandinin and Rosiek (2007) wrote, "Narrative

inquiry is an old practice that may feel new to us for a variety of reasons" (p. 35). Indeed, conducting research through narrative inquiry was new to me. Among the many struggles, I had to learn how to keep the considerations of the three-dimensional narrative inquiry space in front of me – thinking of and exploring the contexts of the storied experiences. I also had to learn to actively reflect upon the inquiry as it progressed in order to uncover tensions, unpack meaning-making, and recognize the formation of interpretations. As I sought to deepen my understandings of the storied experiences, I had to learn to navigate the many aspects of narrative inquiry, including the recognition of justifications for the work and processes to unfold meaning (e.g., burrowing and broadening). I had to learn how to rely upon relational knowing and research – a struggle which required being willing to "be changed" by what I heard and found through "openness to others" (Barrett & Stauffer, 2009, p. 221). As I worked with my data, the storied experiences became more familiar to me. However, the inquiry required that I make the familiar strange again by not taking for granted the particularities and nuances of the storied experiences. I relied upon reading other narratives when I encountered these struggles. At a topical level, structuring the dissertation represented another struggle. I had to consider what the chapters might look like and how the narrative elements might be represented throughout – including how to first represent the participants. The narrative inquiry process – from being in the field to composing field texts to co-constructing research texts and their interpretations – was full of challenges – but rewarded with opportunities to learn about the richness of storied experiences and their contributions to scholarship.

Research Quality

Questions of quality in interpretive research, such as this narrative inquiry, is

upheld through by addressing the trustworthiness of the research (Curtis, 2013).

Specifically, trustworthiness addresses the credibility, transferability, dependability, and

confirmability of the study and its findings (Curtis, 2013). Gay, Mills, and Airasian

(2006) wrote:

> First, a research must take into account the complexities in the study being
> conducted and address problems that are not easily explained (credibility). The
> research should also include descriptive, context-relevant statements so the
> consumer can identify with the setting (transferability). Qualitative researchers
> should include as much detail as possible so others can see the setting for
> themselves. Another issue the researcher needs to addres is the stability of the
> data collected (dependability). Finally, the researchers should address the
> neutraility or objectivity of the data (confirmability). (p. 403)

The elements of trustworthiness are reflected in validation techniques of theoretical

validity, descriptive validity, interpretive validity, generalizability, and evaluative validity

(Maxwell, 1992). Walther and Sochacka (2014) outlined a quality framework, termed

Qualifying Qualitative Research Quality (Q3), for engineering educators that addresses

various validation techniques. Below, I outline the validation measures used for this

inquiry.

Theoretical validity is the "fit between the social reality under investigation and

the theory generated" (Walther & Sochacka, 2014). For this narrative inquiry, I linked the

phenomenon under study to relevant theory and wrote a discussion of the narrative

analysis to address its fit within theory and the contributions the findings might make to

known theory. Descriptive validity (or process reliabilty, according to Walther and

Sochacka (2014)) concerns the accuracy of the data in order to mitigate any distortation

of data. I relied upon field texts to mitigate risk of distortion of data. I also reflected upon my experience of the research experience through field notes with attention paid to the influences within the environment, including the conversations I had surrounding the narrative inquiry process. I also relied upon validation by my research participants by providing them with research texts, allowing for feedback, and engaging in a negotiation of the research texts, or narratives. These interactions with the participant also led to interpretive validation, whereby the participants were able to provide feedback on the meanings constructed from the field texts. As the participant and I negotiated the meaning of the narrative as a validation check (Creswell & Miller, 2000), we both come away learning and having been changed by the other (Pinnegar & Daynes, 2006). Generalizability (or communicative validation, according to Walther and Sochacka (2014)) addresses whether the study and its findings can be shared with the relevant communities. For my inquiry, I attempted to construct findings within the research community most relevant to the work, specifically engineering education (Walther & Sochacka, 2014). Evaluative validation is intended to minimize bias and judgement towards the data. For the narrative inquiry, the researcher's role and experience of the research experience is acknowledged and treated as a crucial dimension along the three-dimensional narrative inquiry space. By acknowledging my presence in the narrative inquiry process, I addressed the biases I may have had. Additionally, the tensions that I experienced through the narrative inquiry were documented and openly addressed in co-construction of the narratives.

Ethical considerations. First and foremost, institutional ethics were upheld in this study by gaining institutional review board approval from Arizona State University

in August 2014. Relational ethics were also critical throughout the duration of the inquiry (Clandinin, Pushor, & Orr, 2007), as I considered the quality of my interactions with each participant in the "negotiation of [our two] narrative unities" (Clandinin & Connelly, 1998, p. 281). Specifically, I was dedicated to: (1) upholding a trusting relationship between myself and the participants, (2) maintaining confidentiality of the participants, and (3) upholding proper ethics throughout the negotiation of the formation of the research texts. To uphold a trusting relationship with each participant, I was mindful to be transparent with the purpose and goals of the study, how the study was progressing including shifts and turns in the study, and sharing the research texts with the participant (Clandinin & Connelly, 1998; Curtis, 2013). To maintain confidentiality of the participants, I used pseudonyms for each participant and omitted location names, such as their places of work, to protect their anonymity (Clandinin & Connelly, 2000; Curtis, 2013). However, it should be noted that each participant was willing to identify themselves as part of the study in order to inspire next generations of Native students in following their path. These transparent discussions are an example of maintaining a trusting relationship between myself and the participants throughout the research process. Connelly and Clandinin (2000) wrote that "relationship is key to what it is that narrative inquirers do" (p. 189), and indeed this was paramount to this narrative inquiry.

Summary

This narrative inquiry research process was firstly dependent upon collaborative inquiry, which acknowledged that both myself, the researcher, and participant are co-creating knowledge and have influence over one another in the three-dimensional space. Collecting data can be a reflection on power, and so the narrative inquiry allowed

participant voices to come to the forefront and, according to Brayboy (2005), recognized stories and oral knowledge as legitimate forms of data (Brayboy, 2005, p. 439).

Within this inquiry, words as data took various forms. I worked with the participants to collect research interviews, documents, and observations. I also made voices memos for myself and field notes; these were particularly helpful in documenting my own journey and my own challenges and realizations. The narrative inquiry process then required me to move from listening to stories told by the participant to the empirical narrative, called the research text. This process involved logistical steps, such as organizing data, and considerations that grounded the process, including: (1) theoretical considersations that called for focusing on the phenomena under study through a narrative view of experience, (2) interpretive-analytic considerations that called for thinking through meaning-making and social significance of Jaemie, Mia, and Catherine's stories, and (3) practical considertations that enabled the move from field text to research text. Additionally, to move the field text to the final research text, I used strategies such as broadening, burrowing, storying and re-storying, debriefing, and resonant threads.

The final research text, or the narrative, is one that, in its complexity, revealed something about the phenomena under study: Native women in engineering and technology who are leading initiatives to improve their Native communities. As a narrative, it was comprised of storied elements, such as time, place, characters, and events, and built a sequence to the larger unit of what the narrative is about, which is to unpack meaning and experiences of these Native women. Figure 9 provides an illustrated summary of the narrative inquiry research process for this study, visually showing the

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collaborative move from field text to research text. The forms of data, strategies employed, considerations, and steps in the process are also represented within the illustrated summary.
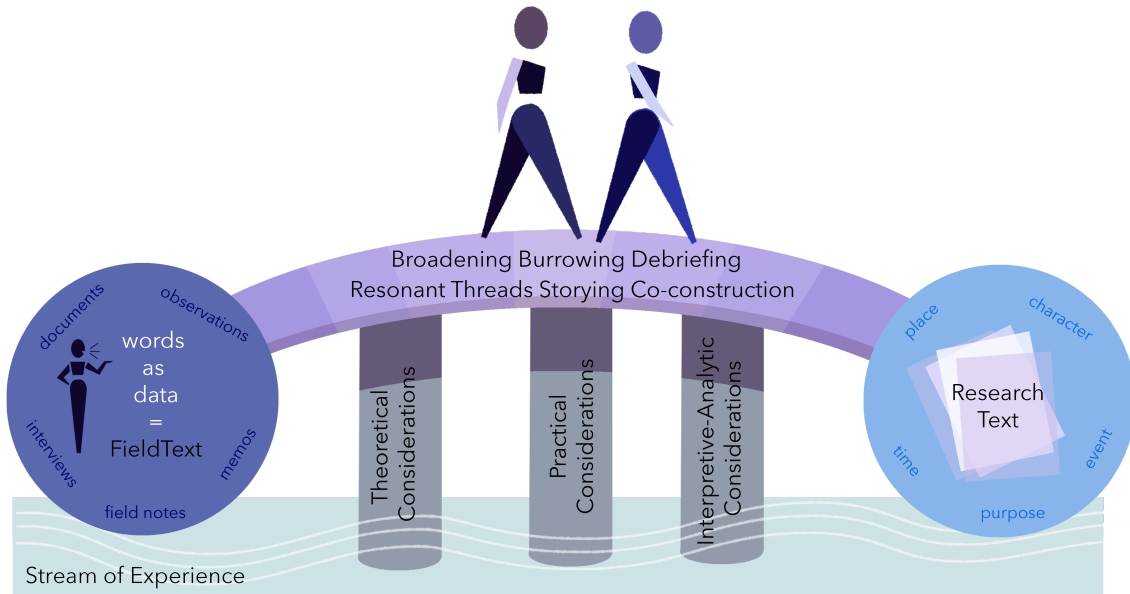
Figure 9. The narrative inquiry process

CHAPTER 4

NARRATIVE ANALYSIS

This chapter provides three narratives – with each narrative revealing the particular lived and told stories of a Native American woman working in the engineering and technology field and leading initiatives to improve her Native communities. The three Native women, Jaemie, Mia, and Catherine, worked within three different contexts: a large technical corporation, a tribally-owned technical business, and a self-made technical business. Within these contexts, the initiatives that they led to improve their Native communities were complexly varied. The narratives are presented to gain insight into how the Native American women's understandings of their work and leadership acts are embedded within her constructed, multiple, and intersecting identities – recognizing each individual is unique in their understandings and constructions.

Across the three narratives, there are variations in narrative structure and how the storied experiences are nested. The variations were guided by the data collected and the co-construction of narratives between the participant and myself, the researcher (detailed in chapter three). However, all three narratives were structured around the theme of transition, which is a form that evolved as I moved from field texts to research texts with each of the participants. Specifically, as I reflected on the field texts and interim research texts with each participant, there seemed to be major life transitions that were emphasized within the storied experiences. One conversation with Jaemie illuminated this. She explained that speaking in terms of transitions comes from her Navajo perspective – that all of life, in its seasons and cycles and ups and downs, are transitions, and this applies to her personal life as well. Life is balanced by transitions, which provide opportunities to

face challenges and give lessons to others. Catherine (Navajo) and Mia (Akimel O'odham-Mexican), too, responded that they speak in terms of transitional moments and of major challenges faced because it provides an opportunity to learn and reflect, which is useful to themselves and others. With a framework of transitions, I co-constructed the narratives of Jaemie, Mia, and Catherine to reflect the transitions within their storied experiences (see Figure 10 for a conceptual illustration). The transitions within the narratives reflect lived and told stories within a specific three-dimensional narrative inquiry space, influenced by situation, place, and temporality. As is the nature of lived and told stories, the Native American women's storied experiences are dynamic.
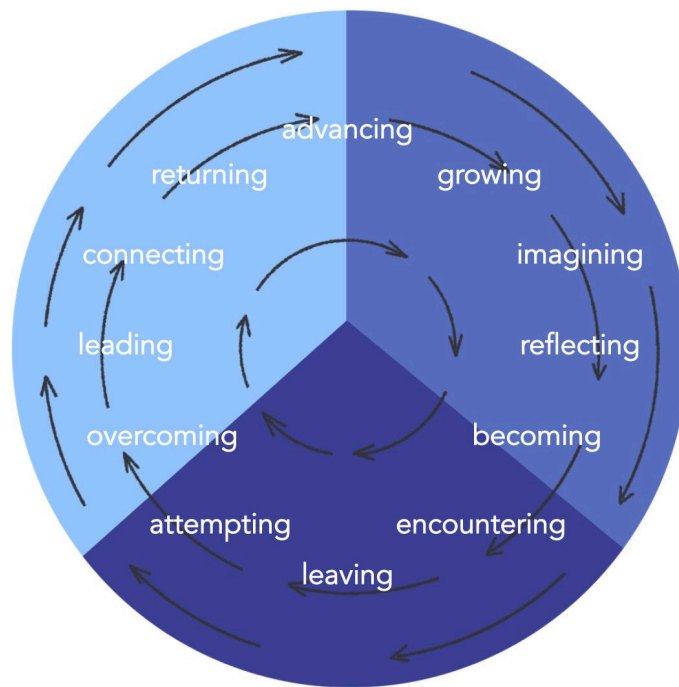
Figure 10. The narratives were structured with a framework of transitions

The Narrative of Jaemie: A Navajo Woman in a Technical Corporate Workplace

Jaemie is a Navajo woman who is committed to improving her Native community, including herself and her family's lives. Her commitments drove her to take action to create positive impact within all aspects of her professional and personal life. Over the course of her sixteen-year technical career, Jaemie advanced from a technical representative, followed by a manufacturing technician, to her current role as an engineering specialist on a research and development team at a large technical corporation – a professional pathway not typical of technicians within her technical workplace. In an effort to stay connected to her Native community, Jaemie joined a Native American support network within her technical workplace. Jaemie soon identified ways in which she could contribute her professional expertise to improve the lives of Natives. Specifically, seeing the limited number of Natives within her technical workplace was "unacceptable" to Jaemie; and so she began efforts of constructive change. First, she took a position of leadership as chapter president within the workplace's Native American support network to grow the support network, a role which she still serves in today. As is revealed in this narrative, Jaemie grew her role as chapter president to developing a comprehensive outreach program. Jaemie also served in Phoenix AISES as a member and then as the secretary for 2015, lending her professional expertise and volunteerism to the goals of improving Native community through STEM. Jaemie became a force for advocacy for Natives working within her technical workplace and, more broadly, for improving Native communities through STEM, including Natives seeking careers in STEM and exposing Native youth to STEM. As Jaemie dedicated herself to change within her Native community, her professional, cultural, and gender

role identities became increasingly intertwined, with each reinforcing one another by Jaemie's own design and for the benefit of herself, her Native community, and her technical workplace. As the narrative inquiry came to a close, Jaemie's professional efforts were rewarded with national-level recognition and the proposal of a partnership with a local politician and a grant from a state science advocacy organization. As Jaemie broke professional barriers, she was raising four children (three boys and one girl) as a single mother, currently aged fourteen to twenty. She was dedicated to raising strong, independent, successful children – the next generation of Navajos. As such, she spent countless hours before and after her work day driving them to and from their after-school activities, taking the oldest two on college tours around the country, preparing home-cooked meals, checking on their school work, and making certain they had a strongly grounded upbringing. Her commitment to family extended much beyond her children. She often drove home to the Navajo Nation, a five-hour drive one way, to remain connected to her family and help in any way she could, including caring for her 75 year old mother. The narrative of Jaemie are her lived and told stories of her professional pathway and how her constructed identities as a Navajo woman and professional influenced her pathway.

By the time I sat down with Jaemie for her first interview as a participant in my dissertation study, we had known one another for nearly five months. During this time, I had interviewed her for another research study (in which I was serving as a research assistant); we had both attended Phoenix AISES meetings; we had exchanged several emails about various initiatives on our overlapping interests to improve STEM education within Native communities; we had both been elected to serve on the Phoenix AISES

board for 2015 and were one month into our one-year term. During this time prior to beginning the narrative inquiry process with Jaemie, I had come to know Jaemie as a Navajo woman who was working in engineering and technology while advocating for her Native communities to advance through STEM.

Over the course of seven months, I interviewed Jaemie for this narrative inquiry six times, with the majority of interviews taking place within the first two months. We met nearby her work office and, occasionally at a local restaurant. Beyond the interviews, I had met with Jaemie (along with others) twice a month, on average, to organize the Phoenix AISES activities that would take place each month and host the monthly general meetings. These times provided us with an opportunity to grow our understanding of one another. Jaemie had lived a life much beyond her forty years. It was abundant with experiences and each time we met she had new stories to tell that helped me to understand her perspectives as a STEM professional who was leading initiatives for Native communities. She was open and forthright about the experiences she had gone through, sharing both the good and bad. During the interviews and conversations, I found it challenging to ask all the follow up questions I had while allowing the conversations to move in new, unexpected directions. Not only did she have many stories to tell, but also there was incredible depth to her stories. Following up on the particularities of her stories had relevance to illuminating the complexities of being a Navajo woman in the engineering workplace and leading initiatives to improve Native communities. However, the inquiry process required that I move on from my follow-up questions at times, knowing that there was more stories to hear and that the narrative would represent a portion of Jaemie's stories within a certain situational, temporal, and relational space.

When it came time to use the interim research texts to work toward this final research text, the narrative of Jaemie, I found it difficult to detach from actively seeking to hear Jaemie's lived and told stories and switching my primary focus to the co-construction of Jaemie's narrative. This struggle revealed the some of the difficulties of narrative inquiry; Jaemie and I had established a trusting relationship and I missed hearing her stories and adding them to the possibilities of what this narrative could be. Throughout the inquiry process, including the construction of this narrative, I exclaimed to Jaemie several times, "You have gone through so much!" Each time, Jaemie would flash her joyful smile, tell me that she loves life, and explain that there is no other choice than to move forward in life and that she enjoys challenge. She also told me that my reaction to her stories was not uncommon. Her friends tease her that she seems to have lived "many lifetimes of experiences" despite her age.

Transition 1: Becoming an engineering technician. Jaemie was in the sixth grade when she decided her future career would involve work with computers. She was living on the Navajo reservation in Chinle, Arizona with her family – including her four siblings and her widowed mother. Her father had died when she was four years old and her mother worked as a teacher to support herself and her children. Jaemie's four older siblings were attending a Catholic school in New Mexico, but her mother had allowed Jaemie to make the choice to attend the local public elementary school. The elementary computer lab teacher required each of the students to design an object and write a program to move the object. Jaemie chose to design a turtle to match the computer's green lettering, and she wrote a program to move the turtle around in a pattern. Jaemie thought it was fun to design her own game and unlike anything she had done before. As

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Jaemie reflected on her childhood experiences, she told me that this was when she decided that she wanted to work with computers in the future. She had a developing interest for "problem solving," "exploring new ideas," and "figuring out how things occur." As Jaemie grew up and attended middle school and high school, she told me that she always enjoyed her math and science subjects – knowing that these subjects were related to working with computers. Her interests in middle school and high school spread beyond her science and mathematics courses. Overall, Jaemie told me that she enjoyed school and was very social. She was involved with sports, mainly basketball and volleyball, and student council. She served as the class president for three of four of her high school years and was often the team captain of her sports teams. When asked what might be the common draw to her interest in science and mathematics courses, sports, and leading activities like student council, Jaemie responded that challenge motivates her.

When it came time to graduate from Chinle High School, Jaemie chose to go to a community college in the greater Phoenix area, where she could "venture to new places away from the reservation," "explore," and "experience self-discovery." She recalled that growing up her elders told her that she needed to "go get an education, become successful, and come back." As she looked back on this time, Jaemie said that many elders tell the youth the opposite: "Stay. Don't go." If Jaemie's elders had told her not to leave the reservation, she would not have. That is the power of the elders, Jaemie explained – the youth are to respect their wisdom and follow their lessons. As she prepared to enter community college of the reservation, she selected her major as Computer Information Systems. The community college was over eight hours away from her home and although she welcomed the experience away from the reservation, it "was a

huge culture shock." Leaving home was a difficult transition for Jaemie because she was

leaving everything she was familiar with, but her curiosity and desire for an education

and career in a computer-related field drove her decision to leave home for school. She

visited home as often as possible, when finances and time would allow. When she was

attending community college, she was overcome with the differences between the ways

of life off and on the reservation. Jaemie described how she adjusted to her new life off

the reservation by creating a "comfort zone" with things she was familiar with from home

– seeking other Native Americans and her love of playing basketball, a sport commonly

played back home.

> I moved away from home, Chinle Arizona, at the age of 17, two and a half
> months after graduating high school. I recall the excitement and anxiousness to
> get on my own. I had very little knowledge of what I would face. It was a
> transition I wasn't completely prepared for. I was born and raised on the Navajo
> reservation so transitioning from always being surrounded by Native people to
> having no Native people was a shocker. The whole city life was overwhelming,
> living a fast paced life compared to a rural area where time doesn't race by. I was
> away from my childhood friends; I didn't have them around in the city. As a child
> I grew up exploring the outdoors, its not so easy to do that in the city – I felt like I
> always had to be on guard/careful about who I interacted with and where I
> visited. In college people weren't so easy to approach and there wasn't anyone
> who could relate to my 'norm' and vice versa. It was out of my norm and I found
> myself working to recreate a comfort zone at school and in my own living
> surroundings.
>
> I eventually adjusted to the city life surroundings; however, I never felt it was
> home for me. I sought out other Native Americans in the local areas of where I
> went to college, soon discovering a few pee-wee and high school basketball
> rivalry opponents. Basketball is a big sport, if not the biggest, on the Navajo
> reservation and I started playing in the 4th grade. I played all the way through my
> high school years and during those many years of competitive basketball I
> developed friendships with many players on the opposing teams. The two
> commonalities of being Native American and the love of playing
> basketball provided ease with building a comfort zone with building friendships.

By the time Jaemie graduated from community college, she had given birth to her first son. While residing in Phoenix, Jaemie stayed home to care for her son for the first two years of his young life, but faced personal hardship and realized that it would be up to her to provide for herself and her young child. Jaemie told me that she decided she needed to complete her education if she were to have any decent job opportunity in the STEM field. As Jaemie recalled these hard times, she is, and always has been, "driven to learn" and able to "face challenges." And so rather than move back home to the reservation, Jaemie relied upon personal determination to raise her young son while taking courses at a local technical institute. One year into a two-year electronics engineering program, Jaemie was in need of income to support both her and her son. She interviewed for her first technical job and was hired as a technical service representative at a large corporation, Communication Corp (pseudonym). She worked during the day at Communication Corp and went to school at night, all while raising her son. Once Jaemie graduated with her Bachelor of Applied Science in Electronics Engineering (a degree earned from a combination of community college and technical institute courses), she found a job at another large technical corporation, Semiconductor, Inc. (pseudonym), as a manufacturing technician. By now, she had four children, three boys and one girl. She had left much personal heartache behind, leaving the father of her four children and moving into her own residence with her children. During this time, she was working twelve-hour days "testing an end product that had been developed" in addition to raising her children. She was proud of herself for working within the industry that she had dreamed of since she was a little girl.

Transition 2: Moving for personal change. When Jaemie was three years and seven months into her position as a manufacturing technician, she saw an opportunity to move out of state to another branch of Semiconductor, Inc., located in the Pacific Northwest. The job posting was for a manufacturing technician, a parallel position to the job Jaemie currently had. Jaemie was seeking a "personal, positive change" and saw the new job as an opportunity to go explore a new place and have a fresh start with her children. In the summertime of 2004, she moved herself and her four children to the Pacific Northwest and began working as a manufacturing technician. As she settled into her new home, she enjoyed meeting new people and living in a new place, but experienced sadness due to the physical distance between her and her family on the Navajo reservation in Arizona. Jaemie faced personal hardship when she began to struggle with the financial obligations of childcare for her youngest son, who was three years old at the time. She called home to her family on the Navajo reservation regularly and was open about her experiences in the Pacific Northwest, including her struggles. During one of these conversations, Jaemie's children's paternal grandparents offered to take in her youngest son and care for him at their home on the Navajo reservation. Jaemie put much thought and prayer into this decision. She decided that despite her personal heartache over the idea of having her son not live with her, she needed to allow her children's paternal grandparents to do this for her and to give this opportunity to her son. Jaemie knew that it was a rare opportunity for one of her children to " learn from the paternal grandparents – the lessons, the prayers, the teachings, how to care for the livestock." "It was a sacrifice" to let her son go, but he would be cared for those who loved him and would "create a bond with his paternal grandparents." Jaemie accepted the

offer and helped her son move to their home on the Navajo reservation. She took a sabbatical from work and for several weeks she lived on the Navajo reservation (along with all her children), helping her young son to adjust. When it came time to go back to work, Jaemie left her son in the care of her son's paternal grandparents. Jaemie's son stayed there for one year. As Jaemie reflected back on this time and thought about the present time, she told me, "Even to this day, he is one of two of many grandchildren that knows how to care for livestock." "He is one of the few that they [paternal grandparents] can count on to do the things that need to be done."

Transition 3: Connecting with the Native American support network. When Jaemie returned back to work from her sabbatical, Jaemie began to yearn "to connect to something [she] was familiar with" and interact with people that she could "feel at ease with." She began to research online and found Semiconductor Inc.'s Native American support network. She immediately joined the group and "just felt the presence and the positive vibes and everything that [she] felt comfortable with." Within Semiconductor, Inc., there were three chapters of the Native American support network; two were located in southwestern states and one in the Pacific Northwest. A leadership team, comprised of a president, vice president, secretary, and treasurer, directed each chapter. According to Jaemie, the mission of the Native American support network was to be a "centralized group where we are all professionals, where we all can relate to one another culturally and to really strive to be the positive role models." She described that the values of the support network drove the goals of the group. Jaemie explained the five core values:

(1) The first one is engaging our members and promoting self-development. We want to our members to be active in their own self-development and we want to help them achieve this as a team.

(2) The second one is cultural awareness. This is important because Native Americans are a diverse group of people. Many people are not aware of the different cultures within the Native American society. We have different traditions, values, and beliefs. Cultural awareness extends to helping all of the employees at [Semiconductor, Inc.] to understand that there are cultural differences.

(3) The third one is retention. We want to hire and retain Native peoples within [Semiconductor, Inc.]. We are a small number, less than one percent here at [Semiconductor, Inc.], but we want to look for new ways to attract and retain our people.

(4) The fourth one is serving as a positive role model. This is related to the fifth goal. We strive to do outreach programs for our youth, who look up to not only their own family members but to people who are within their culture.

(5) The fifth and last one is community outreach. Community outreach is striving to give back to our people and when we do so, we strive to be positive role models.

I asked Jaemie how the values and mission of the support network have impacted her personally, and she explained to me:

There's two things come out of the [Native American support network]. I'm a female… a technical female and that's a minority of [Semiconductor, Inc.]. And I'm Native American. We're also a minority of [Semiconductor, Inc.]. I represent two minorities, two groups that I want to support with my passion.

I had expected Jaemie to tell me a story of how the support network's values have aided in her own professional growth, beginning the story with something like, "The values have helped me to ...." However, this was not the case; rather, she told me who she was and how Native groups are those she strives to support, as her words communicate above. I questioned Jaemie about this to resolve my misunderstanding. She explained to me that Native cultures are rooted in a family bond and that all Natives share this family bond;

and so by Jaemie belonging to the Native American support network and supporting

other Natives, she was in turn supporting herself. For Jaemie, this family bond applied in

all settings, even the corporate setting, whereby she viewed all Natives as part of a larger

family.

I asked Jaemie if she had any examples of how the support network has helped

her grow professionally. She explained that the network is a "valuable resource," and she

has relied upon the group to gain insights on how to deal with challenges at work.

> Jaemie: When I was in [the Pacific Northwest], I was facing a team development issue. I didn't know how to go about it as a leader to try to resolve the issue. I leaned on my corporate sponsor ... My [Native American support network] corporate sponsor ... And the [Native American support network] president at that time in [the Pacific Northwest]. I asked them if they'd be willing to sit aside with me and give me their input and that kind of thing. They did. They were more than willing to and they heard my story. The corporate sponsor said, 'Okay, here are some things you can do.' He gave me some options. I chose what I want to do and I approached my manager in that manner and my team and we went about that ... Those actions.

> Me: Did it resolve the issue?

> Jaemie: Yes, definitely.

As Jaemie described the team development issue she faced and how her corporate

sponsor helped her in navigating a path to a solution, I wondered about the role of the

corporate sponsor and the overall structure of the Native American support network

within Semiconductor, Inc. Jaemie described the corporate sponsor position as "an

advisor who leads the team into different ways." She elaborated by saying:

> If we have issues within the team or within our department tams or whatever he provides guidance and he provides resources. He can be that sponsor who does delegate some of his local budget to the team.

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I asked Jaemie if the corporate sponsors for the Native American support network had been Native American or, more specifically, a Native American woman. She told me no, that for her, they were White males, saying "There are few Natives in management." She elaborated by telling me that she has been "very lucky" because her corporate sponsors have been "very supportive." When individuals within Semiconductor, Inc. decide to form a support network, they must identify a identify a corporate sponsor who serves as a manager within a corporate department, and the Native American support network has always, in Jaemie's experience, found good corporate sponsors who have focused on removing obstacles from their path rather than re-route their goals.

As for the fit of the Native American support network within Semiconductor, Inc., Jaemie told me that Semiconductor, Inc. is "striving to be the number one [...] in the world" and that they "strive to embrace diversity, not only as far as cultural differences but just in general, between men and women because we all have our own points of views and different ideas and different minds and steps of the way we approach things." Therefore, Semiconductor, Inc. valued the support networks as groups who could contribute to attracting and retaining a diverse technical workforce. Semiconductor, Inc. had numerous support networks, for women, Christians, Muslims, African Americans, and Latinos, for example. Despite the contributions of the support network to the corporate goals, Jaemie told me that some individuals within the Native American support network found it difficult to balance the demands of their job while belonging to the group, which was purely voluntary. Members usually attended a meeting that took place once a month during lunch hours if they were available, and volunteered in events throughout the year, that took place before or after work or on the weekends. Jaemie

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explained that she has navigated this obstacle by communicating to her managers her volunteer work and how it fit within the corporate goals. As such, they have considered this volunteer work in her quarterly reviews. She also credits her managers with being supportive of her work with the Native American support network, and recognizes that not all managers are like this. Jaemie heard that participation among Native Americans in the support network was difficult to sustain, particularly because it was a small support network. For Jaemie, however, participation was a necessity – both in terms of receiving the support and contributing her support to fellow Natives, or in Jaemie's words "our people."

Transition 4: Leading a chapter of the Native American support network.
Two years after joining the Native American support network, Jaemie was nominated to lead the Pacific Northwest's chapter in the role of president. She viewed the new role as a way to "not only advance [herself], but also to support others and reach out to the youth," the latter of which she called her "big passion." Jaemie recollected that coming into the position of president was the "perfect way" to achieve her goals.

Curious about how the new position of leadership impacted Jaemie, I asked her how she felt coming into the president's role. She told me that she has always considered herself a leader, that it was "natural" for her.

