Voices in the Mountains: A Qualitative Study Exploring Factors Influencing Appalachian High School Students' Engineering Career Goals

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ABSTRACT

Though some research exists related to career choices among Appalachian youth, and literature exists which broadly examines choices to pursue engineering degrees, information specifically related to Appalachian students' career choice toward engineering is limited. Engineering typically represents high paying, stable jobs so it is particularly important to understand what attracts students to, or deters them from, engineering careers in the Appalachian region, which is beset by poverty and low representation in higher education. The purpose of this research was to explore what influences students from the Central Appalachian region of Virginia in choosing their career goals, in particular, relative to engineering careers. Therefore, the overarching research question was: How are Central Appalachian high school students influenced as they choose their career goals, especially with respect to engineering?

In this qualitative study, I used semi-structured interviews and case study methods, guided by Lent and Brown's Social Cognitive Career Theory, to explore career choice goals of high school participants in Southwest Virginia. The twenty-four high school participants and twelve college engineering student participants represented a diverse sample with respect to school and county demographics. Through thematic coding, the data revealed patterns relative to 1) reasons students chose their career goals, and 2) variation in factors contributing to career goals. Specifically, I identified six high school categories of reasons and only three reasons for college engineering students. High school students' career choice reasons, while related to interests, were largely influenced by critical life events. Additionally, patterns emerged based on whether or not the student was a continuing generation Appalachian (CGA), parent/guardian educational attainment and place of employment, and the location of the high school relative to college resources. This is consistent with previous literature, which points to the importance of parental education and student interests as factors for determining a student's career choice, and STEM literature, which often links interests in math, science, or engineering activities as key influencers. However, this research also revealed that critical life events, a student's family background (First Generation College and CGA), and parental job location are patterned with career goals.

Dedication

To my husband, Jason: Thanks for being you and bringing out the best in me.

To my sister, Cindy: Thanks for always being there for me. I want to be just like you.

In memory of my parents:
Captain Charles E. Steel, USN and Dorothy Marie Waite Steel. I think of you both often.

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SMILE research group, I appreciate you listening and critiquing as I formulated my research thoughts, and plans, and actions. Thanks for reviewing various stages of my research and your continued support.

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List of Acronyms

ARC	Appalachian Regional Commission
CAD	Computer Aided Drafting
CGA	Continuing Generation Appalachian
FGC	First Generation College
FLL	First Lego League
FPS	Future Possible Selves
GPA	Grade Point Average
IRB	Institutional Review Board
NSF	National Science Foundation
PCAST	President's Council on Science and Technology
PFGC	Prospective First Generation College
PLTW	Project Lead the Way
SCCT	Social Cognitive Career Theory
STEM	Science, Technology, Engineering, and Math
SVETN	Southwest Virginia Educational and Training Network

Chapter 1. Introduction

Though limited research exists that explores and explains career choices in Appalachia, and literature exists that broadly examines choices to pursue engineering degrees, the literature contains a paucity of information specifically related to Appalachian students' career choice goals toward engineering. Engineering typically represents high-paying, stable jobs, so it is particularly important to understand what attracts students to, or deters them from, engineering careers in the Appalachian region, which is plagued by poverty and low representation in higher education. To begin filling this gap and understanding choices to pursue engineering degrees or not, my research used qualitative case study methods, guided by Lent and Brown's (1994) Social Cognitive Career Theory (SCCT) framework, to explore career choice goals.

Specifically, the purpose of this research was to explore what influences students from the Central Appalachian region of Virginia (case study region) in choosing their career goals, and particularly with regard to choices relative to pursuing engineering degrees and careers. I used qualitative methods and SCCT to center my research on the perspective of the participants. SCCT considers both person variables (e.g., self-efficacy and interest) and environmental influences (e.g., family background and learning experiences) and has proven useful with regard to examining rural Appalachian settings (Ali & McWhirter, 2006; Ali & Saunders, 2006, 2009; Bennett, 2008; Tang & Russ, 2007) and engineering education (Lent et al., 2003; Lent et al., 2005; Lent, Sheu, et al., 2008; Trenor, Yu, Waight, Zerda, & Ting Ling, 2008). In addition, qualitative research was used to get a richer sense of the "why" behind career choices (Merriam, 2009). Exploratory research on students from this demographic area was warranted because of the lack of literature specific to engineering as a career choice in Central Appalachia, the lack of

engineers from the region, the growing need to increase the number of U.S. engineering graduates, and the call to increase creativity through diversity in engineering. In other words, it is possible that engineering as a career choice may benefit the Central Appalachian region and Appalachians, as a cultural group, may increase the diversity and creativity in engineering.

Chapter 1 introduces my research and includes the need for, and significance of, this research. First, a brief review of the literature is provided to substantiate the research needs and highlight gaps in the current literature. Next, the research problem, research questions, and protocol used to ensure the research design meets the intended purpose are delineated. Limitations of the study are then stated to scope the research conducted. Finally, definitions of key terms are provided.

1.1 Need for the Research

Recent reports have claimed a growing need for increasing the number of engineering graduates, including U.S. born engineering graduates, and increasing the diversity of engineers (National Science Board, 2010). Graduation rate data from 2010 showed minorities graduating with engineering degrees at a lower rate than non-minorities, and identified difficulties in recruiting and retaining engineering students (National Science Board, 2010; Ohland et al., 2008). At the same time, the Appalachian region, especially the Central Appalachian subregion, had less than the national average of college graduates (27% compared to 46% nationally), fewer white-collar jobs overall, and, within Virginia, about half the percentage of people reporting engineering degrees (3.7% versus 9.1% for Virginia) (U.S. Census, 2010). Thus, there is a potential intersection between a desire for more engineering graduates and Appalachia, a region with less than the national average of college graduates.

Figure 1 shows the region of Appalachia including the subregions of Central Appalachia. This research specifically focuses on the seven counties of the Central Appalachian region of Virginia and two adjacent South Central Appalachian counties (referred to as Southwest Virginia for this dissertation). These counties are outlined in green and predominately are on the boarder of Virginia and an adjoining state. Based on census data reporting bachelor degrees by county, the percentage of people within Virginia reporting their first degree as engineering was 9.1%. However, for the counties reporting data in the Central Appalachian region of Virginia, only 3.7% of the people reported an engineering degree and for the counties of this case study, only 4.3% of the people reported an engineering degree (U.S. Census, 2010). In addition, data available from Virginia Tech from 2007 – 2012 showed only 0.2% of the students applying to Virginia Tech's College of Engineering were from Central Appalachia even though Virginia Tech is a highly ranked school nationally that sits on the border of Central Appalachia. Why so few students pursue engineering is unknown and this research is a first step in exploring engineering as a career choice for the region.

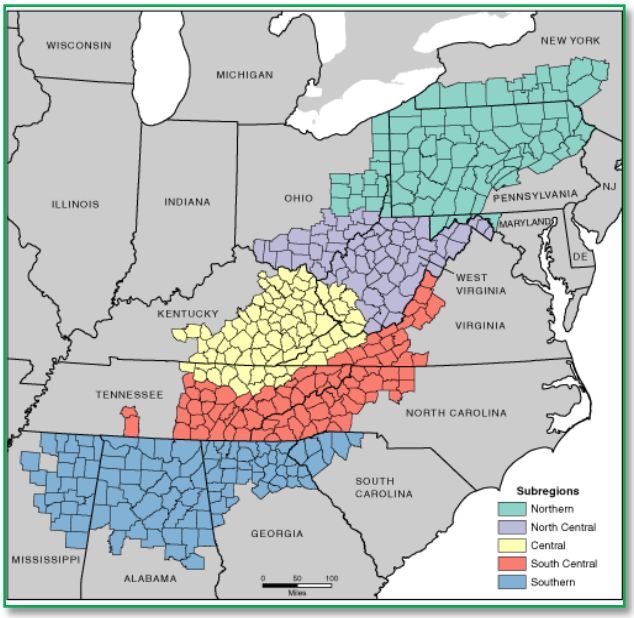

Figure 1. Appalachian Subregions (ARC, 2010)

Based on graduation rates, Appalachians are underrepresented in higher education and in engineering in particular. Definitions of underrepresentation often refer to minority classifications of ethnicity, race, and gender. However, when we view Appalachia as a cultural

group, it, too, is underrepresented with respect to educational attainment, job opportunities, and economic wealth. Because they do not fit standard definitions, Appalachian students are an atypical underrepresented group. People of Appalachia have become an "invisible minority because they do not appear outwardly different from mainstream Americans" (Tang & Russ, 2007, p. 34). Within the Appalachian region, as defined by the Appalachian Regional Commission (ARC), Central Appalachia has the greatest disparity with respect to education, poverty, median income, and population density and produces a low percentage of engineering degrees. Fewer students in Appalachia attained four-year College degrees in relation to the U.S. rate overall, with the Central Appalachian region containing the lowest percentage of people with four-year college degrees.

Understanding underrepresentation in higher education means understanding career choices because it is career choices and goals that lead to higher education pathways or not. How and why high school students make career choices is complex and involves many factors. Viewed from SCCT, these factors include such things as environmental aspects and influences (local jobs, community, family background, and learning experiences), perceived supports and barriers, personal motivators, and expectations of outcomes (Lent & Brown, 2006). While there is considerable research on the career choices of K-12 students in general (e.g., Gordon (1998)), little research has focused on the Appalachian region (despite the underrepresentation of this demographic in higher education) (Ali & Saunders, 2009; Irvin, Byun, Meece, Farmer, & Hutchins, 2012; Tang & Russ, 2007) and literature of other underrepresented groups is not necessarily transferrable to Appalachia (Irvin et al., 2012). The addition of research specific to engineering and to rural Appalachia improves our ability to design and advocate for

interventions that help students make better-informed decisions about their career goals and associated needs for higher education.

1.2 Purpose of the Study

To understand gaps relative to higher education attainment, and specifically engineering degrees, in Appalachia, my research explored how Appalachian high school students made decisions relative to their career goals. I used an exploratory case study methodological approach (Creswell, 2007; Yin, 2009) framed with SCCT (Lent, Brown, & Hackett, 1994, 2000) to answer research questions. The primary data source was semi-structured interviews with participants who live in the case study region (nine counties in Southwest Virginia). Participants for the research included high school students, college engineering students, and working engineers. Although the focus was on the high school perspective, reflective perspectives from college engineering students and working engineers added depth and context to the high school student perspectives. All participants went to high school in the region and all working engineers lived in the region. The overarching research question was:

> **How are Central Appalachian high school students influenced as they choose their career goals, especially with respect to engineering?**

To guide the research, the following sub-questions were developed:

1) What are the salient reasons and factors influencing Central Appalachian high school students' career goals?
2) How do the reasons for choosing engineering as a career compare to other career choice reasons for Appalachian high school students?
3) What are the salient reasons and factors for college engineering students, who went to high school in Central Appalachia, to choose engineering as a career choice?

4) How do the reflective reasons for a career goal of college engineering students compare to high school students' prospective career choice reasons in Central Appalachia?

These findings from these research questions were developed from thematic coding and pattern making (Miles & Huberman, 1994b) as described in Chapter 3 and are presented in Chapter 4. The findings are discussed within the context of existing literature in Chapter 5.

1.3 Significance of the Research

My dissertation work fills a gap in the literature by using qualitative case study methods to research factors relevant to engineering-related career choices of rural Central Appalachian high school students. Improving our understanding of how and why Appalachian students make their career choices will improve our ability to help students make those choices. My study was significant because it adds to both the body of literature on engineering as a career choice goal and to the literature on Appalachian students' career choice goals. My research resulted in several tangible outcomes and artifacts. First, data synthesis revealed a concrete list of influences on high school students' career choices. In particular, students in Appalachia do not necessarily pursue a career based on their interests and instead have critical events occur in their lives that determine their career path. In addition, important factors include being a continuing generation Appalachian (CGA), level of parental education and work exposure, and school location relative to college resources. Second, the data provided by college students overlapped with high school students, yet also differed considerably. For example, more college students expressed engineering as a career choice due to related hobbies and, unlike the high school participants, none of the college students cited a critical major life event as a reason to pursue engineering. Through this research, I developed a list of contextually relevant findings for use in developing survey questions for future work on this issue; such a survey will be developed in the next phase

of an NSF funded research project on barriers to engineering as a career choice for Appalachian youth. In addition, a set of interview protocols were developed that capture information in context for residents of Central Appalachia. Because these protocols are so comprehensive, they will be useful for future research in the context of Central Appalachia. Finally, this research supports the findings of other authors who report on the importance of research being contextually and culturally relevant for the population researched.

1.4 Study Context: NSF funded Research Project

As mentioned, my work conducted for this dissertation was part of a larger NSF-funded research project designed to "Understand the Barriers to Engineering as a Career Choice for Appalachian Youth," referred to as ECC for Appalachian youth (or simply ECC). ECC is a multi-phase mixed methods project designed to answer three key questions:

1) What factors influence the career choices of rural Appalachian students?
2) How do Appalachian students perceive and understand careers in engineering?
3) What barriers inhibit rural Appalachian students from pursuing careers in engineering?

These questions, and primarily the first question, guided the specific research questions of my dissertation. Appendix A contains an overview of the ECC project.

1.5 Study Limitations and Author Worldview

My study was limited in two primary ways: 1) characteristics of participants, and 2) use of a quasi-longitudinal design. Future work possibilities that could overcome these limitations are discussed in the future work section of chapter 5. The reasons for citing these limitations are provided below.

With regard to the characteristics of the participants, all participants were volunteers and thus a self-selected sample. In addition, access to the high school students required a contact person at each school, which may have influenced the sample pool. For this study, all of the high school participants were planning to attend college or entering the military after high school, the lack of high school participants who planned to go directly into the workforce is a limitation. Person characteristics that are limitations involve differences by gender or ethnicity. Diversity within this study relates more to socio-economic diversity than ethnic or gender diversity. This diversity by socio-economic status and not gender was important because engineering students tend to be white males and fewer low-income students obtain a higher education (National Science Foundation, 2013; U.S. Census, 2010). The sample was insufficient with regard to gender and ethnic diversity for conclusions to be drawn in the current analysis. Additionally, the author was unable to find college and working engineer participants from each socio-economic category present in the region, as defined by ARC resulting in no working or college engineering participants from a distressed county.

With regard to the quasi-longitudinal design, participants were interviewed once and not longitudinally. Instead, to represent a time sequence, participants were at different points in a career path, requiring some participants to reflect on their career goal reasons and influencing factors. Additional details on the participant characteristics, limitations, and interview timing are provided in Chapter 3. Although limitations, these acknowledged situations did not significantly detract from the value of researching how students are influenced with respect to career goals.

The purpose of this study was to explore and understand influencers of how high school students make career decisions in Appalachia with a social constructivist approach. According to Creswell (2009), a social constructivist's worldview purports that individuals develop subjective

meanings of their experiences, that the context is paramount to these experiences, and that the meanings are a complexity of viewpoints. Thus, social constructivists rely on the participants' views of a situation.

1.6 Definitions

The following definitions are provided to orient the reader to the terminology used in context for this research. Definitions include some of the constructs used in the SCCT model that are most relevant to this study. Additional definitions and detail of the SCCT model and constructs are contained in Chapter 2.

A **Choice Goal** is the intention, plan, or aspiration to engage in an activity (e.g., engineering studies) or to obtain an outcome (e.g., become an engineer). Choice goals may be toward a career or an academic degree. For this research, career choice goals of high school students were studied (also referred to as a career goal). An academic choice goal (also referred to simply as an academic goal) includes plans to pursue college and the type of degree planned. A career choice goal (also referred to simply as a career goal) refers to one's aspiration to work in a particular job or field (e.g., engineering) (Lent & Brown, 2006). In addition, the job or field is the career choice (e.g., dentistry or engineering) and the career goal or career choice goal is to aspire to become the person (dentist or engineer).

Contextual Affordances refer to supports and barriers, documented or perceived, that are proximal or distal to goal and action choices. For example, a proximal contextual affordance can be emotional support or financial aid for college. In comparison, distal background resources (a type of contextual affordance) affect learning experiences, such as geographic location limiting exposure to certain types of and context of learning experiences. Distal contextual affordances include items such as family background. Distal contextual affordances and are early

shapers of self-efficacy (one's belief in their capability to attain a performance of a task) and outcome expectations (Bennett, 2008; Lent & Brown, 2006).

An **Outcome Expectation** is the belief about a consequence of performing a behavior, that is, what the person will get from engaging in the behavior. Outcomes may be positive, neutral, or negative. Outcomes may be financial, personal, or societal. For instance, outcome expectations may be financial stability, prestige, hard work or long work hours, or the ability to help others or the environment (Lent & Brown, 2006).

Vicarious learning occurs through observation of the learning event. The behavior can be video recordings or live interactions. Vicarious learning occurs when the learner sees or hears a learning situation; the situation does not need to be intended as a learning situation for the learner (Bandura, 1986).

Continuing Generation Appalachian (CGA) refers to participants whose parents were from Southwest Virginia, the region of interest for this study. For this term, "Appalachian" was not intended to refer to people from the entire Appalachian region, as defined by ARC. Instead, this term was intended to capture whether a participant has family roots in the area where the participant currently lives.

First Generation College (FGC) has several meanings in the literature. Specific to this research, FGC student refers to a student for whom neither parent/guardian had a 4-yr college degree, this use aligns with the definition used for Government programs sponsored by the U.S. Office of Education TRIO programs (Billson & Terry, 1982). In this study, students with at least one parent who attained a 4-yr degree are considered second-generation college students.

Prospective First Generation College (PFGC) applies to a high school student, if they pursue a college degree and neither parent nor guardian has a 4-yr college degree.

1.7 Summary

The purpose of the study was to explore factors influencing Appalachian high school students' career goals, especially with respect to engineering, from the perspective of the high school student participants. The study is significant because career choice varies based on context and students in Central Appalachia have unique backgrounds, contextual affordances, and learning experiences. This study was situated in an Appalachian context and represented Appalachians' perspectives. I used a qualitative exploratory case study approach to help fill a gap in the literature with respect to Appalachian students and engineering as a choice goal. The resulting reasons for high school students from the case study region, to pursue career goals include information that both agrees with and diverges from the existing literature.

Chapter 2 synthesizes the literature with respect to Appalachia, Appalachian and rural career choice goals, and Science, Technology, Engineering, and Math (STEM) choice goals. The literature review provides support for the significance of the study. Chapter 2 then uses literature to provide details to explain why my methodology was a good choice to answer my research questions. Chapter 2 concludes with information on the SCCT model and relevant SCCT literature for this research.

Chapter 3 describes the research methodology used, including details of the research design, participants, interview information, data collection procedure, analysis methods, Institutional Review Board (IRB), ethical considerations, and the role of the researcher.

The research findings are presented in Chapter 4 and a discussion of their implications and how they answer the overarching research question is included in Chapter 5. Conclusions and implications for future work are also contained in Chapter 5.

Chapter 2. Literature Review

To support the purpose, scope and methods used in my study, the literature review is divided into three main sections; background on Appalachia, the framework, and a justification for my proposed research approach. Section 2.1 provides background information on Appalachia to provide context for this research. In particular, this section describes the geographic, cultural, educational and economic characteristics that distinguish Appalachia from other regions of the United States. In this section, I also justify selection of the sub-region of Appalachia used for my study. Section 2.2 presents the theoretical framework, Social Cognitive Career Theory (SCCT), used to frame the methodological approach and answer the research questions. I describe the framework and define key constructs specifically with regard to the Appalachian region. Finally, I shift to a justification for my research method as an explorative qualitative case study in section 2.3. The argument for my approach is grounded in what is known through current literature as well as extending to what is left to be discovered.

2.1 Appalachian Region

To understand this research on Appalachian high school students' career choices and, specifically, choices to pursue engineering degrees, it is necessary to understand the Appalachian region itself. The Appalachian region has several factors distinguishing it from the United States as a whole and, in particular, from urban areas that are also typically studied as pockets of underrepresented groups in STEM fields. Such distinguishing characteristics include a higher percentage of Caucasians, a lower population density, a lower percentage of people with a college education, and a higher percentage of people living below the poverty level. Less tangible are factors such as loyalty to family and a connection to the community. Drawing on

data the government uses and characteristics highlighted as important in literature on career choices, four key variables emerge as essential to describe Appalachia: geography, culture, education, and economics. Describing Appalachia requires considering the connections between the physical (e.g., geographic boundaries and availability of natural resources), the cultural (e.g., family) the educational and the economic demographics. Appalachia, however, is not uniform with regard to these characteristics; it has diversity within its geographical boundaries and is a place with diverse individuals. Therefore, it is also important to bound studies to capture and understand the unique interactions of the land, the culture, and the individuals in Appalachia. Therefore, information on the specific sub-region of Appalachia selected for this case study is also detailed in this chapter.

2.1.1 Defining Appalachia

Studying Appalachia requires first defining Appalachia. Popularly, the region is most often defined by the Appalachian Mountains - and its well-known trail - that stretch roughly 2,000 miles in the United States from central Alabama to Maine. Though the Appalachian Trail (or AT) ends in Maine, the mountains themselves continue into Newfoundland in Canada. The highest peaks are Mount Mitchell in North Carolina (6,684 feet) and Mount Washington in New Hampshire (6,288 feet) (Owens, 2000). The Appalachian Mountains are rich in minerals and contain the world's largest deposits of asbestos, anthracite, and bituminous coal, as well as copper and zinc (Martis, 2005; Owens, 2000). Above ground, the southern Appalachians contain the world's largest broad-leafed deciduous forest. In the central and southern regions, these deciduous forests distinguish Appalachia from the adjoining areas that are dominated by southern pines and croplands (Martis, 2005; Owens, 2000). However, the Appalachian Mountain range is not a singular region; the portion from Pennsylvania and north is part of the "Northeast,"

the Mississippi region is part of the “Gulf Coastal Flats,” and the remaining portion of Appalachia is the “Upland South.” (Martis, 2005). These regions have geographical and cultural similarities and differences. The changing boundaries and cultural differences demonstrate the complexity in saying what Appalachia and who Appalachians are, and highlights the need to be specific when researching and reporting on Appalachia. In fact, a study conducted “in Appalachia” would have no meaning without explaining important geographic characteristics of the particular region under investigation or comparing and contrasting across multiple geographic regions.

Official geographic definitions of the region, in contrast, are often based on state or county boundaries. Historically, these definitions have included a nine-state definition by Campbell in 1921, a thirteen-state definition in 1962 by Ford, to the current designation by the Appalachian Regional Commission (ARC), which itself has also changed over time (Cooper, Knotts, & Elders, 2011; Moore, 2005; Whisnant, 1997). Figure 2 shows the varying boundaries used to describe “Appalachia.”

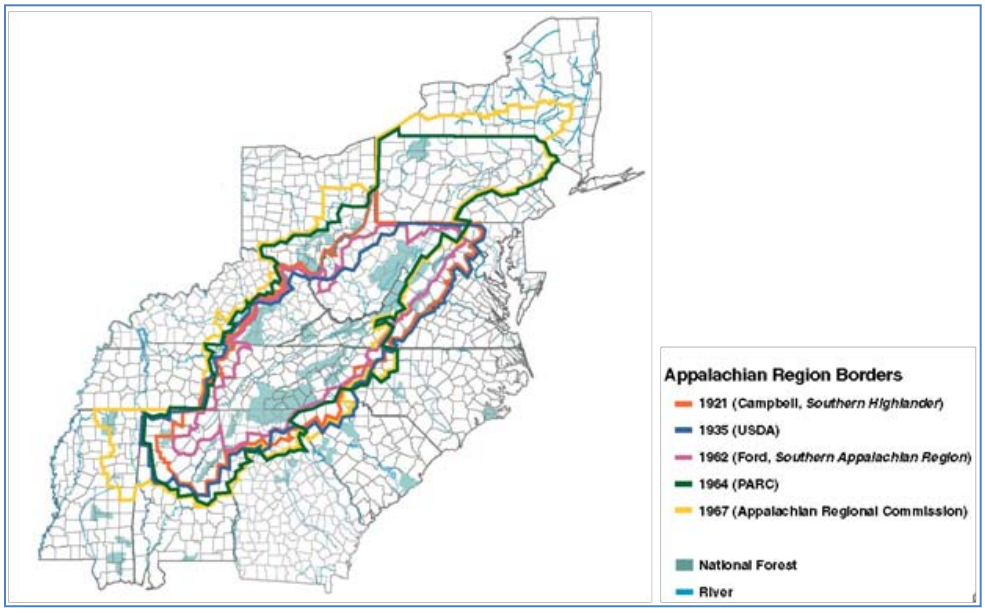

Figure 2. Changing Appalachian Regional Boarders (Whisnant, 1997)

The original ARC boundary (established in 1965) went beyond the physiographic boundaries of the mountains to consider what was politically needed to expeditiously pursue federal funding for the area. In 1967, the expansion to include portions of Eastern Mississippi and New York further reflected an "administrative region based on public policy for jurisdictional purposes" (Moore, 2005, p. 51). Consequently, references for Appalachia also refer to areas of Northeast Mississippi and parts of Ohio as "Appalachian" and cite the ARC as rationale. According to the ARC, Appalachia currently includes part (or all in the case of West Virginia) of thirteen states, contains 420 counties, roughly 205,000 square miles, and nearly 25 million people (Appalachian Regional Commission, FY 2010).

These differing geographical definitions suggest that "Appalachia" is not a geographical region as much as a socially constructed region such that people have a varying sense of being part of Appalachia. Studies of Appalachian identity confirm this notion further, suggesting that the extensive geographical definition by the ARC is too broad. For example, people in the ARC defined region of Eastern Mississippi and parts of Alabama show little evidence of identifying as Appalachia and are more likely to self-identify as Southerners (Cooper et al., 2011). Likewise, those in the ARC defined northern states are more likely to identify as Northeasterners or New Englanders (and in fact, the ARC definition extends only into southern New York and excludes New England altogether). Still, some commonalities exist among those who consider themselves Appalachian, including aspects of community, folk culture, and policy opinions such as opposition to zoning (Cooper et al., 2011; Shapiro, 1978).

Despite these similarities, the wide disparities across the ARC officially defined Appalachian region (highlighted in subsequent sections) make it critical to frame studies of Appalachia in

more specific terms. For this study, the Virginia portion of the Central Appalachian subregion (see Figure 3) plus two South Central counties was selected as the case study for several reasons:

- Central Appalachia embodies typical Appalachian characteristics of rural, mountainous, and blue-collar / company towns
- Central Appalachia has among the lowest economic and educational levels of the region
- The Central Appalachian portion of Virginia has fewer engineers than the state average
- High school requirements vary by state so choosing a portion of Central Appalachia within a single state (Virginia) minimizes variation between states, and
- The Counties chosen allows for variation within the case study region with respect to the economics, educational levels, and populations. The variation allows for comparison of variables within the case study

Figure 3. Subregions of Appalachia (ARC, n.d.)

The following sections highlight both broad characteristics of the Appalachian region as a whole and the specific characteristics of the subregion of interest.

2.1.2 Geographic Variety of Appalachia

The Appalachian region contains unique geography relative to the United States as a whole, and some characteristics, such as the coal and the mountains, are tangible identifiers for "Appalachia." These geographic characteristics have influenced transportation, population, migration, and key employment sectors within Appalachia. Subsequently, the geography of Appalachia has influenced the culture, education, and economics of the region. This section discusses the unique geographical influence, including early settlements, in Appalachia.

During the early American migration westward, the physical barrier of the Appalachian Mountain system inhibited transportation and compounded the difficulty of settling in and developing the region, particularly the Upland South and Appalachian coal fields; with the coal fields being another physical geographical element that defines Appalachia. The physical difficulties of the region caused it to be bypassed by canal systems such as the Erie Canal, roads, and railroads (Martis, 2005). Based on a review of several geography textbooks, Martis (2005) surmised that the lack of transportation infrastructure, coupled with the topography of the region, resulted in the region's isolationism and lack of large urban areas.

The geography and settlement of the region contributed to another identifiable feature of much of Appalachia - its rural setting. The Appalachian region as a whole (defined by ARC) has a mean population density greater than the U. S. average (123.5 and 87.4 people per square mile respectively). However, less than half of the Appalachian counties have a population at, or above, the nation's average. In other words, the median density is below the mean. Appalachian metropolitan areas such as Atlanta and Birmingham (that also relate to a southern identity) and

Pittsburgh contribute to the skewing of the mean population density, as does the Appalachian area of Maryland. However, the areas of Central Appalachia (see Figure 3) tend to have a density of 87.4 or less people per square mile, which is below the national average (Pollard & Jacobsen, 2011) and Central Appalachia contains the counties used in this case study. Figure 4 shows the population density by county and Table 2 provides the population density values for the counties included in this study. Note that within this case study, only the counties of Washington and Wise have a population density greater than 87.4; they are 96.8 and 102.3 people per square mile, respectively.

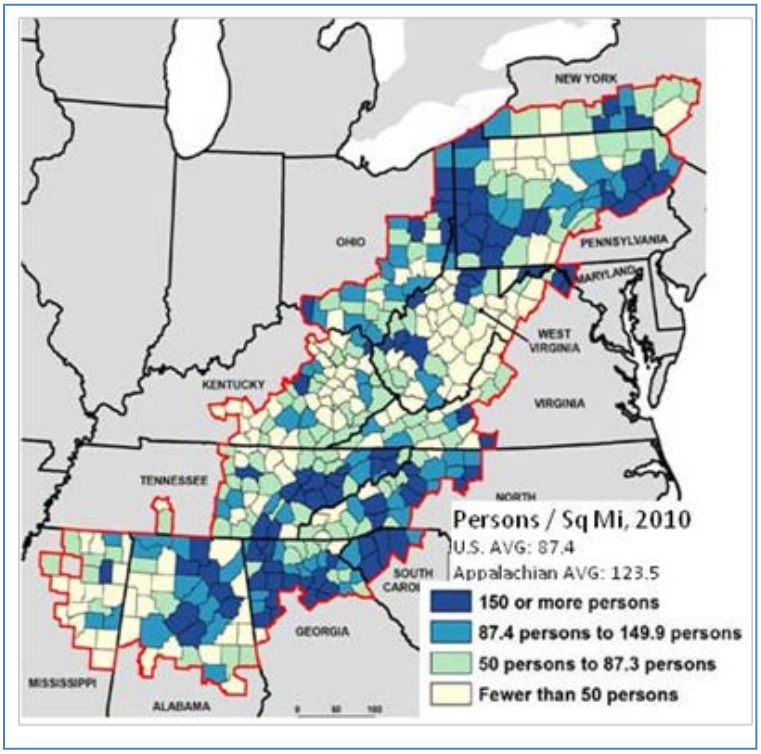

Figure 4. Population Density (ARC, 2010)

As previously stated, the ARC definition of Appalachia is broad and though it defines Appalachia as a portion of 13 states from Mississippi to New York, the core of Appalachia, and the portion that does not overlap with other established regions contained in Appalachia, is Central Appalachia (shown in Figure 3). Characteristics of Central Appalachia include a high

percentage of rural counties, a geographical location in the Appalachian Mountains, and an area self-identified at a high rate as “Appalachian.” Historically, the Central Appalachian region has a unique social and cultural identity and has been affected the most by poverty (Thorne, Tickamyer, & Thorne, 2004) and, per ARC, contains the largest number of low-income (or distressed) counties. Information on the cultural, economic, and educational diversity within Appalachia and Central Appalachia is provided next, followed by a statistical summary of this information for the specific counties included in this research.

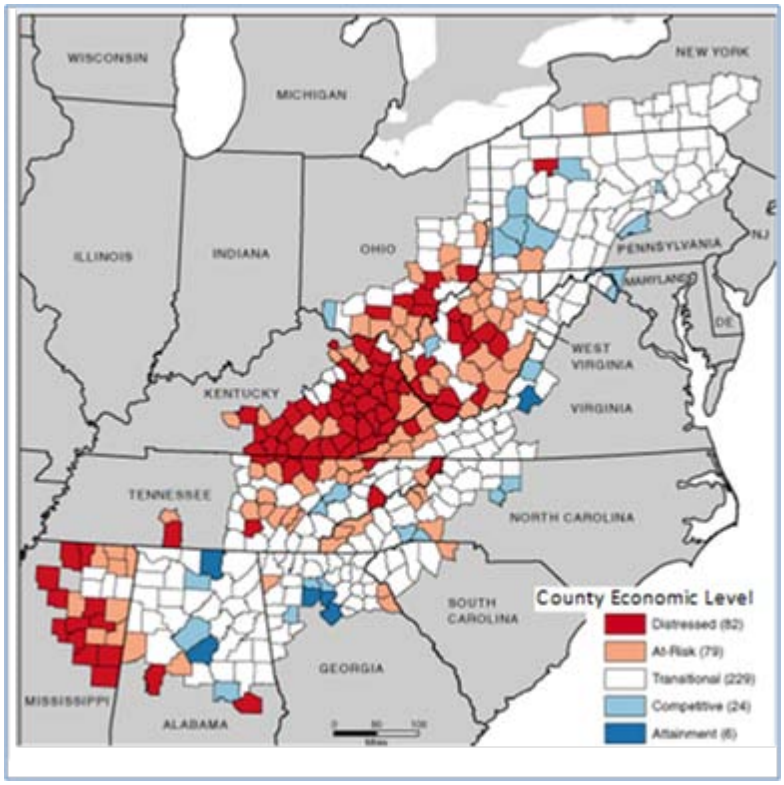

Figure 5. County Economic Level of Appalachia (ARC, 2010)

2.1.3 Cultural Diversity of Appalachia

Coinciding with the effects of the geographic features of the area, is a rich cultural heritage that affects the way young people formulate career plans. To understand this heritage, we must look at the people that originally settled the region (along with the geographic

isolationism described in the previous section) as contributing to the values lived today, particularly with regard to attaining higher education.

Appalachians do not fit the typical cultural profiles for affluent or poor Americans. However, the majority of Appalachia shares ethnicity characteristics of many affluent Americans – predominantly white, largely Anglo-Saxon ethnicity, predominantly Protestant, and roots tracing back several generations to the region (Bennett, 2008; Cooper et al., 2011; Sarnoff, 2003; Tang & Russ, 2007). Consequently, there is debate with respect to Appalachians as a distinct cultural group due to the lack of ethnic diversity (e.g., (Shapiro, 1978)), even though Appalachian people are often negatively stereotyped and marginalized in similar ways as ethnic minority groups (Ali & McWhirter, 2006; Ali & Saunders, 2006; Chenoweth, 2004). Compared to the broader population, Appalachians have a distinct dialect (Ali & McWhirter, 2006), a higher percentage of "intact" families (82% in Appalachia) and less female head of households (14% in Appalachia) than the nation on average (Consortium, 1996). Thus Appalachians, and primarily Central Appalachians, do not fit the "poor" stereotype of people being non-white, foreign-born, or part of a female-headed household (Sarnoff, 2003), even though Appalachian families are more likely to be poor.

The pattern of settlers to this region is one important factor contributing to the ethnic make-up and culture of Appalachia. Historically, Native American tribes, such as the Cherokees, settled in the Appalachian mountain region. Over time, Scotch-Irish and German immigrants settled in the Northern, Southern, and Central regions of the Appalachians while migration of African Americans occurred primarily after the Civil War and during work on the rail system. Settlers of Scotch-Irish descent left England due to war, famine, and poverty. Migrants from the northern area of England, Ireland, and Scotland arrived after many of the first immigrants from

England. The early immigrants of the United States tended to settle in the coastal areas and as a result, later immigrants tended to settle further inland including areas of Appalachia. In addition, these later immigrants were from areas of England that already had some prejudice toward them from the earlier immigrants (McNair, 2002). The pattern of settling that leads to dialects may distinguish family background and type of work (e.g., farming versus factory) within Appalachia and many Appalachians continue to use dialect as a means of determining whether people are local or outsiders and for cultural cohesiveness (McNair, 2002; Sarnoff, 2003; Tang & Russ, 2007).

Cultural values such as loyalty to family, self-sufficiency, community ties, and close friendships resonate throughout literature on Appalachia. Reasons for strong family ties are credited to several factors: the Scotch-Irish clan culture, migration patterns involving prejudice traced back to England, isolation, and distrust for outsiders who are seen for exploiting the land and labor force (Ali & McWhirter, 2006; Bennett, 2008; McNair, 2002; Sarnoff, 2003; Tang & Russ, 2007). In addition, several outcomes are reported in the literature based on the strong bond of family in Central Appalachia. Examples of the strong family bond include the proximity of relatives to each other, including for several generations; family members as role models; and the reliance on family and the community for support (Azano, 2011). Within the diversity of the participants' for this study, most of these characteristics (strength of family bond, family members as role models, and connection with the community) were present.

With respect to self-sufficiency and community ties, according to Tang & Russ (2007), when in need of help, Appalachians turn first to their family and church and then to their community and neighboring churches. It is only after seeking help from within, that they will then turn to an agency or institution. The Christian church is considered a part of the extended

family in Appalachia and shows up in writings throughout the Appalachian heritage (Tang & Russ, 2007). Consideration of the church as being part of the extended family is not typical within literature addressing career choice for engineering.

Gender may also play a prominent role in female socialization in Appalachia due to the cultural tradition of females not working outside the home and engineering as a male's job (Haight & Gonzalez-Espada, 2009). Though more Appalachian women began working outside the home in the 1990s as the coal mining industry was decreasing, the effect may still be less support for education and fewer learning experiences for women. Within Appalachia, adherence to gender stereotypes and sexism may limit the breadth of female's learning experiences (Bennett, 2008).

The cultural values such as closeness of family, church, and community are portrayed as a common characteristic within Appalachia. Thus, the importance of these cultural characteristics should be considered, however, they should not be assumed to hold for all individuals. Therefore, questions related to family, church, and community must be asked in a neutral, open-ended manner, to allow the participants of this case study to report how these factors influence them; patterns for commonality and diversity can then be made. Another characteristic that is generalized across Appalachia, and in particular Central Appalachia, is the high level of poverty.

2.1.4 Economic Diversity of Appalachia

Though the Central Appalachian region as a whole suffers from high rates of poverty, within the region, there is economic diversity. The ARC publishes data on the region including assessments of population, economics, and educational achievement. Consolidated census information for comparison within and between Appalachia and the nation is available on the

ARC website (ARC, n.d.). Included with the data are graphical representations, including economic and population data. Figure 5 shows the subregions of Appalachia and the current economic status of the region. As shown in Figure 3 Central Appalachia is divided into North Central, Central, and South Central. Central Appalachia is an area defined as portions of four states and includes southwest Virginia, West Virginia, Tennessee, and eastern Kentucky (Shaw, De Young, & Rademacher, 2004). Recall that the Central Appalachia counties in Virginia are the area of primary interest for this research. Another ARC-defined reference is the county socio-economic designations (county conditions) of Distressed, At-Risk, Transitional, Competitive and Attainment. The economic levels are a national ranking from a composite of three indicators (three-year average unemployment rate, per capita income, and poverty rate). The results are then divided into the five economic levels with the top 10% in the nation considered Attainment, the 10-25% best are Competitive, Transitional are between the worst 25% and best 25%, At-risk represents the worst 10 – 25%, and the worst 10% in the nation are Distressed (ARC, n.d.). Central Appalachia contained some of the deepest poverty levels equaling or exceeding urban areas and central city ghettos (Thorne et al., 2004). The poverty rate varies from 14.2% (Tennessee) to 24.4% (Kentucky) while the U.S. average is 12.4% (Appalachian Regional Commission, FY 2010). Figure 5 (section 2.1.2) shows the county economic level designation for Appalachian counties and Table 2 (section 2.1.6) shows the percent poverty and ARC county economic designation for the counties included in this research. For this research, only three of the five county economic designations are included: Distressed, At-Risk, and Transitional. Note that there are no Competitive or Achievement counties in the Central Appalachian subregion, or within several counties of this case study region. Some people, such as Harrington in his 1962 book *The Other America*, have referred to Appalachia as a “culture of poverty.” The concept of a

"culture of poverty" suggests that the poverty in Appalachia is systemic to the region based on historic economic, cultural, and political developments. Harrington argued that poverty in Appalachia is unique because it does not stem from discrimination of minority status, continues regardless of the United States' strength of economy, and people raised in Appalachia would not want to disseminate into urban areas (Sarnoff, 2003). According to Sarnoff (2003), "the culture of poverty implies that the poor are lazy and unwilling to work" (p. 132) and that income differences often relate to productivity differences. Sarnoff (2003) further suggests that Appalachian poverty may be unique in part because productivity differences are a result of Appalachians' resistance to exploitative employers. Furthermore, others, such as Billings and Blee (2000), have discredited the claims that Appalachians are lazy and unwilling to work as discriminatory and victim blaming and that the "culture of poverty" is not based on the individual.

With regard to the types of employment available in the Appalachian region, there is a lack of technical white-collar jobs (Seufert & Carrozza, 2004) which can have a negative effect on the employment expectations of Appalachians, as can the distrust of outsiders and history of exploitation by businesses (Tang & Russ, 2007). Key employment sectors in Appalachia are mining (#1), manufacturing (#2), farming and natural resources (#3), and utilities (#4). However, in 2010, the ARC projected employment opportunities to decline for mining, farming, and manufacturing in the Appalachian region through 2015. Utilities, however, were projected to increase (Appalachian Regional Commission, FY 2010). Within the region, companies that do employ engineers have a difficult time hiring and retaining engineers and companies reported a need for an increase in the number of engineers local to the region, based on information received from several companies while developing the ECC project.

2.1.5 Education in Appalachia

Most research suggests that education is paramount to individual, economic, and social growth (Haaga, 2004; Seufert & Carrozza, 2004; Shaw et al., 2004), yet the region of interest for this study lags behind the national average for post-secondary education and the gap is increasing. Details on educational attainment are presented in this section as well as how cultural views may impact intensions to pursue post secondary education. The education data covers a twenty-year span to show the trend of, and between, the U.S. and Central Appalachia. In addition to the region of this study, the educational attainment in Appalachia as a whole lags behind the national average (Haaga, 2004; Shaw et al., 2004). However, the gap with the Central Appalachian region is the greatest and Table 1 shows the comparison between the United States and Central Appalachia.

Table 1. College Completion and Attainment (ARC, n.d.)

	College Degree 1990	**College Degree 2000**	**College Degree 2010**	**Attended College 2010**
United States	14.8%	18.4%	24.4%	50%
Central Appalachia	8.8%	10.7%	14.2%, Va only	25%

The 1990 data indicates 8.8% of Central Appalachian residents had a college degree and by the year 2000, the percent of residents with a college degree in Central Appalachia was 10.7%. For post-secondary education, the gap has widened between the national average and the Appalachian average from 1990 to 2000; the 1990 gap was 6% and the 2000 gap was 7.7% (Shaw et al., 2004). By 2010, the national average was 24.4% while the Central Appalachian region of Kentucky was 10.7% and the Central Appalachian area of Virginia was 14.2% showing that the gap continued to increase (Appalachian Regional Commission, FY 2010). Similar to

other key variables, the percentage of college completion varies for the counties of interest in Virginia; ranging from 6% for Dickenson County to 17% for Washington County.

The educational data indicates that the number of degreed individuals is increasing as a percentage of the population both in the U.S. and in Appalachia. However, the gap between rural Appalachia and the U.S. is growing and the average college-completion percentage in the Central Appalachian region of Virginia relative to the U.S. completion rate remained the same at 58%. The percent of college-completion in the region of interest (Table 2, page 30) shows that only Washington County is above the Central Appalachian average and the remaining counties are noticeably lower. In addition, once in college, students from lower income families are more likely to drop out (Haaga, 2004). Comparing the percentage of college graduates with the county economic status, as demonstrated by comparing Figure 6 with Figure 5, shows a positive correlation between college completion and a higher economic level.

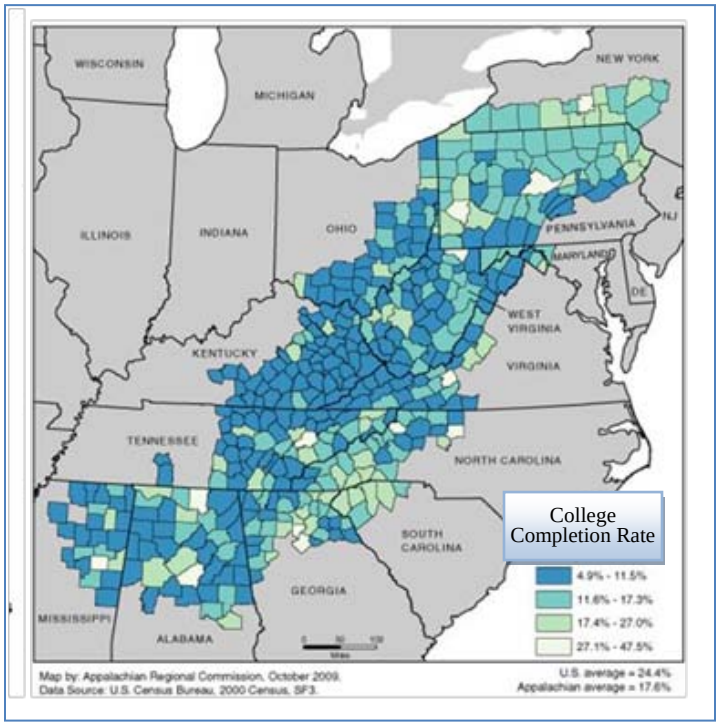

Figure 6. College Completion Rate (Adults over 25 yrs) (ARC, 2010)

In addition to correlations between college degree completion and county economic status, parental educational level may correlate with student career aspirations and career choices. Research by authors such as Irvin et al. (2012); Stake (2006); and Ali and Saunders (2006) support the importance of knowing if parents, legal guardians, or close relatives attended college or have college degrees when researching career choices. For example, Stake (2006) reports that a students whose parents have higher educational degrees are more likely to continue in science fields and posits that the example of parents with higher education represent commitment to life-long learning which outweighs the ability of economic status to inspire academic goals.

A sense of self-reliance, hard work, resistance to change, and loyalty to family may also feed a negative perception of higher education. This sense of family results in some students reporting pressure to remain close to home even though there are few educational opportunities or jobs close to home. Remaining close to home may also result in students from low-income families having pressure to earn an income, work with their hands, and not pursue college (Azano, 2011). Therefore, not only is education correlated with economic growth, but it may also influence students as they choose their career goals.

Within literature on Appalachian youth, the bond of family is reported as both a support and a barrier for students considering post-secondary education. As a support, students indicate encouragement to attend college. As a barrier, educational attainment competes with the Appalachian sense of family and community. A perceived reason for this conflict is that many people who leave for college do not return to their home community, which is counter to the Appalachian culture of remaining close to family. Another potential barrier reason is family members may deem higher education as a “waste of time” and some college students are accused

of acting “better” than others. Students also report their parents and family members as their role models and thus may want to immolate their actions, possibly remaining close to home and earning a living directly after high school (Ali & McWhirter, 2006; Wallace & Diekroger, 2000).

Another important factor may be that school sizes in rural Appalachia tend to be small and the distance students travel to school lengthy. In rural areas, the distance that students travel to schools can be greater in spite of their being more schools per student and these travel distances can require students to spend more time going to and from school and between schools. In addition, rural schools tend to be smaller with the majority having less than 400 students (Khattri, 1997). A positive impact of smaller school sizes is a greater sense of community. However, a limitation of small schools is the number of course offerings (e.g., calculus) and reduced extra-curricular activities (such as gifted and talented programs and athletics) (Khattri, 1997).

2.1.6 Case Study Demographics by County

Based on the literature for Central Appalachia, nine counties in Southwest Virginia were chosen to bound the unit of analysis for this case study. Seven of the nine counties are labeled as Central Appalachia and two of the counties are labeled South Central Appalachia by the ARC (ARC, n.d.). Overall, the region included in this research had an average per capita income of less than $30,000/year, an average population density of less than 100 persons per square mile, and less than 20% of the population completed college (Appalachian Regional Commission, FY 2010). Within the region, there is a variety of socio-economic characteristics, such as the county economic condition, poverty rate, population, and post-secondary education rate. Though generalized in the literature by region and by county, the variety of details within this area of Virginia shows that it is not homogenous. Table 2 shows details, organized by county, for the

specific region of this research; note that typically, Washington County, Virginia, is at one extreme of the county demographics and Dickerson County, Virginia, is at the opposite extreme of demographics within the case study counties. For each column, the highest and lowest values are coded with blue and red to show the variance. Note that these values are at each end of the spectrum of values and, in cases such as population, are not intended to suggest if a value is positive or negative. The parameters used in Table 2 were chosen based on three factors; 1) data published by the ARC, 2) common parameters used to describe Appalachia in the literature, and 3) data related to career choice (engineering degrees and post-secondary education attainment). Chapter 3, Methods, contains additional data collected at a level lower than county level, for example the high school size and parental background of the participants. Chapter 3 also provides additional detail on the purposeful choice of the nine counties used in this case study.

Note that the percentage of college completion provided in Table 2 is relative to the U. S. average of 24.4%. Washington County therefore has an absolute degree completion rate of 16.3% (67% multiplied by the national average of 24.4%). Within the case study region, all of the counties are below 100% of the U.S. average for education. Likewise, for poverty, all of the counties are over 100% of the U.S. average signifying all the counties in this study have a poverty rate greater than the U.S. average. Finally, in the 2010 census, for counties reporting data, the average percentage of people reporting an engineering bachelor degree in Virginia, as their first degree, was 9.1%. For the counties of this case study reporting information, the average is 4.3%. For the seven Central Appalachian counties in Virginia, the percentage of people reporting engineering as a first degree reduces to 3.7%, with several counties not reporting data. Thus, participants are less likely to have access to engineering within this case study region than elsewhere in Virginia.