> Me: How did you react to the new role as president? How did you feel about getting the new position?
>
> Jaemie: I've always felt like I was a leader so it wasn't a big transition for me and actually was exciting because I could mold the team as I want and really strive to work through our goals. It wasn't a big deal for me; I've always been a leader on a multitude of areas in high school and just throughout my childhood.

Me: Why is it that it wasn't a big deal?

Jaemie: It's natural for me. I thought it was natural for a lot of people. It's not.

Me: Right.

Jaemie: I think I just like to get myself involved in change and be that leader and be that positive role model overall, you know?

As the new president, Jaemie set her focus on actively engaging the existing members within the chapter, rather than recruiting new members. She gathered the distribution list of all individuals who had participated or joined the chapter in the past and began to reach out to them, asking them to come to the meetings. She told me that prior to her being nominated for president, "we [the chapter] didn't put too much emphasis on recruiting new members." Part of the reason was that there was not enough active participation within the existing membership to recruit new members. Jaemie was determined to engage the existing members; the goal would serve a dual purpose of supporting existing Natives at Semiconductor, Inc. and then, with their help, the chapter could work together to achieve other goals, like doing outreach events and recruiting new members for the chapter (and potentially additional Natives for Semiconductor, Inc.). She clarified that she was eager to take on new members, if the interest was there:

It doesn't mean, I didn't push anybody away if they were interested. I would have encouraged it. My thing was just getting the current members more out there and try to keep them active without overwhelming them.

Part of the obstacle with engaging the existing membership was the overwhelming nature of completing daily work duties and adding volunteer work to that, on top of any home commitments they already had. Jaemie explained that she would ask for volunteers to fill the roles on the board, but there were none. This left her filling all

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the positions beyond the president's role – vice president, secretary, and treasurer. She

committed to serving all roles, without obligating any other individual. And in an act of

leadership for positive change, she was completely transparent with her process, making

all documentation accessible to the membership, regardless of whether they were actively

participating or not. In doing this, she aimed to gain the membership's trust and

encourage them to participate by leading by example. She never forcibly requested her

members commit to any activity, but rather allowed them to make their own choice about

how much time they would give and when.

> It can get overwhelming and again I reassured them that, as a leader, that's not
> what I wanted. We didn't have ... I didn't host elections. I asked people if they
> would be willing to volunteer. No hands were raised. It can be a lot of work but I
> don't want it to be a lot of work. I reassured them. I showed them what we did last
> year. They saw all our numbers. We documented everything. I left all our
> documents accessible to everybody. Our budget, our goals, everything. It was
> open to them and they had access to this. I just really want to develop ways and
> try to get them more active and reassure that they can trust me as a leader. I'm
> going to be sure to my word; I'm not going to have this overwhelming.

Jaemie's focus on her membership extended to helping them advance

professionally as well. She would inform the membership that they could, and should,

communicate with their managers about the volunteer work that they were doing with the

Native American support network and that this volunteer work contributed to reaching

the diversity goals of Semiconductor, Inc. She walked them through how to track and

submit their volunteer time to their managers to be considered during their quarterly

reviews. Later in her leadership, she began to request that the corporate sponsors write a

letter to the members' immediate managers letting them know of the volunteer work that

they do and how this fits within the corporate mission to diversify the workforce, hoping

that the letters would serve as validation from higher authority of the worth of the

volunteer work. She recognized that "support from department managers has not always been supportive" for the chapter's members, although Jaemie's experiences with her managers were positive. When a member came to her with an issue, Jaemie dedicated herself to helping them in the ways she could, which most often included having conversations, brainstorming solutions, and providing contacts that could help the member further. She told me a story of one particular Native female who was contemplating quitting her job soon after being hired:

> I had a new, she's a new employee – female, technical. She's really struggling with the transition here. We're mean people here. It's fast-paced. It's very different than what she was used to. I just keep encouraging her. I keep encouraging her. 'Stick it out one year in your department.' It's a male-driven, dominated company and that can be... I've had my share of it and I shared my experiences with her. I've told her, 'You're not going to be the only one experiencing this so please just hang on for at least a year. After a year, here you have the option of moving around.' I gave her resources to look into. I really encouraged her to network and talk to other females, even men. They can drive you in directions that you're not aware of. Just find something you're really passionate about. She is. She's doing that and she's going to hang on. Opportunities will come up for her, I'm sure.

I asked Jaemie to explain why this new Native female employee had such a hard time with her new position. She told me that difficulties are not uncommon for Natives who have recently moved from off the reservation or away from their families. It is a "huge shock" because off-reservation workplace culture, especially places like Semiconductor, Inc., are "fast paced" and technologically demanding in order to keep pace. Jaemie sympathetically explained that for herself she already had been living off the reservation many years prior to being hired at Semiconductor, Inc. and had taking courses at a technical institute and worked at Communication Corp prior; she had more time to adapt to the technical workplace culture that did others. Jaemie's "confidence level" in the

workplace came from her time in the field and she adapted by realizing that working within a technical workplace requires some "molding to their culture" – learning to work fast, hard, and speak up. Jaemie saw that some Natives who were new to the technical workplace were not given the support they needed from their departments or managers to adapt, and generally this was because the managers or departments may not be aware of the differences in culture. Jaemie saw that the alienation of new Native American employees was a contributing problem to retaining the Native American employees.

> That pool [Native Americans] is small here, but even within that small pool they are showing that we are losing them. We're not retaining them. We're really trying to understand what we can do to retain them and keep them here. I think, as a leader, knowing this information I'm reaching out more to my group, ensuring that I'm taking steps to try to keep them here. To really let them know that I want to know what we can do to keep you on board.

Jaemie committed herself whole-heartedly to her role as president. Her commitment required long workdays and much sacrifice of her own time, all while balancing the needs of her children and family. She would create her daily and weekly schedule, and every hour was filled. After work, she came home to care for her children, including cooking dinner and checking homework, and then worked again after her children were in bed. She would spend many lunches working through issues for the Native American support network and rarely slept past four a.m. Her goal was to be a "positive role model" – and she was living this through her actions by helping other Natives succeed professionally.

Transition 5: Advancing with a new role on the manufacturing floor. Jaemie had worked as a manufacturing technician for five years when her manager asked her if she would like to fill in for his position when he took his sabbatical. This was a unique

opportunity for Jaemie because she would serve in an engineer's role as the engineering floor manager, rather than in her technician's role. She gladly accepted. She worked long days learning all the equipment within the labs and the expectations of the various technicians. When it came time for her to take on her new, temporary role as an engineering floor manager, the other technicians had difficulty accepting her as their superior rather than peer. I asked Jaemie how she handled this, and she told me "by being me." "Being me" meant that Jaemie assured the other technicians that she would help them in their professional goals. "I told them that this position would not change who I am as a person, and that I would use the knowledge I had to help them grow. They were all very receptive." Prior to the original engineering floor manager returning from his sabbatical, an engineering director approached Jaemie with a new opportunity. The engineering floor manager had indicated he would be retiring and they wanted to offer Jaemie the job, permanently. By accepting, Jaemie would be given training and would advance from a role as a technician to a role as an engineer. During the same time, Jaemie saw a job opportunity in research and development back in her home state's branch of Semiconductor, Inc. She now had to decide what she would do.

Transition 6: Returning with a new role in development. Jaemie missed home and being close to her family. She was "ready to move back." She accepted the job in development, where she would support engineering teams in the development department. After nine years and one month of living in the Pacific Northwest, Jaemie left her job and packed up herself and her four children, now aged 12 to 18, and moved back to the Southwest. Jaemie's new position was uncommon when compared with the linear progression of other engineering technicians and represented a pivot in her

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professional pathway. She had been given the opportunity because she was willing to take risks within her manufacturing role (e.g., taking on new responsibilities and succeed as the temporary engineering floor manager) and communicate her goals to her managers, both of which were enabled by the skills she was developing by leading the Native American support network.

Jaemie's new role in development required that she test new micron technologies (sent to her by the engineering departments), write reports based upon the tests she ran, send the reports back to the engineering departments, and then run retests and new reports based upon the engineering department's needs. The process was iterative and so the test-report-retest-report cycle could last anywhere from weeks to months. She worked with numerous engineering departments and with, on average, six labs at any given time (each lab contained specialized equipment for the specific tests that were needed, for example a high volume microscope lab or a lab with glass cutters and polishers). Each of the projects required that Jaemie meet regularly with the managers and engineers within the engineering department to gain an understanding of their needs. Most of the engineering departments were under deadlines, and so all of Jaemie's projects were labeled "high priority." Jaemie's job required a lot of precision due to the nature of the "detailed work," and as such she had to have a lot of patience to get her work completed.

Jaemie described that the "learning curve was steep" when coming into the development role. She had to take numerous courses to learn about the lab equipment and safety protocols. It was different than her previous role in manufacturing in that "everything was structured, everything was laid out for you, with every task documented through methods." In her new role, Jaemie said, "It's like I have to be the developer of

those things" and run "design experiments." Jaemie's biggest challenge with her new role in development was the "hustle" and learning to work faster and better, but drive to learn suited this need and she enjoyed the challenge to grow professionally.

Transition 7: Growing the Native American support network. When Jaemie moved back to her home state, she joined the local chapter of the Native American support network. The group was very small and, as such, was merged with the Veteran's support network, being led by an engineering director named Reed (pseudonym), a White man in his 50s. Jaemie recalled that one of the first events that she was involved with was an honorary event for Veterans. Each chapter of the Veteran's support network within each branch of Semiconductor, Inc. was honoring a Veteran. Jaemie helped to secure honoring Chester Nez, the World War II Veteran and the Navajo code talker from the Marine Corps. The event was a big success. Jaemie and Reed had the personal honor of greeting Chester Nez at the airport and transporting him to the event. Jaemie recalled that she learned a lot from the meetings leading up to the event. Reed would phone in and "create opportunities." When someone needed funding or had a request, Reed would say, "I will take care of that and get the funding. Don't worry about that; I will do it. Next agenda item." He had the "networks" to get things done, and the heart to want to help.

Soon after the Veteran's event, Jaemie became the president of the local chapter of the Native American support network. She continued the work that she had begun in the Pacific Northwest to engage Natives within the corporation to participate in the chapter. She also pledged to focus on her passion to develop outreach events to engage Native American youth and professionals alike, specifically to expose the Native youth to opportunities within STEM and the professionals to opportunities to grow professionally

in STEM. Jaemie envisioned the significance of such a program to be "developing an outreach program that we [Natives] can all get involved in," to represent a "directed focus." Jaemie also envisioned a particular goal for educational outreach to Native STEM professionals and youth:

> I see it as potentially a one day conference that will encompass hands on learning, general speakers about people who we can relate to, people who grew up on the reservations, people who are familiar with the culture shocks of transitioning from the reservation to a city life, sharing their experiences and their struggles of not only their educational areas but also their household, the different lifestyles that they've had to live and go through to get to where they're at but also maintaining that culture and making sure that that's never taken away from anybody. That's your true identity. Then just an overall positive environment for kids to feel safe at and just become more aware of the opportunities available to them.

Jaemie envisioned that the one day conference would be an event whereby all Natives could share their experiences and grow in their understandings of STEM and STEM opportunities, while recognizing that their culture is their core. The professional's role in the conference would be to participate as "not only as presenters and guest speakers but also organization of the whole event." She told me that it was necessary for the Native professionals to "communicate and just get the word out there and making those connections with key players." As Jaemie spoke to me about the one-day conference that she wanted to develop, I had difficulty understanding the role of the professionals and the role of the youth in such a conference. As I asked her to clarify and she explained further, I realized that I had presupposed an approach to outreach whereby boundaries were placed around professional level and age, with each professional and age group having distinct events (e.g., an event for youth and an event for STEM workers). Jaemie, rather, had a more fluid approach to envisioning her outreach events, whereby she aimed to gather all Natives to learn and communicate with one another, whether it be those

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working within the context of STEM or interested in STEM. For those professionals

within STEM, she was inclusive of all facets of conducting STEM work, including

engineers, technicians, and business employees, for example.

Me: Where is that focus on the youth? Where does that come in to play?

Jaemie: It's how we grew up as a family. You see a lot of the Native homes where
        we're family driven. I know, for my family, it feels awkward when we
        don't have one of my brothers or one of my nieces or one of my kids gone
        because we want to be together as a family. This past Christmas my niece
        texted me, and she's like, 'We should just cancel Christmas.' I'm like,
        'Cancel Christmas? What are you talking about?' She was mentioning we
        had a couple of people that weren't able to make it home. I said, 'No,
        we're together as a family rarely. We understand why people can't make
        it. They have to work and that kind of thing. Let's continue with it and
        make the most of it.'

Me: So it is important for everyone to be together. And that translates to the
        professional world too?

Jaemie: We're always, I think, just the family bond. That family bond is what it's
        about. I look at, personally, I look at it as all Natives no matter what tribe.
        We're Native and that's what it comes down to. We might have different
        cultures and different believes and different clans and all that but we're
        family. We're all one family. In order to strive as a culture and grow in a
        positive manner we have to be those role models. We have to always be
        pulling the youth up. I heard an excellent, I guess, theory or thought
        about how to give and take. You keep one hand up because someone's
        always trying to pull you up. You always look for someone who is
        willing to pull you up but you also keep one hand down because you have
        to keep pulling up the youth and others.

Jaemie envisioned the outreach event to be focused on the theme of "empowerment" –

empowering the youth to be exposed to STEM, empowering Natives to enter into the

STEM profession, empowering Native professionals in STEM to grow their careers, and,

importantly, each Native group empowering one another. She recognized that not all

people, Natives included, want to be STEM professionals, but there are many pathways

in support of STEM. Her goal was to "keep that in mind with the outreach event and keep

it in balance," with representation from different sectors and experiences. As for Jaemie's

"big passion," the Native youth, Jaemie had a specific goal for empowering Native youth:

> I just really want kids to know that they have opportunities. We lived it. We come from where you guys [do]… We can relate to you. We lived on the reservations. We weren't bound to stay there. I'm not saying that in any negative way that they can't stay there, but they have these opportunities where they can grow and they can experience the same things we did and take it back to the reservation, if that's what they choose.

To put her ideas to action, Jaemie started to map out the specifics of the outreach

program. She traveled to Navajo reservation schools with members of the Native

American support network chapter to speak to the Native youth and do STEM activities

with them. She also hosted professional development workshops for Native professionals

who were looking to enter STEM or transition positions within STEM. As time would

pass, I asked Jaemie how her goal to organize and host the outreach event had advanced.

She told me that she had announced the goal verbally last year in the summer of 2014 and

"put it down on paper" this year (2015). Her corporate sponsor was "gung-ho about it and

so open to hearing about it." She began to assemble a strategic plan with the corporate

sponsor's help, proposed it to the Native American professionals within the chapter for

feedback, and sent it to points of contact within Semiconductor, Inc. for feedback. One of

those points of contact was Reed.

> I told him, 'Look, Reed! I am taking [Semiconductor, Inc.] to the Navajo Nation! I am going to make change happen!' He was so proud. He encouraged me to take this to the CEO of [Semiconductor, Inc.]. I laughed. Keep in mind, this was the CEO who had pledged $300 million to diversity initiatives for [Semiconductor, Inc.]. Looking back on it, I had no idea what was going to happen.

Jaemie's willingness to share her plan with others allowed her to make professional

relationships that she otherwise might not have and gave her opportunities that she might

not have known existed. As she worked towards developing her outreach program and writing her proposal, she sought out those who she could learn from. She met the chapter president for the Latino network, who had a "large, fully developed program that's been functioning for several years." The Latino network's chapter president gave Jaemie advice and told her stories of how the Latino network was started and the steps it took to get the program started. Jaemie began to broaden the vision of her outreach event into a full program, one that included outreach STEM curriculum for the K-12 Native youth and events for Natives (professionals and youth alike).

Jaemie also used her roles outside of her work at Semiconductor, Inc. to advance the development of her outreach program. As the Phoenix AISES secretary, Jaemie's goal was to continue to advance her Native community and to use the resources to advance her goals for the corporate Native American support network. "There's two levels of Phoenix AISES. There's the professional level and they have a student level. I categorize that as two different paths, and Semiconductor, Inc. is all professional." Jaemie utilized Phoenix AISES as a "resource for professional development, as a resource to local networks that have access to areas where I may not be familiar with and also just to key in on all the professional leaders to give me ideas." She viewed this resource as an opportunity to request that other professionals "feed [her] the experiences so that [she] could learn and create the outreach program." She saw the student level of Phoenix AISES as being able to see "the younger, the youth, to see them actually pursuing their career paths and what that looks like." She sought to hear the experiences of others; to "hear how they visualize themselves at the current state they're at and how

they got there." She then used these stories of experiences to inform the development of her outreach program.

Throughout the time that Jaemie was growing the Native American support network and developing her outreach program, she had fully functioned as the leadership board for the local chapter of the Native American support network – serving officially as the president and also performing the duties of vice president, secretary, and treasurer. She had dedicated 460 volunteer hours to the Native American support network during the year. She led sixteen professional development events, mostly taking place on Saturdays, to attract more Natives to the corporation to "make the candidate pool of Natives for STEM workplace stronger and broader." She traveled to the Navajo Nation to conduct prototype workshops for Navajo middle school students to test the K-12 components of her outreach curriculum. She hosted meetings for Native American university and college students to engage them in the STEM opportunities available. Throughout these volunteer hours, she was assembling the pieces that would comprehensively form her outreach program, represented within her proposal.

In August 2015, Jaemie achieved a major milestone for her outreach program. Months prior, Reed introduced her to an opportunity to partner under a STEM grant with a state STEM foundation. As Reed had suggested, she submitted her proposal to Semiconductor, Inc. executives. "All three Vice Presidents had to agree. They had to say, 'Yes.' They did." The "yes" certified that Jaemie would be leading the corporate component of a mission to develop a STEM education program for Navajo high school students. The program was intended to honor the Navajo code talkers in a modern-day context: by teaching Navajo students code writing (programming). Through her

dedication and persistence, Jaemie would be managing a $250,000 grant to achieve goals that she had set out for her Native community. As Jaemie reflected on this award, she told me, "I always knew my empowering outreach program would be powerful, but I never knew it would lead to something this big." She is currently managing a team of twelve to bring the outreach program into full implementation. Jaemie's technical manager has taken notice of her outreach work and has given her flexibility in her workday to dedicate time to the Native outreach program, including travel time to the Navajo Nation. Jaemie's manager and corporate managers value the work that she was doing:

> We are taking on so many more roles than a typical engineer or typical business leaders because we are recruiting, we are actually going out and talking to communities. We're impacting on a broader range.

On September 28, 2015, Jaemie traveled to the Navajo Nation to deliver an address to announce the new outreach initiative at the Navajo Code Talkers ceremony, honoring Chester Nez, the Navajo code talker. Dressed in ceremonial Navajo attire, Jaemie delivered the speech to the Navajo community, politicians, and corporate business leaders. She was honored to be standing there. She introduced herself in her Navajo language, her journey, and how she hopes her outreach project with impact the prosperity for the Navajo community.

> Yá'át'ééh shik'éí dóó shidine'é! Shí éí [Jaemie] yinishyé. Tó'aheedlíinii (Water-Flows-Together Clan) nishłį́, Kinyaa'áanii (Towering House People Clan) bashishchiin, Tódích'íi'nii *(*Bitter Water Clan) dashicheii, Tába a há (Water's Edge Clan) dashinalí. Chinle doo Arizonadi dé é ' naashá. Shi'ma ei Valeria Begay doo shi'zhe ei [Jaemie]. Sha'áłchíní ei [children's names] do'lye.

> Hello my family & friends. My name is [Jaemie]. I am of the Water-Flows Together Clan born for the Towering House People Clan. Chinle, Canyon de Chelly, is where I call home but live in … My mom's name is … and my father's name is ... I'm a single parent of four beautiful kids.

Growing up on the reservation, like many Native Americans, I've experienced a unique way of living. Shi'nali (my paternal grandmother) … showed me what hard work is (not relying on a vehicle, walking miles to/from her house to her winter camp herding her livestock; hauling water to cook and bathe; lighting kerosene lamps nightly because she had no electricity) … this is still the Navajo reservation life for some.

Shi'ma (my mom) … was raised by her grandfather after both of her parents passed on. Although faced with challenges she achieved a Master's Degree in Education, after living in the boarding schools, which then she became a dedicated educator in the Chinle school district for many years. My dad passed on when I was four years old, my mom became a single parent, raising my 3 brothers, my sister and I. Again faced with challenges my mom set expectations for my siblings and I to pursue a college education. Experiencing both Shi'nali's (my paternal grandmothers) traditional way of life & Shi'ma's (my mom) educational push to reach a higher education, they play an important role to my life successes.

I share these life experiences because they contribute to me earning a Bachelor's of Applied Science degree in Electronics Engineering, which led me to becoming a 14.5-year [Semiconductor, Inc.] employee. [Semiconductor, Inc.] is an amazing company to work for – the products we engineer impact how the world interacts using technology – the people I work with are truly passionate and are driven on success. I'm extremely honored to announce the STEM initiative, a collaboration between [Semiconductor, Inc.], [a state science foundation], and other successful companies. As the [Semiconductor, Inc.] project leader and leader of the [Semiconductor, Inc.] Native American network, I assure you that we will work diligently to make this a successful program without jeopardizing our Native beliefs. This is a win for the Navajo reservation schools and the supporting companies, but more importantly for the Native youth. Improving our educational systems is a must and this is step towards many arising opportunities for our future leaders – our Native youth. I encourage you to embrace this change so that in future years our Native American youth become brilliant, humble, resilient business and technology inventors and leaders. We need to educate more Native American engineers!

Let's reflect on why we're given today. Today offers many life opportunities, which we should not take for granted and it's because of our humble heroes who brilliantly engineered an unbreakable secret code using our Navajo language. In our passed days, our present, and everyday going forward, we pray for and honor our Navajo Code Talkers. Our future endeavors are because of their own sacrifices. Simply giving gratitude does not exemplify their greatness to our freedom. Walk in beauty Navajo Code Talkers, family, friends and leaders. Ahéhee'. Thank you.

I asked Jaemie how her life's experiences have helped her grow professionally. She credits her experiences with growing the Native American support network to helping her be "more aware of transforming into leading a fast-paced, high expectation team." She tells me that she was always capable of achieving this professional milestone: "At the same time, I always saw myself as a leader and I always just step in and handle it"; but the transition would have been difficult without the experiences of leading and growing the Native American support network: "I probably would have struggled in the beginning [without the support network]." She hopes to continue to be "that person that helps our people achieve their dreams." Beyond the many, many hours Jaemie has dedicated to developing the outreach program, she has not lost sight of the support she wants to give all Natives who are coming to the corporation as new hires.

> We just had a new technical female that just got hired about six months ago. When she first came we greeted her and welcomed her to [Semiconductor, Inc.]. We meaning the [Native American support] group, we welcomed her with a little gift pack. I went to lunch with her. I invited her to lunch and I basically got an idea of what experiences she's had with her previous company. Just kind of relate to her on a personal level. She is Navajo but with anybody I would do the same things just because I want to hear what they're looking for. She did express that she feels so overwhelmed and I totally can relate. I shared my experiences with her. Again, I think one of the biggest things is the male-dominated companies, wow, this is a male-dominated company. It can be intimidating, but I think it just makes you a stronger woman overall. That's the key that I kept reminding her, that yes, I was once there where you feel intimated, where you feel like you can't speak up, but this is a place you have to speak up.

Strength and perseverance, including "speaking up," have helped Jaemie bring her professional goals, technical and outreach alike, to fruition. She strives to continue to grow professionally and wants to change the status of Natives in STEM. "Natives make up less than one percent … and it is unacceptable."

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Concluding thoughts: Reflecting on being a Navajo woman in engineering and technology and imagining the future. I asked Jaemie how she persisted through the transitions in her life. She told me of her grandmother and mother and how she learned overcome obstacles by being in their presence. She watched them live "the hard way" with no running water, no electricity, and no transportation.

> I reflect back and I see my childhood. A lot of that childhood memory is built around my dad's mom, which in Navajo terms she would be my nali' and that's my paternal grandmother. She was such a strong woman. She was traditional. All traditional. She wore the clothing. She did not work. She did not get paid to work rather. She worked the way she ... I saw her work physically was herding her sheep and her cattle and just taking care of her home and her kids and providing what she could for her family. That was, to me, a lot of work. I look at it now and it's like, 'Whoa!' I got to see those many miles that she had to travel from her home to her winter camp. She did it all by foot. We used to help her herd her sheep and her cattle to her winter camp. As little kids you're supposed to have all this energy and we couldn't even do that long walk. We would ride on the back of the trucks while she walked the entire way.

As for Jaemie's mother, Jaemie recounts that her mother's parents passed away when her mother was young, and, as a result, Jaemie's mother grew up "the Christian way" in boarding school with no parents.

> [My mother] was faced with being discouraged from talking her Navajo language, being told that she was never going to succeed in life. Yet she overcame those challenges and achieved her master's degree in education and she raised the five of us. My three brothers, my sister, and myself. And she just, again, was very humble with everything she had and everything that she worked for.

These challenges, according to Jaemie, made her grandmother and mother humble and able to overcome. This is how Jaemie learned "what hard work is" and learned not to complain while also being thankful for what she has. This is who Native American

women are to Jaemie. They are women who have different life challenges than most, but it is what allows them to have different successes too.

> That's in general I think who Native American women are: we're very humble, we're very resilient. We're hard working. We're driven. And you know, when faced with challenges we just have to figure out how to get through them. And be thankful in the end. That's what it boils down to.

It is with this mindset of that Jaemie has navigated her life pathway and her "many lifetimes of experiences." Each new "transition," whether pursuing a degree or job, was a "culture shift" where she had to "mold to their culture." But it was those transitions that she attributes to realizing that her culture "is always inside of [her]." Through her personal and professional challenges and growth, Jaemie told me that she carries the teachings from her paternal grandmother and mother with her.

> It guides me and I see those characteristics in myself. I think about them often. I carry my mom and my paternal grandmother. [My paternal grandmother] passed away many years now but I still carry those thoughts of her and those prayers with me. And it has molded me to be the person I am.

Jaemie will be celebrating her fifteen-year anniversary at Semiconductor, Inc. in 2016. She will be forging new paths for the outreach program, as supported by grant funding. Her managers are allowing her to define her new job role so that it fits her technical interests and allows her time to do outreach. She told me that she would never sacrifice her engineering role because this is as much a part of her as is her calling to outreach to Natives and improve Native community. Before the end of 2015, she suffered a great loss with the death of her mentor, Reed. She mourned his loss with a heavy heart and took the time to remember him and his impact on her. As she moves forward, she will do so without her mentor beside her, but with the strength from within herself. Outside of her professional life, she continues to raise her children and connect with her family. Her

oldest son is an engineering major at a Pacific Northwest state university, her daughter

recently graduated from high school and determining her life path, and her other two

children are in the local public junior high and high school. She makes certain to return

home to the Navajo land to rejuvenate her spirit and purpose in life. On her latest trip

home for the holiday break, Jaemie wrote of walking her homeland:

> My daddy's presence was strong. I imagined him riding his horses herding shi'nali's (my paternal grandmother) cattle through these lands many years ago. Shi'nali graced me with a warm welcome home.

By the end of the break, she had to say goodbye to her son who was returning back to

school: "My mother consoled me knowing it's hard to depart from our kids." She was

"reassured" that her kids "listened and interpreted [her] teachings well" over the break

during their time together on their homeland. As she prepared to return to again to work,

she has a heart and mind ready to change the status of Native in STEM. I asked her what

her concluding thoughts are on her journey. She responded by saying,

> I give thanks every day for the struggles I have been through. It's molded me. If you don't recognize the struggle you've been through and see how you've overcome then there is no lesson learned.

An Illustrated Summary of the Narrative of Jaemie

(1) becoming

(2) moving

(3) connecting

(4) leading

(5) advancing

(6) returning

(7) growing

reflecting and imagining
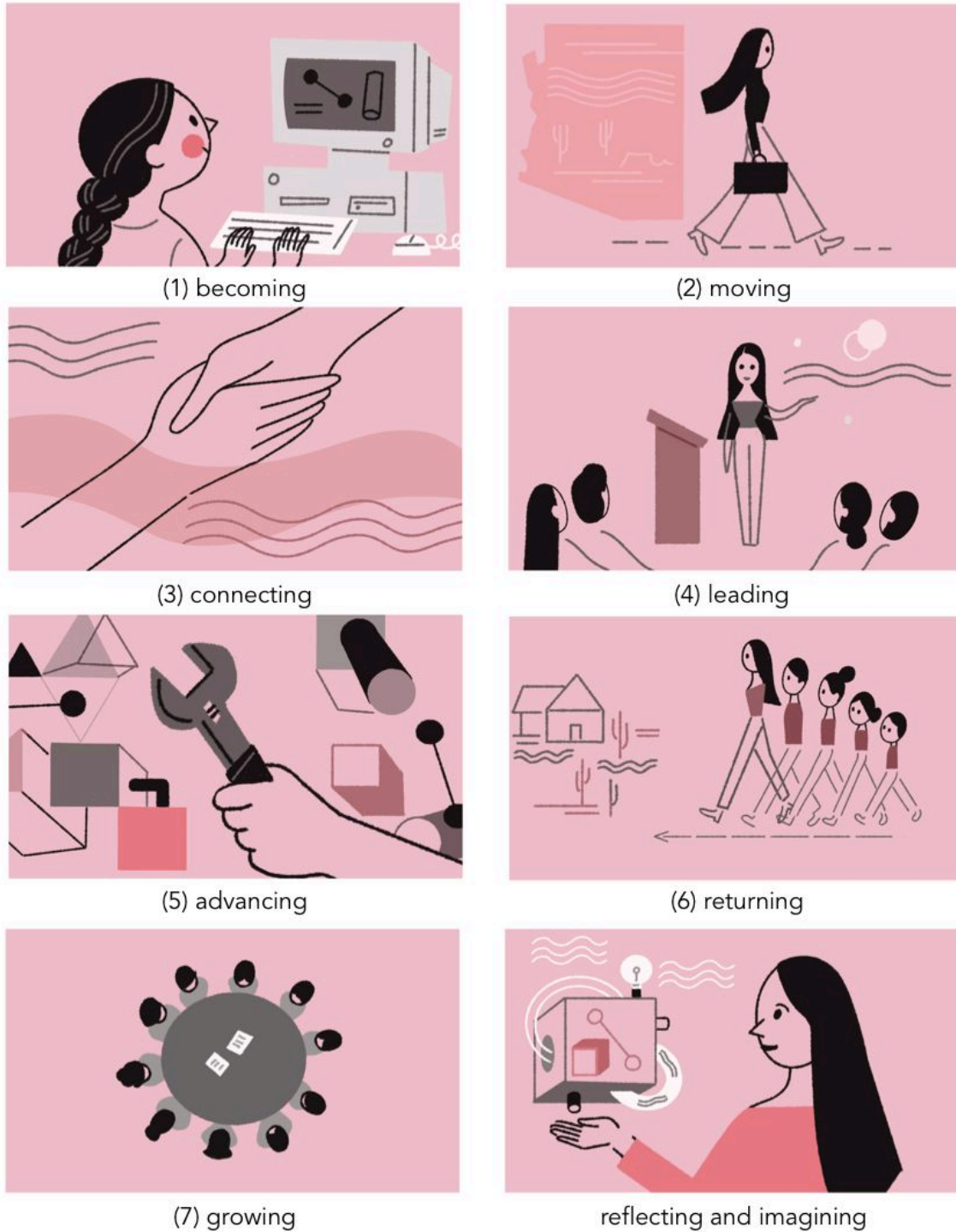
Figure 11. An illustrated summary depicting Jaemie's narrative transitions

The Narrative of Mia: An Akimel O'odham-Mexican Woman in a Tribally-Owned Technical Workplace

Mia is a thirty-four-year-old Akimel O'odham (Pima) and Mexican woman, with her mother being Akimel O'odham and father being Mexican. She grew up on reservation land of the Gila River Indian Community (GRIC) in the district of Sacaton, a district spanning 39 square miles and serving as the center of government activity for the community. Sacaton is known as the "Big House" in the O'odham language and was named in honor of the "vigorous growing Sacaton grass" that once grew across the land (GRIC, 2015). As an infant and toddler, Mia attended the GRIC Head Start Program, an educational and childhood development service for low-income community members. When Mia was three years old, her father left the family. Mia's mother soon married again, introducing a stepfather to the family, but after "a couple of years" the stepfather went to jail. Mia's mother was left to raise her children on her own. Mia was the oldest of four siblings, and as such she helped her mother raise her younger siblings. As she grew up, she attended the local public schools in Sacaton. At eighteen, Mia moved out of her mother's home. Although Mia had dreams to move out of state to go to art school in New Mexico, she decided to go a nearby technical institute after hearing their pitches at her high school that she could make "twenty dollars an hour by just working on a computer." The vision of a steady income, something that her mother struggled with while raising four children, lured her. Mia's trajectory was aimed towards a technical path, but over the course of the next fifteen years she encountered obstacles in all aspects of her life - financial, personal, and professional. Despite hardships, Mia persevered, relying upon

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entrepreneurship and intrapreneurship, grounded in her culture and community, to overcome. Throughout her young life, Mia remained dedicated to advancing herself, her family, and her community. She has a very different story than Jaemie's story, but she too is an example of advocating for positive change for her Native community through her work in technology.

When I first met Mia she was working for Gila River Tech (pseudonym), a technology solutions business owned by the Gila River Indian Community and a subsidiary of a larger tribally-owned technical business, Gila River Telecom (pseudonym). I had spent five days at Gila River Tech hearing the stories of those that worked there when the business manager, Mark (pseudonym), arranged for me to spend a workday with Mia. Mark, an enrolled tribal member of GRIC, told me that Mia had been referred to Gila River Tech by the tribally-owned job placement agency. The intent of the agency was to connect members of GRIC with jobs in the community - matching an individual's skill set with a business's needs. Mark explained to me that a goal of all entities owned by GRIC (including nineteen enterprises and service departments, such as educational and healthcare facilities) was to work together to create mutually beneficial relationships between community members and businesses to support the community in prospering. Mia had begun working for Gila River Tech as a part-time phone and printer support technologist, spending most of her days traveling to clients' offices to replace cartridges, set up phone systems, and fix system errors. Over the course of three years working for Gila River Tech, Mia was hired as a full-time technician, managing the support technologies (e.g., printer and phone systems) and running the broadcasting efforts for the tribe's government council meetings. She was also hired by Gila River

Tech as a web designer consultant to improve the business's website. Mia was the first community member to be hired into such a role at Gila River Tech. Mark told me that to get to her current position, Mia had faced much adversity as most community members had, but was persevering above it. As a success story for job placement and thriving within a tribally-owned technology business, Mia represented a future of growth and prosperity for the community.

The importance of Mia's experiences led me to bring her story to the forefront of those that I collected at Gila River Tech. The lived and told stories of other individuals at Gila River Tech, primarily that of Mark's stories, are intertwined in this narrative as they relate to Mia's experiences. My time collecting field texts with Mia lasted over the course of six days, spread over several months. We spent one day traveling to her off-site business together, two days in her office at Gila River Tech, two half days at the local library, and shared a meal at a local restaurant.

Situating Mia's professional role within Gila River Tech. Mark formally introduced Mia and me electronically on October 29, 2014 (although we had briefly met prior to this date). After exchanging emails, Mia and I arranged to meet on Wednesday, November 5, 2014 at 7:30 a.m. so that I could travel with her to a daylong Native government council meeting. I waited for Mia outside of the Gila River Tech office. Another woman, Catherine, arrived shortly after I did, then Mia arrived. Mia told us we would be taking a business vehicle to the GRIC governance center. Along the way, Mia told Catherine and I that we would need to stop to pick up a woman named Carol, a part-time technician of Gila River Tech. During the 45-minute drive from the Gila River Tech office to picking up Carol then to our destination, Mia was friendly but quiet. I sat in the

backseat of the car next to Catherine with printer and phone supplies piled around us. As we neared our destination, Mia began to speak about the day's duties. I came to realize Mia was training Catherine to support her and Carol in the broadcasting efforts. Mia led the broadcasting efforts for the tribe's government council meetings, a job that included troubleshooting and managing all technologies (e.g., microphones), managing the cameras (e.g., directing the camera operators on the shots throughout the meeting and making certain the cameras were off during private counsel), and managing the monitors (e.g., displaying the agenda on the monitors so that the community could see the meeting's agenda items). For the day that I was with Mia, she diligently sat in the "director's chair" to conduct the behind-the-scenes broadcasting for the duration of the meeting, taking a break only when the tribal council was on break. The tribal government council meeting lasted into the evening, which Mia said was typical. "Sometimes, these meetings can last a long time. We might be here for twelve hours or so, until 8 p.m. sometimes. Those days, they have a lot of community issues to cover." After the broadcast of the tribal governance meeting, I came into the Gila River Tech office to meet with Mia twice. During those times, I was able to see how Mia managed to perform different job roles within the business. She organized customers' requests and needs for phone and printer support, which included determining her travel schedule as well as other support technicians' schedules (she oftentimes unofficially served as a supervisor to the support technician team). Organizing the schedules was of importance because of the distance across the reservation and between customers was significant. Once a support technician left the office for the day, it might take a half or full day to complete one customer request.

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As I spent time in the Gila River Tech office, I was able to speak with Mark on occasion. He explained to me that Mia's role in the business was critical for reasons much deeper than what was visible on the surface. The business was currently in its ninth year of operations, but had tumultuous beginning years and was just beginning to stabilize. Part of the stabilization was returning the business to the vision of a "community-first model," a business vision designed and promoted by Daniel (pseudonym) – Mark's older brother and the manager of Gila River Tech's parent business, Gila River Telecom. The mission of Gila River Tech was to (1) provide the community with the knowledge and expertise in the technologies (including telephone systems, network systems, video surveillance, access control, intrusion detection, and printer services), (2) partner with leading manufactures and service providers, and (3) utilize and train local resources, including offering employment to community members. Fulfilling this mission involved a lot of change for the community – specifically changing the way people did their work.

> It was a mission to bring automation to people's workday – by bringing technology, we brought automation. There were, and are, still a lot of manual processes that people have to go through to get to, to use to accomplish their responsibilities.

In the beginning years of Gila River Tech, an outsider to the community (a White male) was managing Gila River Tech with a staff comprised almost completely of those outside the community. Mark told me that his approach did not work with the community.

> [The original manager] was a very motivated individual, almost overly-motivated in getting this company up and running. Very forceful with the community trying to make change. Night and day. It just didn't work. It was like rubbing sand paper. And so [Gila River Tech] from the start, because of that strong-arm approach, really had a negative connotation associated with the company. We are still fighting it today.

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The community (GRIC and its entities, including the community's hospitals, service centers, resorts, golf courses, attractions, restaurants, schools, businesses, new home builds, and the headquarters) refused to work with Gila River Tech. In an effort to save the business, Daniel stepped in – then managing Gila River Telecom and now taking over managing duties for Gila River Tech. One of the first changes Daniel made was "opening up the lines of communication with the community." Mark told me, "He [Daniel] worked better in cooperating, in getting cooperation with the tribe rather than to force the work or the solutions down." Now, many years later, Mark is continuing this "cooperation with the community." Once Daniel opened up communication, Mark was hired as the new manager – coming from a previous information technology position with the community itself (the community, GRIC, has a centralized information services department). I asked Mark what it took to gain cooperation with the community. He told me there were two major "areas to overcome." The first was trust.

> The biggest area we had to overcome was gaining their trust. 'I'm here to help you. Truly. I'm here to help you. I'm not here to do anything else except to make your job easier. Not only your job, but how your job affects several other departments. And because you've always done it this way, other department's processes may not be able to change because of that.' Built a trust and then you start laying out the benefits, 'This is why, this is why. You can come to work and press an easy button, how great is that, rather than re-forming an Excel spreadsheet 20 different times because you have to send a report out to 20 different departments.' A lot of that has to do with that.

The second was integrity.

> With our cultural values, you have to have integrity. You have to have integrity with the tribe. You have to have trust with the tribe. You have to know that you're there in their best interests and that's the – we value that trust and if you step out that, if you step out of it with our tribe, then that is deemed as not trustworthy. It takes a long time to get back in and communicate with those people again. Really, integrity is very important.

Mark told me that "several, several sessions of communication with all different types of members of the community" - over the course of years - on the basis of trust and integrity allowed the business to recover. Now that Gila River Tech was not under threat of closing, the business was focused on furthering its growth through the "community-first model." This meant focusing on growing local technical resources, meaning training members of the community to do technical jobs. Within Gila River Tech, members outside the community were performing core technical operations (e.g., engineering and technical procurement). Although the individuals were dedicated to advancing Gila River Tech and had the technical expertise necessary for these positions, it was necessary to grow the local technical expertise to advance the community as a whole and strengthen the relationships within the community.

Mark explained that Mia and her dedication to her roles at Gila River Tech were significant to the business and to the community. Mia was not only growing the technical mission of the business and the technological advancement within the community, but she was also representative of local capacity for technological knowledge and skills. Nonetheless, Mia faced many challenges in her pathway to this position.

Transition 1: Encountering difficulties with technical school. After Mia's high school graduation and moving out of her mother's home, she moved off the reservation to Scottsdale, Arizona. Mia wanted to distance herself from the reservation. As Mia reflected on this time, she told me that there was "not much to do on the reservation" and she was looking to have new experiences. She was attending a technical institute, funded by a scholarship from GRIC, and working "crazy hours." However, when she was halfway through her program, she wanted to quit, as she was tired of the long days. Her

friends from the reservation begged her not to give up on school; they told her she was

lucky to be given the opportunity. Mia credited her friends' encouragement with keeping

her going. She graduated with an Associate's degree in Computer Networking and

Information Technology. She took a year off, working small jobs when she needed

money. After a year, a technical support office - a government entity for GRIC - had an

open position and hired Mia as a computer support technician. "For the first time in a

long time," Mia was excited about her future. She had moved away from her community

after high school, but the job brought her back. She was able to "get to know [her]

community again" as the job required she travel about the 584 square miles across seven

districts to respond to technical service requests at various GRIC entities (e.g.,

rehabilitation center, hospital, government buildings).

> And that's really where I got to know the community again. Right? I'd known it
> when I was young, just from traveling here and there, but working there is when I
> learned all the departments, all the people. I had to cover from 91st Avenue, to
> almost Coolidge, you know, Blackwater, so, there is a thousand people that I just
> worked with, on and off. So, it was a good experience because it led me to meet a
> lot of people and become familiar with my community.

Mia began to feel confident in her technical role. She was promoted to "computer

specialist" and began to seek new opportunities for professional advancement. She

applied for a network analyst position, but was told she would need to obtain her

Bachelor's in Computer Science first. Mia started to realize she would need more school

if she wanted to advance professionally.

> I tried to apply for a higher position, and you needed a Bachelor's degree. And
> that's when I was, like, man, I'm going to have to go back to school if I want to
> get anywhere.

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Mia told me that she was discouraged at this point in her life. She knew school would be expensive and time consuming. She had already used her financial assistance from GRIC for her technical associate's degree and there was no other opportunity for funding. She would have to take out student loans if she were to go back for her bachelor's degree. Compounding the issue, Mia knew it would take a lot of work to both go back to school and perform her job well. At a low point in her life, she made a bad decision that resulted in a driving-related offense. This resulted in being fired immediately because her job required driving across the reservation.

        Transition 2: Overcoming hardship through entrepreneurship. Mia knew she had to return to school if she was going to recover from her low point and advance herself professionally and personally, but she was stalled. As she attempted to determine her next move, she was in need of an income and began to take "little odds and ends jobs." She saw an advertisement for an opportunity with GoDaddy to become a domain reseller. She told me, "The website, it was taking off. Like, if you're going to be anything online, this is what you've got to do," so she started her first business to "help other Native business owners get online." Mia explained to me that many Natives, even those who owned businesses, were not online during that time. "Not everyone is technically inclined. Some people still use flip phones." She envisioned that Native business owners (her potential customers) would want their customers to "be able to go to a website, get a contact number and say, 'Oh, I want to order this, or order that'." Although it was "nothing all extravagant," she told me her purpose was to "give them an online identity." I asked Mia for example of someone who had registered for a domain name, and she explained to me that many Natives sell their art at shows and on the side of the street.

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However, if the weather is bad then they may not sell anything. The "online identity" allows for the Native artist to sell their work online, despite the weather or other conditions.

> Because if we are all on the side of the road, selling jewelry, blankets, whatever, and the rain comes, what are you going to do then? You're out your money for that day. So, if someone is just browsing online and sees a blanket, or jewelry, they can call you up and be, like, 'Oh, hey, when are you going to be set up next?' And you can let them know, or even display, like, where they set up times and days and all that.

Transition 3: Attempting to return to school. Going back to school was continually on Mia's mind so that she could advance professionally. She reached out to a local community college and was told that since she had obtained an associate's degree from a non-accredited institution her credits would not transfer. Mia felt defeated. She would have to start all over again and accrue more student loan debt than she had anticipated. There was no possibility for financial support from her family; in fact, she was the one who had financially supported many of her family members when she could. She decided to take the certification test for entry-level network engineers, the Cisco Certified Network Associate (CCNA), hoping that the certification might land her a technical job. However, she failed the test. She told me that she was "discouraged," "not motivated," and "burnt out" from working her whole life. In order to escape, she decided to move to East Coast.

Transition 4: Moving away from home. As Mia settled in to an apartment on the East Coast, she immediately felt alone without the support from her community.

> I was just this little poor lost Indian girl in the concrete jungle. I didn't have a service center to call. I didn't have a government center to call. I didn't know where the reservations were. I, just, was a normal, average person stuck in the middle of nowhere, you know?

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Turning her loneliness and longing for her community into something

constructive, she began to expand upon her domain reselling business into a network

where Natives could find one another. She told me:

> Okay, well, the My Native Network was the very first thing I did in Philly. I was,
> like, man, I wished I had just somewhere I could go and just find out who's
> around me, what's around me, what I can do.

It was with this idea that she pursued her entrepreneurial path. She "hunkered down" and

began to attend entrepreneurship seminars to learn about how to run her own business.

She recognized that her status as a woman and minority might benefit her in business,

and so she sought out opportunities for entrepreneurial women minorities: "Because I'm a

woman, I'm a minority, and I know those [were] two great advantages for me." As she

assembled her business plan, she began to reach out to her community back home. "I

looked into the economic development, that was a [GRIC] department that they had

solely for people who were interested in starting their own business." She wanted these

people to join the network so that they could connect and support one another. She was

making progress when "about, ah, four months into it and the economy shut down."

There was lack of funding and lack of opportunity. Mia felt like it was home calling her

back. After five months away from home, she decided to move back to Arizona.

Transition 5: Returning to connect with home. When Mia returned home, she

moved back "onto the res." She told me it was the first time she had lived on the

reservation since she moved out when she was eighteen years old.

> I, mean, I lived close to the res, like twenty minutes to drive, but I would be
> driving there all the time to see family and friends and go to events and stuff. I
> was wasting so much money in gas. When I moved back, I knew I needed to live
> on GRIC.

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She told me, "I tried hard to create some distance between me and where I grew up, but it shouldn't be that way. I belong home." Once Mia had moved back to the reservation and began to interact with her community, she was offered a volunteer-based "secretary job" for a district representative who worked with the Gila River Business Owners Association (GRBOA). The mission of GRBOA was, and is, to provide an entrepreneurship support group to strengthen the "wealth creating capacity of our members and promoting economic development" (GRBOA, 2015). The district representative was aware of Mia's initiative to start My Native Network and gave her the opportunity to both work for the non-profit and be exposed to a broader Native entrepreneurship community. Mia began to learn the steps she needed to take to grow My Native Network. At that time, a resolution was being passed by GRIC that stipulated any business that took place on Native lands must be approved by GRIC. Her work for GRBOA required that she "put together the lists of approved people." She told me that is when "we [GRBOA] started the whole listing of artists, vendors, construction, janitorial, like, anybody's who's doing anything, we'll print a listing for that." The lists needed to be online, and Mia began her third business: website design. She designed and built the website for GRBOA. When "outside people" came in to do business with GRIC, they were then able "go to this website and look up, like, 'Oh, I need someone to clean the building, I need someone to do my uniforms'. And, you know, just whatever you need."

Now that Mia was home, she invested further into her community. She joined the volunteer board for an annual cultural festival that promotes Native artists, musicians, and dancers and offers scholarships for Native students from the Four Sister tribes: Salt River Pima-Maricopa Indian Community, Gila River Indian Community, Ak-Chin Indian

Community, and the Tohono O'odham Nation. She valued the contributions that the scholarships could give Native students because the festival scholarship was more inclusive of Native students with non-Native blood. The GRIC education department required one-fourth Native blood to receive any benefits; whereas, the festival scholarship required on-eighth Native blood from any of the Four Sister tribes. As an Akimel O'odham-Mexican, she advocated for the youth who had partial non-Native blood.

> We're extending it to the next generation because it's not your fault your parents wanted to marry and have a baby with a non-Native, like Black or White or Mexican.

I asked Mia what motivated her once she was back in the community. She said, "For kids not to end up like my brother." A few years prior, her youngest brother died of a drug overdose. As Mia lowered head and cried, she told me that for having one of the smallest populations in the United States, tribes have some of the highest percentages of deaths due to alcohol, drugs, and suicide. In fact, the *Encyclopedia of Human Services and Diversity* reports that the alcoholism mortality rates for Native Americans are 514 percent higher than the average population, sixteen percent of Native youth have substance dependence (with the highest rate of methamphetamine of all groups), and suicide rates are over double the general population - with Native teens having the highest rate of suicide than any population group in the United States (Cousins, 2014, p. 176). Mia had lived through the horror of addiction and depression, with some of her closest relatives and friends being affected. Her close friend had committed suicide and her sister, now the youngest of three rather than four siblings, was currently battling drug addiction.

> I'm fighting for that with my sister right now. I don't want to lose her like I lost my brother. I lost my baby brother, I don't want to lose my baby sister too, you know, and I try so hard to help my family.

Mia goes and picks up her sister's children each weekend, who are in a residential program while their mother, Mia's sister, completes a drug rehabilitation program. She has hope for sister, but fears that the drugs will take over. "When you're older, and you get hooked on drugs, like, you're almost hooked for life. It could take away years, decades even." Mia is committed to her family and spends much of her time with them (outside of work and volunteering), helping as she can. She told me that she wonders that if she had tried harder to help her friend and brother if they would still be alive. "I tried to help them and if there were just more people out there, more support, a better support system, it might not have happened. You know?" Mia said this is why she works so hard and why she tries to create support systems – whether it is for Natives running their own business or Native youth trying to go to school. She wants them to have "something better to do than to go with the wrong crowd."

Mia understands first-hand that growing up on the reservation can be tough. Native Americans experience homelessness, poverty, and unemployment more than two times the national average with "thousands of households living without basic telephone services and indoor plumbing" (Cousins, 2014, p. 926).

> In my upbringing, I wasn't really afforded a lot, you know, like, just to go to town was like a fifteen minute drive. Just to go to a theater, to a mall, to a park. We barely got our park built, just a few years ago, where we have a skate boarding thing, and we have a, where children can go play, a ball field and all that. And very rarely, we'll have a van come around so we can go play ball. That was the highlight of your life just to be able to go play ball. … We didn't have the internet, you know, we had to go outside and play with dirt, mud pies, make a tree house, or something. Entertain ourselves.

Mia recognized another challenge is that many parents are giving birth to their children young, as teenagers and young adults, and many grandparents are raising their grandchildren with obstacles of poverty, physical limitations, and crowded living conditions (Cross, Day, & Farrell, 2011, p. 44). Many Native children, therefore, do not have the same educational and career opportunities as those who live off the reservation.

> The main thing is just to make a difference in these kids' lives, because they're just stuck on the res. They're limited in their resources, and they don't know what's out there. They really don't know what's out there. And the parents themselves are either young or elderly, and the elderly don't have energy, or whatever, to push them to get after them to make sure their home in bed, to make sure they're going to school, and then the kids who are having kids are just still out there, being young, running around, trying to live their life. Which is the case for my sister's kids.

Mia envisions herself as someone who can make a difference in her community, and seeks to be an active change agent by creating support systems for Natives, including the youth.

Transition 6: Advancing with Gila River Tech. Mia was working to advance herself and her community - through volunteer work for GRBOA and the cultural festival as well as through growing her entrepreneurial endeavors - when the GRIC job placement agency worked with her to gain employment. They provided her with many professional development and logistical services; including financial support until she found a job, interview training, transportation to training and interviews, professional counseling, and so on. After months of working to find a job, the job placement agency identified a position for Mia within Gila River Tech, the place in which this narrative begun. For Mia, starting in a position at Gila River Tech was an opportunity for steady income, and an opportunity to be able to contribute some of her income to her family members. As she

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worked at Gila River Tech, she was offered increasing responsibility, starting as a phone

and printer support technician, then hired as a full-time technician, then as the lead

technician for the broadcast of the tribal government council meetings, and then as a

manager of four part-time technicians. Mia describes her advancement as:

> I was given more and more contracts because of my technical background. I
> would just bang them out. … And then we got another contract that put me to
> sixteen hours a week, and as we got more contracts I was offered full time. Which
> is great because I got the benefits. Then the next thing I know I am, you know,
> kind of leading the broadcast and training some others.

Mia was fully dedicated to her work. She never missed work, remained sharp, and made

certain her and her team's work was of high quality and serving the community's needs.

Staying connected to her community was critical for Mia's success.

Her dedication to her job, and specifically the broadcasts of the tribal government

council meetings, caught the attention of the managers of Gila River Tech and GRIC

officials. She was offered to help launch a new broadcasting venture being led by the

community. The intent of the broadcasting venture was to work with the community to

develop content that would enhance the well being of the community, including content

for education, culture, health and wellness, public safety, and public announcements. The

broadcasting venture was also intended to promote industry within GRIC by enhancing

professional, tribally-led production, including news, entertainment, and commercials.

Specifically, Mia was asked if she was interested in helping to launch the venture by

going out to the community and brainstorming content. She proudly accepted. As the

infrastructure was being built to support the broadcasting capabilities, Mia developed

content. To design content, she spoke to community members, attended community

events, attended tribally-related events (e.g., Phoenix AISES meetings). I asked Mia how

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she determined whether content was of interest to the community members. She told me

that she was working with another Native woman, and her Native identity was critical

because they both understand what it is like for community members.

> So, I have all these different ideas and everything, and it's just a matter of getting help and someone to agree or disagree, or just let me know their thoughts and stuff, so, Amanda (pseudonym), I've been working with her. And she's Native, and she's qualified. Because she's Native, so she knows how it is to grow up on a reservation. It's like a third world country, like, just five years ago people were living without running water. They're barely getting their houses built and it's different from the world, you know? People out here don't have to drive half an hour to go to the supermarket, you know, so, it's really different living on the reservation.

As Mia embarked on this new opportunity, she was excited but knew it would be "quite

different that what [she] was doing with live broadcasting." She told me that she was

"learning so much." She felt as though her life's experiences were preparing her for

opportunities like this, opportunities that benefitted herself and her community. She was

proud to be Native and proud of the technical skills that she had acquired, both of which

allowed Mia to lead this effort.

> I feel like I'm basically running it because I'm a tribal member. I know what it's like in my community, and the big boss is busy, you know, the other people are non-Native. They don't know what our community wants to see, and they're relying on me because the other guy that is in charge with me is also non-Native. So, I'm the go to person, as a speaker for the community. And also that's why they want me to head it, because I'm the only one who knows that system. I'm training Peter (pseudonym), and we're probably the only two who know how to function that system. But he knows a couple, or a few, of the components and I know all the systems. But, yeah, that's way complex stuff.

Transition 7. Returning to school and contributing to growing the Gila River

Indian Community. As Mia remained busy with work, Gila River Tech approached her

about obtaining her Associate's degree in Broadcasting from a film and theatre

department at a nearby community college, and paying for it. It was a chance to return to

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school and fulfill a future vision of herself - a Native woman who had used education to advance herself and her community. Mia was, and is, currently going to classes at night and studies whenever she can, including on lunch breaks and the weekends. In one of our last meetings together, she told me she was getting good grades and excited because it is something that she can relate directly back into her work that will make an impact on her community. Her family is proud of her, being the first of the fifteen grandchildren to go for an Associate's degree. She proudly tells me she is a "shining star" in their eyes.

Mia still works on her entrepreneurial ventures, although they have taken a back seat now that she is in school again. She hopes to have My Native network become a partner to GRBOA (the business owners association). She is still approached about new opportunities within her community. Recently, she was asked to collaborate with Catherine on continuing to update the Gila River Tech website, since they both had website design businesses. I asked Mia about her thoughts on collaboration, especially between businesses. She told me, "Sharing knowledge is better." Mia considers herself a connector and sharer of knowledge.

> It doesn't do me good to hold knowledge in for myself. I don't only want to make myself better, I want to make my community better. So, why would I hold in information that could benefit my community as well? I guess that's what my thought process is, because if you share what you know, people find you as a resource or something, you know, and they in turn, turn you onto other people. And then, you just gain something else from them.

Mia is fully committed to working with her community and works to connect Natives together so that they can be stronger together than by themselves: "You are who you kick it with, and so you want to surround yourself with positive people because then everyone wins, everyone is stronger." She has ambition and sees her future as full of opportunity

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and wants the same for her community.

Concluding thoughts: Reflecting on being an Akimel O'odham woman in engineering and technology and imagining the future. As Mia reflected on her life's experiences, she told me that she wants to be someone whose story impacts other Natives and her community for the better. For Mia, part of telling her story is being "real honest" about the difficulties she has encountered and how she survived and "made something of herself." Mia wants to connect to Natives through the stories of her experience because the hardships are similar to other Natives' stories. She wants her past to be part of her future - communicating with her community that she overcame and so can they.

> I just want to be someone that's like, I remember people coming to my school and speaking, and just saying, you need to stay in school, and you need to stay sober, and you need to do this, and you need to do that. And, I kind of want to be one of those people, just be able to do that.

> So it's important that I tell them that I started out from the ground, like, no license, I had a record, I didn't have a job, I didn't have a car. You know, I was basically sleeping on someone's couch. I was, just, my life was a mess. You know? And when you're at rock bottom, the only way you can go is up.

> Because I started from the bottom, I can share that story, and let them know, my life wasn't handed to me on a silver platter, either. I had to go to school. I had to wake up early. I had to pay for my bills and find a job. And I had to save up for nine months to buy my car. Nothing was really given to me. I had to work for it all and that's what I want them to know, like, it's up to you. Nobody's going to pave your way for you. You have to create your own path.

> And, I want to stress that to them and let them know that you have help out there. You have the resources, you have people that you can call, and contact, and, just be, like, 'Hey, I'm stuck, I want help'. And I want to be someone who helps.

For Mia, part of "helping" is the understanding that "everyone makes mistakes and needs the chance to learn from their mistakes." Mia wants to help her community through her work by "giving them support, and a checklist, like, 'Do this and do that', a pathway, or

something, to help them go further in life, to not make the mistakes I did." One aspect of this "checklist" is education and the other is connecting to your community. Education offers opportunity and those opportunities can be rooted in community.

> And when you're just stuck on the res, you're just stuck in that area. So, I'm a firm believer that the more education you get, the more you're aware of what goes on. And I think that's important. Then you can help better.

As Mia looks to the future, she is dependent upon the strength and independence that she learned and witnessed from her mother to move her pathway forward. She is thinking of re-branding herself and the work that she does under the umbrella term "PIMA – Partnership, Innovative, Mexican, O'odham."

> It's me. That's why I like it. It encompasses everything I have done, and it's all me. And that's what I am doing and planning on doing for the community. Giving the mentorship, the leadership.

An Illustrated Summary of the Narrative of Mia

(1) encountering

(2) overcoming

(3) attempting

(4) moving

(5) returning

(6, 7) advancing, returning, & growing

reflecting and imagining

Figure 12. An illustrated summary depicting Mia's narrative transitions

The Narrative of Catherine: A Navajo Woman Growing Her Own Technical Business

I first met Catherine the morning that I was meeting Mia to travel to the daylong tribal broadcast meeting for Gila River Indian Community. I had not expected to meet Catherine, as I did not know what the day would entail other than traveling with Mia and attending Mia's work day with her. Catherine introduced herself and asked who I was and what I would be doing with them that day. I explained to her that I was a graduate student at Arizona State University in the PhD program for engineering education and that I was studying how to better support Native Americans, particularly women, in STEM. Shortly after, Mia arrived and we were on the road traveling toward our destination. In the car, Catherine handed me her business card and told me that she operates her own technical business and works as a consultant on various technical projects. Knowing that I was from ASU, Catherine told me that she also volunteers for STEM education-related projects and explained one such volunteer project in more detail - a NSF-funded project in which she was working with a university professor, assisting her in recruiting ninth and tenth grade Native students to join the program and learn how to code and create electronic apps. During that day at the tribal broadcast meeting, I came to know that Catherine had a background in computer information systems and had entered the technical workforce after raising her three daughters. Twelve years after entering the technical field, Catherine started her own technical business to "help build electronic Native communties" by providing business development and technology services to Native nations in a "culturally-sensitive way." Catherine's business was young - only three years old - and she was in the process of navigating the start-up stage.