Table 2. County Characteristics for Select Virginia Counties

County	Economic Condition (2010)	Poverty, % US Ave. 2006 - 2010	Per Capita Income (2010)	Population Density	Population (2010)	Population Change 2000 – 2010	College Completion (% of US Ave., 2000)	Engineers, % by B.S. degree
U. S.	Various	100%	$39,937	87.4	308,745,540	9.7%	100%	
Virginia	Various	74.5%	$44,267	202.6	8,001,020	13.0%	120.7%	9.1%
Appalachia	Various	113.2%	$32,645	123.5	25,243,460	6.8%	72.2%	NA
Buchanan	At-risk	157.6%	$30,099	47.9	24,100	-10.7%	32.6%	NA
Dickenson	Distressed	138.5%	$28,871	48.1	15,900	-3.0%	27.3%	NA
Lee	At-risk	153.2%	$27,258	58.8	25,590	8.5%	39.0%	4.0%
Russell	At-risk	124.1%	$27,995	61.0	28,890	-4.7%	38.4%	2.8%
Scott	At-risk	133.3%	$26,989	43.3	23,180	-1.0%	34.2%	2.1%
Smyth	Transitional	138.5%	$27,381	71.4	32,210	-2.6%	43.5%	3.8%
Tazewell	Transitional	122.5%	$32,424	86.9	45,080	1.1%	45.1%	5.1%
Washington	Transitional	121.9%	$32,084	96.8	54,800	6.2%	67.0%	6.5%
Wise	At-risk	148.7%	$31.285	102.3	41,450	3.1%	45.6%	3.5%
Case Study Population Extremes in Red and blue								

- Sources: Appalachian Regional Commission, Virginia Department of Education, and U.S. Census Data
- U.S. rate of poverty = 13.8%; U.S. College Completion = 24.4%
- Blue and values are the two largest values and red are the two smallest values for the given column (poverty is reverse coded)

2.1.7 Appalachian and Case Study Region Summary

In summary, the region of Central Appalachia, as defined by the ARC, is at the heart of Appalachia and the focus of this research. The characteristics of the counties in this case study were compared and contrasted with Appalachia (on average) and the United States. Based on the information presented, there are commonalities within Appalachian regions and between Appalachia and other regions in the U.S. Similarly, gaps are not just between Appalachia and the U.S., but also within Appalachia. College completion rate is an example of commonality with Appalachia, yet variety between the Appalachian counties of this case study. All of the counties in this case are below the national average of 24.4% for college completion, as is typical for Central Appalachia; however, within the counties the variety of completion rate varies from 6.7% (Dickenson County) to 16.3% (Washington County). Similarly, 13.8% of households in the U.S. are below the poverty line and on average Appalachia and all of the counties in this case study have an average of more households below the poverty line. Within the case study counties, the rate of poverty varies from 16.8% (Washington County) to 21.8% (Buchanan County).

Based on the literature, within Appalachia, factors related to economics, lower educational attainment, loyalty to family (including desire not to relocate), and learning experiences are expected to be salient influences for career choices and for reasons related to engineering as a career choice. The nine counties in Southwest Virginia representing the case (or unit of analysis) represent Central Appalachia and provide diversity within the demographic data, to allow for a thorough exploration of career goals. Using the SCCT model as a guide, the next section shows how the factors discussed in this section may influence high school students, who live in the region.

2.2 Framework

Social Cognitive Career Theory (SCCT) (Lent et al., 1994, 2000) has extensive use as a theoretical framework for understanding career choice processes (Irvin et al., 2012; Lindley, 2005) and focuses on constructs that are relevant to Appalachia and the region used in this study. SCCT was developed to understand the processes during which individuals form interests, make choices, and attain varying degrees of achievements in occupational and academic pursuits (Lent et al., 1994). SCCT literature includes studies on Appalachian students (e.g., (Ali & Saunders, 2009), K-12 students' career goals (e.g., (Gibbons & Borders, 2010)), and college engineering student career goals (e.g., (Lent et al., 2005)) all of which informed the design and interpretation of findings from this study. SCCT is an appropriate framework for this study because of the way the economic, cultural, and geographic factors discussed in the previous section can be associated with one or more of the SCCT constructs (see Figure 7 for the model's constructs). Therefore, SCCT guided this case study research by providing a road map for developing interview protocols and for what published statistical data to collect on the case. The framework also assisted with initial organization and coding of the data collected.

Background information on SCCT is provided in this framework section, followed by information about each SCCT construct. Each construct section contains the construct's definition, relevant characteristics about Appalachia associated with the construct, relevant findings from the literature, and how the constructs interrelate. For this research, the emphasis was on proximal (supports and barriers) and background (distal) environmental influences, learning experiences, and outcome expectations as they pertain to influencing a career choice goal.

2.2.1. Overview of SCCT

SCCT is based on a career choice being a function of contextual supports and barriers, self-efficacy, outcome expectations, and interests. Thus, SCCT posits that students will base their career choice on having 1) the skills and knowledge for the career, 2) expectations of the reward for the career, 3) a commitment to do the work related to the career, and 4) a supportive climate for pursuing the career. SCCT has been used as a framework for studying career development and academics (Betz, 2008; Lent et al., 2005) including in rural Appalachian settings (Ali & McWhirter, 2006; Ali & Saunders, 2006, 2009; Bennett, 2008; Tang & Russ, 2007). More recently, SCCT gained ground in college engineering student research (Lent et al., 2003; Lent et al., 2005; Lent, Sheu, et al., 2008; Trenor et al., 2008) and underrepresented groups (Flores & O'Brien, 2002; Gibbons & Borders, 2010; Lent et al., 2005; Tang, Fouad, & Smith, 1999; Trenor et al., 2008). In addition, several articles (e.g., (Ali & Saunders, 2006; Lent, Sheu, et al., 2008)) use quantitative path analysis to demonstrate the validity of the model's constructs and relationships to each other.

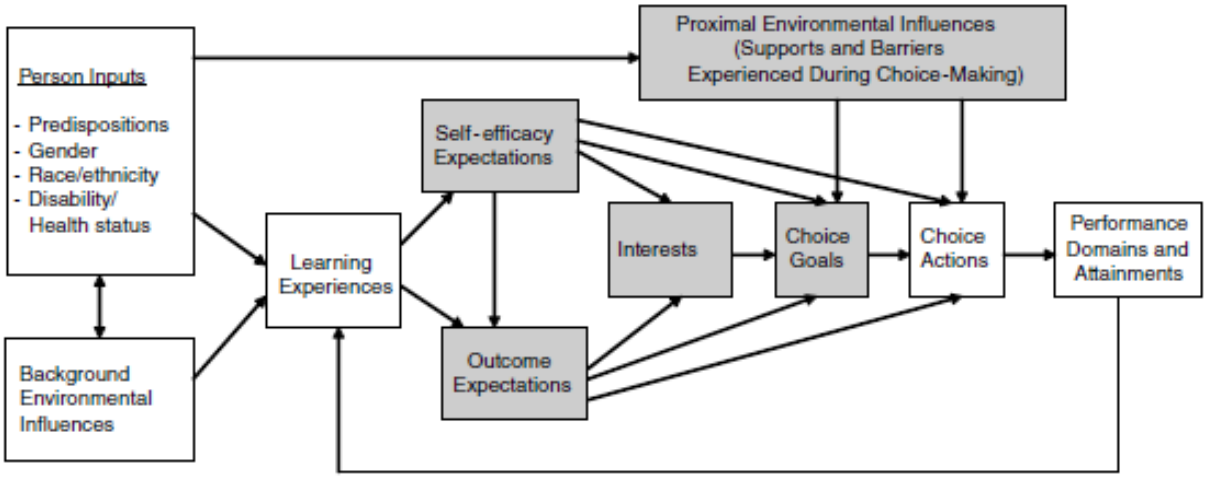

Figure 7. SCCT from Lent & Brown (2006)

Figure 7 shows the full SCCT model and how the model's constructs relate to each other. Constructs either influence a student or are personal factors. The external, influencing constructs include person inputs, background environmental influences, learning experiences, and proximal environmental influences (supports and barriers). These influencing factors flow into the individual's personal factors, which are self-efficacy, outcome expectations, interest, and choice goals. SCCT also considers the timing of the inputs as either distal or proximal; proximal influences are those that occur during the career decision-making process (the shaded boxes in Figure 7 are proximal constructs). The model predicts future plans, in the form of performance attainments, based on how a student pursues a goal by performing actions (as shown by the choice goals influencing choice actions resulting in performance attainments). The performance attainments then cycle back into the model and influence learning experiences. The cyclical nature of the model suggests that people go through it multiple times during their career; how often and for how significant a goal, action, or attainment depends on the individual. As an example, for this study, the college engineering students are reflecting on what influenced them as high school students to choose a career goal. These same college students, upon completion of high school, acted on their goal of going to college.

Using information from SCCT literature (Lent & Brown, 2006; Lent et al., 1994, 2000), definitions for the SCCT constructs are provided in the following subsections. Claims of how the constructs can be operationalized for the uniqueness of Appalachian culture, family, and community are provided along with relevant research to warrant the claim. Ideally, all references would deal with K-12 science, technology, engineering, or mathematics (STEM) and Appalachia, but insufficient research specific to Appalachia and STEM exists. In fact, current literature is scarce with respect to educational research for the Appalachian area of the United

States (Arnold, Newman, Gaddy, & Dean, 2005; Tang & Russ, 2007). However, some research conducted in rural areas, including Appalachia does exist, though, for example, not specific for engineering as a career choice. Examples of career choice research with high school and college students, specific to science and math fields, include work by Chenoweth (2004). Non-Appalachian related career choice research for students pursuing STEM fields exists (Dick & Rallis, 1991; Fouad & Smith, 1996; Lent et al., 2005; VanLeuvan, 2004), as does research for engineering (Lent, Sheu, et al., 2008; Trenor et al., 2008), and for underrepresented groups (e.g., gender, ethnicity, FGC) (Dick & Rallis, 1991; Flores & O'Brien, 2002; Gibbons & Borders, 2010; Lent et al., 2005; Morgan, Isaac, & Sansone, 2001; Stake, 2006; Stake & Nickens, 2005; Trenor et al., 2008). Though quantitative, the research that is the most similar to the present study includes Ali's work using the SCCT model and Appalachian youth (Ali & McWhirter, 2006; Ali & Saunders, 2006, 2009). Ali researched a combination of career pathways (e.g., 4-year college, work, and vocational/technical school) and the importance of interest, self-efficacy, outcome expectations, and family background with respect to career goals. The Ali and Saunders (2006) article specifically looked at college expectations of Appalachian youth, but did not analyze the college or choice of academic degree.

2.2.2. Person Inputs

Person inputs are internal, biological attributes with socially constructed meanings such as ethnicity, gender, health status/disability, and predispositions (e.g., intellectual ability) (Lent & Brown, 2006; Lent et al., 1994). This means that person inputs are internalized and expressed based on a socialized process (Lent & Brown, 1996). For example, SCCT suggests that gender is an important variable in career choice because people respond differently (e.g., perceived as a support or discouragement) based on gender for different careers, and this may lead to different

opportunities for learning experiences and more or less exposure to different types of career. Relevant to this study, is the notion that engineering careers are more appropriate for men (Turner, Steward, & Lapan, 2004), which could influence career choices. Within Appalachia, Chenoweth (2004) considered gender, role models, and jobs as factors influencing career goals and noted that gender differences existed in terms of reasons for attending college, but not in terms of a preference to remain local. Also, literature on Appalachia supports that there remains the traditional stereotyping of females not working outside of the home and an adherence to gender stereotypes for jobs (Haight & Gonzalez-Espada, 2009). Note that the intent of my research was not to highlight minorities or females; however, ethnic minority and gender information was collected and reviewed during analysis.

2.2.3. Environmental Influences

Environmental, or contextual, influences are resources related to social, cultural, and economic variables and can be objective (documented) or perceived (Lent et al., 2000). Environmental influences can be either background (distal) or proximal to the career goal selection and are represented by two separate constructs within the SCCT model. The primary difference between the two environmental influences is the timing of the event, thus both background and proximal are discussed together in this section. With respect to the timing, the background, or distal, environmental influences involve role models, family background, and economic status and the proximal environmental influences involve supports and barriers such as career contacts and money for college. Examples of proximal versus distal include financial and family education situations. For example, money to pay for tuition can be a proximal influence, but living in poverty a distal influence. Having a parent support a student applying for college is proximal however, a family situation of single- or two-parent household a distal influence.

Parental education achievement is a background influence; however, if a parent is in college when the child is actively making a career decision, the parent's act of being in school may act as a proximal support.

Background environmental influences (background influences) are the distal external factors that are early shapers of self-efficacy and outcome expectations (Lent & Brown, 2006). These factors are rooted in the past, may be at a more global level than a task level (for example, it may be parental education and not specific to a particular degree), and typically occur prior to developing career-related interests. According to Coleman (1988), the family background portion of the background influences can be broken into three categories: 1) financial capital (family wealth), 2) human capital (e.g., parental education), and 3) social capital or the relationship between children and parents (e.g., parental availability for a child's education). Background influences relevant to this study include economic attainment (includes financial capital of the family), job prospects, parental educational attainment (a part of human capital per Coleman), parental support (or social capital as described by Coleman) and cultural values.

Background influences may be particularly important in Central Appalachia based on quantitative research results, using the SCCT framework, of underrepresented groups. Authors such as (Tang et al., 1999) concluded that background influences may have a greater influence on career choice than other constructs such as interest. Within Central Appalachia, background influences may be affected by the below average number of college graduates, thereby increasing the likelihood that family and parental backgrounds include non-college graduates. Because research shows that students are more likely to have college career plans if at least one of their parents went to college (Ali & Saunders, 2006; Bennett, 2008), fewer students may have career plans requiring college. Ali and Saunders (2006), who used quantitative methods and a

hierarchal regression analysis, determined parental support toward college is an important predictor of expectations to attend college, more than the status of parental education and occupation. However, because many adults in Appalachia lack experience with the process of applying to college and factors that improve likelihood of acceptance, the students may be at a disadvantage for college admissions. Because the parental education and occupation was a low predictor of students' college expectations, Ali and Saunders postulated knowing the parents education and occupation alone is insufficient (Ali & Saunders, 2006) for predicting career goals.

Cultural values such as loyalty to family, community ties, close friendships, and a preference to remain local form part of the distal background influences that are prominent in the Appalachian culture and may play a prominent role in career decision-making. The importance of culture on career decision-making within underrepresented groups is illustrated by research conducted by Flores and O'Brien (2002), who reported on the importance of acculturation in career decision-making for non-traditional careers among Mexican American females. Within Appalachia, for example, loyalty to family may restrict how far a student plans to go for college, subsequently limiting their college options. Likewise, a preference to remain local and a lack of having (or knowing about) local jobs for a particular career choice may influence a student away from a career choice (Ali & McWhirter, 2006; Bennett, 2008; Sarnoff, 2003; Tang & Russ, 2007). In addition, the sense of self-reliance, hard work, resistance to change, and loyalty to family may feed a negative perception of higher education, so background information acting as a barrier to higher education is of interest for this research.

Another distal background influence is economic attainment. Both Figure 5, for the Appalachian region, and Table 2, for the case study region, show the variety of economics for

the region. As previously stated, the average economics for the case study region is below that of the U. S. and students from lower economic status families are less likely to pursue post secondary education (Ali & Saunders, 2009). Related to economic attainment is consideration of local job prospects. You may recall from the section on Appalachian economics, the key employment sectors are projected to decline (mining, farming, and manufacturing) in the Appalachian region through 2015 (Appalachian Regional Commission, FY 2010). Therefore, information pertaining to local jobs (type of jobs and education required for the jobs) within the case study region is necessary to evaluate their influence on students' career choices. In addition, because of the parental influence mentioned previously, information on parents' jobs and educational attainment is important to compare with students' intended career choices.

Environmental influences that occur during active phases of career decision-making are the proximal influences and include both supports and barriers. Supports are enabling conditions or assets and barriers, or deficits, inhibit a person's ability to achieve their career choice goals or choice actions (Lent et al., 2000). Proximal influences can be documented (e.g., financial support, parental income) or perceived (e.g., role models or bias, presence of gender bias). Positive conditions help to strengthen the belief that goals can be achieved (Lent & Brown, 2006). Lent and Brown (2006) recommend looking at specific supports and barriers to "strengthen predictive relations as well as to identify fruitful targets for intervention" (Lent & Brown, 2006, p. 18). Supports toward engineering may include encouragement from friends or family to purse engineering. Barriers may include either pressure from parents to change majors or financial constraints (Lent et al., 2003). Discrimination and stereotyping (for example, based on having an Appalachian dialect) can be impactful on proximal environmental influences due to negative comments on ability (Bennett, 2008).

The SCCT framework postulates that the distal background influences directly affect learning experiences, but the proximal support and barrier influences directly affect the choice career goal decision-making process. Based on research directly pertaining to underrepresented groups, environmental influences, regardless of timing, may influence students' learning experiences and career goal decisions.

2.2.4. Learning experiences

Learning experiences pertain to educational learning experiences that may be formal or informal, and they are considered with respect to performance accomplishments in subjects (e.g., mastery experiences, successful or not), verbal encouragement (or discouragement), and vicarious learning (e.g., watching a role model succeed or fail). In addition, learning experiences may occur at school or outside of school (Lent & Brown, 2006). For example, family members who have successfully accomplished what they want to do act as positive vicarious learning experiences for their vocational domain, and students gain outcome expectations from these experiences (Bennett, 2008). In addition, parents who attended college may provide learning experiences specific to the college experience and how to be prepared for college. Specific to this study and based on the literature, access to role models in a variety of careers, availability of career related activities (such as for engineering), exposure to negative stereotypes about Appalachia, and exposure or vicarious learning about job stability (or lack thereof) were important learning experiences.

Specific to Appalachia, learning experiences and opportunities to participate in educational activities can be hampered by the isolationism, poverty of the region, and difficult transportation situations as previously described. For example, the transportation issue may be distance, quality of roads, and lack of public transportation in the rural areas. The lower

population density may require students to travel greater distances and times to participate in group activities and require additional time for people to travel to schools to provide learning experiences (e.g., career days), thus fewer learning experiences may be available to students. Typically, schools in rural areas are smaller (Khattri, 1997) and this trend existed within this case study as well (descriptions on the schools is provided in Chapter 3, section 3.4). In addition to the transportation and resource difficulties, knowledge of local jobs and job availability coupled with a desire to remain close to home and family may result in self-limiting career choices. Specific to engineering, recall that the pool of degreed engineers, based on census data for first degree reported, is under 4% for the Central Appalachian counties used in this study and over 9%, on average, for Virginia (U.S. Census, 2010). As shown in Table 2, most counties in this research did not have data for the percentage of people reporting engineering as their first degree, suggesting few engineers to assist with role model and learning experience activities. Within Appalachia, learning experiences related to engineering careers may be limited due to reduced role models (e.g., parents who are engineers) and the reduced educational opportunities (e.g., physics and engineering courses) in rural Appalachia (Ali & Saunders, 2006; Bennett, 2008).

Vicarious learning experiences involving racism and negative stereotypes about Appalachia may hurt an individual's expectations of their potential (Bennett, 2008) and studies show a negative stereotype associated with the Appalachian dialect (Ali & McWhirter, 2006; Bennett, 2008; Tang & Russ, 2007). The negative connotations associated with the Appalachian dialect and stereotypes (including those in the media) may increase the perception of being personally affected if a student leaves the region. Bennett (2008) reports on a study where independent of the speaker's educational background, the voice with the Appalachian accent was rated more negatively. Because the connection to family is powerful in the Appalachian culture,

familial role models and learning experiences may play a more dominant role than learning experiences provided by outside influences. Family learning experiences, thus vicarious to high school students, can include an assessment of parents' years of education, levels of educational attainment, fields of study (content specific versus domain specific), and number of books in a home (or literacy information). For example, Ali and Saunders (2009) argue the lack of role models for post-secondary education is a contributor to rural Appalachian students' reluctance to set high career aspirations (Ali & Saunders, 2009).

In summary, learning experiences are influenced by person inputs, background influences, and a student's performance attainment via a feedback loop contained in the model. Learning experiences pertinent to this study need to include contextually specific considerations of the Appalachian culture, strength of family, perception of local jobs, and knowledge of college. According to the SCCT model, these learning experiences feed into outcome expectations.

2.2.5. Outcome Expectation

An outcome expectation is the belief about the consequences of performing a behavior and is associated with the question, "If I try doing this, what will happen?" (Lent & Brown, 2006; Lent et al., 2003), for example, if I become an engineer, I will earn money, get respect, or help others. Outcome expectations relate to what one will get. In contrast, believing an outcome will occur is based more on one's belief in their ability to do something (self-efficacy). Expectations of an outcome help people decide if their primary values will be fulfilled if they pursue a career choice. Outcomes may be positive, negative, or neutral. Learning experiences that are not positive or supportive of one's ability to perform a behavior, or that minimizes what will happen, can have a negative effect on determining what outcome to expect. For example, if

Appalachian students do not believe they will have engineering job opportunities, then they may not develop a goal of becoming an engineer, even if they believe engineering will provide their desired outcome expectation (e.g., earn money, respect, or have reliable job security). Therefore, the lack of technical white-collar jobs in Appalachia (Seufert & Carrozza, 2004) can have a negative effect on the outcome expectations, as can the distrust of outsiders and history of exploitation by businesses (Tang & Russ, 2007). Moreover, learning experiences and role models can influence outcome expectations to avoid, such as "If I work in a factory I will not be happy" or "will not make much money."

Outcome expectations are based on consequences of achieving a goal and not necessarily the requirements to achieve the goal. For example, a student may have an outcome expectation associated with being an astronaut, but not have the learning experiences to know how to become an astronaut. However, the SCCT model indicates that the outcome expectation would influence an interest (liking astronaut activities in the example). In addition, because Appalachians tend to be present-oriented, experience-based and not future expectations based, it may be difficult for Appalachians to project outcome expectations and goals (Haight & Gonzalez-Espada, 2009). It may also be difficult for students to have career goals that are several years (or college degrees) in the future, especially if they do not have learning experiences to help relate the tie between the outcome expectations and the career goal.

As discussed in this section, outcome expectations are influenced by learning experiences and, in turn, influence a person's interests and career goals.

2.2.6. Interests

Within SCCT, interests refer to people's likes and dislikes (or indifference) about career-related activities. Though interests can be studied broadly, such as an occupation level (e.g.,

engineering), more specific inferences are possible when specifics of an interest are used (Lent & Brown, 2006). It is important to provide context and definition to factors being evaluated for interest to ensure the reasons for the interests are understood. For example, interest in a career may be based on a student's interest in the school subjects, hobbies, or perceived prestige related to the career. According to the SCCT model, interests are supported by outcome expectations and in turn influence career goals. Several studies on STEM career goals report interest as a key variable for predicting career goals. Examples of research evaluating the role of interest on are described below to illustrate how the SCCT variables that are inputs to interest may affect a student's interest and how interest subsequently influences career goals.

In a study on career plans for science-talented rural high school girls, Jacobs et al (1998) determined that an intrinsic interest in science was the key indicator for girls to want to pursue science. From an SCCT perspective, this data supports that interest influences career choice goals. Other research using the SCCT framework also supports the prominence of interest in determining career goals (Fouad & Smith, 1996; Jacobs, 1998; Lent et al., 2005; Lent, Sheu, et al., 2008; Turner et al., 2004). These studies are quantitative and evaluate the role of interest as a direct predictor of choice career goals. For example, Turner et al. (2004) conducted a quantitative study surveying sixth-grade girls (middle class, Midwestern setting) and tested the causal relationships (directional pathways) of the SCCT model relative to math and science career interests. Factors included in the Turner study included math self-efficacy, math outcome expectations, and math and science career interest. The Turner (2004) research (N=318, seven schools) showed a positive relationship between math self-efficacy, outcome expectations, and an interest in math and science careers.

Within the context of this study, interests of the students both in and outside of school were sought, as were academic and non-academic interests. Because rural areas and small schools are reported in the literature to have fewer course options, exploring the importance of academic interests influencing career choices is important. For this study, the role of interest in a career or related subjects was sought. For example, the analysis considered if a student had an interest in engineering, math, or science and if that interest resulted in a career choice of engineering. Another consideration for this study was if the strength of family background or barriers (real or perceived) would override a student's interest, resulting in a career goal that was not based on an interest. In other words, if the case study region was unique to general SCCT results by not having interest play a dominant role in career choice goals decision-making. A finding of interest not being a key influence in career choice goals decision-making is significant because SCCT posits that interest is a direct and prominent influence on career choice goals decision-making. However, research on underrepresented groups suggests that some specific instances, such as amount of acculturation and non-traditional career choices (Tang et al., 1999), may result in career goals not being formed through an interest.