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Catherine's story was unique to me in that she was a Native American woman who had a non-traditional path to a technical career and was using a path of entrepreneurship to advocate for her Native communities to advance through STEM.

My time with Catherine for this narrative inquiry, not including the day we first met, lasted over the course of four days, spread over several months. When we sat down for the first time to conduct the research interview, we met at a local library where she, on occasion, works on her business and holds business meetings. Subsequently, Catherine and I met at local restaurants where she would share her storied experiences with me. My time with Catherine extended beyond these meetings – we exchanged emails regularly and she on one occasion attended a Phoenix AISES meeting. As Catherine shared her lived and told stories with me, she focused on the inspiration for starting her business, the obstacles she has faced, and the successes she has had as a technical business owner. As such, Catherine's narrative is structured around these categorizations of experiences.

Transition 1: Moving away from home. Catherine grew up on the Navajo reservation - forty-five minutes east of Tuba City. She attended the public schools in Tuba City, graduating from Tuba City High School in 1979. She moved off the reservation to the greater Phoenix area after high college "partly for college and partly because of family survival." She married immediately following high school graduation, and her husband took a job with an electrical company in the city. As Catherine's husband started work for the electrical company, they began having children. Catherine's husband was "more traditional" and wanted her to raise the children. When her youngest of three children turned three years old, she sought to return to school, as a college preparation program (Upward Bound) had impacted her during her high school years. As

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she prepared to return to school, her husband supported her. I asked Catherine why her husband supported her goal to go back to school at this stage of her life. She responded:

> We came from families with a low socioeconomic status, and this pressed us towards wanting better for our children. Better meant that while he was working full time in the city and I was going to pursue a degree so together we can be examples while we earn a decent living.

To gain entry into a community college, Catherine took the mandatory assessments (e.g., writing and math). Catherine became interested in "machines and technology" from taking classes with computers in high school, and so she began to look at computer-related degrees. She met with a guidance counselor at a local community college to review her assessments and enroll in a computer-related degree program. She recalled the guidance counselor telling her:

> You want to go into the computer field? Your assessments score in math are horrible! You might be able to take the basic math courses here at the community college and get by, but the math courses at the university are beyond your abilities.

Catherine went on to recall that these statements "lit a fire" under her. She knew that she had to start from "the bottom" with math, but she was wiling to do so for a career in the computer field. She graduated with her associate's degree "in the arts" and had taken computing and math courses up through trigonometry. She immediately enrolled in a bachelor's degree program for computer information systems in the business school of a state university, where she remembers successfully taking Calculus. While at the state university, she found the Native American Business Organization and volunteered as the executive assistant. Catherine explained that she joined the Native organization to help her "get out of the tunnel vision outlook on life that is just about coursework and the material, and consider others factors like her community." She also saw the Native

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organization as a way to connect to other Natives on campus. In 1998, Catherine graduated with a Bachelor's degree in Computer Information Systems, all while "being a mom, raising three daughters, and being a wife."

Transition 2: Returning home and entering the technical field. Catherine's her life took an unexpected turn the year after graduation in 1999 when her husband passed away. Instead of entering the workforce, she turned her focus to helping her grieving children through a bereavement process. She traveled back to the Navajo reservation with her three daughters to honor her late husband's life. Shortly after, she had to return to her home in the city and earn an income to provide for herself and her daughters. She was thirty-nine years old when she entered the technical field. She began working "as a W-2 employee for many years with various organizations, both on the private sector and also on the federal government side." Her positions included working for the city's Native American medical center as a medical records technician, with the state's department of education as an administrative assistant, with a large private technical firm as a "project coordinator for a software development crew," and, lastly, with a state government agency first as a procurement technician, then a contracts administrator, and then as a buyer – "buying anything IT related, products or services, for military, federal government agencies and also some tribal governments and their organizations." Over the course of her work experience, she told me that she was "fortunate to gain experience on both sides of the fence" – with Native and non-Native communities, and with private and government organizations.

Transition 3: Overcoming hardship through entrepreneurship. Catherine was working as a buyer to "procure IT, both software and hardware" when the location of her

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job through the federal government agency was moved. She had choice to move to out of state to another city in order to keep her job. She turned down the offer to move as was "not ready to leave home." This was the "turning point" in Catherine's career path. As Catherine thought of what her next steps could be, she reflected on the positions that she had held in the past. Her work experiences with her Native communities stood out to her and she realized that she wanted to continue to work with her Native communities - recognizing that she could be "a voice for tribal nations … to bring technology expertise to the nations." Catherine decided that she would have more freedom to help her Native communities with her own business.

> There I think is where I think my turning point was in my career. I really found it satisfying to return service back to the tribal nations that I procured IT for, software and hardware. That's where I decided that that's what I wanted focus on, was to give back to the tribes. Whether it be my own Diné Nation or any other tribe. That's really how I got started. As a W-2 employee you can't really return your service or help the nations the way you want to because you're just doing what the company owner is wanting you to do. You're limited to their stipulations.

> I asked Catherine to "tell me more" about those beginning moments of deciding to start her business and how she envisioned her business contributing to the Native communities. Catherine spoke about her "big city perspective" and how living off the reservation helped her to see what she could do for her Native communities. She equally spoke about the need to bring "best practices that we learn in big cities" to the Native communities while approaching the work in a culturally compatible way – something she had learned from her work experience and from being a Native herself.

> I saw and felt immeasurable satisfaction of giving back to our own kind was when I was employed at the medical center. I was working with a diverse work group from various tribes. The staff members, my team, were from all different tribes from around the valley and also from all over the nation. I got to work with a really high level of cultural sensitivity while we were all working together. That's

where I gained that exposure. Other than that my job as a buyer for the government, I was able to work with some tribes as well, buying. They were my customers. I was fortunate enough to see things from a big city perspective and looking into the reservation.

I realized there that it would be valuable for a lot of tribal members to gain experience off the reservation and then from what they learned of best practices that we learn in big cities, take it back to the reservation and tweak it accordingly being cognizant of cultural sensitivity and also their economic development activities, if there's any. To this day there's some area that there's not and they're trying to. They're struggling. All the nations are struggling to build their economic development powerhouses. We lack so much. When you're off the reservation and you see how the cities build their communities with such success and then you look back to your own community, wow, we lack at building an economic development infrastructure. That's how they're all tied in all the time. As a Native being in the city, making a living in the city, you see those areas that need attention.

With the intent to contribute the best practices she had learned to Native nations, Catherine began to read all that should could on how to start a business.

Transition 4: Starting a technical services business to serve Native communities. Soon after Catherine had the idea to start her own business, she "took a leap of faith" and started her own LLC, remaining steadfast in her belief that the best way for her to help Native communities was through her own business. The mission of her business is to utilize the knowledge that she had gained off the reservation and take it to the reservation to help grow technology knowledge and skills within the Native communities.

In 2012, the urge was so strong that I couldn't just keep pushing it away anymore. I just took a leap of faith and started my LLC. The only way I can truly help the tribes the way they need help is if I have my own business. Then I can form a team that will help me take technologies, best practices in business, operations in any business setting, take a team back and help with what's needed. Problems need to be solved, we need help in best management practices, project management, there's got to be some kind of a better way of delivering training so that our leaders, our program managers help leaders in all the tribal reservations are more effectively managing their operations. We're in dire need of that. So as

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we advance technology, we need skill-sets in that to grow our own IT professionals.

One of Catherine's first tasks was to come up with a name for her business so that she could file the appropriate paperwork. Naming her business was significant to Catherine – the name represented the first step in executing her plan to start her own business and would signify everything that she stood for as a Native woman business owner.

> I went around and around and around for a couple months trying to come up with a company name, but I was just getting nowhere, and one day I told my brother ... I was with my brother during that time. He was helping me piece together the infrastructure or how we were going to structure the business when I first told him that I was starting a business. Bless his heart, he was there and offering, helping me talk about it and talk it out, and as we have the LLC forms before us there, I said, 'It's got to be short, it's got to be catchy and it's got to stick with everybody out there that come across it,' but we couldn't.

> I mean I wanted to be like Apple, short and saucy and it sticks. But to no avail, I could not come up with anything by two months. I told my brother, I said, 'I'm sick of this ... Anything. Just throw me anything, I'm ready to fill this form out,' and he looks at me and he says, 'Spotted Horse.' I looked at him like 'What? Spotted Horse? That's long.' And he goes, 'Yeah, grandpa's Navajo name.' And I said, 'Oh yes!' And then it just clicked and it just took off from there, because I love horses. We grew up with horses. My grandfather had mustangs and his Navajo name is 'He who has [description of animal].' That's how the community knows him. If you say, if you're at a store and some grandma comes across you and says, 'Hi grandchild. Where are you from?' And you say 'I'm from [grandfather's name in English] family.' And they'll just look at you like, 'Who?' And then if you say [grandfather's name in Navajo] and they say 'Oh, yea. Okay.' Because they know who you are talking about once you say the name in Navajo. It's our clanship system.

> It's just a long time of a tight knit family with our grandparents being involved in our every day lives plus my mom and dad's teachings. All our elders' teachings. We were brought up to respect that. And that's what really stuck. I guess in a way we think of our grandfather as someone who will make something out of nothing. He farmed, he had large flocks of livestock - cows, sheep, horses. He bred mustangs that were spotted. That's how he got his Navajo name.

> So when my brother suggested this name, I added the computer information

systems part. I wanted the technology part of the name to be broad enough to where it covers business management support services in addition to technology, so tribes would know what the business problem is that I am addressing, the area I am in. It's under the umbrella of business, but focused on technology and the tribes need that.

In a single name, Catherine's business honored her past and her elders while looking towards the future of technology. Catherine respected her elders for their entrepreneurial spirit and her business honored them – upholding her vision to have a business that "knew where it came from and knew it could persevere." The business name would serve as a "constant reminder" of the struggles that her elders survived and that she too could survive.

> I think not only of my grandfather, but also my grandmother, my dad, and my mom. In a sense, they were already entrepreneurial in their own way back on the reservation. Even if we didn't have regular paying jobs as a W-2 employee or what have you, not even being in the workforce, somehow they made due. And they still made a living. As I said earlier, my grandfather, he could make something out of nothing. When I get frustrated in my business now, being a brand new start up and just now getting started there are a lot of challenging times where you get stuck. You have to stop and just reflect back upon how we all suffered but yet we still made it through. We have to persevering with all my elders, my grandfather, my grandmother, my mother, and my father persevering attitude that I saw is what's really carrying me now even though I knew going into starting this business it was everything but stable. I needed that, I needed that upbringing, the persevering attitude upbringing, so that name is a constant reminder. It may not seem like we might make it but somehow, someway something's got to give and we'll make it. So that's what the name is a constant reminder of.

Transition 5: Connecting to Native communities and finding clients (the first year of business). Catherine told me that starting a business is "very hard." As she reflected on the young life of her business, she spoke about the first year and the changes she experienced going from being a W-2 employee to a business owner.

> The first year was very hard because, of course having had a salary position prior to starting to my business I was use to just, I knew that there would be a check in

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the bank every two weeks. After I started my business, I really had to be mindful of where every penny goes, because there was no bi-weekly deposit in the bank anymore. The first year was tough because I didn't have any contracts and I started to think, am I made for this?

Without any clients (or contracts) in that first year, Catherine doubted her ability to succeed in the first year. Yet, she relied on her perseverance by immersing herself in learning and networking opportunities. She read business and technology articles daily to keep up to date on her field, and regularly attended business-focused workshops. Her intent was to "keep [her] momentum going, to keep focused on it, and not give up."

> Like I said, about perseverance, I guess that's what kicks in when you're at your lowest point. I just kept going to workshops, networking. One of the things I do almost on a daily basis before I start my day is read some kind of an article online, whether it relates to growing a small business or whether it relates to current technology that's emerging and how it affects small businesses, or anything that is within the realm of keeping the business going.

> In order to bring in income while she pursued contracts for her business, she took

a W-2 job two hours south of her home with a business, Native Services Corp. The job required that she "take care of the Bureau of Indian Affairs, the Veteran's hospitals, and Native health services." Two years after legally starting her own business and as she also worked as a W-2 employee, Native Services Corp offered to sponsor Catherine for a SBA course. She eagerly agreed - having previously signed up and attended "every free workshop available and that would fit." I asked Catherine what the incentive was for Native Services Corp to sponsor her:

> The SBA course was a federal seven-month training initiative and was specifically focused on businesses poised for growth. So, for me, my incentive was to train to be an executive and build an organizational framework (my own business one day soon) and learn the resources, networks, and motivation required to build a sustainable business. For their gain, the incentive was for me to learn about tools to catapult their company to the next level of growth using their company financial data. From this, we created a five-year strategic plan for their

business. They are a women-owned and partially Native-owned business. They were past the startup phase and were trying to get through the growth phase of their business.

The training course was the SBA e200 Emerging Leaders initiative - an entrepreneur and executive-level training initiative focused on leadership in underserved communities, including Native communities, that provided resources and trainings for leadership and business skills. The SBA e200 Emerging Leaders conference site stated that "e200 has been a catalyst for expanding opportunities for many promising small businesses in underserved communities" by helping leaders to "drive local economic growth in their communities" (U.S. Small Business Administration, 2015). The SBA e200 training took place over seven months with one hundred hours in the classroom, time with assigned mentors, and networking connections and opportunities with "peers, city leaders, and financial communities" (U.S. Small Business Administration, 2015). Catherine recollected that was one of the more consistent attendees in the e200 leadership course - showing up and staying for every class. She took the opportunity seriously. She learned about "how to read and know your own financial ratios and have your own readily available so you know the health of your business at all times."

During the training course, she met the top-level manager, Daniel (pseudonym), for the parent technical company of Gila River Tech. She recalled that Daniel was "impressed by her dedication" and they both "took [the training] very hardcore." Two years after Catherine graduated from the leadership training course, Daniel told Catherine to come to his business so that they could begin to work together. He would help her grow her business. Catherine explained to me that Daniel respected her ability to complete the e200 leadership course, related to her struggles with growing her business,

and believed in her vision to help grow Native communities through technology. As a manager of a Native-owned business and a Native himself, Daniel sought out relationships with other Native-owned technology businesses, intending to establish a Native-to-Native support system for technology business seeing that there may be "mutual benefit … to go after jobs from two different ways" and "opportunities to share." Daniel followed through on his word, signing as Catherine's first client. Catherine told me, "I am so thankful to them, they were my first contract as a business owner"; and as this narrative begun, I first met Catherine as she was working as a technical consultant for Gila River Tech – a contracted consultant position that came about from meeting Daniel.

> He knew that I had that success in a strenuous, challenging task and completing the e200 course. I think that's how I got the buy in, on more of a company, business-to-business level. They as a small business know how it is to start - the challenging start, the humble beginnings. It's very challenging to start a small business. They are sensitive to that. They are also sensitive to Native-to-Native business, really encouraging other Native to start their own businesses. … and they were, bless their hearts. I really think highly of them because they gave my business a chance when it had no past performance. Other than, of course, my personal resume, they knew that I was a buyer with the federal government, so in a sense they knew what I was capable of. My being familiar with federal contract that's what they were interested in.

I asked Catherine about the Native-to-Native business support and whether that was common – wondering how impactful Native-to-Native business support is for Native communities. She told me that the support was "not uncommon" and that "more and more tribal organizations are starting to do that." However, Catherine specified that although Native-to-Native business has always been a part of formal policy for Native communities, Catherine saw that Native communities and businesses were just beginning to put this to practice as a pathway to develop their own professionals and "preserve" their own talent.

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It's always been there; it's been morphed into some of the policies within the tribal administration to promote their own tribal members to preserve their education or either their skill set in the workplace. For the most part, the literature's there already. Policies and procedures are there already to do that. But it just hasn't been practiced enough. Now they're picking it up because how else are we going to start growing our own professionals. There are such things as tribal employment rights ordinances. The purpose is to address Native preference in employment/contracting, if a non-Native enters into a tribal reservation wanting to do business and if they get a job or a contract they must first try to employ tribal members or train them before they hire from outside.

Catherine took great pride in her status as a being registered with the Navajo Nation as a "priority one certified vendor" and used this status to look for jobs to grow her business. With her Native-owned status, she explained to me that she is notified of requests for proposals for those who are seeking the services of Native-owned businesses. Sometimes, she said, "You'll get a phone call." "'Hey I found your company name on a source list. We have this technology, software or hardware, that we're thinking about buying, are you able to bid on that? Yes, no?' If yes, I put together a proposal." She is also registered with fedconnect.gov as a Native-owned business and looks for potential contracts through the Bureau of Indian Affairs.

Despite the Native-to-Native support and potential leads, Catherine explained that it is still very difficult to land the jobs. She has submitted many responses to proposals and spends many, many hours doing so, but many Native communities cannot afford the technical services and do not understand "all that goes into technical solutions – how much the resources cost." Catherine explained to me that "trust" is an important concern in Native communities, so Catherine tries to sign a client from a Native community "for basically free to establish the trust." "Then, after they know who I am and what I can do for them, I will explain how much goes into this, including the subject matter expertise

and resources, and how much it all costs." Catherine told me one example – she had

recently traveled for several hours to a tribal reservation to pitch an idea for a website that

could electronically collect housing dues. The tribe was collecting those dues by "having

their customers drive long hours to the reservation offices to pay dues in person" and to

"file even just a paper." It was a time-consuming and tedious task for the team and their

customers. Catherine pitched the idea, but when it came down to price the board was

"split." "Half of the board knew the value, but some just didn't get why this was even

needed. So I don't think we can get it unless we do it for almost free – even then, I don't

know." Compounding the issue, Catherine explained that when a job requires a

technology team, she has difficulty finding a technology team comprised of Natives and

any technical professionals, Native or non-Native, that are also willing to do the work

"for basically free in the beginning." This makes proposal submission very difficult

because she "has to think about the people she needs to hire."

> So even though I have Indian preference in hiring for their jobs, what do I do if I
> need a Cisco engineer that's certified in Cisco networks. What if it's a job that
> requires CCNA certified? About 90% of the time you can't find a Navajo or
> Native that's certified in that. Maybe there are, it's just that they're working
> somewhere with really good companies. But I want to bring that to the Navajo
> Nation.

Transition 6: Leading in Native communities (the second and third year of

business). To overcome obstacles, Catherine committed a significant amount of time to

volunteer work for her Native communities – both because she is passionate about giving

back to Native communities and she views it as a networking opportunity to grow her

business.

> I volunteer to keep my momentum going. Just to keep focused on it and not give
> up. I do that. I did a lot of work for free, lots of hours free work. Even now it's

like that. I feel like I work 100 hours and only get paid for 20 hours. I'm looking at it with hope that it's, you've got to give to receive. I do a lot of volunteering.

I asked Catherine if volunteering has helped her business in anyway, whether it be landing a contract or otherwise. She told me that it has helped her "tremendously," specifically helping her to learn new knowledge and skills.

> I was an introvert. I was very shy, that's usually the nature of Native Americans. I was very shy and that's really where I was forced to start talking. Start learning and actually exercising your elevator speech. It's a few seconds and that's really where I tried my weaknesses, I faced my weaknesses. It taught me a lot in that aspect. I started to learn how to market my services and then also it's teaching me human resources skills in working with the volunteers. I try to apply it to where, how is it going to be when my business starts growing and I have to hire employees and be managing my own employees. So I'm putting myself in those contexts. Just seeing how large corporations, small, medium-size businesses, tribal leaders, federal agencies, and tribal government organizations, how they all come together and how they interact. Where do I fit in that whole scheme of things? It's making me think about strategy and marketing and business. And of course I could probably go all day long in trying to pull up all the positives that I get from volunteering.

Catherine's dedication to volunteering has earned her recognition from Native communities and affiliations. In 2015, she was awarded the Volunteer of the Year award for her work with a Native American economic summit, hosted by the National Center for American Indian Enterprise Development (NCAIED). When being honored, Catherine recognized the collaboration that volunteer work requires and that she was grateful to the team.

Catherine's mindset and commitment towards volunteering has also helped her with growing her business. As she spent many hours volunteering for the Native American reservation economic summit - hosted regionally around the nation and annually in Las Vegas every year, she served as one of the lead project coordinators, a job specific to volunteers and one that required her to coordinate the volunteers, their

assigned jobs, and scheduling. With this volunteer role, she learned about the logistics of the conference and saw "what was and wasn't working." Catherine saw an opportunity to help improve the conference's registration system and provide those services from a Native-owned business (which previously were being handled by a non-Native business). Catherine told me that supporting Native businesses was a mission of the conference.

> The reservation economic summit, that's really the underlying factor for having that conference: to promote Native businesses to do business with each other, Native-to-Native business. In fact, their slogan I think is 'We mean business for Indians', or something like that, so it is promoting doing Native-to-Native business.

With the summit's slogan in mind, Catherine approached the non-profit's president with a proposal for her business to manage the registration system. After the board reviewed her proposal, Catherine secured a contract to provide technical registration services for a regional conference. She had to "prove herself" at the regional summit and was told, "Then there may be more opportunities" in the future. As I emailed with Catherine, she told me that the regional summit went "wonderfully" and she would be given more contracts for upcoming regional and national conferences, "fingers crossed." Catherine also used her time at the summits as an opportunity to meet potential customers. On her own time when she was not volunteering or working, she attended networking sessions, spoke to fellow Native professionals and business owners, and handed out many business cards. She landed one customer from these efforts.

> I was at a networking event at the [economic development summit] and happened to be introduced to another person that had a tribally owned enterprise and that person says "Who is she, I've been seeing her run around all over right here." … My involvement with federal contracting came up and that person's ears perked up, and he said, "Hey, I'm interested in that area. Where are you located, where is your office?" I said, "I'm headquartered in [the city] for right now, until I get situated, then hopefully my office will be on the Navajo reservation." He says

"Great, let's meet when you get back to [the city]." I said okay. Two weeks later I was having my first meeting with him. I did my presentation, did my marketing spiel, and on the second meeting I was signing a contract with them. I was fortunate enough to find somebody else to give my business a chance.

Catherine also volunteered for many education-related projects, as she told me the first time we met. Her primary goal with these projects is to involve Native youth in STEM and also to look for opportunities in which Native STEM students may want to intern with her business. Although she has not identified any university or college Native students who are looking for internship opportunities, she said that she wants them to have a less arduous path than her. She recognizes that her path was non-traditional – as she entered the technical workforce much later in life – and she wants them to become specialized in engineering and technology and have work-related experiences from a young age.

> I went straight into workforce not having any experience so there was quite a delay. One of the things that I would like to see with these young college students that are studying for their career is to start early on some kind of intern or either some type of a grant project. I want to help get the youngsters prepared to be specialists.

Despite her volunteer efforts, Catherine spoke to me about the frustrations of trying to balance volunteering with looking for paid contracts. She told me:

> I used to think about my business and volunteer work almost twenty-four-seven no matter where I was. This led to bad consequences of chaotic and unbalanced days. I saw and felt the dangers in trying to 'do it all' – the unbalanced feeling is not pleasant when everything caves in on you.

She has since tried to resolve her chaotic schedule by using time management techniques and asking herself what is most important to her, and that is: being a grandmother, having time with her family, focusing on her own self, and reaching out to the youth.

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I now have to utilize time management to find and keep a balance throughout. So, I'm learning to practice time management with a constant reminder of my priorities and using electronic calendaring in my palms to keep track of how much time I spend on each of my priorities. It's tough and as they say, it all comes down to keeping a steady pace and it's a balancing act. I have to constantly revisit a serious self-analysis. It needs to be done where you ask myself "What's the most important to me in life?" Being a grandma, of course, family and "me time" are the most important to me and then comes business and volunteering to continue personal/professional development. No doubt, volunteering enriches one's life, but one of the ways I had to learn time management is to say no. It's tough to say no, however knowing that family is priority and have some traction going with my business, I have to be more selective with volunteer opportunities. I decided to limit my volunteering to only those organizations that are involved with youth development.

Transition 7: Advancing the business and Native communities (approaching the fourth year of business).

In the first three years of business, Catherine secured six contracts. She still holds two of them, one being with Gila River Tech and the other with the Native American economic development non-profit organization. During one of our last meetings, Catherine told me that she is a still a "starving entrepreneur" and that she continues to look for clients and contracts. She is seeking opportunities to provide information systems and technical services to advance Native communities – including technical procurement, website management, and technical business support – as well as Native liaison services to non-Native groups who serve Native communities. She is hoping to build relationships with "like-minded professionals that [she] can team up with, to participate in that history [of the business] with." She hopes to one day be at a level with "really good, well rounded professionals to have as my management team." She tells me that one of the biggest obstacles for her now, as a "one-woman band," is that she "sometimes feels very lonely because you don't have anybody around you to make these

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big decisions with, or to bounce off of, or to talk it over with." She relies upon her "cheerleaders" – Native friends who are business owners and professionals within various private entities and Native organizations. She speaks to them regularly, asking for their advice; and they call her with potential leads. They tell her, "Keep going, keep going, we need you and your skills back at home."

Concluding thoughts: Reflecting on being a Navajo woman as a technical business owner and imagining the future. Throughout my time with Catherine, we spoke about what it meant for her to be a Navajo woman forging an entrepreneurial path. She explained that the transition from motherhood to being in the technical field as a business owner was tough, but the disposition required of motherhood and her upbringing as a Navajo set her up for being a business owner who is focused on her Native communities.

> Just speaking from my own experience, I would have to say it falls back on being a mother and just naturally being a caring person, thanks to our elders in our upbringing, I think makes us good business owners. … I think women in general are detail oriented and very caring. … I think that's my experience – it's just being a caring person, having been a mother I just want to help where I see a need. So as a Native American woman taking the entrepreneurial path means flexibility allowing more family time coupled with a sense of independence and freedom as we make contributions to our communities – contributions that are tailored to our indigenous needs.

Catherine further explained that speaking her Navajo language has helped her make the transition to being a business owner who is, in part, serving the Navajo Nation. Catherine sees her ability to speak the language as a strength that enables her to be able to communicate with her Navajo tribe.

> I have to say that one of the things that really helped me was in speaking my language. I'm fluent in my language. In running the business, if I am marketing in my own reservation my marketing strategy is to, when I present to the prospect

buyer, I introduce myself in my Navajo language, identifying my clan-ship, that's the protocol in introducing yourself to somebody you've never met. Then I just talk with them in Navajo. "Where are you from? I'm so and so, I'm from this area." In Navajo, of course, to get them all relaxed and by then they're looking at you like "Whoa, she talks Navajo so maybe I should pay attention." So then I start, I tell them "If need be, I can explain whatever it is that we're talking about right here in Navajo." I rely upon that too. It's a strength for me to be able to communicate with my people.

Catherine also credits the traditional nature of her Navajo upbringing with giving her the strength she needs in life, including the strength it takes for her to be "a Navajo in the big city, making it on my own." Catherine goes back home when she feels burdened and is in need to recharge her strength. Back home on the Navajo Nation, she spends time with her elders, visits with family, and attends traditional ceremonies. Catherine's mother taught her to rely upon her Navajo spirituality in order to gain strength. Catherine puts this practice and lives this out in her daily life.

I was brought up very traditional. My mother doesn't speak English, so just that much more traditional. We were taught to always have faith. In their generation it was this spirituality that they know in their own traditional ceremonial ways, rituals, things of that sort. In our generation it's gotten to finding a balance between two worlds... because now you have to go out in the non-Native world to make a living. It's gotten to where you've got to have faith. It doesn't matter what it is. It can be traditional, you can be a traditional spiritualist. You can be a Western denomination believer out there, go to church, whatever. My mom would always tell me, no matter what it is always have faith. I draw a lot of strength from there. I have to be spiritual to keep things in balance. And that's another major teaching from our tribe, our cultural upbringing is that it's all a balancing act. You can never forget where you came from. Every so often I go home, I get the traditional ceremonies done, just to get back in touch with my grassroots. Because out here everything is going 100 miles per hours, you could go crazy, get caught up in things and just go, go, go. After a while everything is going to be out of whack. So I stop and I go home and spend time with my elders and my traditional ceremonies to remain grounded.

As Catherine imagines her future, she anticipates growing her business through networking and "strategically looking." She expressed frustration that she has pursued new contracts on her homeland, the Navajo Nation, but she has not signed any as of yet.

> Even though I am priority one certified, Navajo preference in contracting, it seems as though we as Navajo small businesses are usually the last to the finish line with non-Native business from the outside the reservation beating us by the time the dust settles – meaning, service requests are awarded. On the other hand, I have my own people tell me, "Why do you want to do business with Navajo Nation? You're crazy! They have no money and all kinds of corruption going on!" I excitedly tell them I started a business and one day I would like to return service to my own tribesmen. To them I say my grandfather, [grandfather's name in Navajo], told me to never forget my relatives. There has got to be a way we all help one another.

Catherine is "determined to break down the door so [she] can one day provide services to [her] Nation and hopefully all the Nations." For every new opportunity, she asks herself, "Why not a Navajo-owned business? Why not bring on someone from the community?" She is proud of her journey so far and is also focusing on building her business off the reservations. She recollected that when she graduated a classmate asked her where she wanted to be in five years. She responded, "Well, I would like to be in a business suit and with a briefcase." Showing me her black leather briefcase (now 18 years later after graduating), she said, "It's taken a lot longer and not quite the briefcase that I'd like, but I'm getting there." Although Catherine has many challenges as a new business owner, she is learning to be "a forward thinking professional."

> It's an every day practice that I have to really put myself into and I'm still struggling with it. I'm so use to just being the caretaker, just caring for everybody. As a mom that's what you do. You put everybody before you, so it's hard to think of yourself as the professional and this person that runs the show. I still struggle with that. I don't see myself like that. I try to help every day. That's probably one of my strengths in starting the business, is that I want to help. That's the natural urge that I have. It may be a trait, a good trait to have.

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Catherine is using her "wanting to help" as a business advantage and as a motivator to contribute to advancing Native communities. She remains dedicated to her vision to "grow [her] own IT professionals and then with that start jobs at the professional level with the proper compensation on the reservations." In her vision of what her business could be in the future, Catherine imagines a team of information technology professionals located on and off the reservation serving Native communities.

> I would have my own team of professionals. To be resourceful, I'd like to have our offices on the reservation and also here [in the city]. … So we don't have to hire from outside. I want to bring technical expertise to the Navajo Nation.