2.2.7. Goals

Goals are the intention, plan, or aspiration to engage in an activity (e.g., engineering studies) or to obtain an outcome (e.g., become an engineer) (Bandura, 1986; Lent et al., 1994). Goals are stated in terms of what one will do, as in an intention to do something. This is distinct from self-efficacy, which relates to what one can do (i.e., ability) (Lent & Brown, 2006). Goals are divided into choice goals (type of activity to perform) and performance goals (how well the activity will be performed); this research focuses on choice goals not performance goals. According to SCCT, goals are directly influenced by the outcome expectations, proximal

environmental influences, and interests; while person inputs, background influences, and learning experiences are mediated through outcome expectations, proximal environmental influences, and interests (Lent & Brown, 2006).

The choice career goals construct in SCCT is the main independent variable for this research. Recalling the research questions presented in Chapter 1, factors influencing choice career goals were explored for both high school and college engineering students. Based on the literature of Appalachian career goals and STEM career goals, several factors were expected to influence a participant's career goal and are discussed below.

By using factors discussed within each of the SCCT construct sections (sections 2.2.1 through 2.2.6), the groundwork for possible influential factors for career goals of Appalachian students exists. For example, within the Appalachian culture, when the background influences of a strong connection to the family and community and the outcome expectation to remain in the area are coupled with the lack of white-collar job opportunities in the region (especially distressed and transitional counties), there may be few career possibilities for the students. With respect to learning experiences, the lower quantity of white-collar jobs in the Appalachian region limits exposure to career choices that in turn may affect one's goals (Bennett, 2008; Martis, 2005). Thus, background factors such as a desire to remain local, parental knowledge of jobs and college are all relevant for this study. In addition, parental support for a career choice and perceived financial barriers for obtaining the career goal are important. Finally, learning experiences (or lack of) relating to perception of local jobs relative to expectations (e.g., job stability or pay) or exposure to career opportunities are important. Finally, within the context of this research, career goals were operationalized to include what the student reported as their choice of a job, career, or vocation (Ali & McWhirter, 2006).

2.2.8. SCCT Summary

SCCT is a reputable career choice framework, capable of allowing an exploration of key factors cited in the literature as well as additional, or more refined, factors that emerge from the study. The SCCT provides a framework to consider the economics, educational attainment, family backgrounds, and learning experiences of Appalachian youth as they make their career choices. The SCCT framework also provides an approach to explore the interactions of salient factors and the factors' influence on reasons for a career choice. In addition, the SCCT model goes beyond the career choice goal and includes actions and performance attainments to help understand a student's understanding of how they plan to attain their career choice goal. Because of the scarcity of research on engineering as a career choice in Appalachia, a framework such as SCCT, which allows an exploration of influencing factors, is appropriate for this study.

2.3 Need for Qualitative Research

Qualitative research, compared to quantitative research, has a unique combination of characteristics that align well with my research questions and the gaps in current literature. The main advantage of qualitative research for this study was its ability to provide rich insight into a situation and capture salient aspects of a situation from the perspective of the participants (Creswell, 2007; Lent & Brown, 2006). Qualitative research focuses on meaning and understanding (Merriam, 2009) and allows "why" and "how" questions to be answered by allowing themes to emerge. Qualitative research also provided a means of obtaining rich, deep understanding of the situation investigated. Due to the paucity of research on Appalachian students' career choices about engineering, and the complexity of factors at play, qualitative research was preferred to quantitative research; qualitative research is capable of exploring the participant's salient reasons, in their natural setting and context. In addition, using an exploratory

case study design and allowing themes to emerge yielded the most meaning for my research questions. In other words, the research provided a holistic account of a complex problem by "reporting multiple perspectives, identifying the many factors involved in a situation, and generally sketching the larger picture that emerges" (Creswell, 2009, p. 179). For example, we can speculate, from the existing literature, the following factors should be included: education level of parents, poverty level of the region, etc. However, qualitative research can help us understand which factors are truly salient for our population and specifically for engineering. Conducting qualitative research that seeks to understand the career choice goals of participants from their perspective also allows factors that relate to the literature, but are not explicitly commented on; for example, being a continuing generation Appalachian participant. We see the usefulness of qualitative research with some of the studies described above, such as Anderson (2006) and Trenor et al. (2008), who followed up on survey results to understand why students made the choices they made. Moreover, the inductive approach allowed salient themes to emerge by combining information from a variety of data sources. Merriam (2009) distinguishes the focus of qualitative research from quantitative research as qualitative is quality (the nature and essence) and in the case of SCCT, may include why a career choice was made – not just what the career choice was. Contrasted to that, quantitative is quantity (how much and how many) and, in the case of SCCT, may also include the strength of a relationship between the constructs. Qualitative research was useful to answer the research questions posed in this study and to explore and advance our knowledge base with respect to Appalachian students and career choices toward engineering.

2.4 Summary

Research on factors influencing career choices needs to consider a variety of factors in context for the participants of the study. Appalachia, as a region, contains diversity of culture, economics, and educational attainment compared to the rest of the United States, and yet, within the ARC defined borders and the boundary of this case study, there is a combination of commonality and diversity with respect to these same characteristics. Lent et al. (1994) include a variety of constructs, and how they interact, in their SCCT model so that details such as culture, economics, and educational background can be considered when researching career choices. A qualitative case study research design guided by SCCT is a valid approach to studying career choice decisions in Appalachia, especially with respect to engineering which is a gap in the literature. Therefore, a qualitative case study, informed by the literature, and guided by SCCT, is a solid foundation for exploring career choices of Appalachian high school students.

Chapter 3. Methods

3.1 Introduction

This chapter presents the research methods used in this exploratory case study project. The SCCT theoretical framework supported the case study method and this chapter provides information on my research process and research details to substantiate that I conducted a comprehensive and quality research project. Recall that the purpose of the study was to explore factors influencing Appalachian high school students relative to their career goals, especially with respect to engineering, resulting in the overarching research question:

How are Central Appalachian high school students influenced as they choose their career goals, especially with respect to engineering?

To help guide the research design and analysis, the following sub questions were used:

1) What are the salient reasons and factors influencing Central Appalachian high school students' career goals?
2) How do the reasons for choosing engineering as a career compare to other career choice reasons for Appalachian high school students?
3) What are the salient reasons and factors for college engineering students, who went to high school in Central Appalachia, to choose engineering as a career choice?
4) How do the reflective reasons for a career goal of college engineering students compare to high school students' prospective career choice reasons in Central Appalachia?

With these research questions in mind, decisions on the research approach, process, data collection, and data analysis were made to ensure the research findings would support answering my research questions. In this chapter, I provide the rationale for and details of the research

design, participant selection, interview protocol, data collection, and data analysis. I have also included a discussion on trustworthiness of my research process, ethical considerations, and limitations.

3.2 Use of Qualitative Case Study Design

I used a qualitative exploratory case study design, guided by the Social Cognitive Career Theory (SCCT) (Lent et al., 1994, 2000) to focus on the participants' perspectives (qualitative), to help understand the complex interactions of career decisions by high school students (exploratory), and to bound the scope to an area within the Central Appalachian region of Virginia (representing a case). In this section, I provide criteria for the necessary components of a case study and describe how the specific components of my study meet these criteria. I also describe how using a case study analysis approach links to the study purpose, how the case study design allows outcomes to be developed to answer the research questions, and why the case study was bounded to include the specific counties chosen.

My use of a case study approach is consistent with the purpose of and criteria for case study approaches as described in the literature. With regard to purpose, case studies are often used to explain or explore decisions by asking "how" and "why" questions (Merriam, 2009; Yin, 2009). As previously described, the scope of my research focused on exploring, from the participants' perspectives, the reasons influencing the participants' career goals. This purpose of understanding why and how they make their choices is consistent with case study research. Specifically, I interviewed high school students about their intended career goals and college engineering students and working engineers about their reflection on their intended career goals. With regard to criteria, my study is consistent with criteria provided by Creswell, Merriam, and Yin (Creswell, 2007; Merriam, 2009; Yin, 2009). Focusing on Yin's definition, case study

research is used to examine an event in-depth and in-context even when the boundary between the event and context is not clear. Events do not have to be singular moments in time and can occur over extended time. The event here is the process of establishing a career choice goal. For the process of making a career choice goal, the context within which this decision is made is important; for my study, the context is a specific region of Appalachia. My study fits the case study definition as I am examining how Appalachian high school students make career goals (event) in the context of Central Appalachia.

Yin (2009) provides five components of the research design necessary to conduct a thorough case study on a topic. How the case study components are manifested in my research are shown in Table 3. Having already addressed the top two components in the prior paragraph, the remaining three components, in relation to my study, are described in following paragraphs.

Table 3. Case Study Components

Research Design Components	Definition	Relevant Study Component
Focus/ Event	Topic of the Study	Choosing Career Goals
Study Question(s)	Specifics of what is being studied	How are Central Appalachian High School Students Influenced as they Choose their Career Goals?
Study Purpose	What should be examined as in scope to the study	Exploring Influences on career goals
Case Study / Bounded System	Also referred to as "Unit of Analysis" and often at the same level as the research question	9 select counties in Appalachia Virginia representing a single case
Linking Data	Analysis methods used to connect data to study purpose	Exploration via pattern matching
Criteria for interpreting findings	Analysis strategy to report meaning of findings	Comparison of 1) qualitative data with literature & demographics, 2) qualitative data between participant groups

While many of these elements are common across all research studies, bounding of the system is particularly important in case study research (Yin, 2009). Bounding the study situates

the study as being in a particular place and time. For my research, the case is the unit of analysis bounded by nine counties in the Central Appalachian region of Virginia (i.e., these nine counties make up a single case). The interviews occurred during the 2012 – 2013 school year and therefore this timeframe bounds my study as well.

The location (Southwest Virginia) and size (nine counties) for the unit of analysis of this case study were selected for several reasons. The location was chosen in part because I am resident, working engineer, and volunteer of K-12 STEM outreach in the region, and in part because the region embodies Appalachia (as discussed in Chapter 2). Seven of the nine counties are the Central Appalachian counties contained in Virginia and Central Appalachia contains some of the greatest disparity relative to the U.S. with respect to income and educational attainment. The remaining two counties boarder the seven counties, but are in South Central Appalachia. These counties provide additional diversity to the study as described in section 2.1.6. All nine counties embody the literal (geography) and metaphorical (e.g., type of work) characteristics that are the heart of Appalachia. Additionally, the case study is limited to Virginia because the study focuses on the experiences of high school students and it is important to recognize that high school learning experiences are highly influenced by state mandates, funding levels, and educational standards. As a result, while the ECC project is multi-state, in this study only a single state is included to minimize initial variations arising from state influences on secondary education; after examining a single state region, the findings can be examined across the multi-state setting. It should also be noted that the region is in close proximity to a major U.S. university with a strong engineering college and where the ECC project is based. The close proximity of the case study location with the ECC project simplifies logistics of working with the study's stakeholders on the outcomes, contributions, and future work of this research.

Consistent with case study approaches, data was collected from multiple sources such as interviews, documents (primarily from school and Virginia Department of Education websites), and published statistical data and linked. However, semi-structured interviews were the primary source of evidence and provided the participants' perspectives and explanations of their lived experiences (Seidman, 2006; Yin, 2009). The participants are from the region of interest and thus their experiences are in the context relevant for this study. Descriptive statistics for county demographics and characteristics of the high schools were used to aide in ensuring a maximum variation sampling and as part of the pattern making during the analysis phase. The statistical data was also used to provide a basis for interpreting results by comparing the interview information with the demographics of the case study region.

To link the collected data to the purpose of the study, within-case descriptions, pattern making, and emergent theme development was used (Miles & Huberman, 1994b). The within case sampling used participants nesting, was framed by SCCT for initial codes, and the sampling had an iterative approach. For example, the high school participant nesting involved students at particular schools in particular counties. The initial coding was conducted using the SCCT constructs in an iterative manner. Again, using the high school participants as an example for iterative sampling, after conducting interviews at each school the field notes were reviewed for patterns and additional participants sought to clarify patterns and look for exceptions. As themes and patterns emerged from the data, they were evaluated to allow an inductive exploration of the participants' reasons for choosing their career goals and influencing factors. An advantage of the qualitative nature of this study was that reasons for goals did not have to be fixed to an SCCT construct, and as patterns were developed career reasons were not restricted to the individual

SCCT constructs. Consolidating the SCCT environmental influences and not separating them as background or proximal allowed better data linking and interpretation of the results.

The planned research outcomes were development of 1) reasons, and 2) factors for the region regarding high school participants' career goal plans. Criteria for success in this research included a mapping of the interview data into patterns relevant to the Central Appalachian region of Virginia and identifying salient factors that influenced the participants as they made their career goal plans. The patterns were based on a set of factors, involving the participants' backgrounds, locations, parental factors, school factors, and level of preparedness; the patterns are intended to aide future research on the topic of career goals of Central Appalachian high school students. These factors are included in the findings tables contained in chapter 4 (e.g., Table 16 and Table 17).

Use of a qualitative case study design enabled the research questions to be answered in a manner that expands the literature on Appalachian career choice research, and specifically with respect to engineering as a career choice. The design of the study, from inception (choosing a case study methodology) to completion (synthesis of the findings), was planned to ensure case study methods were employed, logistics considered (such as Institutional Review Board approval and high school interview coordination), and quality of research considered during the entire process.

3.3 Overall Research Design

To address the research questions, I used an exploratory qualitative case study approach (Creswell, 2007). This section provides details on the overall research design process, including the use of theory, and the specific research process steps, to demonstrate that a high quality research project was conducted and to provide credence to the findings.

3.3.1 Use of Theory

In addition to the criteria already provided, case studies rely on prior theoretical assertions (commonly theories or models) to aide in data collection and analysis (Yin, 2009). For this study, the SCCT framework was used "as a blueprint" as described by Yin (2009). This means SCCT guided the research design, data collection, and data analysis. Specifically, the SCCT constructs and associated background literature presented in Chapter 2 guided the interview protocols, data collection (including the sampling process), and initial data analysis. Though SCCT helped guide the research, this research was not intended to prove the constructs, connections, and links in the SCCT model. Based on existing literature (e.g., (Ali & Saunders, 2006)), the causal pathways of SCCT are already proven to have merit. Therefore, SCCT was used to aide in the development of questions, what artifacts to collect, and the initial considerations for data analysis. Essentially, SCCT provided a way to collect, process, and think about the data.

3.3.2 Research Process Steps

My research process involved six main steps, as shown in Figure 8. Mapping the steps helped ensure the research questions remained a focus, the Institutional Review Board (IRB) compliance (Virginia Tech IRB #12-444) was upheld, and the overall quality of research was maintained. Moreover, the research process map itself contributes to the quality of research by representing careful documentation of what occurred throughout the project. The highlights of actions conducted in each process step are provided in Figure 8 and additional detail for each step located in the following sub sections; the sub section paragraph number is indicated in parenthesis within each title box of Figure 8.

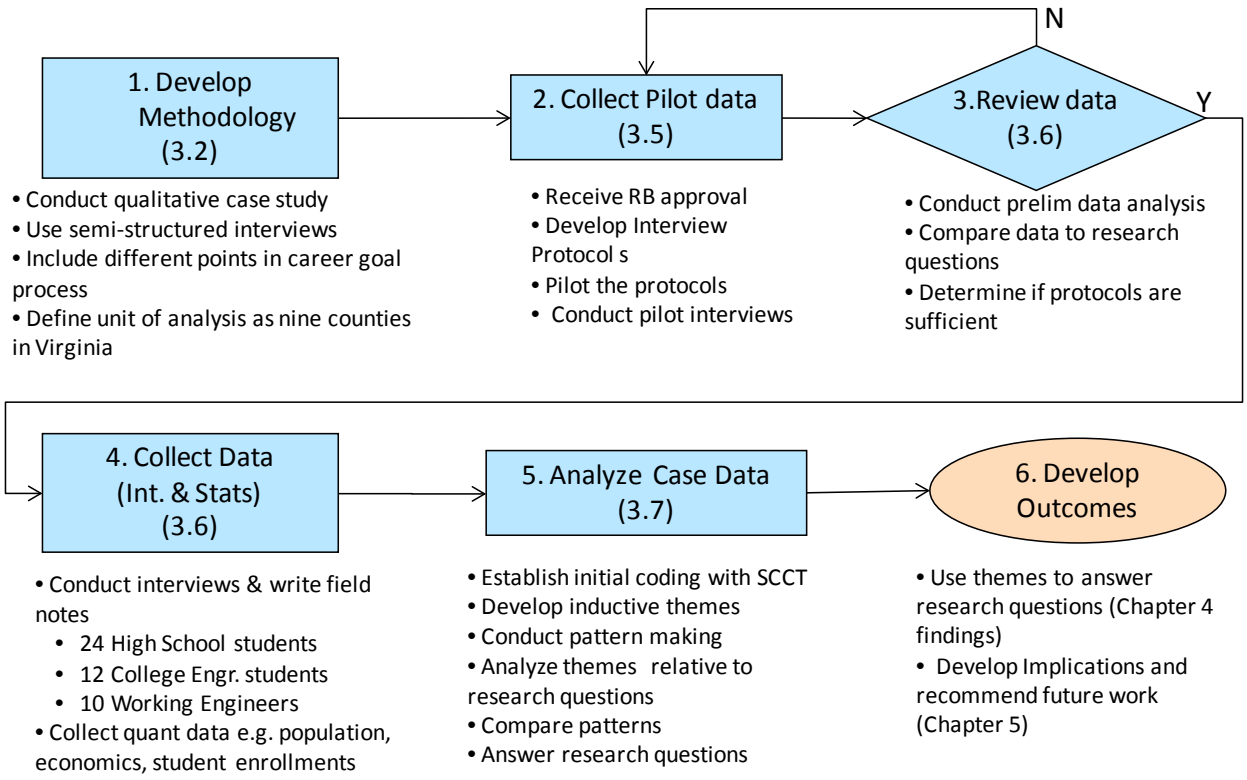

Figure 8. Research Design Steps

Overall, the design steps depict a process of making choices, justifying choices, and verifying choices. The explorative case study methodology was chosen, in part, because of the limited research on engineering as a career choice in Appalachia. The case was bounded to include a particular area of interest, the Central Appalachian portion of Virginia, and interviews were chosen to gain the perspective of the high school students. Data was collected during the pilot phase as a means of ensuring data could be linked to the research questions and to provide a process to improve the quality of the data collected. Once the interview protocol was set, interview data was collected to a point of reaching redundancy for each of the different participant groups. Data analysis and pattern making began prior to the end of data collection. However, analysis continued until career choice reasons and patterns (findings) were established that explained commonalities and differences in the data relative to the research questions. In

addition to answering the research questions, outcomes from the research included implications of the research and recommendations for future work.

3.4 Participants

3.4.1 Participant Overview

All participants come from the intentionally selected nine counties that make up this case. The counties included in my research were chosen based on three criteria: 1) being part of Central Appalachia, based on ARC criteria, 2) being part of Virginia public schools Division 7, and/or 3) bordering Central Appalachia (Washington and Smyth are part of South Central Appalachia). By using these criteria, the case study physical boundaries encompassed a combination of county socio-economic statuses, population densities, educational attainments, engineering intervention opportunities, and employment opportunities. These factors were chosen as important for my study based on published literature about Appalachia as discussed in section 2.1, which delineates these as relevant factors when evaluating choices to pursue higher education. In addition, a single school division in Virginia was chosen to minimize the school variables, such as different degree requirements, different governor schools, and to minimize community college variables such as entrance requirements and dual credit practices. Two South Central Appalachian counties (Washington and Smyth) were included because they use the same governor school, belong to the same community colleges as the other counties, and to improve the diversity within the maximum variation sampling. Maximum variation sampling's strength is improved when patterns emerge from across large variations to capture core experiences of the participants (Patton, 2002). Table 2 contained on page 30, shows the detailed comparative data for the counties used in my research. To summarize that information here, the counties include relative variation in economic condition, poverty rates, population density and changes in

population, college completion rate, and percentage of engineers (bachelor's degree). I use the term relative to qualify the variation as appropriate for an economically distressed, rural area, and because none of the counties are above the national average with respect to income or college completion rates.

The participation rate for high school students, college engineering students, and working engineers was not equivalent by county. Table 4 shows the number of participants by academic/career stage for a variety of demographics and factors. High school participation was predicated on approval from the county superintendents and not all high schools were included, but the participant representation covers the full variety of variables considered for the maximum variation sampling (Table 4 columns). For classifying college engineering participants and working engineers, the county represents where the participant graduated high school. The participants are not reported in this table by county to help ensure participant anonymity. Though only the county status level is shown, the diversity of counties (based on Table 2) exists, unless otherwise reported.

Table 4. Study Participant Table

Participant Type	Total Partici-pants	Gender		Ethnicity, other than Caucasian	P/FGC any college	P/FGC 4-yr degree	ARC County Status			High School Size				Engineering Activities			CGA	
		M	F				D	AR	Trans	Home	Small	Med	Large	No	Yes	unk	Yes	No
High School	24	8	16	2	11	13	5	5	14	0	12	7	5	18	6	0	19	5
College	12	9	3	0	2	5	0	3	9	2	2	3	5	6	6	0	10	2
Working	10	9	1	0	6	6	0	5	5	0	4	0	6	9	0	1	10	0

- P/FGC = Prospective First Generation College student for high school students or First Generation College student for college students and working engineers.
- CGA = Continuing Generation Appalachian
- County Status from ARC (FY 2011). D = Distressed; AR = At Risk; Trans = Transitional. (No Competitive or Attainment counties in region)
- School size: small is an average Junior and Senior class <100; medium is an average Junior and Senior class < 130 in school; and large has an average Junior and Senior class > 130. Home means the participant was home schooled through high school.
- Engineering Intervention Activities include classes such as project lead the way or Governor's school engineering classes. This includes organized activities such as First Lego League (FLL) or US First competitions if mentioned by the participant.
- Continuing Generation Appalachian (CGA) means the participant's Parents were from the Appalachian region.

3.4.2 Sampling Procedure Overview

A combination of purposeful maximum variation sampling and snowball sampling was used to obtain participants for the data (Creswell, 2007; Miles & Huberman, 1994b). Maximum variation sampling is a sampling strategy that documents variations and commonalities within the case to determine if the main patterns hold for diverse instances. For this research, maximum variation was based on the categorical columns in Table 2 (page 30) and includes variation by county for education, population, and socioeconomics; the final participant variation is shown in Table 4. The criteria used to judge a maximum variation sampling are variables often included in the literature about Appalachia and published ARC data. Other criteria, such as parental education and continuing generation Appalachian were recorded for the participants based on the interviews and used as a validation that within the varied sampling pool these personal (i.e., not county or school) variations were represented.

The actual sampling procedure varied slightly between the high school students, college engineering students, and working engineers, but all participants were obtained in accordance with the approved IRB requirements. Recruiting individual participants is where the snowball approach came into play. The snowball approach (or chain approach) allows participants to recommend additional participants based on their knowledge of the topic being studied to improve the depth of information gained and improve the diversity beyond convenience or typical case sampling (Merriam, 2009; Miles & Huberman, 1994b). As a general overview, the three categories of participants were recruited as follows:

1) The high school participant interviews were conducted using proper channels and approvals, per the Virginia Tech IRB and Virginia school system requirements.

2) The college engineering participants were recruited using contacts at local community colleges, internships where the researcher worked, and a snowball approach.

3) The working engineers where recruited using a combination of direct contact of people the researcher knew and a snowball approach.

The snowball approach helped to ensure people the researcher did not know directly are included in the sample population and to increase the counties represented in the study. Though the researcher knew some of the participants from previous work experience and community involvement, no college or working engineer participants were interviewed while they and the researcher were employed at the same location. The interviews were audio recorded and transcribed verbatim. Details of the sampling procedures by participant group and final variation of participants relative to the maximum variation sampling are contained in section 3.4.3.

3.4.3 General Characteristics of Participants

The participants were from three categories: high school juniors and seniors, college engineering participants, and professional working engineers from within Central Appalachia. The participant sampling is diverse with respect to characteristics relative to county data and commonly cited characteristics in Appalachian and STEM career choice literature as described in Chapter 2. As data collection progressed, a table of participants was maintained. If a column in the table had no participants, an intentional search for participants occurred in an attempt to fill those gaps. Table 4 shows the demographic information for all participants. Table 4 was used to support that the actual participant sampling met a maximum variation sampling. The variables used in Table 4 were chosen to match a combination of the demographic information in Table 2 (page 30) and other characteristics associated with the Appalachian region and this research, such as high school size, engineering activities (EI), and continuing generation Appalachian

(CGA). The participant information is presented in the following sections, separated by the categories of high school, college, and working participants. As discussed in chapter 2, a key variable for the region is county economic levels (distressed, at-risk, and transitional); therefore, the participant information is also given by county economic status within the participant descriptions. The organization of the participant characteristics is designed to show the level of variety of the participant base without being detailed to the point of not protecting participant anonymity; for example, high school participant information intentionally does not link participants with a specific high school.

High School Participants. Table 5 shows the 24 high school participants separated by county designation. The columns then differentiate participants based on seven categories: 1) gender, 2) prospective first generation college (PFGC), 3) continuing generation Appalachian (CGA), 4) if the participant reported any engineering interventions (EI), 5) was planning on attending a 2-yr college, 4-yr college, or did not know which type of college, 6) how many counties were included within the higher level ARC county designation, and 7) number of different high schools sampled. These categories were chosen because they are discussed in the literature on Appalachia (gender, PFGC, Plan 2-yr, Plan 4-yr) or because they emerged as salient in pattern making during data analysis (CGA, EI), as discussed later in this chapter.