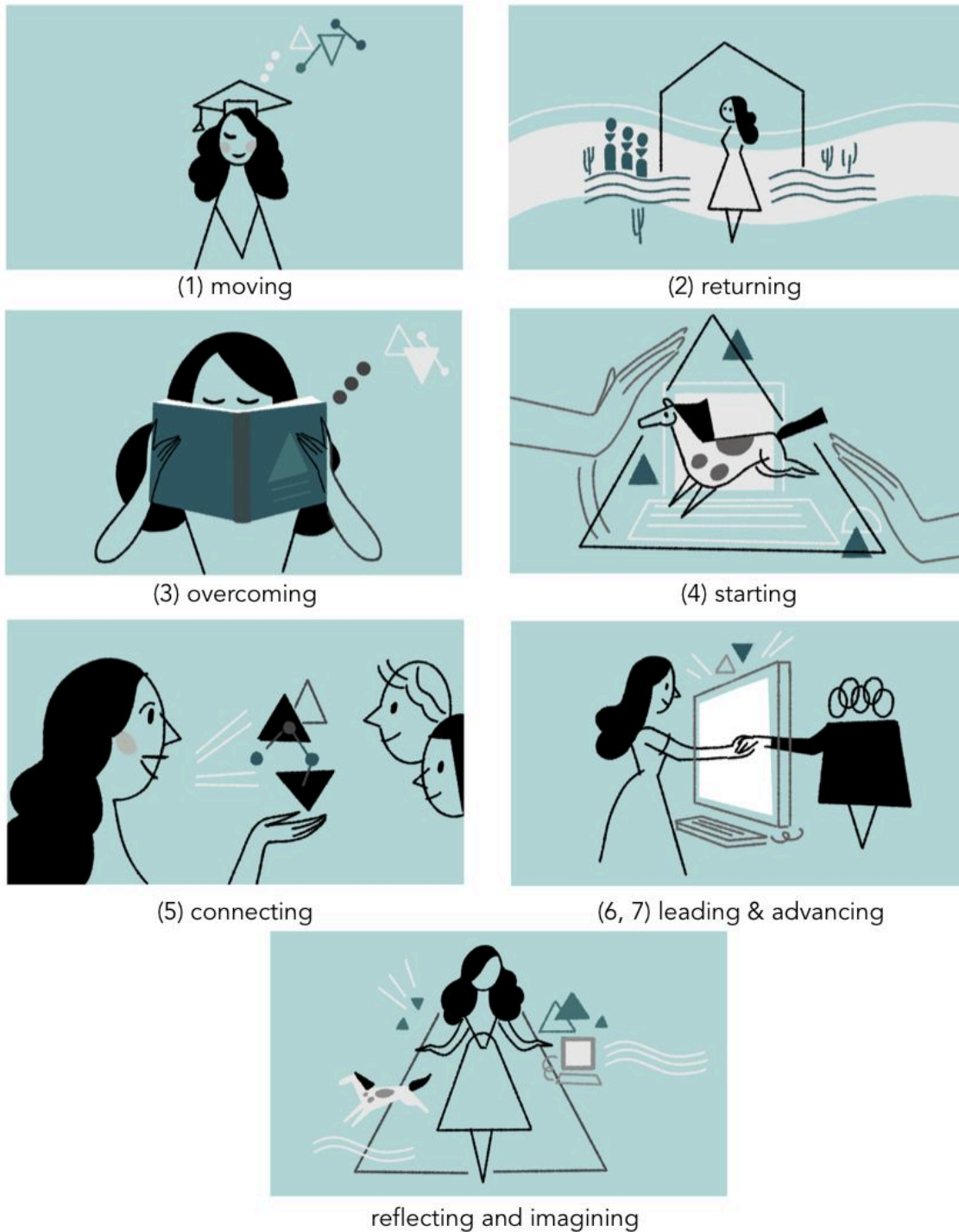**An Illustrated Summary of the Narrative of Catherine**

Figure 13. An illustrated summary depicting Catherine's narrative transitions
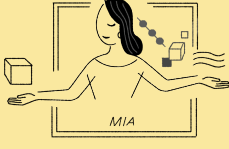
Conclusion of the Narrative Analysis

This chapter provided three narratives: (1) the narrative of Jaemie (pseudonym), a Navajo woman who worked within a large technical corporation and pursued a path to connect to Natives in the workplace and, in the end, was designing and leading new initiatives to support Natives in STEM through the corporation's Native American support network; (2) the narrative of Mia (pseudonym), an Akimel O'odham-Mexican woman (and an enrolled member of the Gila River Indian Community) who worked for a tribally-owned technical business and, in the end, was leading a new technical venture formed to serve the tribe and pursuing the completion of her higher education; and (3) the narrative of Catherine (pseudonym), a Navajo woman who turned to entrepreneurship by launching her own technical business in order to overcome hardship and serve her Native communities.

Each narrative revealed particularities and complexities of Jaemie, Mia, and Catherine's lives as they were working in the engineering and technology field and leading initiatives to improve their Native communities. These particularities and complexities are embedded within each of the transitions across the narratives, and illuminate that the lived and told stories were situated within a specific three-dimensional narrative inquiry space, influenced by situation, place, and temporality. Table 3 provides the transitions embedded within each of the narratives. The transitional framework was useful in structuring the narratives around the storied experiences that Jaemie, Mia, and Catherine emphasized.

Table 3

Transitions within the Narratives of Jaemie, Mia, and Catherine

Transition	Jaemie	Mia	Catherine
1	*Becoming* an engineering technician	*Encountering* difficulties with technical school	*Moving* away from home
2	*Moving* for personal change	*Overcoming* hardship through entrepreneurship	*Returning* home and *entering* the technical field
3	*Connecting* with the Native American support network	*Attempting* to return to school	*Overcoming* hardship through entrepreneurship
4	*Leading* a chapter of the Native American support network	*Moving* away from home	*Starting* a technical services business to serve Native communities
5	*Advancing* with a new role on the manufacturing floor	*Returning* to connect with home	*Connecting* to Native communities and finding clients (the first year of the business)
6	*Returning* with a new role in development	*Advancing* with Gila River Tech	*Leading* in Native communities (the second and third year of the business)
7	*Growing* the Native American support network	*Returning* to school and contributing to *growing* the Gila River Indian Community	*Advancing* the business and Native communities (approaching the fourth year of business)
Concluding Thoughts	*Reflecting* on being a Navajo woman in engineering and technology and *imagining* the future	*Reflecting* on being an Akimel O'odham woman in engineering and technology and *imagining* the future	*Reflecting* on being a Navajo woman as a technical business owner and *imagining* the future

CHAPTER 5

DISCUSSION

This chapter provides a discussion of the themes that emerged from the narrative

views of experience (presented through three narratives in chapter four). The discussion

is grounded within the stance that there is no universal experience of what it means to be

a minority in STEM, and, furthermore, there is no universal experience of what it means

to be a Native American woman in engineering technology. As such, this chapter

discusses particularities of individual narratives, while also considering themes that were

shared collectively across the three narratives. The themes presented within the

discussion are connected to known scholarship in order to consider how the narrative

experiences might extend our understandings in engineering education. The chapter

begins by addressing the first research question through a discussion of what we can learn

from the lived and told stories of Native women in the engineering and technology who

are leading initiatives to improve their Native communities. The chapter then addresses

the second research question through a discussion of how the Native American women's

understandings of their identities influence their work and acts of leadership in the

engineering and technology workplace.

(RQ1) The Lived and Told Stories of Jaemie, Mia, and Catherine

Jaemie, Mia, and Catherine's storied experiences were focused on transitions

within their lives that were critical to their participation in engineering and technology,

including pursuits of education, careers, and leadership acts. As Jaemie, Mia, and

Catherine navigated their lives as situated within the engineering and technology field,

they had to negotiate the local space (embodying their tribal and broader Native

communities) with the global space (embodying the mainstream engineering and technology community). The transitions across education, careers, and leadership acts represented Jaemie, Mia, and Catherine's intent and ability to:

1. Navigate both the local and global spaces through "cultural navigation" (Fixico, 2013b) or "walking between two worlds" (Kenny & Fraser, 2012), evidenced by their belongingness to and participation within the two disparate spaces (see Figure 14). For example, as Jaemie sought to become an engineering technician (transition one within her narrative), the process required navigation of the mainstream educational space and the local space of Native community.
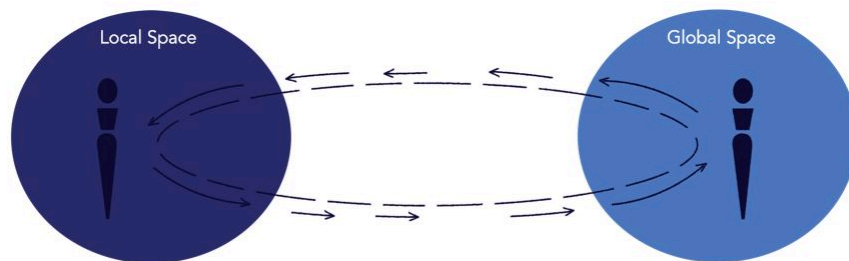
Figure 14. Jaemie, Mia, and Catherine navigated local and global spaces

2. Seek opportunities to join the local space with the global space, evidenced by the actions taken to connect to Native community in engineering and technology contexts (see Figure 15). For example, Mia and Catherine each sought to connect the local and global spaces through entrepreneurship, whereby they could contribute to the local space (Native community) within the use and context of the global space (engineering and technology work).
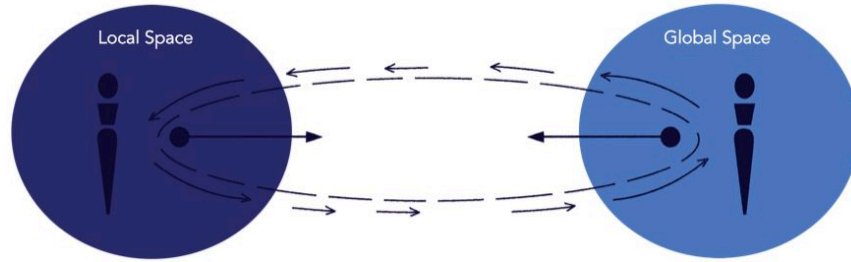
Figure 15. Jaemie, Mia, and Catherine sought to join the local and global spaces

3. Lead the creation of new, hybrid "third spaces" representing new sites that uphold the local space (a space for Native community) within the global space (engineering and technology) (see Figure 16).
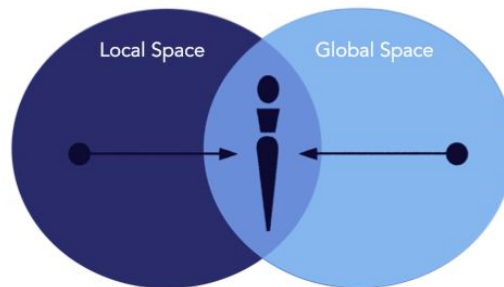
Figure 16. Jaemie, Mia, and Catherine led the creation of hybrid "third spaces"

The resultant hybrid spaces took different forms within the three narratives, illuminating the particularities of storied lives including individuals' backgrounds, their personal professionals needs, and their perceived needs of Native communities. The hybrid spaces came about from a transformation from cultural navigation to joining the local and global spaces and creating a new, hybrid space. Table 4 outlines characteristics of the hybrid spaces created by Jaemie, Mia, and Catherine.

Table 4

Hybrid Spaces Created by Jaemie, Mia, and Catherine

Hybrid Space	Jaemie	Mia	Catherine
Work Context	Large technical corporation	1. Self-run technical business 2. Tribally-owned technical business	Self-run technical business
Work Role	Engineer	Technical Service Provider	Technical Service Provider
Action	Native outreach program to support Natives in STEM education and careers	1. Websites for Natives 2. Development of a culturally-directed broadcasting venture	Technical services to close the digital divide within Native communities
Impact	Leading a chapter of the Native American support network	1. Native e-commerce sites 2. Local, Native-based television: communicating community-relevant information	Technical projects to support Native communities in rebuilding (e.g., technical support for Native economic development conference)

The transformation from cultural navigation to leading the creation of new, hybrid spaces is significant because, according to dominant narratives, it remains a compounded challenge for Native women to remain in engineering and technology, let alone to become leaders in engineering and technology contexts. Jaemie, Mia, and Catherine's narratives counter dominant narratives and provide stories of strength and persistence,

through themes of becoming, overcoming, connecting, leading, and so on. The transitions across the three individual narratives have thematic similarities in their transitional acts from leaving the reservation and pursuing higher education, encountering obstacles, overcoming hardship, seeking connection to Native communities, giving back to Native communities, and seeking to make change happen to better their Native communities – with one transition setting up the need for the next. These thematically-similar transitions embody a pathway from leaving their homes on tribal lands in order to become professionals to leading through returning and connecting to Native community (see Figure 17).
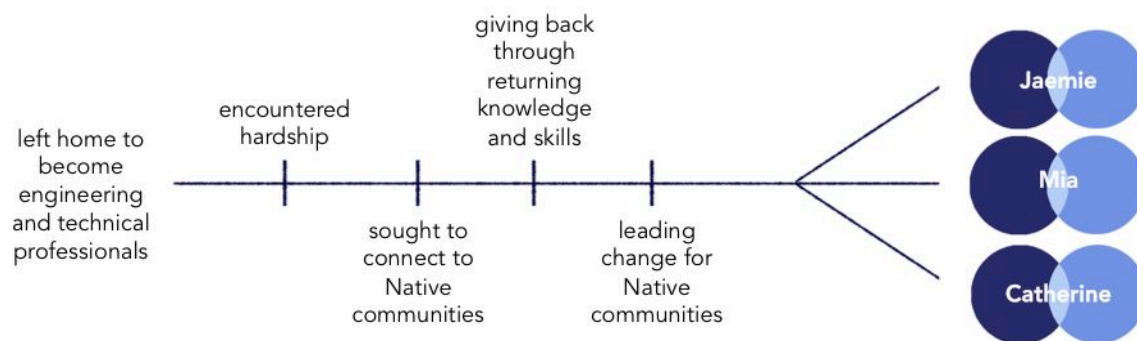
Figure 17. A pathway to leading the creation of hybrid spaces

Further exploration of what we might learn from the narratives of Jaemie, Mia, and Catherine will be discussed according to understandings that were revealed through the inquiry. Discussion of the storied experiences, specifically across education, career, and leadership acts, provides an opportunity to create a dialogue for change. Therefore, as this section delves further into the interpretive process, it brings out the possibilities of what the narratives could contribute to the scholarship.

Understandings of education in engineering and technology. Examining the educational pathways of Native women in engineering and technology provides opportunities to consider their educational experiences and possible opportunities to promote access and success in the educational environment. Much scholarship has been dedicated to characterizing students' educational pathways within engineering education, but the pathways of Native women according to their own voices is missing. For example, the Academic Pathways Study (a long-term engineering education research initiative committed to advancing the scholarship of engineering learning and teaching) has been dedicated to characterizing engineering students' pathways to better understand the decisions involved with becoming an engineer (e.g., what knowledge and skills are needed to become an engineer and how it changes over an educational pathway, how students make decisions to become engineers and how this changes over the course of their education, and how students develop an engineering identity) (Sheppard et al., 2010). The Academic Pathways Study was expansive and focused on sampling students across ethnicity and gender, with a diversity goal to include 50 percent women and 25 percent of underrepresented minorities (African Americans, Latinos, and Native Americans). However, the diversity goal was met with no participation from Native Americans or Native American women (Sheppard et al., 2008), likely because there are few Native women in engineering. Due to the limited participation of Native women in engineering majors, it is beneficial to explore fields connected to engineering, such as technical majors, to better understand educational pathways. Jaemie, Mia, and Catherine's lived and told stories revealed their experiences with technical education (and for Jaemie, additional education in engineering) to enable their careers in engineering and

technology. Their storied experiences surrounding education revealed moments of influence that affected the direction of their educational pathways and overall direction in life, such as what types of programs/schools they attended, the higher education degrees they pursued, and their entry and exit into higher education.

Jaemie's storied experiences of her educational pathway included the following moments of influence: (1) completed a computer course in the sixth grade that sparked her interest in computers, (2) enjoyed math and science courses due to an interest in problem solving, (3) pursued and completed an associate's degree in computer information systems at an off-reservation community college, and (4) returned to school to a technical institute to complete a bachelor's degree in electronics engineering. Mia's storied experiences of her educational pathway began when she was in high school when she heard a pitch from a technical institute that a career with computers could bring in a steady income; from there, her pathway spanned across the following stages and moments of influence: (1) she pursued and completed an associate's degree in computer networking and information technology at an off-reservation technical institute, (2) she examined the possibility of advancing her technical education (through a bachelor's degree in engineering or technology and/or certification), but her associate's credits would not transfer, (3) she took the Cisco Certified Network Associate (CCNA) but failed, and (4) she returned to school to obtain a associate's degree in broadcasting from the film and theatre department of an off-reservation community college to learn about broadcasting technologies and methods. Catherine's storied experiences of her educational pathway began when she graduated from Tuba City High School in 1979 and moved off the reservation with her husband for education and opportunity. Catherine

raised her children until her youngest of three was three years old, and when she was in her thirties, she returned to school at a community college to pursue an education with computers. She completed her associate's degree in the arts (taking math courses up to trigonometry and computing courses), and then entered into a bachelor's degree program for computer information systems in the business school of a state university, where she took Calculus and remembers succeeding. She graduated with her bachelor's degree in 1998.

As Jaemie, Mia, and Catherine pursued higher education in engineering and technology, they navigated the mainstream educational environments of off-reservation schools. To emphasize the narrative view of experience, Jaemie, Mia, and Catherine's understandings of their educations will be organized according to narrative themes.

"Go get an education, become successful, and then come back." Jaemie, Mia, and Catherine all pursued higher education in technology; Jaemie also pursued higher education in engineering. These pursuits led them off the reservation. Jaemie, Mia, and Catherine saw value in leaving home, although they encountered obstacles and difficulties with this transition. They all expressed that it was necessary to leave in order to gain an education in the engineering and technology field; Jaemie and Mia were ready to explore and discover the world outside of the reservation; and Jaemie, Mia, and Catherine knew that their survival and success in the world would be dependent upon leaving for an education.

Although it was difficult to leave their reservations, their family and community supported them. Jaemie's elders guided her to make the decision to leave home to get an education, Mia's community funded her educational pursuits off the reservation, and

Catherine's family gave her a blessing to leave. Without this support, Jaemie, Mia, and Catherine said that they might have never left. The bond to the family and community was critical to decisions they made for their life's pathways, and without the support of family and community their lives may have been different. As Jaemie, Mia, and Catherine received support to leave, their families and broader community stipulated that they must return to help the community with the knowledge and skills they learn. The expectation that Jaemie, Mia, and Catherine return the knowledge to their communities was a critical aspect to their identities of what it meant to be a Native woman, and more broadly the Native ethos that guided them.

For engineering education to be more inclusive of Native women, considerations must be given to how Native youth are raised within a cultural system that values giving back and returning to the community (physically returning or through contributing knowledge and skills). Questions remain of how we, as an engineering education community, can better support Native communities in expressing the value of an education in STEM, specifically engineering, so that Native youth are encouraged to pursue higher education in STEM. Additionally, questions remain of how Native youth are educated within higher engineering education programs, including the values for community and its relatedness to engineering within pedagogy. These questions must be addressed in order to reform engineering education so that it reflects and supports the cultural expectations of Native communities to return knowledge and skills to their communities. Establishing trust with Native communities will be a key aspect of the engineering education community's ability to appropriately reform engineering education and recruit and retain Native American women in educational programs. Trust must be

grounded in considerations with community about how to develop and implement pedagogy of engineering that supports the community and its cultural values. Lastly, questions remain of the impact of tribal colleges and universities on Native communities, especially as many Native communities are beginning to form technical schools (e.g., Navajo Technical University on the Navajo Nation). As tribal colleges and universities represent acts of self-determination, what opportunities might exist for engineering education programs to partner with or learn from these schools?

"I would tell Native youth to just go for the engineering degree. They can do it." Jaemie and Mia both attended community college and technical school in pursuit of a higher education to enable a career with computers (in Jaemie's case) and technology (in Mia's case). Jaemie completed her associate's degree at a community college and then used her associate's credits to complete her bachelor's degree at a technical institute. Mia completed her associate's degree at a technical institute, and then later enrolled in a community college for another associate's degree. The appeal of two-year degree programs, for both Jaemie and Mia, was the opportunity to attend a school that was affordable and had a reasonable class size (that was "less intimidating," according to Mia). For Jaemie, she was bounded by work and family obligations, and so she also sought an educational environment that could accommodate for work and family. Jaemie had given birth to her first son while completing her associate's degree, and then worked and raised her son while attending technical school to complete her bachelor's degree. For Jaemie and Mia, the appeal of technical school was the opportunity for specialized training and the opportunity to move into the workforce with a steady income immediately following graduation, as advertised by the technical institutes.

However, both Jaemie and Mia encountered obstacles with this pathway. Jaemie encountered obstacles with achieving a higher position within her technical corporation; and Mia encountered an obstacle with transferring her associate's credits to complete her bachelor's degree, which would enable her to progress in her technical career and resulted in de-railing her pursuit of a bachelor's degree in a technical field. Reflecting on the stories told within the duration of this inquiry, Jaemie said that she was fortunate to have been given the opportunities to prove herself for an engineering role, but getting to that point took sixteen years of hard work and required the determination to succeed and do her job well. Although Jaemie had advanced to an engineering role, her pathway to this point was not typical or easy. Jaemie expressed her concern for Native youth who enter a two-year program, and specifically technical schools. Native youth who enter two-year programs may not transfer to a four-year program to finish their bachelor's degrees, yet they need a bachelor's degree to advance their careers in STEM. In specific regards to technical school, Jaemie aims to encourage Native youth to consider pursuing a four-year STEM degree because, in the long run, they will have more opportunity and flexibility in their STEM career. Mia also reflected on her journey, and expressed to me that she is surprised that she is "back at it" in school. Mia expressed dismay with the limited education *about* education on the reservation. In Mia's storied experiences, she used her education funds from the Gila River Indian Community on an education at a technical school that was not accredited. As she sought to advance in her career and pursue a bachelor's degree to do so, she was told she had no transferable credits. She also had no additional opportunities for funding to begin her degree program from the start. Mia was unaware of the differences between accredited and non-accredited schools and

suspects that many Native youth are like her, in that they may not be not properly informed as to how to navigate the selection of schools (e.g., checking for the accreditation of an institution). In Jaemie and Mia's lived and told stories, they persisted through a two-year degree pathway and technical school. However, their concern remains that technical pathways through two-year programs might be limiting for Native youth (in terms of career advancement in STEM) and might present unnecessary hardship.

Jaemie and Mia's focus on situating their experiences in terms of how they might help Native youth reveals something about their Native cultural values. By focusing on the youth and structuring their storied experiences in terms of lessons to give the youth, they are returning knowledge to their Native community and fulfilling their cultural roles as those who have a responsibility to pass lessons down to the youth. The transfer of lessons from those who have had life experiences to the youth is a core aspect of sustaining Native communities and ways of life.

Examining Jaemie and Mia's experiences in terms of what we might learn as an engineering education community requires an examination of the participation within two-year and four-year degree programs. According to a report to the National Research Council (Salzman & Van Noy, 2014), the pursuit of a science or engineering career (**S**TEM) requires a four-year academic pathway, while the pursuit of a career in technology (S**T**EM) is "nearly all entered through two-year or less educational routes" (p. 3). According to another report to the National Research Council (Van Noy and Zeidenberg, 2014), twenty-five percent of community college students in STEM majors transfer to a four-year program (like Jaemie) and ten percent attain their bachelor's degrees at the community college within six years. However, over two-thirds of

community college students report that they would like to obtain a bachelor's degree –

representing twice the number of students who actually complete their bachelor's degree.

This latter case, those who express a desire to complete a bachelor's degree, represents an

experience Mia had. Appeals of the two-year degree programs have been documented as:

a faster workforce entry route (after two years rather than four), a more workforce-

oriented education, fewer financial barriers, and fewer logistical constraints (for example,

needing to attend school part-time or at night) (Salzman & Van Noy, 2014, p. 4). These

appeals are evident in Jaemie and Mia's storied experiences. The contributions of

community colleges and technical schools are influential and represents realized

opportunities to educate the STEM workforce. Furthermore, community colleges have

more diverse student bodies, with thirty-two percent reporting to be African American,

Hispanic, or Native American (however, women are clustered in cosmetology, nursing,

and education) (Salzman & Van Noy, 2014). Questions remain as to how two-year

programs can uphold its strengths while addressing the concerns that Jaemie and Mia

have posed. Additionally, four-year programs must consider opportunities to strengthen

their abilities to support students like Jaemie and Mia. Expounding upon the discussion of

tribal colleges and universities, these schools serve 8.7 percent of all Native American

and Alaska Native post-secondary students (30,000 full-time and part-time students)

(Shotton, Lowe, & Waterman, 2013). What opportunities might exist for engineering

education to support students in their entry to engineering from other STEM areas (e.g.,

technology), and how might we borrow from the supports that technical pathways

provide?

"My interest started early." Jaemie, Mia, and Catherine told stories of the times in which they decided to pursue a technical career. For Jaemie, it was in the sixth grade in a computer course; for Mia, it was in high school when a local technical institute told the students of the salary potential for working with computers; and for Catherine, it was in high school when she took a typing course and participated in a college preparation program (Upward Bound). Jaemie's elementary school experience gave her the opportunity to recognize her interest in problem solving and allowed her to build from this interest, which included staying engaged in math and science through high school, completing a technical degree, and pursuing a career in engineering and technology. Mia's high school experience gave her hope to overcome hardship, but her educational pathway was riddled with obstacles – from wanting to drop out of her technical degree program, to not being able to pursue a bachelor's, and then failing a technical certification. Catherine's high school experience gave her the opportunity to recognize her interest with computers and her experience with the college preparation program gave her the opportunity to value higher education.

The reasons for an individual's life experiences are complexly loaded with personal and environmental factors, but the differences in Jaemie, Mia, and Catherine's experiences raise questions of how interest in STEM without the grounding in content knowledge and skills may lead to difficulties in completing higher education in STEM. A report by the U.S. Department of Education (Chen & Soldner, 2013) found that those who come from low-income backgrounds, had lower academic preparation (specifically, a GPA lower than 2.5 and had not taken math courses at or above algebra II or trigonometry), and had parents that did not have a bachelor's degree were at risk for not

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completing their higher education pursuits in STEM. On the other hand, those that engaged with STEM content from a young age and found interest in these areas were more likely to be motivated to persist through higher education in STEM (Wang & Degol, 2013).

   The storied experiences within the narratives reveal the influence that childhood education programs can have on students' interest in STEM. Early childhood STEM programs, and particularly engineering education programs which are not yet widespread in K-12, have the possibility to transform Native youth experiences in STEM. Native youth, particularly those who live on the reservation, are more likely to come from low-income families, have parents who do not have bachelor's degrees, and have lower levels of math and science achievement as compared to their White peers (Executive Office of the President, 2014). Engineering education has an opportunity to develop engineering education for Native communities that is grounded in Native cultures, traditions, and values. One such program in development is the NSF-funded project, Engineering Design Across Navajo Culture, Community, and Society (Jordan, 2015). The research initiative is implementing engineering curriculum – grounded in Navajo culture – within Navajo Nation middle schools. STEM programs are needed for Native communities that engage Native youth in STEM content while honoring Native cultures.

   As Mia has since returned to school to pursue another associate's degree, she has found it motivating that her work is relevant and meaningful – both to herself and her community. "I am using this every day. I need to this to do my job. People come up to me in the community and say, 'Wow. You are doing it." Her grandmother praises her for being the first grandchild to go after the goal of a bachelor's degree. Mia is proud that her

community is proud of her. So too are Jaemie and Catherine – they are proud that they are good examples within their community.

  Understandings of careers in engineering and technology. Like the exploration of educational pathways, examining professional pathways provides opportunities to consider lived realities in the engineering and technology workplace. Jaemie, Mia, and Catherine's storied experiences of their careers revealed struggles and successes of their pursuits within the engineering and technology field, such as the factors that enabled them to advance professionally and the factors that presented obstacles. Considerations of Jaemie, Mia, and Catherine's professional pathways and, more importantly, the experiences within the pathways can inform how the engineering and technology field might better support underrepresented groups in the workplace.

  Jaemie, Mia, and Catherine's careers illuminate experiences within three different contexts for engineering and technology work: a large technical corporation, a tribally-owned technical business, and as a business owner. Mia and Catherine's paths crossed between the latter two (work within a tribally-owned technical business and as a business owner). Within the context of a technical corporation, Jaemie's pathway began when she was hired as a technical representative, then progressed when she moved to a different technical corporation for a manufacturing technician position, and concluded with an advancement to a specialist in the development department (a component of research and development). Within the tribally-owned business context, Mia was recommended for part-time hire from Gila River Indian Community's job placement agency, was then hired full-time as a technician, and concluded with being promoted to manage the formation of a new venture for the tribally-owned technical business. Catherine worked with the same

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tribally-owned business as a technical consultant, but within the context as a small business owner. Mia also owned her own technical business, but was focused primarily on her work as an employee for tribally-owned business once hired there. The variation in their professional paths speaks to the range across engineering and technology careers in the contemporary world and the multi- and trans-disciplinary characteristics of work within any STEM field (National Science Board, 2015). Their professional paths offer an opportunity to explore a broader variation in pathways within engineering and technology, rather than the prototypical engineering pathway from four-year-degree to engineering position within a corporation. Like in the discussion of understandings of education, Jaemie, Mia, and Catherine's understandings of their careers will be discussed narratively.

"The Native American support network gave me the opportunities to learn the skills I needed to advance professionally." Jaemie joined the Native American support network to connect with fellow Native Americans and belong to a group that upheld the Native values and traditions that were familiar and a part of her. Looking back on her involvement with the corporate support network, Jaemie credits the group as a primary catalyst for her professional pathway that was to come. The network offered the security of a family-like bond in the technical workplace and directed her towards goals that were core to her values as a Native. These values included engaging and supporting all members of the Native community, from professionals in the workplace to the youth, across areas of self-development to technical knowledge and skills. The corporate Native support network aided Jaemie with issues of her own (e.g., how to approach a team development problem) and allowed her to aid other Native Americans with their

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obstacles. The infrastructure of the support network (including the role of corporate

sponsors and the flexibility for members to self-direct themselves) enabled this support to

come about. Furthermore, the successes of the support network, which emphasized a

back-and-forth nature of support (e.g., Jaemie receiving support and giving it to others),

were grounded in her Native values. When reflecting on this narrative journey and

constructing meaning from it, she told me later that the value of giving and receiving

support is embedded within the circular values of the Native ethos. As Jaemie became

more involved in the support network (which will comprise a critical part of the

discussion on Jaemie's understandings of leadership), she acquired a range of

professional skills, from learning to speak up, to being self-directed and adaptable, and to

defining her future goals and seeking opportunities to realize them.

Jaemie navigated a pathway that was atypical of technicians in her workplace,

advancing from a technical representative to an engineering role as a development

specialist. Her involvement with the Native American support network fueled this

pathway, enabling her in the face of obstacle. Jaemie's storied experiences bring about

questions of the influence of support networks on the retention of underrepresented

groups (particularly Native Americans) within STEM, characteristics that make these

support networks effective, and the relationship between technical and engineering

pathways (e.g., considering opportunities to enter an engineering position from the

technical pathway). The Department of Commerce's Economics and Statistics

Administration (2012) reports that individuals of underrepresented groups in STEM who

have recently graduated with a STEM degree are less likely to use their STEM degree

than their White or Asian peer, yet report the same desire to use their STEM degree when

entering their STEM degree. This symptom of the diversity issue in STEM might be addressed by examining more closely the role of the support network within technical corporations as well as the supports given to underrepresented groups for advancement within the corporation – for example, for those that enter with a technical background but seek to work in an engineering role. *Winds of Change*, a publication of the American Indian Science and Engineering Society, ranks the top 50 STEM workplaces for Native Americans each year through a collection of surveys. Their criteria for ranking includes representation and retention of Natives in the workplace as well as the company's specific programs that are in place to support Native employees, how additional Natives are recruited, and the number of management positions filled by Natives. As this survey provides a landscape view of the factors of importance to a broader Native STEM community, it calls for considerations of what the metrics look like within lived reality (i.e., the form they have taken at the various corporations) and the experiences of Natives within the corporations. By seeking deep experience, we might better consider how to reform engineering and technology workplaces such that it is more inclusive of Natives in the STEM workplace.

   "So I started my own business…" The Entrepreneurial Research Consortium stated, "Entrepreneurship is one of America's most important mechanisms for adapting to economic change," and a report on Native American entrepreneurship by Adamson and King (2002) wrote, "The most visible indicator of entrepreneurial activity is the creation and development of small business enterprises" (p. 10). Native communities have survived amidst hardship due to their resilience and ingenuity to design new futures and this is, in part, recognizable through Native citizen entrepreneurship and small business

ownership. Businesses owned by Natives offer a wide range of services and products to

Native and non-Native communities, from arts and crafts, restaurants, gas stations,

construction, repair and maintenance, financial services, and personal services (e.g.,

laundry) (Hirschfelder & Molin, 2012). Furthermore, businesses owned by Natives

contribute significantly to Native economies and the broader U.S. economy. In 2007, they

comprised 0.9 percent of all U.S. non-farm firms and brought in 34.4 billion dollars in

receipts (Hirschfelder & Molin, 2012). Native women contribute significantly to these

numbers, owning 47 percent of all Native American-owned businesses in 2014

(American Express OPEN, 2015). The majority of Native-owned businesses have no paid

employees, like those of Mia and Catherine's businesses. The grounding of

entrepreneurship in its intent to design new futures and overcome obstacles has had a

long history among Native communities and represents a source of opportunity to

actualize prosperity through movements of self-determination and Native nation building.

STEM businesses represent a contemporary opportunity and challenge for Native

communities. On one hand, STEM businesses provide the opportunity to leverage the

technologies needed for all areas of development within Native communities –

educational, health care, and economic. However, challenges concerning the "digital

divide" within Native communities pose additional obstacles for STEM businesses

beyond the difficulties with gaining access to capital and growing the business. The

National Congress of American Indians (2013) wrote this of the digital divide in their

report, *Securing Our Futures*:

> The Digital Divide on tribal lands has been constantly referenced over the past
> decade. Initially this disparity reflected the lack of telephone service and the
> challenges associated with connecting tribal lands. Over the years this issue has

transitioned to include the lack of Internet access in its many forms including wireless, satellite, fiber optics, cable, digital service line (DSL), and even dial-up. However, successful use of these technologies cannot be fully realized until tribes make substantial commitments to digital literacy trainings and human capital investments dedicated to STEM (Science, Technology, Engineering, and Mathematics) education. (p. 16)

Mia and Catherine's experiences reveal something particular about entrepreneurship and small business ownership within the "digital divide" of Native communities. The appeal to starting their businesses was multi-layered. They both were seeking new direction in their professions: Mia was in need of income and had experienced hardship with her career and education; Catherine, too, was in need of income as her employee position had dissolved. They also both sought to address some of the technology disparities on the Native communities: Mia sought to give other Native business owners an "online identity" with their own website and then sought to build an online Native network whereby Natives could find one other, including one another's businesses; and Catherine sought to bring technology to the Native communities in a way that was culturally compatible. The appeal to start a technical business represented a balance between upholding cultural values and change to close the digital divide within Native communities.

Mia and Catherine both struggled with starting and growing their small businesses, which led to different outcomes. Mia struggled with obtaining capital for her business while also coping with the struggles of living far away from home. When Mia moved back to the Gila River Indian Community, she began to physically reconnect with her community (of which her business symbolized), which included becoming involved with an entrepreneurship organization for the community. Mia's involvement with her

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community propelled her to her current position within a tribally-owned technical

business. For Catherine, on the other hand, business ownership was a path that she was

committed to and not willing to sacrifice, no matter the struggle. Despite her struggles,

she has maintained her course as a small businesses owner and openly calls herself a

"starving entrepreneur." Her struggles have included her own lack of "subject matter

expertise" of the fast-paced technological field, communicating the expense of

technology to Native communities (who often do not have STEM professionals in the

decision-making roles), the lack of Natives who are trained in STEM and do not already

have steady jobs working for large companies and the difficulties with keeping up with

the work as a "one-woman show" (including all the travel across the expansive

reservations to pitch contracts). However, like Mia, Catherine has found support by

Native communities (of her own tribe and others). She was sponsored to attend the SBA

e200 Emerging Leaders initiative, which opened the door for her first small business

contract with a tribally-owned technical business. Her involvement with a Native

American economic summit has also led to contracts. The lack of technical infrastructure

within the Native communities has presented serious obstacle, however, in the same

community Mia and Catherine have found support.

   As Mia and Catherine worked to address the technological needs of their Native

communities, their experiences, including the challenges that they faced, pose questions

for how to cultivate Native STEM entrepreneurship. How might we spark and sustain

social entrepreneurial interest among Native women within the engineering and

technology field? How might we support social entrepreneurship among Native women

through an engineering and technology education? How might we support Native women

in realizing the social entrepreneurial opportunity with turning their ideas, technologies,

services, and innovations into reality? Heather Fleming, a Navajo woman and product

design graduate from Stanford, co-founded Catapult Design, a business to aid Native

entrepreneurs with engineering and design support. Through a series of workshops, called

Change Labs, Catapult Design offers services to Native entrepreneurs to explore how to

overcome entrepreneurial barriers on the reservation, how to address challenges "in

similar environments around the globe," and "connect promising entrepreneurs with

mentors and resources they need to succeed" (Catapult Labs, 2015).

"My community is proud of me" – working within a tribally-owned business.

Native enterprises, including tribally-owned technical businesses, represent the progress

of self-determination and Nation-building movements led by Natives and their

communities. The report by the National Congress of American Indians (2013), *Securing*

Our Futures, wrote this of the role of Native enterprise in actualizing self-determination:

> Tribal nations striving for self-determination seek increased economic
> development, improved financial capacity, better workforce development, more
> job creation, and the beneficial use of tribal land and natural resources. Facing
> chronic underfunding of federal government programs that serve basic tribal
> needs, tribes are turning to their own productive activities to fund programs and
> services for their citizens.
>
> Today tribes and tribal entrepreneurs are jump-starting economies on their lands,
> creating jobs, and create opportunities for their communities and their families.
> With federal spending and deficit reduction efforts underway, tribes and tribal
> citizens have taken the responsibility for developing their economies with tribal
> enterprises and individual businesses, providing jobs for their people and business
> management education programs for their youth. (p. 18)

This passage demonstrates the importance of Native enterprises in their role to

enable Native nations in taking control of their communities within the larger U.S.

political economy and guide it towards prosperity by building their local community's

innovation capacity. Most tribes within the U.S. have wholly-owned tribal entities that span from social services, health services, economic development, law, gaming, and so on (Thompson, 2015). However, tribally-owned engineering and technology organizations are less common. For example, as of 2015, there were ten tribally-owned and operated telecommunications companies in the U.S. (Pata, 2015), one of which was owned by Gila River Indian Community. Nonetheless, the formation of these entities represents the innovative abilities of Native nations to adapt within the global space and structure their own pillars of a political economy (history, economic, law, political science, and sociology) around their own Native needs and visions (Fixico, 2015).

Exploring the structure and operations of Native enterprises and how they differ from non-Native enterprises (such as non-Native technical corporations) is useful in understanding the unique challenges that Native enterprises face as well as the advantages they have. Native enterprises are unique because it is a business unit owned by "every single tribal member by the virtue of the fact that they are a citizen of the tribe" (according to an interview with Kenneth Grant, a research scholar with the Harvard project on American Indian Economic Development) (Native Nations Institute, 2006). The objectives of Native enterprises, therefore, are to "earn financial returns and other social objectives that accrue to the entire community, so that all the citizens are owners and share in the benefits" (Native Nations Institute, 2006). This allows for advantages that align with the moral economy and communal philosophy that Native societies were founded upon (Fixico, 2013), such as shared norms, common interest in a positive tribal reputation through the Native enterprise, and aligned expectations to do good for all in the community (Storper, 2005). There are also significant challenges that face Native

enterprises that stem from operating within a larger political economic infrastructure (that

opposes the moral economy that Native societies originated from) (Fixico, 2013) as well

as from the hardships that plague Native nations due to the aftermath of colonization and

subsequent policies forced upon Native communities. Lance Morgan, citizen of the

Winnebago Tribe of Nebraska and the CEO of an award-winning Winnebago enterprise,

spoke to the unique struggles that face Native enterprises (Native Nations Institute,

2006). In this discussion, he said:

> You have to think about the situation that we have to function within. We have a
> political system we didn't design. We have a system that doesn't allow capital
> flow to reservations very easily. You have a poor educational system that doesn't
> necessarily deal with business development. We don't have a history of
> entrepreneurial and business success. All of these things combined to create one
> of the toughest business environments in the United States.

As the conversation progressed in the Native Nation Building series (Native Nations

Institute, 2006), Grant and Morgan spoke of the tensions that can arise due to the roles of

tribal citizens as also being part business owners and, for those who are elected,

governing council members – thereby creating a situation that requires agreement and

balance across all individuals who hold multiple roles and investment in the community.

Grant and Morgan also spoke of the government-led economic model (advocated by U.S.

government to the Native nations), in regards that Native governments are the primary

source for larger capital potential; this model reinforces the business entity as a political

entity. While politics and business cannot be separated (whether on or off the

reservations), Native nations must examine methods for managing it in a way that is

grounded in cultural integrity. According to Grant (Native Nations Institute, 2006),

institutional problems have led Native enterprises to fail, rather than operational

problems. Within the institutional problems, Native enterprises must resolve socio-

political tensions rather than looking to add content to an operations manual for the

business (Native Nations Institute, 2006).

As Native nations move forward with developing Native enterprises, they are

seeking for ways to balance the sociopolitical-cultural structures of their societies and

culturally appropriate models for business. A report by the Harvard Project on American

Indian Economic Development, entitled *Determinants of Development Success in the*

Native Nations of the United States (Taylor, 2008), found that:

> Native nations in the United States prepare a fertile environment for development
> by taking charge and by channeling internal political forces over the long term.
> Indeed, one of the paradoxical findings of the research by the Harvard Project on
> American Indian Economic Development and the Native Nations Institute is that
> Native leaders make their nations more powerful by binding their own hands
> themselves. (p. 2)

In other words, successful Native enterprises maintain "self-rule" (Native enterprises

owned and operated by Natives) and root all activity in Native culture, while managing

the institutions of self-government (Taylor, 2008). Elaborating on the latter, "successful

Native nations insulate dispute resolution from political interference," "isolate business

managers from political forces yet keep managers accountable to the community for

performance," and "recruit and train talented citizens for these jobs, but they protect their

government employees from politically motivated firings" (Taylor, 2008, p. 3-4). The

Harvard Project and the Native Nations Institute outlined goals for "understanding the

determinants of social and economic development" within Native nations and sharing

them amongst Native nations (Taylor, 2008, p. 6). Two of the goals are addressed by the

narratives of Mia and Catherine: "(1) Conducting and circulating research about the

conditions under which Native nations initiate and sustain social and economic development" and "(5) Sharing models of excellence in Native self-government across nations and countries" (Taylor, 2008, p. 6-7).

The narratives of Mia and Catherine, embedded within the context of a tribally-owned technical business, illuminate the successes and challenges of working within a Native enterprise that is focused on the digital divide within a Native nation. In particular, the narratives revealed: (1) the need for a Native technical workforce and the need for Native enterprises to fulfill that need by taking responsibility in growing the local technical expertise, (2) the need to be adaptable to the individual's needs in order to retain Native workforce, (3) the need for strong, trusting relations with the community and with other inter-tribal enterprises to sustain life of the business, and (4) the success in designing new ventures that are focused on the community's future technological needs. Regarding the first point, Mia and Catherine represented technical workforce potential for the enterprise and community, fulfilling a goal of the business and community to utilize and train Native resources. The business had survived tumultuous years stemming from a non-Native manager and workforce. The hiring of a Native manager and Natives for technical positions had strengthened the relationship with the community, although this took much time. Mia and Catherine lacked technical expertise, but their desire to learn and to stay rooted in Native community was more valuable to the survival and growth of the business. As such, the business was willing to provide Mia and Catherine with opportunities and time to learn skills and knowledge on the job. As the business took responsibility for growing the technical expertise on the community, they showcased this by placing Mia and Catherine in community facing job roles (meaning, their jobs took

them out onto the reservation). In these roles, Mia and Catherine were living success stories of a business's ability to strengthen the community's technical workforce (Mia more so because she was a community member). Community members were able to see Mia and Catherine and confirm that the business was fulfilling their duties to the community by hiring and training Natives. Furthermore, Mia and Catherine strengthened the performance of the business, as they were able to relate to the community members – both because of their Native identities and because they understood the technical competency of most community members. The business, however, struggled to fill all positions with Natives because some positions required more specific technical expertise (e.g., electrical engineering). There were few Natives with this expertise, and those that did had higher-paying corporate jobs. These struggles sometimes led to internal tensions. Regarding the second point, the business's ability to be responsive to the Mia and Catherine's needs led to its ability to retain them, and, as such, a Native workforce. The business supported Mia in the advancement of her career, rewarding her for her dedication to learning and her commitment to the business. Catherine was supported as an entrepreneur, and hired under her terms as a consultant. As for the third point – the need for strong, trusting relations with the community and with other inter-tribal enterprises to sustain life of the business, Mia and Catherine's narratives showed the importance of cooperation and support of inter-tribal enterprises and across Native communities. On the business front, a major source of revenue came from inter-tribal business within the Gila River Indian Community, and so cooperating with the community and its enterprises was key to the business goals. The tribally-owned technical business had an even broader view of support that extended to supporting their

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employees in participating in Native activities, initiatives, organizations, and even other enterprises. For Mia, this meant that they appreciated and supported her time invested with the Gila River business association and cultural festival; and for Catherine, this meant they valued her involvement in the Native American economic summit and her work as a small business owner with other Native businesses. To strengthen the relationship further with the community, the tribally-owned technical business had sponsored their employees (Native and non-Native) to attend a Gila River cultural training course. This course taught professionals (mainly healthcare professionals) about the history of Gila River Indian Community and core cultural values. This type of support was documented by Jorgensen (2007) in *Rebuilding Native Nations: Strategies for Governance and Development*: "Effective Native nations also invest in building the community's knowledge of its own history, culture, and status as a nation" (p. 318). This investment spans across language revitalization, taking courses in the Native nation's civic history, and "finding innovative ways to get the elders and spiritual leaders more involved" (Jorgensen, 2007, p. 318). Lastly, in regards to the fifth point – the success in designing new ventures that are focused on the community's future technological needs, the tribally-owned technical business had committed to community-based innovation and had promoted a community members, Mia, to lead the new venture. The business and broader community supported Mia and her bosses in traveling throughout the community, to Native and technology-focused conferences, and to other Native nations to learn from and speak about the venture. By doing so, they were designing new ventures by strengthening the trusting relations with the community and other Native communities as

well as by allowing for opportunities to connect with other Native individuals and enterprises (with technical expertise and otherwise).

Any one of these discussion points can be explored further to examine how we might better support Natives in STEM through Native enterprise and within Native communities. Mia and Catherine were given chances to succeed in the technical environment, and the support fueled their professional growth. The obstacles in their lives – whether it was a lack of education, technical expertise, or personal or professional struggles – did not discourage those who ran the business from supporting them. Rather, they understood their struggles and propelled them forward. Looking to the future, there is a need for a "7ᵗʰ generation workforce" in STEM for Native nations (National Congress of American Indians, 2013) or, in other words, a long-term workforce that can be developed and sustained over the next seven generations and onward. The engineering education community has opportunity to contribute to supporting the future generations of Natives and Native women to pursue engineering and technology careers across corporate, tribally-owned, and entrepreneurial contexts.

Understandings of leadership. The exploration of Jaemie, Mia, and Catherine's acts of leadership within engineering and technology contexts was a cornerstone of this inquiry. I initially came to this inquiry, in part, due to my intrigue with the prominence of Native women holding leadership roles within Native contexts, such as the American Indian Science and Engineering Society. As such, the discussion of the first research began with overviewing the creation of the hybrid third spaces, as led by Jaemie, Mia, and Catherine. Through the narrative endeavor, I came to understand particularities of Jaemie, Mia, and Catherine's acts of leadership, their goals for leadership, and the factors

that challenged them and supported them. Here, a further discussion of Jaemie, Mia, and Catherine's understandings of leadership will be provided according to narrative themes as well as a discussion of the connection to scholarship.

Acts of leadership. Exploring the form that Jaemie, Mia, and Catherine's acts of leadership took addresses the need to understand the storied experiences of today's Native women who are leading initiatives to improve their Native communities through STEM. Such an exploration also supports the need to understand leadership through considerations of the local space (Native culture, identities, and traditions) and global space (engineering and technology culture and identities). Their leadership was defined by what they could do for the broader Native community, rather than a certain status or position within the engineering and technology space.

Within the narrative, Jaemie's leadership acts were defined by her role as chapter president of her workplace's Native American support network (although, she always saw herself as a leader). She was elected to this role after joining the group as a member. She initially sought to join the group in order to connect with fellow Native STEM professionals (those that she could relate to culturally) and to share in a mission that was important to herself and her Native community (self-development, cultural awareness, retention of Native in the workplace, positive role model, and community outreach). When she was first elected chapter president, there was minor participation among the membership (mostly, due to the difficulty of adding volunteer work on top of work and family obligations). As she encountered this obstacle, she performed the work duties of all positions herself – president, vice president, secretary, and treasurer – and made it a goal to encourage other Native STEM professionals to become involved in the support

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network. As she earned the trust of her fellow Native American STEM professionals (by making her work transparent, not pressuring individuals to take on more work, and helping them advance themselves professionally), she grew the participation of the membership within the network (e.g., attendance to meetings and outreach events). Under Jaemie's guidance, the support network became a group that helped one another persist in the face of challenges at work – for example, with managers or coworkers. Jaemie became a pillar of support for those Native employees who were newly hired and were encountering a "huge shock" from the differences in workplace culture from Native culture. Jaemie's leadership acts also extended to developing an outreach program that would have broader impact on Native communities. The outreach program grew from her dedication to implement the vision, and the support of a mentor who had initiated a partnership with a state STEM foundation (which resulted in a STEM grant for the outreach program). The outreach program has received national-level publicity and is being implemented on the Navajo Nation. She is now managing an outreach team of twelve Native American STEM professionals from Semiconductor, Inc. to implement the program. Her work is volunteer-based and extends beyond her engineering role. The support she receives from her manager, in terms of allowing time to be given to the outreach efforts, is critical to allowing her to dedicate energy to both roles.

Mia's acts of leadership took on multiple forms during different stages of her life. For example, Mia took on the role of entrepreneur to address a technical void within her Native community (e.g., building websites for Native small businesses so that they have an "online identity"). After she was hired to work for the tribally-owned technical business, Gila River Tech, she worked her way up from a part-time technician position to

the manager of the broadcast for the tribal government council meetings, which involved managing the technologies and individuals operating the technologies. By the end of the inquiry, Mia was working with the tribally-owned technical business to develop a new venture: a broadcasting and television department aimed to provide local, culturally-relevant television for community members. She was responsible for all community-facing aspects of this venture, including developing the content based upon community interest, managing the production equipment, and airing the content and selecting additional content to run from other tribal television programs. In addition to this work, Mia also volunteered her time as the secretary for a Gila River business association as well as for a local cultural foundation.

Catherine's acts of leadership took on the form of a Native entrepreneur aimed at building electronic Native communities. Her business is young (three years old), but she is actively seeking to address the digital divide on tribal reservation lands by advancing technical knowledge, skills, and infrastructure on the reservation lands. With this role, she was and continues to be actively engaged with developing Native communities (by seeking to secure contracts and implement technical services) and seeks to participate in opportunities to learn (such as her participation in the SBA e200 Emerging Leaders initiative). She also volunteered much of her time to a Native American economic summit run by the National Center for American Indian Enterprise Development (NCAIED), helping to run the conferences. She was acknowledged for her volunteer work with a 2015 Volunteer of the Year award.

Goals for leadership. Jaemie, Mia, and Catherine shared similar goals and justifications for their acts of leadership. Each of them told me that they sought to: (1)

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improve their Native communities by making change happen ("change" meaning advancing STEM within Native communities for the purpose of benefiting Native communities and individuals), (2) be an inspiration for the Native community, specifically a positive role model for the Native youth, and (3) develop themselves as professionals and contributors to their community. Jaemie, Mia, and Catherine sought out opportunities – whether through paid-for or volunteer-based work – to contribute their professional knowledge and skills to their Native communities in ways that respected their Native communities (such as gaining consensus for those that they worked with within the community). Jaemie, Mia, and Catherine understood first-hand the struggles that Native communities faced (from the need for better education, improved infrastructure, and fueled economy), but also understood the community's strengths in its cultural vitality and value systems. With a deep understanding of both their Native communities and as STEM professionals, Jaemie, Mia, and Catherine were motivated to lead by applying their understandings of STEM within the cultural framework of their Native communities to advance their Native communities. As they took on acts of leadership to do this, they were driven by a desire to advance their community. In this way, the goal in leadership was not solely for personal gain to advance their status or career (although they did seek to improve their lives), but rather their intent to lead was driven by a community-focused mindset. The community-based mindset in turn satisfied an aspect of their self-development, because as they advanced themselves they were able to advance their communities and vice versa.

As Jaemie, Mia, and Catherine committed themselves to acts of leadership, they became inspiration for other Natives. They understood that there is a lack of STEM

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professionals among Natives and viewed this as both unacceptable and changeable. To support Natives in their pathways to STEM and use their life experiences to help others, Jaemie, Mia, and Catherine were transparent with their personal pathway (including the obstacles they faced and the rewards that they have benefitted from), and took on responsibilities to advance STEM education among the Native youth (e.g., Jaemie's outreach program, Mia's efforts to raise scholarships for the cultural festival, and Catherine's efforts to bring on Native interns to train them). Jaemie, Mia, and Catherine shared in community-focused goals, with their efforts manifesting differently depending on the context for work.

      Challenges and supports. In regards to their leadership acts, Jaemie, Mia, and Catherine told stories of those experiences that challenged them. They shared a common challenge of how much there is to overcome and to achieve in order to better life among Native communities, particularly with the youth. They also shared a common challenge of dealing with on-reservation decision-makers who did not have a background in STEM or an understanding of the realities of STEM. This impacted their work in different ways. For Jaemie, it created challenge with working to implement the outreach program; for Mia, it created challenge to overcome the unsteadiness of developing a new venture and communicating to the community the effort and time that it takes to bring a new venture to fruition; and for Catherine, it created challenge with securing contracts and communicating the costs involved with technical work. They hoped that as next generation of Natives come through STEM educational and career pathways, that they can add to the Native STEM community and contribute to the decision making with their Native communities. Although challenge lied within the Native communities, Jaemie,

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Mia, and Catherine found support from those same Native communities. Despite the lack of STEM expertise within the Native communities, the broader communities valued the intent of STEM and their efforts to contribute their STEM understandings.

Connecting to scholarship: Native American and engineering perspectives on leadership. A research article by Warner (Comanche) and Grint (non-Native), entitled "American Indian Ways of Leadership and Knowing" (2006), presented that there was a need to bring Native American leadership approaches to the forefront of leadership scholarship because they had been largely dismissed in mainstream leadership literature as an "inability to lead rather than a different ability to lead" (p. 225); and furthermore, that there are cultural differences in leadership that arise from different conceptions of time and space influenced by traditions and values. Therefore, Warner and Grint (2006) argued that it was valuable to explore manifestations of Native American leadership. Within literature on Native American leadership, themes of Native leadership emerged as: (1) Native leadership is grounded in the ability to persuade (rather than a position held) (Warner & Grint, 2006), (2) Native leadership is grounded in community, rather than the individual's gain (Warner & Grint, 2006), (3) Native leadership is "distributed to the community based on skills and experience" (Warner & Grint, 2006, p. 235), (4) Native leadership relies upon storytelling (communicating), dedicating service to others (working for community and gaining social cohesion), and relationships (e.g., mentoring and listening) (Wise-Erickson, 2003), (5) Native leadership is knowing one's culture and language and being committed to one's community (Goklish, 2005), (5) Native leadership is collective, interdependent, deeply connected to present, and of deep spirituality" (Bond, 2004; Nolen, 1998; Trujillo-Ball, 2003; White, 2007; Kamara, 2009,

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p. 7), and (6) Native leadership is balancing dominant and traditional worlds and overcoming assimilationist perspectives (Gambrell, 2015) Through these themes, Native leadership is "itself composed of a myriad of different elements in time and space" (Warner & Grint, 2006, p. 226). A common thread of Native leadership is that it is grounded in elements of traditional Native leadership that have provided the groundwork for cultural perseverance.

On the other hand, engineering leadership, advocated by the National Academy of Engineering (2004; 2005), has called for technical coursework of engineering students to be supplanted with leadership training in order to prepare engineering students to be able to tackle the social and technical problems that face us today. Barriers to overcome have been cited as thinking of the engineering discipline as both technical and humanistic, challenging hierarchical notions of leadership, and more deeply connecting leadership to what it means to be an engineer (engineering identity) (Rottman, Sacks, & Reeve, 2015). In a review of professional experiences of engineers by Rottman, Sacks, and Reeve (2015), it was found that conceptions of leadership and engineering identities contradicted one another in key ways (e.g., view of engineer as a technical problem solver versus leadership as solving people problems, an engineer as a task-oriented doer versus leadership as a delegator, and an engineer as an applied scientist versus a leaders as a charismatic visionary). Despite the contradictions, it was found that engineers lead through three engineering orientations: technical mastery (involves being technically expert and mentoring others), collaborative optimization (involved being focused on process optimization and facilitating team work), and organizational innovation (involves seeing opportunity for entrepreneurial or intrapreneurial ideas and fostering innovation)

(Rottman et al., 2015). This study represents one such study of the intersection between engineering and leadership.

Jaemie, Mia, and Catherine's stories involve Native American women engineering and technical professionals in the research process (Smith, 2012), and by this we, as an engineering education community, are able to learn something unique about what it means to be a Native women leader in engineering and technology. Questions remain of how we can support Native women in upholding cultural models of leadership within engineering and technology environments. Furthermore, more work needs to be done to explore leadership among Native women in engineering and technology. Jaemie, Mia, and Catherine represent three such stories, but there are many more Native women leaders in engineering and technology to learn from.

Summary of RQ1. The interpretive analysis of *what* the lived and told stories could tell us about the experiences of three Native women in engineering and technology revealed a process of transformation as well as particular understandings of education, career, and leadership acts in engineering and technology. The process of transformation embodied a move from cultural navigation of the local and global spaces to active connection of dimensions within those local and global spaces. The results were new, hybrid third spaces representing "innovative sites of collaboration and contestation" (Bhabha, 2012, p. 2), whereby change occurred to strengthen the local space (Native communities) and the global space (engineering and technology) (see Figure 18). The resultant hybrid spaces represented opportunity that was realized by Jaemie, Mia, and Catherine and their leadership acts, and with the new hybrid spaces Jaemie, Mia, and Catherine then had a platform for leadership and a direction to make change happen.
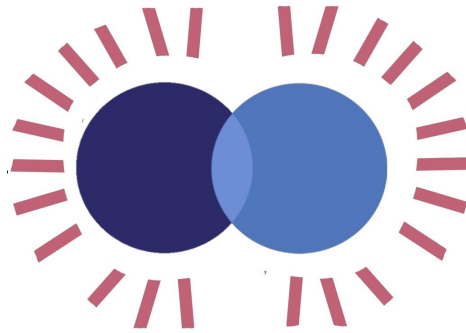
Figure 18. Hybrid spaces offer opportunity to strengthen local and global spaces

Across individualities and differences in contexts, Jaemie, Mia, and Catherine shared similar goals for constructing spaces that could benefit Native communities through engineering and technology. Themes of return and homing were evident in the narratives and propelled Jaemie, Mia, and Catherine's leadership acts to create the hybrid spaces − specifically, returning knowledge, skills, and experiences with engineering and technology (and more broadly, life experiences) to their Native communities and seeking opportunities to connect to, engage with, and be a part of "home" (their Native communities and peoples). These themes are embedded in the rich socio-cultural-historical framework of Native life, including a Native ethos, communal philosophy, cultural values, Native logic, and Native realities (Fixico, 2015). As Jaemie, Mia, and Catherine imagined the future, they envisioned Native communities that are strengthened by engineering and technology and their individual contributions.

(RQ2) Understandings of Identities and Their Influence

The storied experiences of the actions taken by Jaemie, Mia, and Catherine within the local and global spaces and in creating the hybrid spaces represent social behaviors, perceptions, and emotions as influenced by the multifaceted identities held by each of the Native women. While individuals hold multiple social, role, and personal identities, certain identities become more salient in certain contexts depending on the belongingness to a group within a space. For this inquiry, two spaces were of concern: (1) a Native American woman's space and (2) an engineering and technology space. These spaces represent living communities with constructed collective identities residing within each. Jaemie, Mia, and Catherine each had belongingness to the two spaces, both as Native women and as a professional in engineering and technology. As such, the local and global identities that Jaemie, Mia, and Catherine held and constructed from participating in each space were of concern to this inquiry. A discussion of Jaemie, Mia, and Catherine's views of self is offered followed by considerations of the influence of their identities on the creation of the hybrid spaces.