Table 5. High School Participants by County Designation

County Status	Total	Males	Females	PFGC	CGA	EI	Plan 2-yr	Plan 4-yr	Other, unk	# Counties	# Schools
Distressed	5	1	4	3	5	0	2	1	2	1	2
At-Risk	5	1	4	2	4	4	2	3	0	1	1
Transitional	14	6	8	8	10	2	3	11	0	2	3
Total	24	8	16	13	19	6	7	15	2	4	6

Overall, 24 high school participants were from four counties in Virginia and six different high schools. The mixture of high school participants represents all school sizes in the region,

participants from each socio-economic type of county, participants considering engineering, and participants not considering engineering. Note that none of the participants have a parent working as an engineer, though one (from a transitional county) reported that her father has an engineering degree but changed fields in practice; two participants reported having uncles that work as engineers. Details of the participants, separated by county economic status (distressed, at-risk, and transitional), are presented to provide better granularity of the participant features.

Five participants represented the distressed counties and were from two high schools, the overview of their characteristics are shown in Table 5. Both high schools were small with approximately 35 – 70 students per graduating class and one of the schools was located in the county seat. One school was considered in-town and the other was out-of-town; the travel time to school by students at the out-of-town school was up to 40-minutes. With respect to the participants, all of them were continuing generation in Appalachia (CGA), four of these five participants were prospective first generation college (PFGC) for a bachelors (4-yr) degree, and none of them noted any engineering intervention activities. Specific to engineering, none of the distressed county participants had parents who were engineers and none of the participants were planning on an engineering degree. Within the distressed county, two of the five participants were taking college dual enrollment courses (i.e., receiving both high school and college credit for the same course). Of these two participants, one reported intentions to pursue college and the other reported going into military service. From the entire dataset, the only students who reported planning to go to college, but not knowing if they planned to start at a 2-yr or 4-yr college, were from distressed counties. As with all of the high schools, several participants reported being ranked high in their graduating class, including a participant currently ranked as the valedictorian. The majority of participants indicated a preference to attend college locally

(typically meaning within a two hour drive from home) and a preference to live locally after college. Based on these described characteristics, my sample is representative with regard to economic statuses, parental education levels, and school sizes for distressed counties. My sample might over-represent intentions to pursue college degrees for two reasons: First, four of five participants indicated an intention to pursue a degree, but less than one-third of people form distressed counties have completed college (based on census data shown in Table 2), and second, the majority of the participants report being ranked highly in their class.

Five participants from one high school in an at-risk county were interviewed, as shown in Table 5. The school is considered large for the region of this study with over 130 students per graduating class. The school was out-of-town, but students from the county seat attend that school. Unique to the majority of the schools in the study, this school offered engineering courses on-site. Four of the five participants interviewed reported being involved in some engineering activities. Though the participants reported a nearly even mix of intentions to start at a 2-yr or a 4-yr school, the students planning on starting at a 4-yr school indicated they had not ruled out starting at a 2-yr (for GPA or financial reasons). Similar to all of the counties, the majority of participants were CGA and several participants reported being ranked high in their graduating class, including the current valedictorian. Two of the participants reported a strong preference for attending college locally and remaining local after college. Two other participants reported remaining local as a preference, but commented it may not be an option due to job availability; however, they still wanted to remain within a couple hours of home if they had to move. Based on these described characteristics, my sample is representative with regard to economic status, and parental education level. This at-risk sample pool may over-represent availability of engineering courses in high schools; however, having some students who

participate in engineering courses allows the larger study sample of all high school participants to be more representative. In addition, the sample may over-represent intentions to pursue college degrees since all participants indicated an intention to pursue a degree and the participants reported being ranked highly in their class. However, based on census data shown in Table 2, just over one-third of the people form at-risk counties have completed college.

Students from three transitional county high schools were included in the study. The participants from the first transitional county high school included more non-CGA and fewer PFCG than anticipated based on county demographic data. In order to include maximum variation in the sampling, a second high schools was sought from the transitional counties. In addition, students from the trade school in one of the transitional counties signed up for the interviews, adding a third high school to the transitional county participants. Thus, the transitional counties have more variation with respect to number of schools and counties represented, as shown in Table 5. Within the transitional counties participant base was an even split between small and medium size schools. One of the schools was considered in-town, but was not in the county seat. Participants from these schools reported traveling up to 40-minutes to get to school (including participants from the in-town school). Fourteen participants were interviewed from the three high schools. Unlike the transitional and distressed county participants, all of the participants were taking dual enrollment courses and all participants plan to go to college, one also plans to join the military as a reservist. The majority of the students were CGA, but more non-CGA participants were from the transitional counties than any other county. Most participants reported being ranked high in their graduating class, including being the current class valedictorian at two of the schools. Based on these described characteristics, my sample is representative with regard to economic statuses, parental education levels, and school

sizes for transitional counties. However, my sample may over-represent intentions to pursue college degrees since all participants indicated an intention to pursue a degree, but roughly half of people form transitional counties have completed college degrees, based on the census data shown in Table 2 and because these students report being ranked highly in their class.

Early in the participant sampling, several participants from a single school reported moving to the area or their parents not being from the area. Characteristics of the students new to the region did not fit published expectations relative to parental educational and a desire to remain close to family. I captured the characteristic of being a continuing generation Appalachian (CGA) or not CGA as potentially salient. Thus, the characteristic of CGA was added to the participant tracking and, as discussed above, resulted in interviewing participants from one additional high school.

Overall, a diverse sampling of participants was obtained with respect to variables common in literature about Appalachia (e.g., prospective first generation college, county economic status, and smaller schools). The participant interviews reached a point of redundancy within each school and the information gained at the final school fit the anticipated pattern, suggesting saturation of participants (Patton, 2002). However, based on literature about college completion, 2-yr versus 4-yr college enrollment, and students entering the workforce directly from high school, the participant sample was limited. As noted earlier, this was an unintended consequence of the sampling process. Though a limitation of the study, it did not impact my ability to develop outcomes or answer my research questions.

College Engineering Student Participants. All college participants were pursuing engineering degrees at the time of the interviews, attended a variety of colleges, and were at different points in the degree completion process. College engineering student participants (also

referred to as the college participants) were initially solicited using personal contacts with access to undergraduate engineering email lists, in-person contact, and a snowball approach (Miles & Huberman, 1994b). These email lists were general engineering listservs and not specifically targeted at students from Appalachia. The colleges contacted included both community colleges (2-yr College) located in the case study region and Virginia universities offering engineering.

Use of the email lists was beneficial at the community college level, but not at the 4-yr university level; no students responded from the 4-yr university email requests. One possible explanation for the difference in response numbers is that more students at the community colleges were likely to live in the region of interest compared to the 4-year universities. Because of the low number of responses via the email requests, particularly from 4-year universities, I adopted a snowball approach such that I asked participants, at the end of the interview, if they knew of any additional college engineering students who might be interested. In addition, a visit was made to a community college engineering class as a follow-up to the email request. Table 6 provides the characteristics, by county status level, for the college participants.

Table 6. College Participants, by County Designation

County	Total	Males	Females	PFCG	EI	Enrolled in 2-yr	Enrolled in 4-yr	CGA	# Counties
Distressed	0	0	0	0	0	0	0	0	0
At-Risk	3	2	1	2	1	2	1	3	1
Transitional	9	7	2	4	5	3	6	7	3
Total	12	9	3	4	6	5	7	10	4

College participants included engineering students from the counties that make up this case study (shown in Table 2), at all levels of degree completion (e.g., freshman through senior), and pursuing any engineering degree. Originally, female participants were not specifically sought; however, a purposeful attempt to locate female engineering college participants was

made based on the original low response rate. An additional female participant was included based on the purposeful recruitment for college engineering females. In total, only three of the 12 college participants were female.

The college participants represent a sample from a relatively small population. Based on enrollment information from the universities and community colleges in the study, I estimate 40 people in the population. The roughly 40 potential participants include first year students who may be taking pre-engineering courses; these students are considered engineering students for this study because they are taking courses towards an engineering degree. As an example of enrollment sizes, Highland's Community College had roughly 14 total students in their 2-yr program, and only 3 sophomores pursuing an Associate of Science in Engineering degree; by contrast, the engineering program at Southwest Virginia Community college includes approximately 12 sophomores. Data on the number of college of engineering students from Appalachia and Central Appalachia from Virginia Tech's Institutional Resource Effectiveness Office (Virginia Tech, 2012) indicates an average of five students from Central Appalachia and eleven from the counties of interest (i.e. included the two counties in South Central Appalachia) have enrolled each year for the last five years; retention rates are unknown. As an estimate, my sample represents approximately ¼ of the available engineering college student population for the case study region. Therefore, I believe it to be a reasonable sample size and representation of experiences.

Details about the 12 college students, representing four counties, are shown in Table 6. The counties represented in the sample included Transitional (nine participants) and At-risk (three participants), but no distressed counties. All of the participants were attending the college where they started and all started in an engineering curriculum. For example, my sample does

not include any participants that transferred from a community college to a university. Only one of the participants reported a parent as an engineer; two others reported a close relative (sister and grandfather) as engineers. All three of these participants with relatives in engineering were from the same transitional county and high school. Seven of the college participants indicated a desire to remain local after completing their engineering degree and two indicated they would like to remain local, but expect they will have to move for a job. The remaining three participants plan to look for jobs in other parts of the country; only one of these was a CGA.

All three participants from the at-risk counties are CGA, from the same county, and represent one small and one large high school. The high schools include those represented by the high school participants. Two of the three participants from the at-risk county were PFGC; the third participant was in high school when her mother completed college. The only non-traditional age participant was from an at-risk county and this participant was in college after serving four years in the military.

The nine participants from transitional counties were from small, medium, large, and home schools. The participants had overlap with high schools used in the high school participant sampling, but also included additional high schools. The nine participants included two of the three females, the two non-CGA participants, and the majority of participants not FCG. In addition, the majority of participants had an engineering course in high school and they were at a 4-yr university.

College participants came from home-schooled, small, medium, and large high school environments. Two participants were home schooled and they both attend community college (one is a freshman the other a sophomore). At the 4-yr university, the participants ranged from freshman through senior and were all traditional age (direct from high school to college). All of

the college participants interviewed attend college at a Virginia public school. However, no college participants were from a distressed county. Efforts to locate college engineering participants from distressed counties were made by asking participants interviewed and high school personnel who assisted in coordinating the high school interviews for potential participant contacts. While no participants were found through this means, it does not indicate there are no college students studying engineering from these counties. This limitation is discussed in the limitation section, 3.11. Overall, a diverse sampling of participants was obtained with respect to variables common in literature about Appalachia (e.g., prospective first generation college, remaining local after college, and smaller schools). The participant interviews reached a point of redundancy and the information gained from the final interviews fit the anticipated pattern, suggesting saturation of participants (Patton, 2002).

Working Engineer Participants. I interviewed ten working engineers in Central Appalachia from a variety of companies, engineering backgrounds, and years of experience; Table 7 provides a summary of participants. I used personal contacts in the region to request interviews via emails. A snowball approach was used by asking participants if they knew of any additional working engineers for the study.

Table 7. Working Engineer Characteristics

County	Total	Males	Females	PFCG	EI	Enrolled in 2-yr	Enrolled in 4-yr	CGA	# Counties
Distressed	0	0	0	0	0	0	0	0	0
At-Risk	5	5	0	3	0	2	3	5	3
Transitional	5	4	1	4	0	2	3	5	4
Total	10	9	1	7	0	4	6	10	7

The working engineers were all people who attended high school in the region and now work in the region as an engineer (with one intentional exception). The criteria of being from the

region and currently working in the region were used to help understand influencing factors that are bounded by the same demographics as the other participants. Table 4 shows the participant mix for the working engineers. Nine of the ten participants were male and one was female. The female has moved from the area so she is not currently working in the area, but was the only female the researcher could locate that met the criteria of being a degreed female from the counties of interest for this research. Similar to the high school and college participant interviews, a variety of counties and backgrounds were represented. The ten participants went to high school in eight different counties, with five from transitional counties and five from at-risk counties. Six of the participants went to large high schools and four to small high schools. One participant did a series of school, military, 2-yr to 4-yr path to his degree and was the only working engineer that had been a non-traditional college student. Three participants took 2-yr to 4-yr paths to their degree, and six went directly to 4-yr schools for their degree. Eight graduated from Virginia Tech and two from schools in Tennessee (UT-Knoxville and Tennessee Technology University (TTU)). Though the Tennessee schools are similar distances from the participant's home compared to Virginia Tech, reasons for the out-of-state choices were provided. The participant selecting UT-Knoxville indicated the opportunity for a scholarship as his reason for choosing UT. The participant selecting TTU commented on following other students there from his community college. All ten participants were continuing generation Appalachian (CGA). Seven of the participants were first generation college (FGC), and an eighth was in college when his parents (both) finished their college degrees. Two non-FGC participants reported having a parent that was an engineer. Notably, the engineering parent (both fathers) of these two working engineer participants were also interviewed; this comprises four of the ten working engineers interviewed. Nine of the working participants reported no high school

engineering intervention activities; the tenth participant did not comment either way. Overall, a diverse sampling of participants was obtained with respect to variables common in literature about Appalachia (e.g., prospective first generation college, remaining local after college, and smaller schools). The working engineer participant interviews reached a point of redundancy and the information gained from the final interviews fit the anticipated pattern, suggesting saturation of participants (Patton, 2002).

Participant Summary. A summary of all participants and sample sizes is shown in Table 4. The maximum variation sampling strategy, based on the county information in Table 2 (shown on page 30), was used to determine what high schools to target and where to concentrate efforts for locating college and working engineers. Several contact approaches were used to identify college student and working engineers that resided in one of the distressed counties, but none could be located. In addition, special effort was made to ask for female engineering contacts. The lack of female working engineers and lack of college participants and working engineers in a distressed county does not mean there are no people meeting this description; rather it means no participants were located.

Overall, the variation in participant sampling is acceptable. Participants were targeted for and represent a variety of county demographics, school sizes, and engineering interventions. The participants also represent a variety of personal backgrounds such as parental education, being CGA, and desire to stay local. The number of participants within each group is sufficient because of the combination of sampling variation and the participants' stories were showing redundancy.

3.5 Interview Protocol Development

In this section, I discuss the development of interview protocols used in the semi-structured interviews. The interview protocols (protocols) were developed as a collaborative

process combining a pilot study conducted specifically for my dissertation research with final protocols developed by the researchers on the NSF-funded ECC project. Therefore, the purpose of the protocols was to both meet my research goals and the broader goals of the ECC project. For example, the protocols were designed intentionally to use SCCT as well as theories of interest to other researchers such as Future Possible Selves (Markus & Nurius, 1986). The interview protocols were developed by first rationalizing the need for separate protocols for the high school, college, and working engineer interviews; secondly, conducting a pilot study; and third, developing the final protocols. Each of these three phases are discussed in detail in this section followed by a sub-section that provides information on how the final protocols met the protocol research goals; the final protocols are contained as Appendix E through Appendix G (high school, college, and working, respectively). Figure 9 shows the overall process used to develop the protocols.

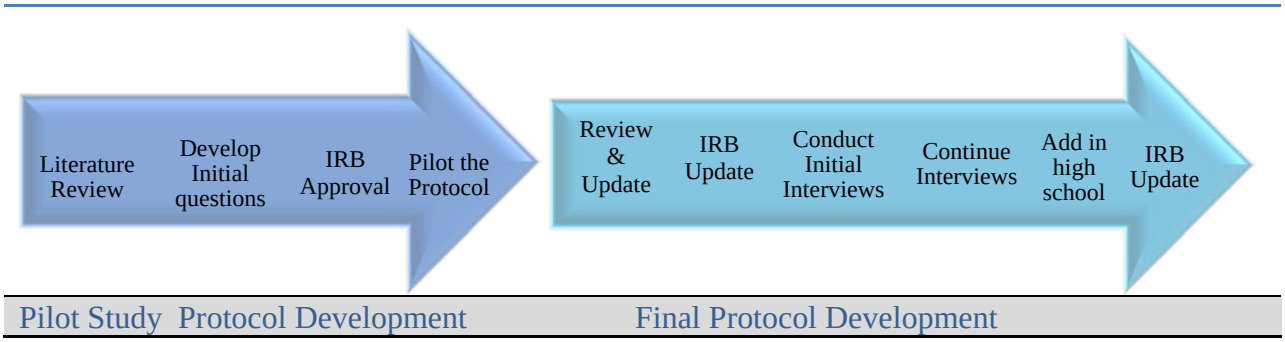

Figure 9. Interview Protocol Development

3.5.1 Interview Protocol Rationale

Four goals were established to assist with the protocol development: 1) to incorporate multiple theories relevant to career choice, 2) to allow for an open conversation so that other, unanticipated, information relative to career goals would be captured, 3) to be usable by multiple researchers, and 4) to be conducted in a reasonable (approximately 1 hour) amount of time. To

ensure quality protocols, guidelines for the interviews followed published recommendations for semi-structured interviews (Creswell, 2009; Leedy & Ormrod, 2005). The interviews were semi-structured, revolving around a few open-ended questions with multiple probes (Leedy & Ormrod, 2005; Wolcott, 1995). Open ended questions were developed to allow rich, deep descriptions of participant's experiences and beliefs (Miles & Huberman, 1994a; Patton, 2002); the interviews lasted approximately 45 – 60 minutes and were audio recorded. Although attempts were made not to ask leading questions during the interview, prompts to the participant were given if they asked for clarification (Schwarz & Oyserman, 2001). Three separate, but similar, semi-structured interview protocols were developed, one for the high school participants, one for college participants, and one for working engineer participants to ensure the questions were appropriate for the participants' perspectives relative to high school experiences. The final protocols captured information on the participants' experiences during high school including reasons for choosing their career goals as well as background and proximal environmental influences and outcome expectations; section 3.5.4 provides information on each protocol.

All three protocols were initiated at the same time, but the college and working participant protocols were intentionally completed prior to the final high school protocol and interviews. The timing of completing the protocols allowed maximum transfer of lessons learned about the process and information garnered from the college and working interviews into the high school protocols and interviews. Because the high school sample is the most critical for this study, it was desirable to have an interview protocol that was as informed from actual data (i.e., college and working engineer interviews) as possible.

The chronological steps of the protocol development process are shown in Figure 9 as a two-phase process. The first phase was the pilot study and the second phase was the final, ECC

team collaboration, protocol development. Note that interviews occurred four different times during the protocol development process: 1) the pilot study, 2) initial study (college and working only), 3) continue interviews with college and working participants, and 4) final interviews, including high school interviews. The protocol development steps included a pilot study I conducted in the July – August 2012. The protocols were further developed in the fall of 2012 by the ECC team resulting in a more comprehensive set of interview questions; Table 8 provides the timing for the interview data collection. During each review, the questions did not change to an extent rendering information in pilot or initial interviews invalid for the study.

Details of the protocol development are provided in sections 3.5.2, pilot study, and 3.5.3, final protocol development. Information on the final protocol is then provided in section 3.5.4. The protocol development process is included in detail to provide sufficient background on the reasons for the question order and wording to support the validity of the protocols and for transferability of their use to others.

Table 8. Participant Interview Timing

Activity	**Timing**	**High School**	**College**	**Working**	**Total**
Pilot Study	Jul ‘12 – Aug ‘12	1	2	2	5
Initial Grant Team Interviews	Sep ‘12 – Oct ‘12	0	3	1	4
Continued Interviews (2 rounds)	Nov ‘12 – Feb ‘13	23	7	7	37
Total Interviews	Jul ‘12 – Feb ‘13	24	12	10	46

3.5.2 Pilot Study Protocol Development

The initial protocols were developed from data contained in the literature such as SCCT career choices of high school students, Appalachian career choice literature, and an SCCT measurement guide (Ali & Saunders, 2009; Bennett, 2008; Lent & Brown, 2006). Prior to conducting the pilot interviews, the protocols were vetted for trustworthiness (Denzin & Lincoln, 2003) by having the questions expert reviewed for context, clarity of meaning, and clarity of

word choice. The original pilot study protocols (Appendix B through Appendix D) were expert reviewed by:

1) Three high school teachers who are involved in technology and science, from two different counties in Virginia, and active in extra-curricular STEM activities;
2) A high school guidance counselor;
3) Two university professors who are active in research in the Appalachian region and knowledgeable in developing semi-structured interview protocols; and
5) Two working engineers who live in the case study region.

Examples of changes made included:

1) Adding the word future to a question on the high school protocol to improve clarity of the question and timing: "What do you want your **future** job or career to provide you?" Changing words in the probe to those more likely used by the audience (high school versus working engineers).
2) Including a "road not taken" question near the end of the high school protocol. The new question asked if there was a job or career they wish they could pursue, but for some reason believe they cannot. The follow-up included asking about engineering or a technical job.

After the expert review of the protocols, pilot interviews occurred with one high school participant, two college participants, and two working engineers, see Table 8 for interview timing during the pilot phase. In addition, the pilot data, via field notes (using a field notes guide contained in Appendix I) (Miles & Huberman, 1994b), was reviewed for content to determine if it provided details capable of answering my research questions. The pilot interview questions were mapped to the research questions and SCCT framework to ensure they remained cohesive; the final mapping of the protocol questions to SCCT constructs is contained in Appendix H.

The purpose of the pilot interviews was to test the interview timing, determine if questions were clear (did I get many questions on what my question meant), and if the responses provided sufficient information to answer my research questions. The timing of the interviews was confirmed to be in the 45 – 60 minute range. The pilot study protocols provided insightful information during all interviews relevant to my research questions. Synopses of the interviews data and comments (e.g., the conversation flow, amount of probing, and relative content on past, present, and future events) were presented to the ECC team. The ECC team then developed the final protocols using the pilot protocols as a starting point.

3.5.3 Phase 2 – Final Protocol Development

As discussed in Chapter 1, this dissertation is part of a larger project researching barriers to engineering as a career choice for Appalachian youth (Appendix A contains added information on the ECC project) and the final protocols used for this dissertation were the same as the ECC team protocols. The ECC team collaborated on developing the final protocols by using an iterative process. The criteria for the final protocols included: 1) being capable of answering the research questions of this dissertation as well as the ECC team's research questions, 2) incorporating multiple motivational and social theories related to career choice, and 3) being usable by multiple researchers and collecting similar data. These ECC team protocol criteria support the protocol goals set out for my research. The process steps are discussed in this section and discussion on the final protocols is contained in section 3.5.4. The iterative process steps included timing of protocol development, reviewing initial data for content, and making modifications until the protocol questions resulted in data sufficient to meet the protocol goals.

Two rounds of initial interviews and protocol updates were conducted (see Table 8 for the timing). The timing of protocol development resulted in developing the working and college

participant protocols ahead of the high school protocol. An advantage of interviewing the working and college participants first was the insight gained about their perceptions of their high school education and experiences after time to reflect on the experiences. The college and working participant reflections were used to inform the high school protocol in several ways including providing areas to probe for information such as dual enrollment and governor school engineering classes. We also improved our high school questions and probes concerning where a participant grew up, where their relatives were from, and how close the family was geographically and socially.

An objective of the ECC team was to develop a protocol capable of obtaining sufficient data for analysis using multiple theoretical frameworks, specifically SCCT and Future Possible Selves (FPS) (Markus & Nurius, 1986). A conversational flow was important during our qualitative interviews so that the "lived experience" (Seidman, 2006, p. 9) and the Appalachian heritage of storytelling and oral tradition (Baghban, 1984; Tang & Russ, 2007) would provide deep, rich data. To support the flow and content of the data, the question order and placement of probes was changed and consolidated for all three pilot protocols during the revision phases. An example of the revisions includes prompting participants to describe their future career aspirations and those they may not be able to pursue to improve the FPS data. If the participant referenced multiple items (e.g., money and location), they were asked to provide relative importance of each item. For the high school protocols, the initial data also suggested that asking about engineering too soon in the interview might suggest engineering as the "right" answer and influence subsequent responses. To reduce this bias in answering questions about interests, career plans, and future expectations, engineering as a career choice was not asked until the end, and only if the participant had not previously mentioned engineering. Additionally, because

reasons for not choosing engineering are of interest, a prompt for this specific situation was added to the question asking if engineering had been considered. The high school protocol added a question that asked if the participant knew any engineers and what they thought an engineer did for a living.

This iterative process resulted in three interview protocols (high school, college, and working participants) capable of meeting the protocol goals of incorporating multiple motivational theories, allowing for an open conversation, usable by multiple researchers, and occurring in a reasonable amount of time. The final interview questions were mapped to the research purpose and research questions of this study to ensure cohesiveness of the questions with SCCT and my research questions (see Appendix H for the mapping). Consistency of the interviews between participants and different researchers occurred by using the interview protocol, discussing the interviews with the ECC team, and having two interviewers at the high school interviews. A consistent field note guide was used to capture high level information after each interview and to assist with preliminary data analysis; a blank field not guide is contained in Appendix I (Creswell, 2009; Miles & Huberman, 1994a).

3.5.4 Final Protocols

The flow of each protocol is provided below along with the type of questions asked. The actual protocols are contained in Appendix E through Appendix G. How the protocol questions map to SCCT constructs is contained in Appendix H. As part of each question, probes are listed that are designed to capture information considered important in Appalachian culture. Examples of probes include asking about preferred geographical location, parental education, and local jobs available. Though some questions appear more likely to provide information specific to my research questions, for example, reasons high school students choose a career goal, the entire

interview transcript was reviewed for each participant. Because the study was structured to obtain the participant's perspective, as they told their story, the order of receiving information and exact question flow occasionally varied.

Final High School Student protocol (Appendix E). The high school student protocol was organized to flow from general information to specifics. The protocol has 16 questions, is grouped into four sections, and starts with an introduction and what high school is like for the participant. The protocol moves from the participant (e.g., likes and dislikes and their high school experience) to the community for the second section of questions (e.g., what it is like growing up there and people influencing the participant). The third section moves from the present to the future and specific questions about career plans are asked (e.g., what type of job they are considering and why and what their next steps are after graduation). This section also contains a "roads not taken" question followed by asking them about engineering if they had not yet mentioned it. In the fourth and final section, the participant is given an opportunity to provide any additional information they expected to be asked and/or advice about career plans they would want other students to know.

Though the protocol is structured from current to future, some participants provided information for future protocol questions as part of an answer to a different question. For example, some participants were quick to provide their career plan (which is a question situated half way through the high school protocol) so that discussion was followed and then the interview continued with the questions in order of the protocol.

Final College Student protocol (Appendix F). The college interview protocol contains 17 questions. Because these participants were in the process of acting on an academic choice goal of engineering as defined by the SCCT model (Lent et al., 1994), the protocol was designed to learn

what the participant thought about college presently (specifically their preparation) and what about their past influenced them in choosing to study engineering. Questions about their past included what, if anything, about high school influenced them and who, if anybody, influenced their decision to pursue an engineering degree. First, however, college participants were asked about where they grew up and what it was like to grow up where they did. Asking about where they grew up helps to situate the participant in the past for most of the interview discussion and not on their current college experiences. Asking the participant about where they grew up improved the participant's responses being situated in high school versus in college. Finally, after taking about the past and the present, the college participants were asked about their plans for after graduation and their future expectations. During the future phase, the participants were asked their preferred geographical location and why it was preferred.

Final Working Engineer protocol (Appendix G). The interview protocol for working engineers contains 14 questions and involves gaining insight into the engineer's reflection on why they wanted to become an engineer and their expectations for when they became an engineer. In order to situate most of the conversation on the past, question #2 asked for some information on their career path which caused the participant to reflect on the past and provided key points to probe later in the interview (e.g., if the participant had moved around during their career). Next, question #3, kept them in the past and asked where they grew up. Similar to the high school and college protocols, questions also included what was unique about where they grew up, who some of the people that influenced them where, and jobs they knew about while they were in high school. The majority of the questions were centered on their high school experiences; what they envisioned their future would look like, when they decided, and why they

decided they wanted to go into engineering. They were also asked for recommendations they had for high school students on how to choose a career path.

3.6 Data Collection

Data was collected via interviews and descriptive statistics. The interview data was collected from participants described in section 3.4 using the protocols described in section 3.5. Likewise, the descriptive statistics were gathered based on information from Appalachian career choice and engineering as a career choice literature for the case study region (e.g., the categories contained in Table 2).

Interviews were conducted from July 2012 through February 2013 as shown in Table 8. The college engineering and working engineer participant interviews were conducted over the course of several months with one to two per month on average. The working engineering interviews concluded on January 3, 2013. The college engineering participant interviews concluded on December 26, 2012. For the protection of the high school participants (all legal minors) and interviewers, high school interviews were conducted in teams of two with one female and one male interviewer; I led the Virginia interviews. Two benefits of interviewing in pairs were: 1) the opportunity for follow-up questions from the second interviewer during the interview and 2) an opportunity to discuss each interview after they occurred with the other researcher. The high school interviews were conducted in batches (multiple interviews on each day a school was visited) and the college and working interviews were not in batches; Table 8, page 76 shows the interview timing. At the end of each interview, I completed a standard field note sheet (see Appendix I), consistent with Miles and Huberman's recommendations on how to create a contact summary sheet (Miles & Huberman, 1994b). The field note sheet was designed to be universal for high school, college, and working engineer participants.

In addition to interview data, publicly available statistical data such as county populations, school sizes, graduating class sizes, and socio-economic data was collected from the ARC, U.S. Census Bureau, and Virginia Department of Education websites (see Table 2 on page 30). This information assisted in the maximum variation sampling as well as the analysis phase by adding to the depth of information contained in the interview data. The statistical data also assisted with pattern making during the analysis phase. Based on literature about Appalachia, the statistical data was expected to assist with the analysis phase and pattern making. The data was also used to compare if information received from students was the same or different from expected and as information learned during interviews that appeared salient was investigated via descriptive statistics as appropriate. For example, the literature cites Appalachians as wanting to stay close to home and less than the national average of college-educated people, thus the participants' parents' educational background and the participants' plans to remain local could be compared to the statistics for the region. Likewise, as participants commented on not knowing engineers, data was sought through the census website relating occupations or degrees by category. This data was used to determine the relative percentage of degreed engineers in the case study region and was compared with Virginia; the data is contained in Table 2.

3.7 Qualitative Analysis

Data analysis focused on exploring salient variables influencing Appalachian high school students as they make their career goals. The use of an exploratory case study as my qualitative method was appropriate to allow themes to emerge "to develop ideas for further study" (Yin, 2009, p. 141). Within case analysis was conducted using a combination of code development, pattern making and clustering (Miles & Huberman, 1994b). The reason for using qualitative case study methods and SCCT as a framework included the complexity of interactions involved with

career choice decision-making and the scarcity of literature specific to Central Appalachia with respect to career choice, especially with respect to engineering.

As discussed in section 3.3.2, the research process, including analysis, involves comparing the data and emergent themes back to the sub questions to ensure the overarching research question can be answered. During the process of collecting and analyzing the data, findings were allowed to emerge; these findings were used to provide clarity to the sub-research questions. A visual representation of this process is shown in Figure 10. During the analysis process, the chain of evidence (Yin, 2009) was maintained (described further in section 3.8.1) and each step was monitored to ensure quality research was conducted.

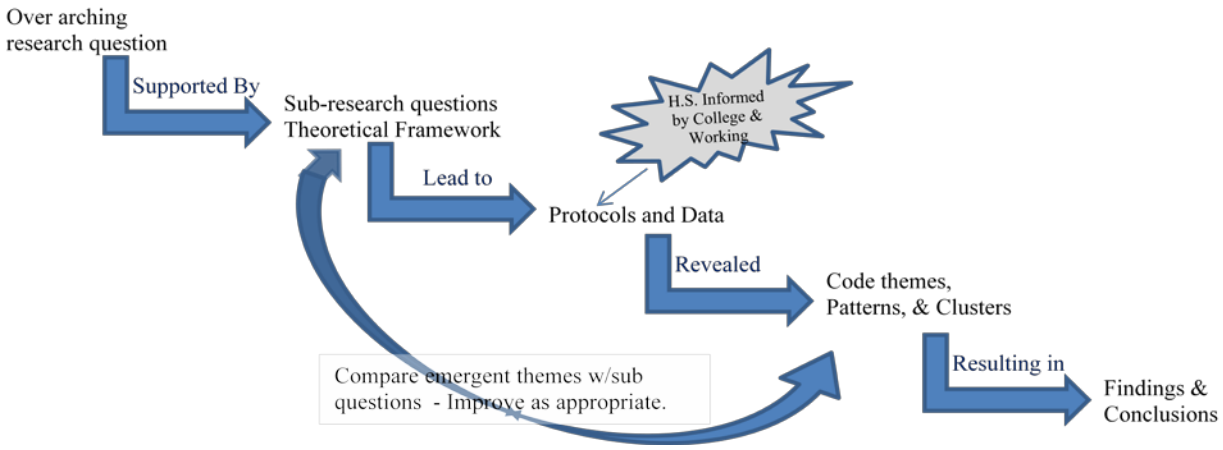

Figure 10. Analysis Process Steps

3.7.1 Coding Methodology

I conducted an iterative coding process using field notes, expanded field notes, a logbook, and coding software (MAXQDA). Before starting formal coding in MAXQDA, I reviewed my field notes, re-listened to the interview, and expanded the content in the field notes. This upfront work allowed preliminary ideas on themes and patterns to be noted in my logbook.

Coding the interviews involved multiple passes through the transcribed interviews. My coding technique involved coding a few interviews, reviewing the codes, documenting added codes, and then coding a few more interviews. A logbook was maintained during the coding and analysis process and it contained notes on when codes were added, when code relationships were developed, and to capture items that were not easily coded for in the data. I used this logbook to track coding progress and to be sure that all interviews were coded with the same final list of codes. Additionally, the repetition of comments in the logbook helped highlight trends and relationships, through repackaging and aggregation of the data, in Miles and Huberman (1994b) terminology.

As an overview to my coding process, I used a variable centered approach (Miles & Huberman, 1994b) to analyze the content of the interviews from a combination of a priori and inductive coding. MAXQDA software was used to aide in the coding. SCCT and existing literature on Appalachian youth career choices and engineering as a career choice provided a basis for a priori coded variables, such as parental education, interests, importance of family, and remaining near family. These initial codes were grouped as background factors, interests, and supports (all SCCT constructs). As interview transcripts were coded, information that was in multiple interviews, or that appeared salient, was added to the codebook and my logbook. All of the variables were compared and aggregated to identify themes and patterns in the data using a combination of the logbook, MAXQDA data export to excel, and review of coded segments contained in each MAXQDA code. For this research, both reasons for making a career choice and factors influencing the career choice where of interest. Thus, it was necessary to develop a codebook for the career reason codes for high school and college students, map salient factors with the reason codes, look for patterns, and develop a possible explanation of how prepared

students appear to be with respect to pursuing their career choice. In addition, it was necessary to be able to segregate the findings as engineering or non-engineering career choice participants. Thus a variable centered matrix was developed using excel with the variables as columns and the participants as rows. The coding began with the college participants, but both college and high school interviews were coded throughout the coding process. Working participant interviews were not coded as they were not required to directly answer my research questions. In addition, intercoder reliability is discussed in section 3.8 and was performed for each type of inductive coding.

3.7.2 A priori Codes

A priori codes were created for categorical variables discussed in Chapter 2 and considered key in the Appalachian career choice literature, the STEM career choice literature, and the categories distinguishing the nine counties of this case study (Table 2, page 30). Categorical codes based on Chapter 2 information included gender, types of local jobs, preference to remain local, plans to attend college, and parental education were included. Other categories, such as year in school (for high school and college participants), continuing generation Appalachian, knows any engineers, and career choice job, were also coded. The majority of these variables were dichotomous, though a couple of the codes I considered open list codes (such as local jobs and career choice job). Open list codes where used to tag responses from each participant; the responses where then reviewed as a group for code condensation, clustering or linking with other categories. All of the above mentioned codes were considered during pattern making analysis and to improve the background description of the participants when discussing their career goals. The items contained in these categorical codes were transferred to an excel file to aide in pattern making, participant descriptions, quantizing

(Maxwell, 2010; Sandelowski, Voils, & Knafl, 2009) and summarizing information in Chapter 4, Findings. Table 9 shows categorical sub codes and comments for each code. If a participant gave a preferred response it was used, though some participants also commented that they may not be able to do their preference, for example some preferred to attend a 4-yr college straight from high school, but acknowledged they may need to start at a 2-yr college for some reason.

Table 9. Categorical Codes

Code	Type	Sub Codes	Comments
Gender	Dichotomous	Male or Female	
Year in school	List	Freshman – Senior	Direct question asked to participants.
Remain Local	Dichotomous	Yes or No	Participant comments on where they want to live when they start their career. Directly asked, but also discussed in additional places of some interviews.
Prospective FGC	Dichotomous	Yes or No	Yes if neither parent has a 4-yr degree.
Continuing Generation Appalachian	Dichotomous	Yes or No	Obtained by asking several questions; where the participant was from, where their parents were from, and where additional family lived.
Knows any Engineers	Dichotomous	Yes or No	Direct question asked. If mentioned in multiple places, all tags were included.
2-yr vs 4-yr College	List	2-yr or 4-yr	Captures high school participants' plans & college participants' current colleges.
Possible Jobs	Open List		Comments on type of job participants want; occurs in multiple places in the interview.

3.7.3 Inductive Codes

Inductive codes were added to the a priori codes based on trends in the MAXQDA coding and recurrence of comments and themes identified in my logbook. Themes were developed as reason codes for choosing a career (see section 3.7.4 for code development), for what I refer to as the student's preparedness for college (see section 3.7.5 for code development), parental experience, and school resource level. The career choice reason codes were developed for high school and college participants, the codes were purposely not restricted to being the

same in order to allow for a compare and contrast situation, as designed by the research questions. In an effort to understand what factors are influencing high school students (part of sub research question 1), the preparedness of students was explored. The resulting preparedness matrix is a synthesis of a series of sub codes and was developed to look for patterns and influences toward a career goal based on a student's apparent knowledge of how to pursue their career choice. In addition, the parent's educational attainment is a common influencing factor analyzed. However, within this data a distinction that included parental knowledge of college based on where the parent worked emerged, as did the college outreach to various high schools.

As recommended by Miles and Huberman (1994b) and as described herein, coding began with a list of codes from a theoretical framework (SCCT) and factors common in the literature. However, as analysis continued via code consolidation and clustering, higher-level codes were added that were not strictly based on SCCT. For example, reasons participants gave for making their career choice decisions included environmental influences, but were not time dependent (e.g., background and proximal) as suggested by SCCT, so the final codes are not unique to a background or proximal timing. Once a final list of codes and appropriate definitions were established, they were applied across all interviews. This insured that each interview was coded consistently.

3.7.4 Reasons for Choosing A Career Goal

As described above, a series of codes related to the reasons high school participants and college engineering participants gave for choosing a career goal emerged inductively from the data . Six primary career choice reasons (referred to as reasons) were developed for the high school participants and three primary career codes for the college engineering participants, as shown in Table 10. The codes are considered primary for several reasons, including occurring

prior to other reasons for choosing a career and resulting in a specific career choice, not a narrowing of the career choice. As commented in the interview protocol section, the entire interview was analyzed to answer the research questions. Thus, the entire interviews were coded to identify primary reasons for career goals decisions for each participant, the participants were then grouped by the reason codes. It should be noted that the designator "critical incident" (*CI*) precedes three codes to note that the participant described a particular salient event or person during their explanation of a career goal. The critical incident designator is inspired by Critical Incident Theory (Flanagan, 1954) though this is not a framework used for this study at this time. The use of this designator is a reminder that it may be a useful lens through which to re-examine this data at a future time and particularly in developing an actionable framework for interventions specific to Appalachian youth.

By primary reason, I mean the initial or main reason given. The high school participants were all coded using the scheme shown in Table 10 to capture these primary reasons. This does not mean that the participant had segments of code only pertaining to this reason. In fact, interviews may have had segments coded with multiple reasons and several participants, after making a decision, developed additional reasons that further substantiated their career choice. In addition, other factors were considered that did not result in a participant's narrowing to a particular career, but the factor may have narrowed the choices. For example, several students indicated the desire to remain local, have job stability, or earn a good income (categories contained in Table 16). Wanting to remain local may have reduced their career options (e.g., considering teaching, social work, or medical), but it did not reduce the options to a single career. Likewise, wanting job stability may have removed options (e.g., work in the coalfields) or narrowed the preferred field of a job to one considered stable (e.g., medical), but it did not

cause a participant to pick their exact career choice (e.g., nursing). A second coder reviewed several transcripts for both primary and secondary reasons based on my codebook and refinement of definitions occurred until we reached agreement on the code characteristics and interpretations for twelve participants. However, in this research, I focused on the primary reasons because of their importance in understanding factors influencing the participants. A complete analysis of the secondary reasons is out of the scope of this research and will be saved for future research.

Table 10. Inductive Codes - Career Choice Reasons

Code	Sub Code	Characteristics
Reason for Career Choice – High School		
	Critical Incident- Major Life Event	➢ Major event such as a death or serious illness ➢ Not a series of occurrences
	Critical Incident – Behavior Altering	➢ A person or event was cited that caused the participant to change career goal. ➢ The changed goal may not be participants preferred goal ➢ The participant considered the result a new career goal
	Critical Incident – Supportive	➢ Key event or person cited as critical in choice decision ➢ The person or activity supported what the participant wanted to do and not change the goal. Support may be recognition of a career that supports an interest.
	Interest	➢ Has always enjoyed the activity ➢ It is what they always wanted to do
	Purposeful Delayed Decision	➢ Multiple reasons in consideration. Participant plans to decide in college. Typical comment includes taking some classes to determine what they want to do
	Unknown	➢ Multiple reasons may be mentioned, none chosen and no clear indication of how they will decide
Reason for Career Choice – College		
	Critical Incident – Behavior Altering	➢ A person or event was cited that caused the participant to change career goal. o The new goal may not be the participant's preferred goal. ➢ The participant considered the result a new career goal.
	Interest – School	➢ Classes such as math and science were a key interest and learned that engineering uses both. ➢ Classes may have included engineering courses, but the engineering course was not considered a "critical incident" causing them to pick engineering.

Code	Sub Code	Characteristics
	Interest – Hobby	➢ Outside of school, hobbies were discussed as reason for choosing engineering. "I was already doing part of what engineering is" type comments made. ➢ No singular event was given that resulted in the student picking engineering.

With respect to secondary or subsequent reason codes, several scenarios occurred including the secondary reason being subsequent to the career decision. For example, if a participant chose a career based on a *CI-major life event* and subsequently received support toward that career choice, the support was a secondary reason. Another example was with a participant having an interest in an activity, but did not know of any careers where they could use their interest, a supportive person learned of the participant's interest and recommended a career that uses the interest. Because the participant would not have known of the career without the supportive person, that example was one of *CI-supportive* not *interest* being the primary reason for the career choice. A third scenario was when a participant provided multiple career choice options, they may have given reasons for why they were considering each career, but the career fields and reasons were distinct; this person was characterized with *unknown* for their career choice and reason for career choice.

As a reminder, the working engineers' career choice reasons were outside the scope of this project. However, based on information obtained through the interviews, the working engineer participants had reasons similar to the college participants. This project focused findings of the high school participants with a comparison to college participant results since the college participants are emulating the high school participants' next SCCT cycle (e.g., going to college). The working participants, however, have acted on their career goal, acted on becoming an engineer, and attained the performance of being an engineer. Therefore, working participants'

reflections of their high school events were potentially contaminated by their added experiences and choices made during their career path. For this reason, the working participants' primary functions, for this research, were to inform the interview protocol development; the working participants' interviews were not fully coded for primary career choice reasons.

3.7.5 Inductive Code – Preparedness for College

In addition to the career choice reasons, level of preparedness emerged as important to both high school participants looking forward and college participants reflecting back on lessons learned about being prepared for college. Several college students commented on experiencing a disconnect between their perception of college and their current reality of college as college students. College participants, such as Dave, commented on being surprised at the academic realities of college. Participants, such as Hannah, also discussed how little, in hindsight, they knew about the process of getting into college and high school classes they should have taken (calculus in the case of Hannah). Likewise, high school participants presented a disparity between apparent knowledge of getting into college and academic expectations once in college. To evaluate this apparent awareness of the "next steps" for achieving one's career goals, a series of items were clustered into a level of *preparedness* code because comparing these factors singularly with the choice reason codes was insufficient to reveal trends. Thus, a matrix was developed, informed by college participant comments on their preparedness, to associate each high school participant with a relative level of *preparedness* (for obtaining their career goal).

Seven factors were clustered to assess the high school participants with respect to their apparent level of *preparedness* for college and to achieve their career goal. Table 11 is the rubric used to assist in the composite assessment of a student's *preparedness* based on the seven factors. The factors were assessed based on a participant's entire interview because information

was provided at different points during an interview. The criterion in the rubric for high, medium, and low for each factor provides information on how the factors were operationalized. A second coder, to improve the quality of the matrix, reviewed the distinctions between high, medium, and low as well as the overall descriptions. Though several factors were used, I made a composite determination of *preparedness* based on an overall evaluation of each participant for the seven factors, as shown in Table 12. The composite *preparedness* level was assessed for each participant by looking at coded segments of their transcripts, but without referring back to information such as the participant's high school or the participant's parent's formal education level, in an attempt to minimize any bias on the results.

Table 11 and Table 12 are presented on the next two pages.

Table 11. High School Participant Preparedness Rubric

Factors	High	Medium	Low
Courses needed/ Courses Taking	Participant is taking advanced or college courses and knows why they will help them get into a college.	Taking advanced or dual enrollment courses, but does not know how they will help. E.g., dual enrollment count as college credit, but does not know if they will help with degree credits.	Not taking dual enrollment classes since they will have to retake them in college. Think all their dual enrollment classes will count toward degree regardless of college credits and intended major.
Application process	Knows the specific process for schools of interest, deadlines, and can articulate their application plans.	Has a sense of the application process, but not deadlines, or what colleges consider; e.g., extracurricular activities	Unaware of process or deadlines. E.g., waiting till the summer to apply to a University for Fall admission.
Financial	Knows approximate cost of schools applying to, can comment on financial aid process/has applied for aide, and can articulate information on looking into scholarships.	Knows college is expensive. Thinks there are loans or scholarships to pay for college, but does not know process for getting them. May know that community college is less expensive than other colleges.	Assumes college finances will work out, but does not provide a plan or understanding of how to be financially prepared. May not distinguish cost differences between community college and other colleges.
Type of College	Participant knows what type of college offers degrees related to their career choice and has some understanding on differences of colleges	Participant is considering features of a college, but features commented on do not include academic consideration for the career field of interest.	Participant is considering colleges based on location, not possible majors. Participant has not researched college offerings and/or does not know which majors are offered at different colleges.
Major & Level of degree needed	Accurately indicates the academic achievements necessary for the career goal they have. Can articulate their need or preference for different degree levels (e.g., associate, bachelors, doctorate)	Knows the academic field for the type of degree necessary to help in their career, but indicates some uncertainty about their knowledge or uncertainty of level of degree needed.	Participant does not match their career goal with the type of major needed or with level of degree needed.
College Expectations	Provides detailed example of what they expect when they get to college, how they plan to succeed academically, & may include having a college support system.	Knows classes will be harder and may need better study habits, but does not know how they will develop better habits.	Participants think that their high school college credit courses are the same as what they will see at a university.
Connecting the Influences	Clearly articulates path from high school through all academic milestones to a career goal. Includes information on why they are making certain decisions, such desire to attend as a particular undergraduate school.	Knows of the basic academic requirements for their chosen career, but has trouble connecting some of the steps or knowing if some of the steps are barriers (e.g., acceptance rate to a medical school).	Comments on following what others (e.g., guidance counselor) is telling them to do. Specifically indicates not being sure of the path for the career they want.

Table 12. High School Participant Preparedness

Pseudonym	Student Preparedness Toward Career Goal	Courses needed/ Courses Taking	Application process	Financial	Type of College	Major & Level of degree needed	College Expectations	Connecting the Influences
Ashley	High	H	H	M	H	H	H	H
Brian	High	H	M	L	H	H	M	H
Cathy	High	H	H	H	H	M	H	M
Emily	High	H	H	H	H	H	H	H
Jessica	High	H	H	H	H	H	H	H
Lisa	High	H	H	H	H	H	H	H
Michelle	High	M	M	M	H	H	H	M
Samantha	Medium	H	H	H	M	M	M	M
Amy	Medium	M	H	H	M	M	M	H
Debbie	Medium	H	M	H	M	M	L	M
Donna	Medium	M	M	M	M	H	M	M
Fred	Medium	M	M	M	M	M	M	M
Gary	Medium	M	M	M	L	M	M	L
Greg	Medium	H	L	M	M	L	M	L
Hilary	Medium	H	M	M	H	M	M	M
Josh	Medium	L	M	M	L	H	M	M
Karen	Medium	M	M	L	M	M	L	M
Kyle	Medium	M	L	H	L	M	M	L
Laura	Medium	M	L	L	M	M	M	M
Paul	Medium	M	L	M	L	L	M	M
Susan	Medium	M	M	M	H	H	M	H
Kelly	Low	L	L	M	L	M	L	M
Kevin	Low	M	L	M	L	L	L	L
Rachel	Low	L	M	L	M	L	L	M

H = High, M = Medium, L = Low

3.7.6 Inductive Code – Parent / Guardian Experience

In general, different levels of parental experience toward college depended on a combination of parental education and employment history, which affected the parental advice provided to the participant (based on the participant's story). The parental advice can range from abstract encouragement, such as "you can do anything you want" phrases to more concrete guidance on what classes to take and why they are important for success in college.