Views of self. Jaemie, Mia, and Catherine held identities in a local space as female members of their tribe and as members of the larger Native community and in a global space as professionals within the engineering and technology field. These identities were at the forefront of the inquiry.

Although Jaemie, Mia, and Catherine shared commonalities in their identities, the reflexive interpretations of their identities were unique to the individual and to the experience in the three-dimensional space, including the ways they perceived their multiple identities as being related or intersecting, and the ways the identities influenced

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them (for example, by informing cognitive processes such as decision making, logic, and reasoning). The individuality and complexity of identity illuminates a narrative view of experience, whereby lived and told stories cannot be separated from the three-dimensional narrative inquiry space (with situational, sociality, and temporal dimensions). Through the particularities of Jaemie, Mia, and Catherine's lived and told stories, we can come to understand the complexity of ways that the many selves can be experienced in relation to a context. As an example, Kenny and Fraser (2007) wrote of how indigenous leadership may be passed down as a cultural teaching but not realized by all:

> Cultural teachings can inform various aspects of identity, but not everyone will be a cultural leader. Leadership is unique to the individual. By looking into different aspects of a person's existence, for example, we have a spiritual existence, we have a locational existence, we have an educational existence. (p. 61)

Further exploration of how Jaemie, Mia, and Catherine made sense of their local and global identities is provided – specifically their views of self as members of the tribe, as Natives, as educated, as professionals, and as leaders. Each of the identities creates a common body of metaphor, guiding the understandings of the self and the environment:

> Through metaphor, our understanding of things is acquired, defined, and organized in terms of our existing knowledge of things already retained in our minds as remembered images, symbols, stereotypes, and theories. … Our understanding of ourselves and the world around us, in turn, guides our behavior. (Peroff, 1997, p. 488).

The self as a member of a tribe and as Native. The inquiry was situated in the exploration of a local space in the midst of a global space, and as such the Native identities held by Jaemie, Mia, and Catherine became more prominent within their storied experiences than their tribal identities. This is likely because the Native identity is a

unifying identity in comparison to the mainstream population and particularly in the field

of engineering and technology. This has been written about as the commonality of

difference (Mihesuah, 1996). Although the views of the Native identity is useful to our

understandings of Jaemie, Mia, and Catherine's experiences, it also illuminates the need

for additional study to more deeply explore the experiences with tribal identities in

relation to the global and local spaces.

Regardless, the Native identity is securely tied with the tribal identity, for the

Native identity could not exist without the tribal identity. The tribal identity, across its

diverse forms, might lend itself to explaining: "Indianness means different things to

different people" (Peroff, 1997, p. 487). An example that might affect an interpretation of

a tribal or Native identity concerns the matriarchal, matrilineal, and/or matrilocal

traditions of the Navajo tribe (Roessel, 1981) (the tribe of Jaemie and Catherine) versus

the patrilineal traditions of the Akimel O'odham tribe (Smithsonian Institution, 1983)

(the tribe of Mia). These kinship traditions influence the constructions of spaces and their

cultures. For example, within the Navajo traditional culture, women have a large role in

the myths and stories (for example, Changing Woman). Changing Woman ceremonies, in

particular, played an important role in Jaemie and Catherine's lives, as Jaemie's daughter

completed the ceremony and Catherine and her daughters too completed the ceremony.

Today, tribal societies are reimagining new futures as the world changes; tribal

identities too are changing. For example, Mia's membership to the Gila River Indian

Community is determined by blood quantum through her mother's line. Additionally,

Mia's father is Mexican, but she identifies strongly as Akimel O'odham because she was

raised by her mother within the Gila River community. Ruth Roessel (1981) wrote, "A

culture is learned – you are not born with the knowledge" (p. 174). Indeed, the social construction of knowledge and identity is defined by the relational exchange between the space comprising living, breathing communities and the individual.

The self in the engineering and technology educational space. This inquiry sought to hear the stories of those who were working and carrying out leadership acts in the engineering and technology field, specifically the stories of Jaemie, Mia, and Catherine. Their work within the engineering and technology space is representative of their ability to persist through engineering and technology educational pathways in a space that few Native women are supported in doing. Seeking to understand how they saw their self in relation to the educational space was pertinent to both their development as a professional and indicative of their future ability to conduct work and leadership in the engineering and technology space.

Jaemie, Mia, and Catherine described different experiences from their childhood educations. Jaemie and Catherine told of a developing interest in science and engineering when they were in K-12 grades, which began her trajectory towards the engineering and technology space. Mia told of her interest in engineering and technology as having the potential for being a career with steady income potential. All three women chose to pursue higher education off their reservations. For Jaemie and Catherine, this meant leaving the Navajo reservation, and for Mia this meant leaving the reservation land of the Gila River Indian Community. All three Native women described their desire to leave the reservation and experience a new way of life. Jaemie described this as a chance to "explore" and "experience self-discovery." Catherine described this in terms of survival and opportunity. Mia described it as a way to have new experiences because there was

"not much to do on the reservation." Across the ways of describing their leaving the reservation, Jaemie, Mia, and Catherine were committed to leaving for self-development. As they pursued their higher educations, they gained a sense of pride, for they had become *educated* Natives. This provided opportunity for themselves and for their communities. Their stored experiences illuminate the impact of personal identities (them as unique beings) and social identities (them in relation to their community).

Questions remain surrounding identity development as professionals through educations in the engineering and technology space. Professional identity development was not deeply explored in this inquiry. However, it is critical that narrative inquiry work, and qualitative research in general, explore the particularities and complexities surrounding the development of professional identities among Native groups. Such work would enable further engineering education reform to support Natives in their educational pathways.

The self as an engineer and technical service provider. Jaemie, Mia, and Catherine were each situated within disparate contexts for work. Jaemie worked within a large technical corporation. Mia worked within a tribally-owned technical business, and also had experiences as a technical business owner. Catherine worked as a technical business owner, and also had experiences working as an employee for small businesses. Their arrival to and participation within the engineering and technology workspaces were informed by the particularities of their life experiences. Seeking to understand how they saw their self in relation to the professional space and, more specifically, as a professional was critical to this inquiry.

Jaemie's professional identity as an engineer grew as she navigated her professional career and took risks to take on new positions (i.e., advancing from a technical representative to an engineering role as a development specialist). As she navigated her self in relation to the engineering and technology workspace, she sought to align her professional and Native identities. She sought out opportunities to participate with the Native community within the workspace and used this opportunity to develop her professional self, such as learning to speak up, be self-directed and adaptable, and to define her future goals and seek opportunities to realize them. As Jaemie constructed a hybrid space, her Native and professional identities were both upheld and became more aligned. Jaemie's solidarity with the engineering and technology space was particularly evident as her outreach program grew. She was given increased responsibility as a result of the outreach program, but made a point that she would not sacrifice her engineering role and identity as an engineer to move to the human resources department (the department that handled much of the outreach activity as it grew). Rather, she felt resolve in knowing that the two positions could support one another.

Mia's professional identity encountered more obstacles than Jaemie's professional identity. As Mia faced personal challenges, she re-invented her self as a professional and through those reinventions she stayed committed to the engineering and technology space. Her commitment to the space was grounded in her ability to participate with her Native community as an educated Native with a knowledge base that was of use both to her own professional career and to her Native community. Catherine, too, faced obstacle with her developing career, but maintained steadfast in her commitment to the

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engineering and technology space and the opportunity it provided her and her Native community.

Although Jaemie, Mia, and Catherine operated within different workspaces, they each grounded their professional identity in the desire to be educated and willingness to learn. Their confidence that they could learn carried their professional identities forward. This is evident in the pivots in their career pathways and their willingness to take on new roles. As they saw themselves as learners and sought to further develop their professional knowledge, their Native communities provided a space to return professional contributions. This was pertinent to both their development as a professional and indicative of their ability to lead change in the engineering and technology space. Jaemie, Mia, and Catherine's views of their selves as learners and as willing to give back to their community are attributes that enabled them to persist in engineering and technology, and also attributes we desire of our future engineers (e.g., the Engineer of 2020's attributes of lifelong learning and practical ingenuity (NAE, 2004)).

The self as a Native, the self as a leader – agents of change and lesson givers. During the narrative inquiry, I asked Jaemie, Mia, and Catherine about their views of themselves as leaders. Jaemie told me that she had always seen herself as a leader and likes "to be involved in change and be that leader and be that positive role model"; Mia saw herself as "just a Native trying to make a difference"; and Catherine saw herself as someone who is trying to "improve her Native nations through her life experience" and also "reach out to the youth." Jaemie and Catherine specifically spoke about their role within the Native community to give lessons to the youth. As they had gained life experience (including personal and professional), they perceived it as their duty to give

those lessons back to the Native youth and they did so through their self-constructed leadership acts. Mia, too, focused on the youth, wanting to help them navigate constructive paths for their future. In this vein, Jaemie, Mia, and Catherine all spoke of being a positive role model for the Native youth. Furthermore, through their Native identities and upbringings, they could relate to the youth while providing them with lessons. This role as lesson giver is deeply embedded in the socio-cultural-historical framework of what it means to be a Native woman. Native women represented life-sustaining force and had the responsibility to carry forward Native life (socially and physically). Inherent to life-sustaining force, Native women were bestowed power as wisdom givers and lesson keepers, and as such, were repositories of the cultural framework for living – holding and passing down traditions, spiritual ideals, and rules to live by. Jaemie, Mia, and Catherine also actively sought to make change happen for their Native communities and did so within engineering and technology contexts. Their readiness and willingness to take action for the benefit of their community speaks to the power that enabled them as a result of their cultural dictates (rather than, for instance, their position within engineering and technology). The narratives are representative of the experiences of Native women as agents of change, written about by Native women feminist scholars (e.g., Kidwell, 1978), but extend the literature to contexts of engineering and technology.

Networking local and global identities to create hybrid spaces. As the hybrid third spaces were interpreted and explored in this inquiry, questions arise as to how Jaemie, Mia, and Catherine were able to leverage their identities and spaces to construct the third spaces. For example, how did their identities activate in the local and global

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spaces? How salient were their identities in the opposing spaces (i.e., the local identity in the global space and the global identity in the local space)? What was the impact of constructing the third spaces on their local and global identities? Although these questions cannot be answered in full by this inquiry, they provide an opportunity to begin a conversation of how we might further interpret the narratives of Jaemie, Mia, and Catherine and their experiences as Native women in engineering and technology who were leading the creation of new hybrid spaces.

Jaemie, Mia, and Catherine's storied experiences revealed that they shared goals that were directed towards the development of their Native communities and their own self-development. Their goals demonstrated a dual commitment to their Native identities, an aspect of self that could have been easily lost in a dominant (global) space, and their professional identities, an aspect of self that could have been easily separated from their Native identities. Jaemie, Mia, and Catherine had desire to strengthen the intersections of their identities as Native and educated professionals, and their ability to network the disparate local and global identities enabled them to create new hybrid third spaces. The new hybrid spaces embodied realized opportunity for networked local and global identities to exist.

When seeking to examine the ways in which Jaemie, Mia, and Catherine leveraged opportunities to network their identities and create new hybrid third spaces, three themes emerged from their storied experiences. These themes were related to local spaces and identities and included: (1) seeking to connect to home in diverse situations and spaces, (2) seeing the self as whole, and (3) implementing traditional teachings and lessons. Overarching the themes, the local space created a strong framework for

understanding that enabled Jaemie, Mia, and Catherine to leverage their local identities in the midst of global identities and spaces. Specifically, they were able to network their local identities with what it meant to think, know, act, and do as an engineer or technical service provider. The result was a networked space and identity, whereby understandings of local and global identities had merged and taken on new forms. Figure 19 provides a diagram of the networked local and global identities from their respective spaces.
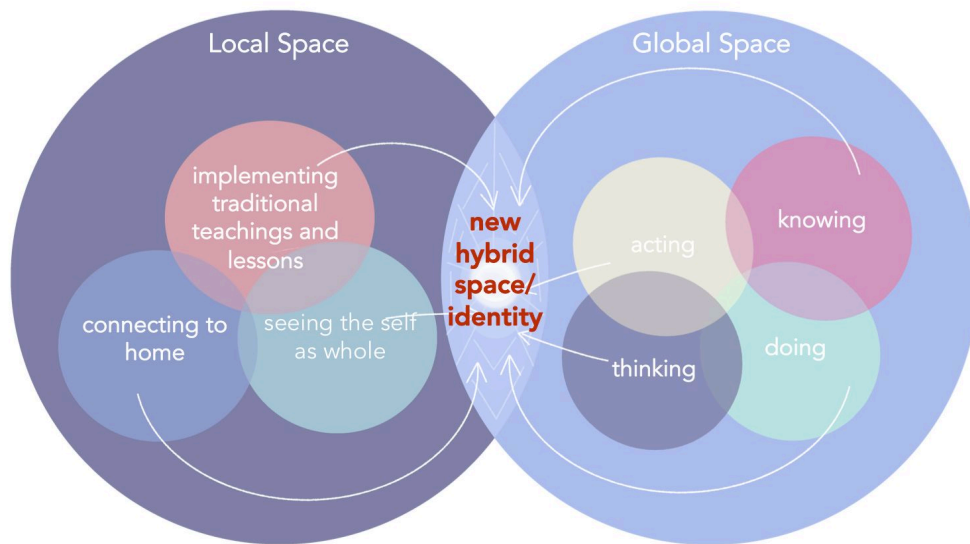
Figure 19. Jaemie, Mia, and Catherine networked local and global identities

Connecting to home in diverse situations. Jaemie, Mia, and Catherine each had left their tribal reservations to pursue their education and careers and sought ways to reconnect to home while in global spaces of engineering and technology education and workplaces. As Jaemie, Mia, and Catherine were constrained with living physically distant to their homelands, they sought out Native groups in higher education and/or the workplace in order to connect them to other Natives and Native ways of life. When this was not sufficient and they were encountering hardships in life, they spoke of traveling

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home to restore balance within themselves by connecting to their communities. These storied experiences were unique to the individual. For Mia, she eventually moved home after encountering hardships while living out of state. For Catherine, she founded her own business and structured it around traveling to her home reservation (and other reservations). For Jaemie, she sought out the corporate network for Natives and began to design a program, which eventually enabled her to travel to her home reservation. By connecting to home, Jaemie, Mia, and Catherine were acknowledging and honoring their Native selves within the dominant context of engineering and technology. The process of connecting to other Natives in the engineering and technology space strengthened their ability to persist through their educational and professional pathways and prompted key education and career decisions.

Jaemie, Mia, and Catherine's experiences with connecting to home could be likened to the homing pattern within the works of Native scholars, most notably Leslie Marmon Silko (Laguna Pueblo poet) and N. Scott Momaday (Kiowa novelist and poet). In these works, homing "involves the reconnection to a homeland and the 'spider-web' of people, place, identity, story and history" (Croft, 2013, p. 5). Indeed, Jaemie, Mia, and Catherine sought to connect to physical and non-physical aspects of their Native home – the people, the stories, the land, the culture, the tradition, and the ways of life. These actions showed a commitment to their Native identities across the diverse situations, including mainstream education and career spaces. Further explorations of the theme of connecting to home in diverse situations will be useful to engineering educators as we seek to support Natives in classrooms and workplaces.

Seeing the self as whole.

> You see, it's in our culture. It comes back to the circle. It's the way we see ourselves. It's all related. (Jaemie, Navajo)

Jaemie, Mia, and Catherine were driven by the need to seek balance among their selves, which included seeking to align their professional identities with their Native identities. In this way, they did not keep disparate identities as professionals and as Native and members of tribes. Rather, they were informed by a cultural framework of seeing oneself as whole with many interconnecting, dynamic, and related parts. This framework for understanding enabled Jaemie, Mia, and Catherine in their quest to create new hybrid third spaces, whereby all aspects of their identities might be balanced. There are many cultural interpretations of this balance in Native scholarship, evidenced by the Native-derived conceptual frameworks of the medicine wheel (Roberts, Harper, Bull, & Heidman-Provost, 1998) and the medicine way (Fixico, 2013a) that seek to illuminate the whole and parts of the whole as needing to be in balance. Further explorations of the theme of seeing oneself as whole will be useful to engineering educators as we seek to enable students to uphold their individual differences in the classrooms and workplaces.

Honoring traditional Native lessons and teachings. As was referenced in the literature review, Leslie Marmon Silko (1996), the renowned Laguna Pueblo writer, once wrote, "Through the stories we hear who we are" (p. 267). Jaemie, Mia, and Catherine were profoundly influenced by the lessons and teachings passed down to them by their grandparents and parents (particularly their grandmothers and mothers) as well as the broader family and community. The lessons and teachings provided a framework for living and influenced all aspects of their being and actions – across cognitive, behavioral,

affective, and social dimensions. The lessons and teachings were established, in part, by the strength of oral traditions in the community through symbolic, behavioral, resilience, and rebuilding narratives.

An overarching theme of the lessons and teachings (through the symbolic, behavioral, resilience, and rebuilding narratives) was that Native women have inherent power that should be realized and are able to overcome hardship and contribute to their communities as agents of change. Here, a review of the lessons within the symbolic, behavioral, resilience, and rebuilding narratives is provided based upon the literature, followed by a discussion of how these lessons and teaching manifested in the narratives of Jaemie, Mia, and Catherine. The symbolic narratives represent the creation and emergence narratives as held in the collective memory of the tribe and establish the spirituality of a tribe. Within the narratives of many tribes of the Southwest, there are female and male deities that represent equal, but opposite, powers. The lessons learned are that there is no hierarchy between female and male, and the female roles embody a life-sustaining, active force. As the symbolic narratives are passed down to the tribe, they then establish the expected roles of members of the tribe. As such, behavioral narratives reinforce that Native women in tribes of the Southwest have realized power in all aspects of life – political, social, economic, and cultural spheres. Additionally, symbols of motherhood are passed down narratively and order life. The Navajo tribe is ordered by matrilineal identification where the mother's clan is spoken of first. Within behavioral narratives, a Native woman gains status by being a biological or sociological mother – and more importantly grandmother – whereby they have responsibility to pass lessons down to the youth. The symbolic and behavioral narratives then inform the resilience and

rebuilding narratives. In these narratives, Native women have been pivotal to resilience

movements with many of these being grassroots efforts to "push back" against the

"unwanted cultural transition" (Fixico, 2013b, p. 126) The lesson here is that there are

hardships and political tensions, but Native women can have a role in aiding their

communities. The ideal Native woman, therefore, is decisive and able to lead.

N. Scott Momaday said, in reference to understanding what it means to be Native,

"The voices are all around us, the three voices. You have the mythic and the historical

and the personal and then they become a wheel, they revolve, they alternate. … Myth

becomes history becomes memoir becomes myth" (Annenberg Resources, 2016). These

voices are heard within the symbolic, behavioral, resilience, and rebuilding narratives.

For Jaemie, Mia, and Catherine, the personal, historical, and mythic voices guided them

as they learned and were shaped by the lessons and teachings of the symbolic, behavioral,

resilience, and rebuilding narratives. Jaemie, for example, spoke of how she learned

lessons from her paternal grandmother and mother on what it meant to be a traditional

Navajo and resilient. These lessons shaped Jaemie's understandings of her identity as

Navajo and Native woman.

> I reflect back and I see my childhood. A lot of that childhood memory is built
> around my dad's mom, which in Navajo terms she would be my nali' and that's
> my paternal grandmother. She was such a strong woman. She was traditional. All
> traditional. … We used to help her herd her sheep and her cattle to her winter
> camp. As little kids you're supposed to have all this energy and we couldn't even
> do that long walk. We would ride on the back of the trucks while she walked the
> entire way.

> [My mother] was faced with being discouraged from talking her Navajo language,
> being told that she was never going to succeed in life. Yet she overcame those
> challenges and achieved her master's degree in education and she raised the five
> of us. My three brothers, my sister, and myself. And she just, again, was very
> humble with everything she had and everything that she worked for.

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That's in general I think who Native American women are: we're very humble, we're very resilient. We're hard working. We're driven. And you know, when faced with challenges we just have to figure out how to get through them. And be thankful in the end. That's what it boils down to.

It guides me and I see those characteristics in myself. I think about them often. I carry my mom and my paternal grandmother. [My paternal grandmother] passed away many years now but I still carry those thoughts of her and those prayers with me. And it has molded me to be the person I am.

As another example, Catherine spoke of the importance of being raised traditionally as a

Navajo, particularly learning the importance of her Navajo spirituality, and on being a

mother. These understandings influenced her identity as a Navajo and Native woman.

I would have to say it falls back on being a mother and just naturally being a caring person, thanks to our elders in our upbringing, I think makes us good business owners.

I was brought up very traditional. My mother doesn't speak English, so just that much more traditional. We were taught to always have faith. In their generation it was this spirituality that they know in their own traditional ceremonial ways, rituals, things of that sort. In our generation it's gotten to finding a balance between two worlds... because now you have to go out in the non-Native world to make a living... I draw a lot of strength from there. I have to be spiritual to keep things in balance. And that's another major teaching from our tribe, our cultural upbringing is that it's all a balancing act. You can never forget where you came from. Every so often I go home, I get the traditional ceremonies done, just to get back in touch with my grassroots. Because out here everything is going 100 miles per hours, you could go crazy, get caught up in things and just go, go, go. After a while everything is going to be out of whack. So I stop and I go home and spend time with my elders and my traditional ceremonies to remain grounded.

Mia's storied experiences exemplified political tensions, but that Native women like her

can make a difference. Supporting this, Mark (Mia's manager at the tribally-owned

technical business) spoke of how the tribal business had almost gone under due to non-

Native management who did understand the ways of life on Gila River land. Mia

represented opportunity for leadership and someone who had the same values and

understandings of the community. Mia spoke of how she hoped to make a difference in the lives of the Native youth and share knowledge with her community. "And that's what I am doing and planning on doing for the community. Giving the mentorship, the leadership."

The narratives of Jaemie, Mia, and Catherine exemplified that the traditional lessons and teachings (as established in the symbolic, behavioral, resilience, and rebuilding narratives) influenced them and shaped their understandings. The lessons and teachings created a strong framework for what it meant to be a Native woman – particularly that they can contribute to their Native communities as an agent of change through resilience, humility, hard work, and spirituality. Jaemie, Mia, and Catherine carried these understandings with them through their educational and professional pathways and used them as a source of strength in the midst of obstacles and struggles. By honoring their traditional lessons and teaching, they were supported in leveraging their local identities in global spaces.

Summary of RQ2. The meanings that Jaemie, Mia, and Catherine attached to their identities and the influences of those identities to create new hybrid third spaces were deeply interconnected with one another. Across the interconnectedness of meanings, the local space created a strong framework for understanding that enabled Jaemie, Mia, and Catherine to leverage their local identities in the midst of global identities and spaces. Jaemie, Mia, and Catherine remained committed to their understandings of their local identities in diverse situations, which served as an enabling factor through challenging scenarios (e.g., education and careers) and navigation to create new hybrid third spaces. Across the interpretations of the understandings, a circular mindset was evident (written

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about in the scholarship as a Native circular ethos (Fixico, 2013a)). Within the circular

ethos, Jaemie, Mia, and Catherine sought balance between their multiple parts of self as

well as the actions of coming and going (physically and symbolically) and receiving and

giving (e.g., through lessons and experience). The narratives of Jaemie, Mia, and

Catherine illuminate the complexity of multiple and intersecting identities and how

spaces influence the understandings of those identities and the behaviors.

Summary: RQ1 and RQ2

Jaemie, Mia, and Catherine's lived and told stories were structured around a series

of impactful transitions that revealed meanings of what it meant for the three Native

women to work and conduct leadership acts in the engineering and technology field. The

narrative transitions revealed a transformation from their ability to culturally navigate

disparate local and global spaces (representing traditional Native cultures and identities

and mainstream, Euro-centric engineering and technology cultures and identities,

respectively) to their acts of leadership to use transcultural influence to create new hybrid

"third spaces". The creation of the hybrid spaces was driven by the need to connect and

contribute to the local space in diverse settings, including the global space. Across the

three narratives, the hybrid spaces took different forms, but each represented new sites of

opportunity where engineering and technology could be used for the benefit of Native

communities.

Jaemie, Mia, and Catherine's lived and told stories also revealed that the social,

cultural, historical, and political contexts of the local space created a driving framework

that enabled them to leverage their local identities as Native women within the dominant

context of the global space. The meanings that Jaemie, Mia, and Catherine gave the

contexts of their local space were established, in part, by their own experiences from being raised within local spaces of reservation life as well as by the strength of oral traditions upholding local narratives of the symbolic and behavioral power of women and the resilience and rebuilding of Native communities. The local space, therefore, guided Jaemie, Mia, and Catherine in their understanding that Native women have inherent power that should be realized and are able to overcome hardship to contribute to their Native communities as agents of change. In engineering and technology work, Jaemie, Mia, and Catherine remained committed to the meanings of their identities as Native women as agents of change and actively sought to utilize their global identities as educated professionals to make change happen for their Native communities.

CHAPTER 6

CONCLUSIONS AND FUTURE VISIONS

The final chapter reflects upon the inquiry process by returning to the purpose of

the study and by examining its significance through the narrative contributions. The

chapter concludes with a reflexive look at the inquiry as a journey and considers new

directions for research in engineering education.

Returning to the Purpose of the Inquiry

The purpose of the inquiry was to access the lived and told stories of Native

American women working in engineering and technology, particularly those who were

leading initiatives to improve their Native communities. The inquiry was guided by two

research questions:

1. What are the lived and told stories of Native American women in engineering and technology who are leading initiatives to improve their Native communities?

2. How do Native American women's understandings of their identities influence their work and acts of leadership in the engineering and technology workplace?

The framing of the inquiry's purpose was necessary, as Native women's voices are currently buried in the statistics or absent from representation and are in dire need to be heard within the engineering education scholarship. The research questions provided a direction for study that allowed for Native women's voices to come to the forefront. Additionally, the structure of the inquiry provided opportunities for the participants to determine what they might tell about their lives in the context of their engineering and technology work and leadership. This allowed for the participants stories to travel and for new understandings and possibilities to emerge.

Contributions to the Engineering Education Scholarship

The inquiry gives voice to the silence of Native women's lived realities in the engineering education scholarship through three narratives: (1) the narrative of Jaemie (pseudonym), a Navajo woman who worked within a large technical corporation and sought to connect to Natives in the workplace and, in the end, was designing and leading new initiatives to support Natives in STEM through the corporation's Native American support network; (2) the narrative of Mia (pseudonym), an Akimel O'odham-Mexican woman (and an enrolled member of the Gila River Indian Community) who worked for a tribally-owned technical business and, in the end, was leading a new technical venture formed to serve the tribe and pursuing the completion of her higher education; and (3) the narrative of Catherine (pseudonym), a Navajo woman who turned to entrepreneurship by launching her own technical business in order to overcome hardship and serve her Native communities.

The three narratives each revealed a series of seven impactful transitions that enabled Jaemie, Mia, and Catherine to work and lead in engineering and technology. The

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transitions revolved around themes of becoming professionals, encountering and overcoming hardship, seeking to connect and contribute to Natives through work, leading change for their Native communities, and advancing their professional selves and their Native communities. Across the transitions of the three narratives, a transformation emerged. Jaemie, Mia, and Catherine began in engineering and technology by persisting in education and work through processes of cultural navigation. However, through their need to uphold their local identities as Native women, they began to create new, hybrid spaces that represented innovative sites of opportunity for Native communities through engineering and technology contributions. The strength of their local Native space enabled them to leverage their local identities as Native women within the dominant context of the global engineering and technology space. As Jaemie, Mia, and Catherine reflected on what it meant to be a Native woman and told of their storied experiences, they were influenced by local narratives of the symbolic and behavioral power of women and the resilience and rebuilding of Native communities. The local narratives were set within the social, cultural, historical, and political contexts of local Native communities. Jaemie, Mia, and Catherine learned lessons of what it meant to be a Native woman, and this enabled them to serve as agents of change for their Native communities by contributing their knowledge and skills in engineering and technology. Their roles as agents of change honored those Native women that came before them and looked towards a better future for Native communities.

Each narrative contributes the depth and richness of lived realities in engineering and technology. Mitchell (2013) wrote, "The call for such local, contextualised research is not to deny the importance of a global perspective, but rather to contribute to it (p. 13).

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Within this reasoning, the inquiry contributes to global perspectives of minority experiences in engineering and technology by challenging universal understandings and assumptions. Jaemie, Mia, and Catherine's storied experiences delve into particularities, enabling whole understandings and considerations of the influences of place, personal and social conditions, and the past, present, and future. Such influences were considered within this inquiry according to the three-dimensional narrative inquiry space of situational, sociality, and temporal dimensions. Through the complexity that the narratives offer, the inquiry is able to deepen understandings of the specific experiences of Native women in engineering and technology.

The theoretical frameworks that guided the inquiry also contribute to the engineering education scholarship as useful lenses for interpretive analysis of lived realities. The theoretical frameworks specifically included: identities as multiple, constructed, and intersectional, hybridity, and third spaces. The approach of identities as multiple, constructed, and intersectional was critical for enabling an interpretive analysis that embraced the complexities of identities and considered the dynamic ways in which identities mutually shape experiences. Hybridity and third spaces drew attention to the relevant local and global identities and spaces. Research in context to engineering and technology is at risk for ignoring non-dominant identities and spaces and their influence, such as local, traditional identities and spaces. The lenses provided by hybridity and third space illuminated cultural navigation and the transcultural negotiation that occurs as individuals participate in local and global spaces and as they construct and uphold identities. Additionally, the inquiry built from the perspectives of Native feminists and

feminist theories in engineering education, offering new possibilities through the inquiry of what feminism might contribute to engineering education scholarship.

Examining the Significance of the Inquiry's Contributions

The narratives of Jaemie, Mia, and Catherine denote the power of story. Within the introduction, three points were made as to the significance of story for this inquiry: (1) stories are relevant to indigenous peoples as a methodological approach, (2) instructive stories are needed in engineering education, and (3) inspirational stories of the contributions of Native women in engineering and technology are needed for Native nations. Concluding remarks on the significance of story will be provided here in regards to the inquiry's contributions.

The inquiry was grounded in the words of Jaemie, Mia, and Catherine, three Native women working and leading in engineering and technology. As the inquiry brought their voices to the engineering education scholarship, the methodology honors oral knowledge and words as legitimate forms of data. For research to be impactful, it must uphold the authentic ways of knowing and being of the community or individuals that we are seeking to learn from. Narrative inquiries represent a research approach that is compatible with Native ways of knowing and being, and are therefore needed in engineering education to extend our understandings of Native experiences in engineering and technology. This inquiry is significant in its methodological contribution.