The Parent / Guardian experience code (simply referred to as *parent experience*) was evaluated as high, medium, or low as delineated in Table 13.

Table 13. Parent Experience Level

Parent Experience Level	Description
High	➢ At least one parent has a 4-yr degree and ➢ Participant indicates at least one parent provides guidance for college based on their experience
Medium	➢ Either one parent has a 4-yr degree or ➢ A parent works in an environment exposing them to knowledge of 4-yr college expectations or exposing them to inside information on jobs/careers
Low	➢ Neither parent has a 4-yr degree and ➢ Neither parent has a job exposing them to college or inside information on jobs/careers their child wants

3.7.7 Inductive Code – School Resource Level

The *resource levels* are specific to information received from the participants regarding available information and knowledge and not intended to be inclusive of all resources available from a school. The school *resource level* primarily entails outreach by colleges to students at local high schools and was divided into three discrete codes of high, medium, and low as delineated in Table 14.

Table 14. School Resource Level

School Resource Level	Description
High	At least 3 of the 4 following items: ➢ College visits the high school, ➢ College provides tutoring, ➢ College supports field trips to their campus ➢ College provides resources for students to talk with (e.g., professors in an area of study the student plans to pursue) ➢ And, many students mention the outreach
Medium	At least 2 of the items listed above ➢ And, several participants mention the outreach
Low	None or 1 of the items listed above ➢ And, very few students mention the outreach

Both the parent *experience level* and school *resource level* codes are used to differentiate ways in which participants discussed their experiences in high school and factors that were influencing them as they make their career choice decisions and as they plan for college, however, these items were not primary reasons for choosing a career. The primary reasons for choosing a career were more explicitly stated by the participants as reasons for a career choice. That is, none of the participants stated, for example, that a parent having a post-secondary degree caused them to pursue a specific career. Nor did any of the participants indicate having, for example, a tutor caused them to pursue a specific career. However, the parent's place of employment and exposure to careers via a college interaction may contribute to the participant's overall decision-making process. The extent to which the *parental experience* or *school resources* can influence participants is not known and is beyond the scope of this research; however, future research should consider these two factors.

3.8 Quality of Research

Multiple strategies were used to improve the quality of my research and demonstrate credibility and transferability of my results and findings. As summarized by Borrego, Douglas, and Amelink (2009), the credibility relates to the believability of the results while the

transferability relates to the ability to accurately apply the findings in other settings. Actions to establish credibility included data triangulation and intercoder reliability. Transferability of the findings was improved via the reliability of research steps and the thick rich descriptions of the process and analysis and findings. These criteria are applicable to all qualitative studies so I close this section with a brief presentation of the ways that my study meets quality criteria specifically for case study research.

3.8.1 Credibility

Credibility of the research is based on the reliability of the data collection, and data analysis processes. The credibility was improved through the accuracy of data collected (Creswell, 2009), intercoder reliability (Creswell, 2009), and maintaining a chain of evidence (Yin, 2009). This section discusses the actions taken for credibility of this research project.

Accuracy of the data collection was promoted in two ways 1) using multiple interviewers, and 2) ensuring accuracy in interview information. Two interviewers participated in each high school interview. Having two interviewers present for the high school interviews meant that sufficient probes and follow-up questions were asked during interviews to ensure that sufficient details of the region were captured in the recording. Because I am very familiar with the area, it would be possible for me to assume information not actually stated in the interview. Having a second interviewer who was less familiar with this particular region and actively asked follow-up questions helped mitigate situations where I might make assumptions and not ask for clarification. Data collection reliability also included recording and transcribing the interviews verbatim. The data collected was a result of the interview protocol and was the primary information source for data analysis. The interviews were audio recorded and transcribed verbatim for accuracy of data interpretation during analysis. The transcriptions were checked in

full by listening to the recording while reading the transcript for each transcriber until the transcriber's accuracy was verified. Portions of the audio recording that were difficult to understand were marked by the transcriber and listened to by the author (interviewer) and the correct wording put into the transcription.

Maintaining a chain of evidence means recording what was done and how it was done for the case study (Yin, 2009). Essentially, another researcher should be able to follow my process (this is use my protocols, data, and codebook) and come up with the same results. This document represents a chain of evidence. The connection between the interview protocol development, linkage of interview questions to the research questions and framework, data collection, and data analysis (including the final codebook), are all provided in Chapter 3.

The intercoder reliability, also known as cross-checking (Creswell, 2009), occurred by having an additional researcher independently code transcripts based on my codebooks and review operational definitions for *reason codes*, *preparedness*, *parental experience*, and *school resources* (Table 9 through Table 14). The second researcher had not participated in the interviews or discussions on the data prior to conducting the intercoder reliability; thus the researcher was not biased by the author or previous discussions. The second researcher is trained in educational research methods and has experience coding. Three rounds of intercoder reliability occurred for the career choice reason codes. The first round included initial coding by the second researcher of six high school interviews followed by a discussion of differences. The second round of reviews involved three new interviews with the revised code definitions. The third round was a review of the interviews based on the final code definitions and how they were operationalized and included a discussion of one college student per college reason code. The intercoder reliability improved the accuracy of the analysis and trustworthiness of the research.

Intercoder reliability for the student *preparedness* ratings included a review of the *preparedness* rubric (Table 11) and discussion of the four high school participants, who did not align with their expected level of *preparedness* (Lisa, Michelle, Greg, and Josh). The intercoder checks were done until agreement of the participant categories and the code definitions occurred.

3.8.2 Transferability

Transferability aides in the ability to accurately compare or apply results from this study to other settings. Three methods were used to improve the transferability of the findings; data triangulation, reporting of researcher bias, and rich, descriptive writing (Creswell, 2009).

Data triangulation involved the use of multiple data sources to substantiate themes. By converging the perspectives of multiple participants and the expectations of the case study region, the context of the results became more transferable. Interviewing 24 high school participants, 12 college, and 10 working participants from a variety of locations within the case study region improved the ability to conduct data triangulation. Patterns found during the analysis phase were reviewed for all participants of the category (i.e., high school or college). The patterns were also compared to publically available statistical data to further improve the data triangulation and representation of the context of the findings.

Researcher bias was mitigated by peer review of my interpretation of and conclusions of the data with the peer reviewers playing the “devil’s advocate” the with a critical eye to help “keep the researcher honest” (Creswell, 2007, p. 208). The peer reviews helped ensure my level of emphasis in the conclusions correlated with the data and information in my findings to help keep my bias in check. Peer reviews included presenting and discussing my findings with my advisor and research group, regular meetings and discussions with the ECC project members, and finally discussion of preliminary findings with the ECC project evaluator. Each of these

groups challenged assumptions thereby highlighting potentially biased interpretations, which could then be reconsidered.

Rich, detailed descriptions were used to describe the protocol development, analysis techniques, and findings to improve the transferability of the information in this research (Creswell, 2007). Because semi-structured interviews have some flexibility in usage, the protocol development description was included in detail to improve a reader's understanding of the purpose for the question order, questions themselves, and follow-up probes, thereby improving the likelihood of the protocol being transferrable to other research settings. In addition, to further aid in transferability, detailed descriptions of the participants and setting characteristics were provided in section 3.4.3, but not in a manner counter to IRB or participant anonymity. Peer review of my writing and use of participant quotes helped ensure the participant's story was captured accurately.

3.8.3 Overall Case Study Strategy

As a final section on the overall quality of this case study research, an evaluation based on criteria from Creswell, specifically for case studies, is presented. Creswell (2009), states that three overall strategies are necessary to ensure quality case study research is conducted. As shown in Table 15 below, my research meets each of these criteria.

Table 15. Case Study Strategy

Creswell (2009) Strategy	**Response**
Adequately define the case	➢ Nine specific counties in Southwest Virginia during the 2012 – 2013 academic year
Have sufficient data sources	➢ Multiple participant interviews at multiple high schools ➢ A combination of high school and college participants ➢ County and high school statistical data
Address ethical considerations, role of the researcher, limitations, & bias	➢ The remainder of this chapter discusses the ethical considerations, role of the researcher, limitations and bias.

3.9 Institutional Review Board and Ethical considerations

All research has ethical considerations and this section delineates explicit considerations with respect to participant identity protection and the nature of my interaction with the participants. The Virginia Tech Institutional Review Board (IRB) is one method used to help ensure protection of participants during human subject research as well as ethical behavior on the part of the researcher. In addition, consideration for interaction between the researcher and the participants both during and after the research phase is important with this research due to my being a member of the case study community and my intention to continue work in the case study region.

This research was conducted with approved protocols for human subject's research. The Virginia Tech IRB number for my dissertation work and the ECC project as a whole is 12-444. In accordance with the approved protocol, participant consent was obtained prior to conducting interviews. Because high school students are typically minors, additional approvals were needed. Therefore, Virginia Tech IRB approval, county superintendent permission, and parental permission were obtained prior to conducting all high school interviews. Throughout the project, the IRB protocol was reviewed and updated as necessary when changes such as sampling procedures and interview protocols were made. Because the chain of evidence must be maintained with case study research (Yin, 2009) while simultaneously protecting the identity of participants in accordance with the approved IRB, the original interview transcripts were assigned a coded number and participants a pseudonym. These precautions allowed careful tracking of participants without revealing individual names or identities. Moreover, specific high school names are not included in this dissertation, and county names are not associated directly with participants (only county classification) to insure participants' identities are protected.

While the exact school and county are important details, revealing them could make participants identifiable.

In addition to anonymity, interviews are personal interactions that invoke additional ethical considerations. First, participants trusted me with their story so it was important that I tell their story without bias. Second, the perspective of the participant was critical to my study, so I needed to remain neutral and not influence any participant's story. Third, to provide a balanced representation of the case study region, a representative mix of participants was necessary. Thus, during interviews, it was necessary to listen, not to omit any information gathered, and not to ask leading questions so the participants' stories were accurate. In addition to the trustworthiness of each interview, a thorough (maximum variation) representation of the nine counties represented by the case study was necessary. Accordingly, it was incumbent upon me to ensure a variety of participants provided information to maximize the perspectives heard. Based on the literature for Appalachia and career choices, participant variety was needed in representing gender, socio-economic background (by county definitions), family background, and high school variety (size, rural location, access to resources).

Listening to the participant(s) as they told their stories and not interject responses, suggestions, or change participants' stories is critical in qualitative research. During the course of interviewing forty-six participants, several participants revealed sensitive information about themselves and/or their families so I had to be respectful and non-judgmental at all times. I also had to recognize that the act of some participants telling their story might function as a critical incident for them. Therefore, I needed to listen, ask the open-ended questions on the protocol, and not try to change their plans or influence them. I am grateful for those participants who

included detailed personal accounts in their responses, their rich detail improved my ability to synthesize the data and explore career goal themes and patterns.

The final ethical consideration involves my role as the researcher and being a member of the case study region. Precautions taken during the research to ensure participant anonymity were presented in the previous paragraphs. Prior to this research, I participated in community activities promoting STEM and plan to continue with my interactions subsequent to this research. Interactions include working with middle school and high school students in organized STEM activities and workshops. I also managed several college engineering summer interns in my role as an engineering manager. My involvement in the schools and community helped enable access for the high school, college, and working participant interviews. In addition, my position in the case study community and as a member of the ECC research team enables me to bridge a gap between the theoretical research and practical application of the information gleaned from the research. However, in this role I represent a highly educated member of the community and therefore am somewhat of an outsider in that regard. Consequently, it is imperative that I remain steadfast in insuring that this research is a partnership and not paternalistic. Maintaining the partnership by engaging the study sites and the community in the interpretation of findings and subsequent phases of research is discussed in Chapter 5.

3.10 Role of the Researcher

With case study research, as with all research in general, it is important to understand the role of the researcher. As a researcher, I assisted in the protocol development, led all high school interviews, conducted all college and working engineer interviews, analyzed data, and reported findings. For this research, it was the participant's perspective and reality that I sought to

understand. Consequently, it was incumbent upon me to report and recognize my bias in all of my research activities to maximize the credibility, and transferability of this research.

As a practicing engineer and resident of Southwest Virginia, I have a personal interest in this research and any outcomes, which could have biased my research decisions. My interest includes gaining a better understanding of why some participants chose engineering and others do not. From a personal perspective, based on my perception of how many local engineers are in the region and my involvement in hiring engineers for a company in Southwest Virginia, I would like to see the number of local students pursuing engineering to increase. I want to improve the information available to students so they can make an informed career decision. The precipitous for conducting this research and pursuing this degree include my reflections on having engineering degrees and seeing others who, I believe, could have been as good or better engineers than me, but do not have college degrees. In addition, I have lived in Abingdon, Virginia for nearly 15 years and have worked with several agencies and schools to promote STEM careers in the region and curriculum at local colleges. I am interested in what influences students in this region and what can be done to improve their understanding of career options. I do not want to change the region, I do not want to push engineering on people but I do want to help provide an environment where students are afforded the same opportunities as me so that they can make informed decisions on their career choice and not feel limited in their choice of career. Ultimately, I wanted this research to continue to the next step, recommending and designing interventions, so that students are better able to make informed decisions about engineering as a career option in context of their situation.

Throughout this project, I took steps to mitigate my bias. I was particularly concerned about my bias as the interview protocol and the wording of the interview questions were

developed. Therefore, I asked teachers to review the interview questions, to ensure neutral word choice usage and to mitigate the chance of asking leading questions. To further reduce bias by interviewing people with only similar experiences, selection of participants was not limited to people I know. In addition, I did not interview people I worked with on a daily basis or that worked for me to mitigate concerns of voluntary participation versus coercion. I also engaged a partner to help with high school interviews to help mitigate any bias that might emerge while conducting interviews. During data analysis, I repeatedly reflected on what I thought I knew versus the data in the transcripts to help separate my anecdotal experiences from the participants' words and experiences. A final consideration to reduce my personal bias was having a researcher not involved in this project conduct intercoder reliability of my codebook and participant classifications.

The bias described were effectively mitigated with two primary methods; assistance from other researchers and following a sound case study research process. The assistance from other researchers was valuable to ensure the interview protocols contained neutral questions and to provide intercoder reliability. In addition, mapping the research process and including sufficient checks and balances to ensure the participant variety was representative of the case study region mitigated the risk of biasing the data sources. Finally, by acknowledging my bias, it provided the other researchers and me with a list of bias concerns to refer to and evaluate me against throughout the research project.

3.11 Study Limitations

My study was limited in two primary ways: 1) characteristics of participants as a self-selected sample, and 2) use of a quasi-longitudinal design such that the time sequenced interviews are not one-to-one matches with time. These limitations should be considered when

readers decide if my findings are applicable to their own context. These findings also highlight potential areas for future research.

3.11.1. Characteristics of Participants

The participants for this study are all self-selected volunteers. As a result, the sample 1) over represents high school students reporting being in the top of their class, 2) is missing the perspective of high school students planning to join the workforce directly after college, 3) is missing college students and workforce participants from counties with distressed economic status.

According to McMillan, a general concern with an all-volunteer sampling includes the concern that volunteers are often from higher socio-economic status and more educated (McMillan, 2008). Within this study, the high school students interviewed often reported being in the top tier of their graduating class, thus potentially limiting the diversity of student goals for after high school. In addition, the vast majority of participants reported taking advanced placement (AP) courses and/or dual enrollment (received both high school and college credit) courses. The high school participants were planning on college or entering the military after high school, none reported plans to enter the workforce direct from high school. Thus, the scope of this project does not include direct to workforce participants.

One possible reason for the disparity that my participants are top tier students planning to go to college, is that participation of high school students included self-selection and required the approval of their parents and several school system gatekeepers to funnel the request to the students. The added layers of parents and gatekeepers potentially limited students (and biased the sample) as parent and teacher support varied. For example on the enthusiastic end of support, we received comments at one school of a teacher encouraging students to consider signing up for the

interview. As an alternative explanation, students not planning to attend college may have assumed I was not interested interviewing them based on the description of the study.

Regardless of the reasons, these limitations did not reduce the variation of the participants interviewed with respect to county demographics and background characteristics, but did limit the possible career choice goals considered. Thus, the research was limited in its ability to explore why students entering the workforce directly are not choosing college or engineering. The impact of not including any direct to the workforce participants is that the factors influencing students who may have an aptitude toward engineering, but are not planning on college, were not heard. In addition, the findings of this research may not be transferable to students intending to go directly from high school to the workforce.

A limitation with the college and working engineer participants exists, as I was unable to find college and working engineer participants from each socio-economic category, as defined by ARC. Thus, experiences of college engineering students and working engineers from a distressed county are unknown despite intentional efforts to locate participants from such counties. Note that none of the high school students from a distressed county indicated plans to become an engineer so it might be that the population is actually very small. However, the actual reasons for this limitation are not known and can only be speculated at this stage. Therefore, further investigation of engineering and engineers in the distressed counties is a suggested area for future research.

The final participant limitation relates to person inputs of race and gender. My sample, though consistent with reported ethnicities for Central Appalachia, lacks ethnic diversity based on the United States' population and therefore may be missing reasons or factors that ethnic variation could bring. Overall, only two participants (both high school participants) identified as

other than Caucasian. The Central Appalachian region as a whole is primarily Caucasian (95.7 percent “White alone, not Hispanic” based on 2010 ARC data) and the sample in this study was 96% White alone, not Hispanic, however all of the college engineering and working engineers were Caucasian. The ARC data also reports 63.7% of the United States as White alone, not Hispanic and NSF data reports 67.4% of undergraduate engineering students report as White (ARC, n.d.; National Science Foundation, 2013). Thus, the majority of students pursuing engineering in the United States are Caucasian and male, but the percentage of Caucasian and male is higher in this study than the national average and for engineering students.

Although the overall combination of males and females in my study was 57% and 43% respectively, the gender diversity varied significantly by participant group. The high school participants were 33% male and 67% female. The college participants were 75% male and 25% female and the working participants were 90% male and 10% female (1 female interviewed). The NSF data on undergraduate engineering students reports a total of 82% are male (ARC, n.d.; National Science Foundation, 2013) therefore women are overrepresented in my sample of high school students and college students. It is possible that my analysis over represents women’s reasons and factors associated with choosing engineering careers. Since women leave engineering careers at higher rates than men, my college student and working engineers sample might be an appropriate approximation. However, the survey planned for future deployment will be a better way to distinguish gender differences, as sample sizes will be larger.

3.11.2. Quasi-Longitudinal Design

The design of the study was such that participants were interviewed once and not longitudinally. The advantage of a longitudinal study would be the ability to track changes in influences and goals over time for individual people to determine if certain influences remain

constant or were temporary. To mitigate this limitation I conducted a quasi-longitudinal (Campbell, Stanley, & Gage, 1966; Kifer, 1975) study where participants were at different points in a career path versus following a participant from high school, through college, and into the workforce. College and working engineer interviews were limited based on ability to locate engineers and their willingness and time available to participate. Therefore, I do not have direct matches between the types of experiences high school students reported and the reflective experiences of college engineering students and working engineers. Future work could follow these high school participants and develop a true longitudinal study.

3.11.3. Study Limitations Summary

All research has limitations and though efforts were made to mitigate the limitations during data collection (e.g., attempts to locate additional female working engineers and encourage high school participants not planning to pursue college); this research is no exception. The limitations described herein may limit transferability of the findings to other contexts and across time. However, these limitations do not negate the ability of this study to contribute understanding Appalachian high school students' reasons for making career decisions and understanding how their reasons relate to engineering career decisions. The limitations presented in this section provide opportunities for future research, as discussed in Chapter 5.

3.12 Summary

The methodology presented in this chapter connected the purpose of the research, research questions, and data collected such that findings from the data analysis are grounded in meticulous research. The case study methodology employed forty-six interviews, incorporated statistical data at the county or school level, and employed a quasi-longitudinal approach to gain multiple perspectives in intended and actual career trajectories. The interview protocols and

participant sampling were based on expected factors reported in the literature and guided by the SCCT framework. The theoretical framework (SCCT) enabled case analysis beginning with a priori coding of constructs and operationalized based on the literature. Field notes, a research logbook, and extensive coding using MAXQDA software, contributed to the data synthesis and emergence of findings to answer the research questions. The combination of research design and systematic approach of integrating the literature, case study methodology, and qualitative analysis resulted in development of a codebook for career reason codes, factors influencing student preparedness for pursuing their goals, and detail relative to engineering as a career choice to answer my research questions. Chapter 4 provides results based on my analysis.

Chapter 4. Findings

4.1. Introduction

This chapter presents findings pertinent to answering the overarching and sub research questions stated in section 3.1 as well as a comparison of the findings to the SCCT constructs and framework. Therefore, the findings are organized into five major categories:

1) Salient reasons for high school students' career choices, including factors contributing to career decisions (section 4.2) and patterns associated high school participants' understanding of pursuing their career goal (section 4.2.2) (sub research question 1),
2) Comparative reasons high school participants choose engineering versus other careers (section 4.3) (sub research question 2),
3) Salient reasons and factors for college engineering students' career choices (section 4.4) (sub research question 3),
4) Patterns between college and high school participants interested in engineering (section 4.5) (sub research questions 4), and
5) Findings relative to the SCCT model (section 4.6).

Through data analysis, findings emerged to understand what influences high school students in their career decision-making process, especially with respect to engineering. During the analysis, I focused on variables discussed in current literature on career choice in Appalachia and variables that emerged from the data as salient. As a reminder, variables common in the literature for career choice, both specific to Appalachia and in general, include parental education, importance of family, interests, and learning experiences (Ali & Saunders, 2006; Bennett, 2008; Lent, Sheu, et al., 2008; Turner et al., 2004). Factors for Appalachian culture included wanting to stay close to home, job availability, lower post-secondary education, and

lower socio-economic status (Ali & McWhirter, 2006; Appalachian Regional Commission, FY 2010; Bennett, 2008). As discussed in the analysis section of Chapter 3; during data consolidation, code condensation, and analytic progression (Miles & Huberman, 1994b), patterns emerged relative to 1) reasons participants choose their career goal and 2) variation in how students talk about preparedness, i.e., what is needed, to obtain their career goal. These reasons were segregated for high school and college participants as well as those considering engineering and those not considering engineering. These patterns and findings also resulted in a variation from the temporal considerations of the SCCT model.

A synthesis of the variables by high school participant is shown in Table 14 with similar data presented for college students presented in Table 15. These matrices were developed to assist in visualizing patterns in the data. The tables are organized based on primary reasons for career choice codes for the participants. Recall that the thematic coding resulted in six categories of reasons why high school students chose their career goal and only three for the college student participants. The reason codes and their definitions are contained in the qualitative analysis discussion, section 3.7. The tables also contain columns for inductive coding of student *preparedness*, school *resource levels,* and *parent/guardian experience*. As a reminder, the school *resource level* and *parent experience* ratings of "high, medium, or low" are not intended to suggest these variables are discrete, but are coded as discrete to assist in pattern analysis.

Tables 14 and 15 also include categorical information to assist in analyzing the responses relative to Appalachian and career choice literature. The columns are based on information shown in Table 9 with the reasons for including each column in the tables provided here. The variable of CGA is included based on differences seen in the data relative to participants' plans to remain local or not and a connection with being CGA. Planning to remain local was included

because of information on Appalachia suggesting people want to remain local and countering information on availability of jobs in the region (e.g., (Bennett, 2008)). PFGC and FGC (for college students) were included because of the current relatively low percentage of Appalachians with post-secondary education and career choice literature that link parental education and probability of their children attending college. The county status and preference for starting (high school) or attending (college) a 2-yr or 4-yr college was to determine if any trends existed for these metrics; within the region of this case study the percentage of people completing a 2-yr degree is higher than a 4-yr degree, and engineering is a 4-yr degree. The column on job income or stability is included based on literature that suggests income is important for males in their career choice decision-making process and less important for females (Conroy, 1997; Dick & Rallis, 1991), perceived job availability may limit jobs participants consider (Bennett, 2008), and increased unemployment and reduction in available jobs (Appalachian Regional Commission, FY 2010; Seufert & Carrozza, 2004), and participants use of the phrase job stability.

Two final comments comparing Table 16 and Table 17, Table 17 does not contain columns on *preparedness* and the job stability/income column is strictly a yes or no. *Preparedness* was not analyzed for college participants due to different information being available from the interviews for the college students, who were more focused on their preparedness for their job outside of college, than reflecting on their high school preparedness for college and a career. Likewise, college participants spoke of job income and stability more as a combined topic than separate. It should also be noted that some of the participants commented on the potential income or stability of engineering as an after fact of choosing engineering, thus the timing (pre career decision-making influence or post decision-making benefit) is not fully

understood. Note that future work could probe *preparedness* for college more and could attempt to distinguish between income and stability.

Throughout the remainder of Chapter 4, Table 16 and Table 17 are referred to for patterns. To provide additional illustrations, the two tables are sorted by different columns, for example, *preparedness* level instead of career reason code, and patterned with subsets of the variables, to illustrate interactions and correlations. Typical quotations from the participants are provided to support my findings and are minimally edited for readability.

Table 16 and Table 17 are presented on the next two pages.