The narratives themselves can be used for instructive purposes, illuminating its social and practical significance. Specifically, the narratives offer storied experiences within engineering and technology, which provides direction for reform so Native women and girls can be better supported in their pathways to working and leading in engineering

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and technology. In an article for the Journal of Engineering Education, Rover (2008) wrote, "To be an agent of change, one needs to understand the paradigms of your own culture or environment" (p. 389). Jaemie, Mia, and Catherine, indeed, understood the paradigms of their own Native cultures and the expectations upon them as Native women and as part of their Native communities. Jaemie, Mia, and Catherine's actions exemplified leadership to drive change for local Native communities through engineering and technology. In engineering education, we seek to strengthen local communities through engineering and technology, which in turn strengthens the broader STEM community. The inquiry's real-world narratives demonstrates how individuals from local, traditional spaces can change the dominant norms and identities within engineering and technology spaces to better reflect the needs of local communities and their upcoming generations. This inquiry is significant in its social and practical contributions by providing instruction for reform.

The narratives themselves can also be used for inspirational purposes, further illuminating its social and practical significance. Stories by and for Native nations and their peoples are needed to inspire future generations of Natives to enter engineering and technology and contribute to rebuilding their communities through their knowledge and skills. Jaemie, Mia, and Catherine's narratives offer stories of leadership in engineering and technology aimed towards Native nation rebuilding and self-determination efforts. The narratives provide inspiration that Native identities and cultures can be upheld within contemporary engineering and technology and be used to transform spaces for the benefit of local communities. Stories of strength and leadership are a pillar of Native nations, but the narratives of this inquiry contribute stories within the context of engineering and

technology. This inquiry is significant in its social and practical contributions by providing inspiration for future generations of Native girls and women to pursue engineering and technology education and careers as a way to lead change for Native communities.

The narratives of Jaemie, Mia, and Catherine represent "innovative sites of collaboration and contestation" (Bhabha, 2012, p. 2) where change occurred to strengthen Native communities through engineering and technology. As the narratives embody contributions to the engineering education scholarship, they are significant in their ability to enrich the conversation surrounding minority experiences in STEM and inspire future generations of Native girls and women to pursue careers and leadership in engineering and technology.
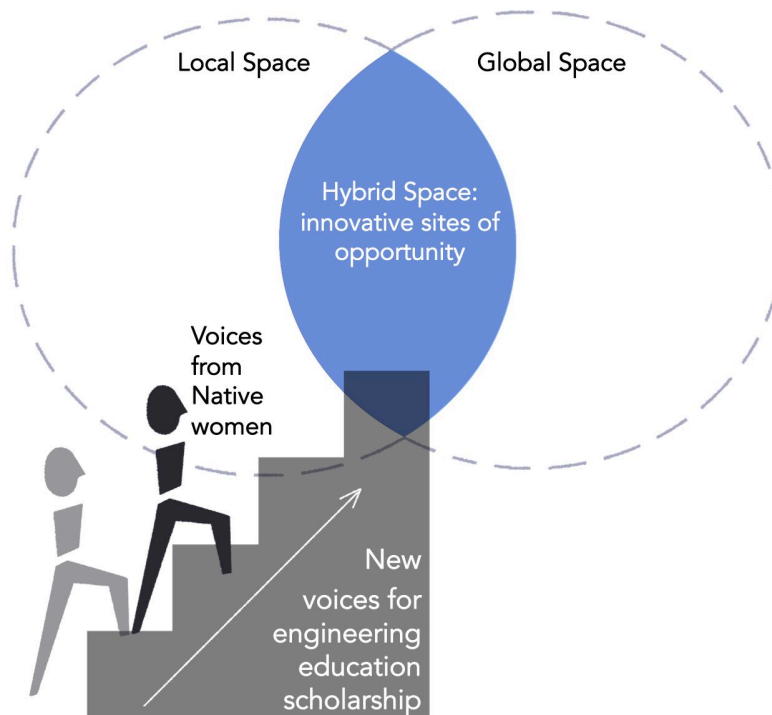

Figure 20. The significance of the inquiry lies in the power of story

Connecting Research to Practice: Implications for Engineering Education

As the contributions of this inquiry and the significance of those contributions were provided, it is also necessary to consider how the inquiry might inform the practice of engineering education. Turns, Paine, & Sattler (2014) wrote, "Making the link between research and educational practice is a highly sought-after and elusive goal." Much of the difficulty in having research inform practice lies in the diverse and dynamic nature of educational environments and decision makers, leading to different ideas of what is meant by educational practice and the use of research (Turns et al., 2014). Across the ambiguity of what is meant by the practice of engineering education, I ultimately intend for the narrative inquiry to inform understandings of what it might mean to be a Native woman in engineering and technology and for these understandings to challenge universal understandings.

I also advocate that narratives should have a place in engineering education spaces for the same reasons that narratives themselves are significant: stories have instructive and inspirational powers. Through instruction, narratives can be used to support students in considering how engineering as a practice and engineers as professionals dynamically *shape* and *are shaped by* social, cultural, historical, political, and economic contexts. By embodying lived experiences, narratives create a place for conversations and considerations that students might not otherwise have until they are in the workplace. The complexities of engineering – as the practice and its professionals are situated in the social world – can be explored with the use of narratives. As an example, the narratives could be used in an engineering education space as personally-oriented case studies to explore community-based design scenarios, leadership within Native

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contexts, and opportunities to create new spaces for engineering and local communities. Within the medical field, personally-oriented case studies have proven to be effective in aiding students' understandings and retention of course content (Young & Anderson, 2010); engineering education could also benefit from such personal stories. Additionally, narratives can instruct students on the importance of their own identities and cultures as well as the value their individuality can bring to engineering and the potential it can have for them to make unique contributions to community. As an example, the narratives could be used to prompt students to trace their own pathways, identities, cultures, and values and how those could be used to inform their work and leadership in engineering and technology. Beyond the classroom, the narratives can be used for instructive purposes for administrators, faculty, and support staff to inform recruitment and retention opportunities of Native students. The narratives themselves can be used to develop better understandings of lived realities of Native women in engineering and technology and also be extended to develop strategies and materials for recruitment and retention (e.g., marketing videos and new outreach programs).

Through inspiration, narratives of Jaemie, Mia, and Catherine have the potential to impact underrepresented students and encourage them in their pathways within engineering, including encouraging them to lead change that strengthens communities. The narratives of Jaemie, Mia, and Catherine provide voices that are not typically heard in engineering and allow students to hear stories of strength through diversity and local contexts. Based upon the narratives' abilities to be instructive and inspirational, specific implications must be developed further for specific educational spaces. Narrative inquiry, as a research approach, has the potential to transform engineering education by taking

aim at the disassociation between the considerations of the complexity of the social world and the theoretical knowledge and skills that must be learned as a developing engineer.

Reflecting on the Journey

"Research as a journey is one of the most common metaphors used to explain the methodological challenges encountered during specific research projects" (Mitchell, 2013, p. 210). As I reflect upon this inquiry as a journey, I am reminded by Jaemie's words that life is balanced by transitions and those transitions provide opportunities to challenge and give lessons to others. Within each transition of this research journey – from coming to the inquiry, developing relationships with the Native women represented in this inquiry, listening to stories in the field, moving to the research texts, and to writing this dissertation, I was met with different challenges. These challenges provided lessons that I will carry with me in future research.

Lesson 1: Wonder and curiosity must be the guide. Social science research that is meaningful to the human condition must be grounded in that which is significant to our lives. Wonder and curiosity are the innate human traits that allow us to discover the world around us and explore new questions. Rachel Carson (2011) wrote in her book, *The Sense of Wonder:*

> Once the emotions have been aroused – a sense of the beautiful, the excitement of the new and unknown, a feeling of sympathy, pity, admiration or love – then we wish for knowledge about the subject of our emotional response. Once found, it has lasting meaning. (ch. 6)

I approached this inquiry with curiosity about the prominence of Native women's roles in the Phoenix American Indian Science and Engineering Society. As I structured the inquiry around questions of Native women in engineering and technology, I wondered if I

was asking "the right questions". As the journey progressed and as the inquiry came to a close, I realized that "the right questions" begin with curiosity and meaning takes hold from there. I could not have anticipated the depth, richness, and directions of Jaemie, Mia, and Catherine's stories, but indeed they were meaningful because the question leading to it had struck a cord in me as a researcher *and* in the participants as Native women in engineering and technology.

Lesson 2: The researcher is in the field to learn. The researcher comes to the field with a set of knowledge, skills, and experiences as an expert (or, in the case of a dissertation study, as an emerging expert). However, rather than use the research tools to guide the researcher in isolation or in private, the research tools are there to serve both the participant and researcher alike. As I navigated the inquiry, I had the urge to come to the field with an understanding of what might happen and my possible responses to that. However, through the journey I gained a deep appreciation for the ability of stories to travel to places that cannot be anticipated. I learned to embrace the collaborative nature of narrative inquiry and my role as a learner. In this role, I was in the field to learn from the participants, to be flexible to the unknown possibilities, and to work alongside the participants to navigate the research path. Perhaps one of the most important research tools in narrative inquiry is the use of reflexivity. I used reflexivity to document tensions and evolutions in understandings, and also to have conversations with the participants about the interpretive analysis. Still, questions remain on how many reflexive thoughts should be included in this dissertation so as to not take away from the Native women's voices.

Lesson 3: New questions must be balanced with an endpoint. Every journey must end at some point, although there is still more to learn. This was perhaps the hardest lesson to absorb. As a White woman, I still have much to learn about tribal cultures and the broader Native culture and community. At the end of the inquiry, there was still so much more to ask Jaemie, Mia, and Catherine. I reconciled the need to complete the inquiry with the need for future research and the need to prepare for the next journey. Indeed, imagining new futures for research sustains curiosity and possibilities for contributions to our social world.

Imagining Future Research for Engineering Education Scholarship

> My hope is that we can learn to live in a way that is less dependent on the automatic. To live more in and through slow method, or vulnerable method, or quiet method. Multiple method. Modest method. Uncertain method. Diverse method. Such are the sense of method that I hope to see grow in and beyond social science. (Law, 2004, p. 11)

For those that are trained in engineering, like myself, narrative inquiries might seem slow and tedious, and even inefficient at times. The rewards, however, are rich with opportunity. Stories can be transformative and disruptive – two necessary qualities for challenging dominant norms. Future research for engineering education scholarship is needed that builds from and adds to the work of narrative inquiry. Here, I discuss three avenues for future research: (1) seeking more stories of diversity, (2) seeking more stories in Native contexts, (3) looking towards the construction of a prototype leader for engineering and technology, and (4) applying new theoretical frameworks to the narratives.

Stories of diversity. Future research is needed that seeks to more deeply understand the experiences of individuals from underrepresented groups in engineering

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and technology. The need for this future research stems from the state of the STEM

workforce remaining predominantly White, male, and able-bodied despite calls for

increased diversity (May & Chubin, 2003). Women and Natives remain vastly

underrepresented in many STEM fields, particularly in engineering and computer-related

fields (NSF, 2014). Participation fares much worse for those groups that are

underrepresented across multiple groups, such as Native women (Hill, Corbett, & Rose,

2010). May and Chubin (2003) wrote, "More than ever, the nation must cultivate the

scientific and technical talents of all its citizens, not just those from groups that have

traditionally worked in STEM fields" (p. 27).

The anticipated outcomes of a diversified STEM workforce are innovations that

improve economic conditions, quality of life, and security within the context of a

globalized world (Ong, Wright, Espinosa, & Orfield, 2011; Wulf, 1998). Diversity – as it

refers to differences across constructs of identities, worldviews, and culture (Andersen &

Collins, 1973) or "every individual difference that affects a task or relationship" (Griggs

& Louw, 1995, p. 6) – enables the divergence of thought required to think about

problems in new ways, develop a broader range of solutions (Daly, Adams, & Bodner,

2012; Daly, Mosyjowski, & Seifert, 2014), and implement those solutions in new ways.

Page (2007) wrote of the importance of the diversity:

> Most people believe that innovation requires smarter people, better ideas. That
> premise, though intuitive, omits what may be the most powerful but least
> understood force for innovation: Diversity. (p. 1)

Diversity, while it meets a condition of fairness for individuals, is an asset to the STEM

workforce and makes "teams more creative, solutions more feasible, products more

usable, and citizens more knowledgeable" (Chubin, May, & Babco, 2005, p. 73).

There have been and presently are many efforts to broaden participation and access of underrepresented groups in engineering and technology on behalf of educational research, educational institutions, corporations, federal government, and nonprofits (Ashby, 2006; Aud, Fox, & KewalRamani, 2010; Hill et al., 2010). For example, educational research has documented challenges that underrepresented individuals face in STEM in hopes to remove barriers; challenges include negative stereotypes, lack of role models, bias against underrepresented groups in the workplace, and family responsibilities (e.g., child-care responsibilities fall disproportionately upon women) (Beede et al., 2009, Hill et al., 2010). To further research on diversity and connect it to practice, the National Science Foundation (NSF) Strategic Plan for 2014 to 2018 explicitly addresses broadened participation in the STEM workforce through two goals: (1) integrated education and research to support the development of a diverse STEM workforce with cutting-edge capabilities, and (2) building an increasingly diverse, engaged, and high-performing workforce by fostering excellence in recruitment, training, leadership, and management of human capital. Within these goals, funding was allocated to the Participation and Advancement of Women in Academic Science and Engineering Careers (ADVANCE), Louis Stokes Alliances for Minority Participation (LSAMP), Historically Black Colleges and Universities- Undergraduate Program (HBCU-UP), and Tribal Colleges and Universities Program (TCUP). As another example, the White House announced in 2015 that 240 million dollars would be committed towards diversity in STEM, including 90 million dollars going towards supporting underrepresented youth in pursuing STEM opportunities (The White House, 2015). Within the corporate context, several STEM corporations have pledged to support diversity through hiring goals and

support of education. Google pledged 150 million dollars in 2015 towards initiatives such as Google in Residence (intended to bring employees of Google to historically Black colleges as mentors and professors), Accelerate with Google (intended to provide online marketing training for businesses), and Diversity Core (intended to enable employees of Google to volunteer twenty percent of their work time to helping boost diversity at the company) (Schoon, 2015). Intel has made new hiring goals to improve diversity at all levels for the company, and in 2015, 41 percent of hires were individuals from underrepresented groups (up 32 percent from the year before) (Schoon, 2015).

Moving forward in meeting the diversity challenge, new paradigms must be developed and implemented that support underrepresented groups in engineering and technology. To transform the current state of diversity, we need the storied experiences of lived realities from underrepresented groups in the forefront of scholarship. Narratives offer the voices that we can learn from and that will give us lessons for reform.

Stories in Native contexts. Future research is needed for Native nations that explore stories of Natives in engineering and technology, specifically as Natives contribute to Nation rebuilding and honor their cultures, traditions, and knowledge. The need for this future research is grounded in the calls by Native nations to improve the prosperity of their peoples and imagine new future for their nations by honoring the cultures and histories of Native peoples (Jorgensen, 2007; NCAI, 2013).

Today, engineering and technology is needed to restore Native homelands and improve infrastructure on Native lands, including housing and transportation, telecommunications, and emergency management (NCAI, 2014). Developing such solutions is urgent. For example, the NCAI (2014) reported that "Native Americans still

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face some of the worst housing and living conditions in the United States", lacking

plumbing facilities (8.6 percent), kitchen facilities (7.5 percent), and telephone service

(19.9 percent) (p. 27). In regards to transportation, roadways on Native nations are

"among the most underdeveloped and unsafe road networks in the nation, even though

they are the primary means of access to and from American Indian and Alaska Native

communities by tribal and non-tribal citizens alike" – only 7.3 percent of all roadways in

Native nations are paved (NCAI, 2014, p. 28). Solutions for telecommunications, too, are

needed to support education, healthcare, law enforcement, and tribal governance (NCAI,

2014, p. 28).

Native nations are looking to Native professionals – who have both "outside

world knowledge along with their tribal knowledge" (Inter Tribal Council of Arizona,

Inc. et al., 2013, p. 51) – to develop solutions for their communities and contribute to

Nation rebuilding. Nation rebuilding has historical importance to Native communities as

it represents the abilities of Native peoples to overcome traumatic histories and rely upon

imagination to design new futures (Fixico, 2013b).

> It's about re-building because if you look at our communities historically, we
> were very powerful nations and all that changed. I believe that we still have the, at
> least, the values and those things that are important to us as Indian people to re-
> build our nations. (Shendo, 2007)

Stories of Natives in engineering and technology can illuminate the ways in which

Native professionals are building local capacity and improving their communities, like

the narratives of Jaemie, Mia, and Catherine. Stories of Natives in engineering and

technology are needed across all individual differences, including across the diversity of

tribes, disciplines, and goals. Diverse stories of engineering and technology in Native

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contexts can contribute to "movement of change for Native communities in a way that is relevant and authentic to these communities" (Inter Tribal Council of Arizona, Inc. et al., 2013, p. 50).

A prototype leader for engineering and technology. Future research is needed to construct new leadership models for engineering and technology that is grounded in indigenous frameworks, as they represent models that are not represented in engineering education scholarship yet can contribute new ways of understanding across cultural spaces. Through this inquiry, the narratives of Jaemie, Mia, and Catherine contributed understandings of leadership for engineering and technology grounded in social, cultural, historical, and political context of Native communities. Due to the richness and depth of their narratives, the collective of narratives should be used for future research to construct a singular profile of a prototype leader for engineering and technology. A profile of a prototype leader for engineering and technology – constructed from Jaemie, Mia, and Catherine's storied experiences – would contribute new understandings and lessons of Native leadership as it is contextualized to the global space of engineering and technology and also contribute new avenues for bringing research to practice.

The need for this future research stems from the calls of STEM and Native communities for leadership to drive innovation and new developments forward, for "leadership will be a key influence on people's willingness to engage in, and their capability for, creative problem solving and subsequent innovation" (Hemlin, Allwood, Martin, & Mumford, 2013, p. 12; Honoring Nations, 2010). Specifically, Native nations are calling for continued leadership that can address their communities' needs in culturally-relevant ways. Honoring Nations (2010), an awards program through The

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Harvard Project on American Indian Economic Development, stated that leadership

within Native nations is required to advance the rebuilding of Native nations:

> Nation building requires leaders who introduce new knowledge and experiences, challenge assumptions, and propose change. Such leaders, whether elected, community, or spiritual, convince people that things can be different and inspire them to take action. (p. 3)

Leadership for and by Native nations must uphold sovereignty, support their own

institutions of governance (e.g., economic development and health care), and be

grounded in culture (Honoring Nations, 2010). Leadership for and by Native nations must

also recognize that Native nations are culturally diverse, and therefore must determine

their own structures within "contemporary culture" (Honoring Nations, 2010, p. 3). To

support the development of local leadership, Native nations are calling for education

reform. The Inter Tribal Council, Inc. et al. (2013) wrote of the importance of leadership

to advance the rebuilding and self-reliance of Native nations:

> The confidence to know that tribal members can contribute as change agents within their communities is impressive. In essence, tribes can now see themselves as true leaders and educators of their own communities. With the early western influence, this role was abdicated to an education system that didn't value traditional concepts and teaching. The idea of self-reliance has gained momentum and serves as the beginnings of forming self-identity and the self-esteem not just for students but for entire communities. (p. 50)

STEM communities, too, are calling for continued leadership in order to meet the needs

of the nation and improve the lives of people and their communities (Hemlin et al., 2013;

Reeve, Rottmann, & Sacks 2015). Specifically, STEM communities are calling for

leaders to be technically expert, to have adaptive capacity, and to create environments

that foster creativity and innovation (Hemlin et al., 2013). Within the STEM context,

creativity and innovation is needed to improve communities, is driven by leadership, and

can be conceptualized as "the implementation of new ideas, whether scientific, technological, or otherwise, that is applied to a certain context in order to be useful" (Hemlin et al., 2013, p. 3). With the context being pivotal, STEM communities cannot be strengthened without local communities being strengthened.

Despite the common calls for leadership, studies of leadership have identified critical differences between Native and Western models of leadership – further establishing the need to extend the work within this inquiry. For example, Western orientations of leadership tend to be focused on position and power, whereas Native orientations of leadership tend to be focused on responsibility within the community (Warner & Grint, 2006). Further complicating leadership studies, effective Native leadership must balance the dualities of Native and Western worlds, requiring leaders to "make bridges between many worlds" (Kenny & Fraser, 2012, p. 4).

As Native communities navigate the globalized world and rebuild their own Nations, new considerations must be made for effective Native leadership orientations and mechanisms. As a collective, the narratives of Jaemie, Mia, and Catherine have the potential to offer new lessons on the navigation between local and global cultures and spaces. The narratives of Jaemie, Mia, and Catherine demonstrate the three Native women's abilities to lead change in contemporary contexts of engineering and technology by upholding a commitment to their Native spaces and cultures. They did so by honoring traditional lessons and teachings as well as the Native women that came before them. Their leadership demonstrated the ability to uphold traditional identities and cultures while leveraging opportunity for Native communities; the results were strong, positive impacts for both the local and global spaces.

In the book *Indian Resilience and Rebuilding: Indigenous Nations in the Modern American West*, Fixico (2013b) wrote of a new prototype warrior that emerged in Native history from the rebuilding efforts of Native leaders. A prototype leader – constructed from Jaemie, Mia, and Catherine's storied experiences – honors the leadership that has been steadfast to Native communities and looks to the future as new paths are navigated.

> These young Native men and women represented a new prototype warrior. Skilled in oratory like many of their ancestors, they possessed an intrepid desire to speak out for Indian rights no matter what the consequence. Standing up for past wrongs against their people, these warrior leaders became modern Indian leaders of the twentieth century on a national scale. Their time had arrived. (p. 124-125).

Like the young Native women and men of the past, new Native leadership for engineering and technology has arrived. The engineering education community has a duty to honor this leadership by exploring its many forms and contributions. To begin, Jaemie, Mia, and Catherine can transform our understandings and extend the instructive and inspirational significance that this inquiry embodies.
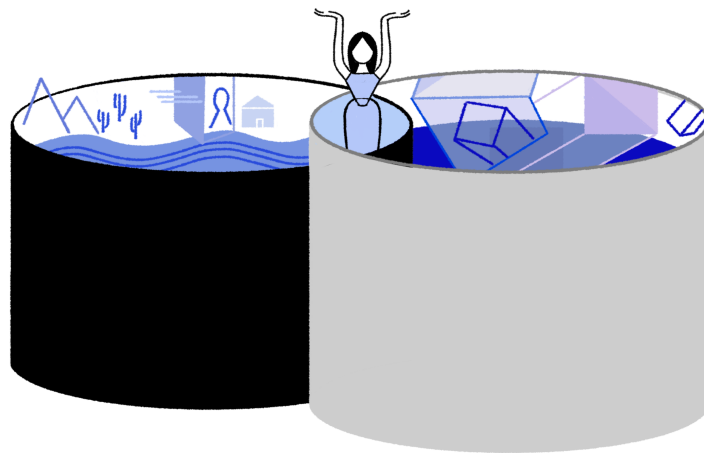

Figure 21. Constructing a prototype leader for engineering and technology

Applying new theoretical frameworks: The community cultural wealth

model. Lastly, future research is needed that further explores the narratives provided in this inquiry; this represents opportunity to utilize the depth of narrative to seek new interpretations and understandings to reform engineering education for the benefit of underrepresented individuals, specifically Native women. For example, social innovation models can be applied to these narratives for interpretations within a Native paradigm that seeks to foster change for Native communities (Alexiuk, 2013; McCarthy, 2014). The community cultural capital model also offers an opportunity to examine the narratives for the forms of cultural capital that strengthens and benefits the local and global spaces. Here, an overview of how Jaemie, Mia, and Catherine's storied experiences align with the community cultural capital model will be provided in order to demonstrate the use of new theoretical frameworks.

Jaemie, Mia, and Catherine's narratives provided evidence for all the forms of cultural capital that together comprise Yosso's (2005) conceptualization of community cultural wealth: (1) aspirational capital, (2) linguistic capital, (3) familial capital, (4) social capital, (5) navigational capital, and (6) resistance capital. (1) Jaemie, Mia, and Catherine storied experiences are structured around resilience and overcoming, representing the aspirational capital that is grounded in resiliency and "evidenced in those who allow themselves and their children to dream of possibilities beyond their present circumstances" (Yosso, 2015, p. 77-78). (2) Jaemie, Mia, and Catherine's storied experiences acknowledge the power of Native oral tradition, providing evidence of the linguistic capital of having experiences with more than one language and communication style. Catherine's ability to fluently speak her Navajo language was critical to her

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connection to and participation with her Navajo community. Jaemie, too, could speak Navajo, although not fluently. Nonetheless, Native oral tradition was a part of the three Native women's ways of making sense of the world. (3) Jaemie, Mia, and Catherine's storied experiences revolved around their understandings of their Native communities, including its histories, traditions, and cultures – providing evidence for familial capital or "a sense of community history, memory and cultural intuition" (Yosso, 2015, p. 80). (4) Jaemie, Mia, and Catherine's storied experiences included their actions to connect to Native groups and their home communities, providing evidence of social capital whereby "networks of people and community resources" are sought out (Yosso, 2015, p. 79). (5) Jaemie, Mia, and Catherine's storied experiences presented conflicting evidence for navigational capital, representing the ability to navigate through social institutions and survive. Indeed, Jaemie, Mia, and Catherine were able to survive in the face of stressful events and ultimately persisted through education and careers. However, their persistence required the ability to adapt and change course when necessary (a part of resilience). However, if we are to strengthen representation of Native American women in STEM, then we must aid in strengthening navigational capital so that individuals do not have to pivot away from STEM education and careers. (6) Lastly, Jaemie, Mia, and Catherine's storied experiences provided evidence of resistance capital, whereby they were able to challenge inequalities by persisting in engineering and technology and gain strength from their identity as a Native woman.

Jaemie, Mia, and Catherine's narratives provide thick description of cultural capital because, indeed, the cultural framework of Native communities is grounded in complex structure of cultural resources. Understanding the many forms of cultural capital

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that Native women might possess, and how they relate to one another, will be powerful to acknowledging their abilities and contributions to engineering and technology. Supporting future generations of Native women will involve asking questions such as: How can we better support the forms of cultural capital in engineering and technology spaces? Answering this question begins with understanding the particular forms that cultural capital takes for individuals of local cultures, like that of Native women. For example, understanding that Native woman may *aspire* to contribute their knowledge and expertise to their Native communities should lead to considerations of how might we better support this goal within an engineering and technology pathway. Specific considerations of how we might embed local, traditional cultural dictates within engineering and technology education and practice are needed.

Extending the work of this inquiry by applying new theoretical frameworks, such as community cultural capital wealth, will be useful in exploring the particularities and complexities of leveraging cultural capital in engineering and technology. New interpretations and understandings can then be used to inform engineering education models across education and professionals spaces.

Concluding Remarks

As the narrative inquiry brought the voices of three Native American women to the forefront of engineering education scholarship, their narratives provided in-depth perspectives of lived realities within engineering and technology. Through the methodological framework that narrative inquiry provides, Jaemie, Mia, and Catherine's storied experiences were analyzed through interpretive, meaning-making processes and re-constructed for the final narrative form. The narrative inquiry called for emergent,

active co-construction that allowed for the possibilities of what the narratives could represent to manifest. The result was new understandings of what it could mean to work and lead as a Native woman in engineering and technology, particularly as the local, Native spaces and identities influenced those meanings.

Looking to the future for engineering education research, narrative inquiries will continue to be instrumental in challenging dominant narratives and extending universal understandings. Native perspectives are especially critical if we are to reform engineering education in ways that support Natives in their educational and career pathways. As I came to the inquiry seeking to learn from three Native women in engineering and technology, I leave this inquiry looking forward to the imaginative possibilities for what we can learn from hearing more stories and applying new lenses to the stories provided in this dissertation.

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APPENDIX A

CONSENT FORM

Exploring Innovation Practices of Native American Engineers

LETTER OF PERMISSION

Dear Potential Participant:

My name is Chrissy Foster, and I am a graduate student in the Engineering Education program within the Mary Lou Fulton Teachers College at Arizona State University. I am conducting a dissertation research study to explore the innovation practices of Native American engineers, including the engineering problems that are being solved, the design processes being used to solve them, and how culture informs the work. The results of the study will add to engineering education literature to inform the development of engineering design curricula that integrates culture with content in order to support Native American students in their development as innovators and creative thinkers within the field of engineering.

I am requesting your participation, which will involve spending approximately (5) to (10) working days with you to gain an understanding of the engineering problems that you are solving, the approaches you are using to solve them, and the obstacles you face when solving them. During the working days, you will be asked to participate in approximately (10) to (20) fifteen-minute interviews (average 2 daily) as well as a (1) hour beginning interview and a (1) hour exit interview. The interviews will provide a time to elaborate upon the innovative practices you are applying to you are applying to your engineering work and why. During the working days, the researcher may take field notes to document critical points of innovation and design practices. These notes will be shared with you and be used during the interviews to reflect upon the decisions being made.

You must be 18 years or older to participate in this study. Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. The results of the research study may be published, but your name will not be used. Although there may be no direct benefit to you, the possible benefit of your participation is helping to transform engineering education curricula into one that integrates culture with content and supports Native American engineering students in the development of their innovation practices. There are no foreseeable risks or discomforts to your participation.

All information obtained in this study is strictly confidential. In order to maintain confidentiality of your records, the research team will replace your name in the data with a unique identifier code. A master file linking the unique identifier code with your identity will be kept in a secure location at ASU. The electronic and hard copy data files will be stored on secured digital storage devices and housed in a separate secure location at ASU. Access to these data will be limited to Chrissy Foster and her graduate committee chairs, Dr. Shawn Jordan and Dr. Dale Baker. After the completion of this study, all data will be destroyed after 5 years.

The results of this study may be used in reports, presentations, and publications, but your name will not be used. Should you decide to end your participation in the study, information obtained from you will be destroyed immediately.

If you have any questions concerning the research study or your participation in this study, please contact Chrissy Foster at (480) 540-9910 or chrissyhfoster@gmail.com.

This research has been reviewed and approved by the Social Behavioral IRB. You may talk to them at (480) 965-6788 or by email at research.integrity@asu.edu if:
- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

Sincerely, Chrissy Foster

 Your signature documents your permission to take part in this research.

Signature of participant	Date

Printed name of participant

Signature of person obtaining consent	Date