Table 16. Summary of Career Choice Reasons and Factors for High School Participants

Person	Reason for Choice Goal	Student Prepared-ness	CGA	PFGC	School Resource	Parent Experience	County	College Plan	Stay Local	Job Income / Stability	Career Choice
Fred	Behavior Altering	Med	Yes	Yes	High	Med	Transitional	2-yr	Yes	Yes - Stability	Nursing
Hilary	Behavior Altering	Med	Yes	Yes	Low	Med	At-risk	4-yr	Yes	Yes - Income	Unknown
Karen	Behavior Altering	Med	Yes	Yes	Med	Low	Transitional	4-yr	Yes	Yes - Income	Dentist
Lisa	Behavior Altering	High	Yes	Yes	Low	Low	Distressed	NA	No	No	Military
Michelle	Behavior Altering	High	Yes	No	Low	High	Distressed	2-yr	Yes	Yes - Income	Pharmacist
Kelly	Major life event	Low	Yes	Yes	Low	Low	At-risk	2-yr	Yes	No	M.D.
Brian	Major life event	High	Yes	Yes	Med	Low	Transitional	4-yr	Yes	No	Pharmacist
Laura	Major life event	Med	Yes	Yes	Med	Low	Transitional	4-yr	Yes	No	M.D.
Rachel	Major life event	Low	Yes	Yes	Low	Low	Distressed	4-yr	Yes	No	Social Work
Donna	Supportive	High	Yes	Yes	Med	Low	Transitional	4-yr	Yes	Yes - Stability	Social Work
Josh	Supportive	Med	Yes	Yes	Low	Low	Transitional	2-yr	No	Yes - Income	Hardware
Ashley	Supportive	Med	No	No	Low	High	At-risk	4-yr	No	No	Engineer
Samantha	Delayed Decision	Med	Yes	No	High	Med	Transitional	4-yr	No	No	Unknown
Greg	Delayed Decision	Med	No	No	High	High	Transitional	4-yr	No	No	Unknown
Jessica	Delayed Decision	High	No	No	High	High	Transitional	4-yr	No	No	Unknown
Paul	Interest	Med	Yes	Yes	High	Low	Transitional	2-yr	Yes	Yes - Income	Architect Drafting
Susan	Interest	Med	Yes	Yes	Med	Low	Transitional	4-yr	Yes	No	Professor
Debbie	Interest	High	Yes	No	Low	Med	At-risk	2-yr	Yes	No	Engineer
Amy	Interest	Med	Yes	No	Low	Med	Distressed	2-yr	Yes	No	Social Work
Emily	Interest	High	No	No	High	High	Transitional	4-yr	No	No	Research

Person	Reason for Choice Goal	Student Prepared-ness	CGA	PFGC	School Resource	Parent Experience	County	College Plan	Stay Local	Job Income /Stability	Career Choice
Cathy	Interest	High	No	No	High	High	Transitional	4-yr	No	No	Missionary
Kevin	Unknown	Low	Yes	Yes	Low	Low	Distressed	Unk	Yes	Yes - Stability	Unknown
Kyle	Unknown	Med	Yes	No	Low	Med	At-risk	4-yr	Yes	Yes - Income	Unknown
Gary	Unknown	Med	Yes	No	Med	Med	Transitional	4-yr	Yes	Yes - Income	Unknown

Table 17. Summary of Career Choice Reasons and Factors for College Participants

Person	Reason Choice Goal	CGA	FGC	School Resource*	Guardian Experience	Home County	Current College	Stay Local	Job Income / Stability	Career Choice
Mark	Behavior Altering	Yes	Yes	High	Med	Transitional	4-yr	Yes	No	BSE
Richard	Behavior Altering	Yes	Yes	Low	Low	At-risk	2-yr	Yes	Yes	General
David	Behavior Altering	Yes	No	High	High	Transitional	4-yr	yes	No	Industrial
Sharon	Behavior Altering	Yes	No	Low	Med	At-risk	4-yr	Yes	No	Industrial
Marie	Interest - Courses	Yes	No	Low	High	Transitional	2-yr	Yes	No	Mechanical
Jacob	Interest - Courses	No	No	High	High	Transitional	4-yr	No	No	Mechanical
Hannah	Interest - Courses	Yes	Yes	Med	Low	Transitional	2-yr	Yes	Yes	General
Shane	Interest - Hobby	Yes	Yes	High	Low	At-risk	2-yr	Yes	Yes	General
Bob	Interest - Hobby	Yes	Yes	Low	Low	Transitional	2-yr	Yes	Yes	General
Dave	Interest - Hobby	Yes	No	High	High	Transitional	4-yr	No	No	Mechanical
Nicholas	Interest - Hobby	No	No	High	High	Transitional	4-yr	No	No	Chemical
Tyler	Interest - Hobby	Yes	Yes	Low	Med	Transitional	4-yr	Yes	Yes	Mechanical
*if had engineering										

4.2. Reasons and Factors Influencing High School Participants' Career Goals

This section discusses the *reason codes* inductively developed to group participants by reasons for making their career choice goal and the *preparedness* level (also inductively developed) of the participant. These inductive codes were compared to the categorical codes (Table 9) using variable oriented approach to assist with explaining the findings (Miles & Huberman, 1994b). The career goal reasons (section 4.2.1) are discussed separate from the preparedness findings (section 4.2.2) because the importance of each finding.

4.2.1 Reasons for High School Participants' Career Goals

In this sub-section, I address the reasons for a career choice portion of sub research question one: What are the salient **reasons** and factors influencing Central Appalachian high school students' career goals? As described through the coding process in Chapter 3, career goals are influenced by the reasons students choose their career and potentially influenced by factors such as being CGA, wanting to remain local, parental background, and knowing about careers. Thus, in this section, I present details of the career choice reasons and how they compare with other salient factors. In addition, the findings are compared to existing literature for similarities and differences.

Consolidating reason codes resulted in six primary reasons for high school students to choose a career. The codes are listed in Table 10 and include three associated with a critical incident (*major life event*, *supportive*, and *behavior altering*), one related to *interest*, and two related to not having a career choice goal yet (*unknown* and *delayed decision*). Table 16 associates a primary career choice reason for each high school participant. As a reminder, although the protocols do have a question asking for a participant's career goal and reason why it

is their career goal, the entire interview was considered because participants may have commented on reasons for choosing their career goal at any time.

The remainder of this section is organized by the six primary categories of career goals: *CI-supportive, CI- behavior altering, CI- major life event, interest, unknown,* and *delayed decision* with discussion on associated patterns for each career choice reason code. When referred to as a reason code, the six categories are italicized. Quotes for each reason for a career choice code are presented that represent a typical response. Because some quotes offer a more stand-alone scenario than others do, thus background information on the participant being quoted is provided to put the quote in context.

4.2.1.1 Critical Incident Codes

Recall that Critical incident codes (CI) refer to an external factor (person or event) influencing a participant and may include a particularly salient event or an external pressure to pursue a particular career. The critical incident codes were subdivided as *CI-behavior altering*, *CI-major life event*, and *CI-supportive;* Table 10 contains these codes and how they were differentiated from each other and the other career choice reason codes. Eleven students were coded as having a critical incident code as a primary reason for their career choice. An overview of the 11 participants shows that 10 participants were seniors and one, Kelly, was a junior; 10 participants were CGA and nine were PFGC students. Only Ashley planned on engineering as a career field. Ashley is also the only non-CGA in the critical incident codes. The majority of participants indicated a career in the medical field; two indicated social work and one was enlisted in the Military. Details by critical incident code, with a summary by code, follows.

CI-behavior altering. A *behavior altering* critical incident code was assigned for participants who had a career goal they were interested in pursuing, but due to a strong external

influence changed that career goal; the influence could be a person or an event. The participant described the specific influence during the interview. Five participants (Lisa, Fred, Michelle, Hilary, and Karen) were categorized under *CI-behavior altering*. Four of the participants referenced their parents as the influence that caused the participant to change their career goal; the fifth participant, Lisa, cited her critical event as not based on a parent, but on a brother-in-law. Job stability and earning a decent income were reasons cited by the four participants for why their parents persuaded them to change their career goals. Fred, Hilary, Michelle, and Karen talked about their preferred career being aligned with their interests (e.g., cars, animals, teaching, and accounting respectively) but that discussions with their parents convinced them to choose different fields.

For Fred, the decline in the automotive industry and lack of automotive jobs in the region made an automotive career impractical. In contrast, the medical field, he and his parents reasoned, would need workers and be stable. Fred planned to attend the local community college to become a nurse or a nurse practitioner. Fred commented that he does not expect to enjoy his job every day, but will keep working on cars as a hobby. A representative excerpt from the interview with Fred, when asked what caused him to change to the medical field from the automotive field is provided:

> Well . . . [sighs] mostly my parents kind of pushed me into it because they, I mean, we both of us, me and dad, uh, really like cars and everything, and he just, we both talked about it, how the auto industry is failing and how everything else is going up in the medical field so that was pretty much the deadline of how we pretty much chose it.
>
> - *Fred, High School Senior*

Similarly, Hilary talked about her love of animals and interest in becoming a veterinarian, but did not think the field was viable where she lived (she was not sure many people take their pets to a veterinarian), so she switched to medicine based on her mother's urging. Hilary's mother works at a medical office and has gained insight into the medical field, including fields such as pharmacy becoming saturated in the region, but that the medical field overall always had openings and pays well. Hilary's comments on switching to medical were:

> I love animals. Like I always wanted to be a veterinarian, I know this sounds awful, but it's just like I don't know if there's that much money into it, and it's just like I want to get a really good job so I can, you know, not have to worry about money and the economy. And I don't know if many people actually take their animals to the vet. So I, I really kind of am geared more toward the medical field and going into something like that, because my mom, um, she works in like a nursing office, or whatever, and they always talk to her about how there's always jobs opening up and stuff like that.
>
> - *Hilary, High School Senior*

Hilary later indicated she was unsure which medical field she was interested in and over the course of the interview discussed anesthesiology, surgery, and medical research as a PhD. Hilary commented on job security and income as additional factors supporting her choice in a medical field.

Karen also chose her career goal, dentistry, through a strong influence by her mother. Karen is considering a double major of accounting and biology for her undergraduate degrees, although she plans on going into dentistry, because she "wants something to fall back on." Karen spoke of especially liking math (including taking multiple dual enrollment math classes) and early in the interview indicated an interest in accounting. However, Karen also spoke of her mom influencing her to attend college and pursue something in the medical field; to which Karen

picked dentistry. When asked about why her career goal is to become a dentist, Karen's answer was based primarily on her Mom's influence. Karen secondarily justified dentistry based on the good income and the possibility of helping others. Karen's mother influenced her to pursue a medical career and then Karen narrowed her choice by a process of elimination. Karen provided comments on why her preference was not other medical fields; she did not want to be around too many people, have too much stress, or give shots (nursing); she did not want to "work on dead bodies"; and she did not want to memorize all the medicines (pharmacist). Karen thinks dentistry is low stress, not extremely hard, and still helps people. The advice Karen received for going into the medical field was:

> My mom's in the medical field, and she said, you know, it's, it's a field that's never going to die. There's always going to be people sick. There's always going to be people needing medicine.

Karen, later in the same response, justified the choice as,

> I really want to, if I can get a good job like that and make a good income, I really want to try to help people that are like, that don't have as much.
>
> - *Karen, High School Senior*

With respect to earning a good income, Karen commented that she does want to earn a good income and wants to help people:

> I guess, why I want to be a dentist, I know they make good money, so I know that when I have kids, I can give them more than my parents gave me. And um, uh, I mean, sometimes you can't always have the job you love, like sometimes you just have to, have to do what to, to survive and stuff. And, um, I guess we all love our comfortable lifestyles. Like I've always, I know they make good money, and I know that I could save my money and build the house that I want and, you know, not go overboard but be comfortable. And I can be comfortable with my kids, like sending them to college, and, and like I've always kind of just wanted to maybe help people. Like maybe once a month [*give free dental care]* help people

> that don't have as much, if I could do that, like maybe I can make a difference to people that don't have.
>
> - *Karen, High School Senior*

Michelle's story was similar to the others in that her family wants her to make a good income. However, Michelle's story is also different from Karen's story because Michelle's father does not want her to pursue his field (education). Michelle talked about her interest in teaching and that her father worked in the educational system of the county where she lived; her dad has a master's degree. Though her interest was teaching, Michelle's father told her not to pursue education because of the low money. Michelle also commented on how her father references his brother; his brother says if you are going to do something, you need to do something big instead of being a teacher; the father's brother is an engineer and makes good money. Michelle's father wanted her to get a medical degree because doctors and pharmacists make good money ($100,000 according to Michelle) and are needed. Other participants from Michelle's school commented on teaching as a job requiring a college degree, but that teachers in their county made the least in the state. Though Michelle indicated she would pursue pharmacy, she said her favorite subject is English and she is not very good at math, but does not mind it and she does not want to let her parents down.

Lisa cited seeing her brother-in-law (married to her twin sister) graduate from boot camp as her critical event. Note that she is the only participant characterized as *CI-behavior altering* who was influenced by someone other than a parent. In addition, Lisa is the only *CI-behavior altering* participant for whom the critical incident did not result in pursuing a career in the medical field and it actually took her away from the medical field. Lisa talked about financial concerns for attending college, wanting to do more than just finish high school, being willing to

leave the area because of a lack of jobs in the area, being patriotic, and not knowing a better way to show her patriotism than to join the military. When asked what she wanted to do, Lisa said she was "all about the military" and that specifically what got her interested in the military was seeing her brother-in-law's graduation, commenting:

> Probably when I went to my brother-in-law's graduation. That completely changed my whole entire idea of it [the military]. And then I was interested in it ever since.
>
> - *Lisa, High School Senior*

Lisa's event occurred two years before the interview and in that time, she had already enlisted in the military and planned to begin boot camp in June of 2013. Prior to her critical event, Lisa was considering a career in the medical field. When asked why she changed from thinking about college and the medical field to going into the military, Lisa said,

> I just kind of thought like do the most important thing, like try to make the big difference and then, go to college eventually, in the military.
>
> - *Lisa, High School Senior*

For Lisa, the event of seeing her brother-in-law graduate caused her to change her career choice from a medical field to the military. Though Lisa commented on being interested in the military, it was specifically not until after and because of seeing her brother-in-law's graduation that her interest in the military occurred. Thus, Lisa's career reason is *CI-behavior altering* and not interest.

Patterns emerged with regard to the participants with a primary career reason of *CI-behavior altering* and other factors identified with them, include the following:

- All participants are CGA
- All but one (Michelle) are PFGC
- All, except Lisa, mentioned income or job stability as important

- All, except Lisa, want to remain in the area
- All three county economic conditions are represented
- A variety of schools (size and location) are represented.
- Two of the students planned to start at a 4-year college, Hilary and Karen.
    - Karen planned on a local college that is geographically within 30-minutes of her home, in part because that particular college provided outreach to Karen's high school.
    - Hilary hoped to attend a 4-year college with a good medical reputation that is out of state, but is concerned about finances. At the time of the interview, Hilary did not know if she would start at a community college, an in-state 4-year, or an out of state 4-year college. Hilary was in the top percent of her class and cited several extra-curricular activities, however she did not know if those factors would help her get into college or help with any scholarships.
- All, except Lisa, who enlisted in the military, planned to go into the medical field.
- All, except Lisa, had a parent encourage them to pursue a career in a medical field.
- All of the participants categorized as *CI-behavior altering* are pursuing careers that help others; only some of them emphasized that point while all commented on job stability and/or income as a factor.

The patterns for participants in the *CI-behavior altering* category both match and contrast factors cited in the literature. For example, they are prospective first generation college (PFGC) and want to stay close to family (Ali & McWhirter, 2006). However, within STEM career choice literature, males are more likely to cite income as a factor and females helping others (e.g., (Dick & Rallis, 1991)), yet all of these participants, regardless of gender, cited job stability and/or income as important.

CI- major life event. The code *CI-major life event* was defined as a specific, personal event, such as a death or illness, which lead the participant to choose a career. The participants grouped within this code reason did not articulate changing a career choice based on the event (i.e., *CI-behavior altering* incident); rather they described forming a career choice based on the *CI-major life event*. For participants to be grouped under the primary career reason code of *CI-major life event* they needed to say that the specific event was why they chose their career goal; other participants may have had *CI-major life events*, but they did not relate the event to why they chose their career goal. Four of the participants, Kelly, Rachel, Brian, and Laura, emphasized a *CI-major life event* as the reason for making their career goal decision.

Kelly was born premature and born with life-long health issues. Because of family circumstances, she also helped raise two of her cousins. Kelly cites her premature birth and health issues as why she chose her career goal of being a doctor of pediatric medicine and indicated that raising her cousins supported her decision. Rachel was adopted at a young age by her grandfather because her parents could not take care of her; she was old enough to remember the interaction with the adoption social worker and it inspired Rachel to choose a career in social work. Rachel also wanted to remain close to her "Papaw" and brother and believed a career in social work would allow her to work in the area she was from and to help others in the same way she was helped.

The *CI-major life event* for both Brian and Laura was the death of each of their mothers. Laura's mother died of cancer and the help and kindness her family received from the oncologists inspired Laura to choose oncology as a career choice goal. Brian's mother died unexpectedly from an undiagnosed medical condition when he was in elementary school. Brian's mother had not gone to college, but worked at a drugstore and was taking classes to get her

pharmacy technician certifications with plans to become a pharmacist. When asked if his mother was still thinking about becoming a pharmacist, Brian said:

> Oh, no, she passed away, but, um--, but she was like going after her pharmacy degree or whatever. So it kind of inspired me to fill her shoes, to pursue that.
>
> - *Brian, High School Senior*

Brian would occasionally go with his mother to where she worked and the pharmacist there helped Brian learn about schools and degrees necessary to become a pharmacist, in this manner the pharmacist acted as a critical support for Brian. However, Brian was not coded under *CI-supportive*, because the pharmacist's support occurred subsequent to Brian choosing pharmacy as a career goal. Brian planned to attend a college that has pre-pharmacy and is a feeder school to a pharmacy school in a nearby county.

Patterns emerged with regard to the participants with a primary career reason of *CI-major life event* and other factors identified with them, include the following:

- All four participants are CGA
- All four participants are PFGC
- None of the participants related job income or stability as a factor
- All four participants indicated they would like to remain local
- None of the parents or guardians worked in the participants' field of interest
- Only Kelly indicated starting at a 2-yr community college
- All three planning on starting at a 4-yr college named colleges within an hour drive of home as their preferred college
- All four participants are planning a career in the medical or social work fields, which are known for helping others

- All three county economic conditions are represented
- A variety of schools (size and location) are represented

The participants in the *CI-major life event* category fit the demographics and some of the characteristics commonly cited in Appalachian career choice literature because they want to remain local, are PFGC, and are CGA (Ali & McWhirter, 2006; Haaga, 2004). However, the participants in this category do not refer to job stability or income when talking about their career preference, contrary to many of the other participants.

CI -supportive. The critical incident code *CI -supportive* was assigned to participants who cited a situation or person who specifically helped them learn of the existence of a career. The career goal allows the participants to do something they were interested in, and as such, supported the participants in pursuing an interest. This is different from the *interest* code because *CI-supportive* required the intervention of a person to help the participant learn that a particular career existed. Likewise, some participants may be receiving support to pursue a career, but the support was subsequent to the participant choosing a career goal. For example, Brian is being supported by a pharmacist, but this began after Brian was inspired to become a pharmacist by his mother's death; in this manner, the support is not the primary reason for a career choice.

Three participants were categorized under *CI-supportive*, Donna, Josh, and Ashley. They each had different interests leading to a career choice after the critical incident: science workshops (Ashley), theater (Donna), and computers (Josh). For Ashley, the incident occurred while she was in middle school and was based on a school event and her teacher. When asked what made her want to be an engineer, Ashley responded:

> In my middle school we had a robotics team and a science fair team, and it was very fun, and what we did was we had a thing called Lego robotics where we made robots with Legos, and I really liked that. And, um, when my teacher said,

> you know, there are people out there which actually do this for a job, and I was like, I would love to do this for a job. And, after I started researching what jobs out there had the same things around that, then I realized I wanted to go into an [chuckles] engineering major.
>
> - *Ashley, High School Senior*

Ashley was attending a large (for the case study region) high school in Southwest Virginia at the time of the interview. Ashley transferred to the school as a sophomore from a more suburban environment in a Midwest state. The critical incident happened prior to Ashley moving to and attending high school in the case study region. Ashley was one of only two participants of "other than Caucasian ethnicity."

Unlike Ashley, Donna's family was from the region and she had never moved. Similar to Ashley, however Donna had an interest in a career field, but did not know of a way to use her interest in a career choice. Donna liked theater in high school, but commented on the lack of practicality of pursuing a career in theater because, as she said, people in theater do not always have work or have money. Her high school theater teacher suggested Donna consider a career in social work where she could work with children by incorporating theater. Donna was excited to hear such a career existed because, as she explained, she wanted to help people and she gets to use theater. Donna had spoken with a social worker about this possibility prior to the interview. Donna's career choice was introduced to her by a supportive teacher and allowed Donna to pursue a career she wanted. Donna did not mention a career plan prior to the teacher's assistance, so Donna's experience was not *CI-behavior altering*.

Josh had always like working with computers and was planning a career with computers. As a sophomore, Josh decided he needed to look into careers more seriously and knew, from an eighth grade visit, that the county trade school offered computer repair classes, so Josh signed up

for that class. The guidance counselor, however, enrolled Josh into Cisco computer training (offered at the trade school). According to the Cisco website (www.cisco.com), Cisco is an international company with headquarters in the U. S. and nearly 70,000 employees providing solutions to customer computing needs. The Cisco classes are specific computer certifications through Cisco that are more advanced than generic computer repair training. Once in the Cisco program, Josh realized that he wanted to pursue Cisco certifications and work for Cisco. When asked how his decision happened, Josh said:

> I decided I was going to go into computer repair, and signed up for it and I got Cisco [a *specific class*], and learned all the stuff about it in the class and stuff, and I decided that's what I want to do. Because there's a big field for Cisco.
>
> *- Josh, High School Junior*

Josh also talked about job security and the money he could make by working with computers for Cisco. In addition, Josh joined the military as a reservist to help with money. When asked why Josh wanted to get a computer degree, he said:

> Well, really just because I like computers and working with them and, like I said, it's a big field and there's a lot of jobs in it and stuff. And, it pays pretty good money, too.
>
> *- Josh, High School Junior*

Three participants were grouped under the *CI-supportive* reason; all three participants have different careers and perspectives with respect to the factors being tracked. Within the group, Donna and Josh have the most in common. The summary of their factors is:

- Donna and Josh are CGA; Ashley is not
- Donna and Josh are PFGC; Ashley is not

- Donna and Josh commented on wanting stability or a good income; Ashley did not
- None of the three are planning on a career similar to their parents
- Only Donna wants to remain local; Josh wants to live in a town larger than his current town, but not a large city; and Ashley was thinking of having a "home base" in the United States, but wanted to work and travel internationally.
- Donna and Ashley plan to start at a 4-yr college; Donna is planning on one within an hour of where she lives
- All three plan a different type of job: social work, engineering, and computer systems analyst
- All three live in different counties
- Donna and Josh attend small schools and Ashley attends a relatively large school in the case study region

Unlike the other critical incident reasons, two of three participants (Ashley and Josh) do not have plans to remain in the region, which is counter to expectations presented in Appalachian literature (e.g., (Bennett, 2008)). In addition, Ashley is the only non-CGA of all the critical incident codes; she does not plan to remain local and does plan to pursue engineering.

4.2.1.2 Interest

Six high school participants, five females and one male, were grouped as having *interest* as a primary reason code for choosing a career goal. *Interest* was defined as a pattern of liking activities that the participant relates to the career choice (Lent & Brown, 2006). This category is different from the three *critical incident* codes because *interest* is an internal, personal, construct versus an external, or environment influenced, construct. Likewise, the participants categorized as *interest* for their career reason, conveyed a long-term interest and provided multiple examples

of their interest in their career choice. Some of the participants explicitly said that they could not remember an event or person that caused them to suddenly pursue a career goal, or that the career was something they always wanted to do.

Paul exemplified the *interest* reason code because he repeated throughout the interview that he has always liked to make drawings and cannot pinpoint when his interest started. Paul also talked about the money he can earn by working with architectural drafting compared to a factory or blue-collar job, stating that he was from a blue-collar family (his words). For Paul, he liked his Computer Aided Drafting (CAD) work and wanted to pursue architectural drafting or architecture (Paul talks about architectural drafting more than being an architect). Paul was taking his CAD and drafting classes through the trade school in his county. When asked about other possible jobs, Paul indicated drafting was all he was looking to pursue. When Paul was asked what he wanted to do, he responded with "Architectural Drafting." Paul was also asked if he had considered any other jobs and responded, "not really that I've looked into. This [architectural drafting] is the only one I've really looked into." When asked why architectural drafting, Paul said it was "basically that I like to draw" and that he wants to be involved in residential buildings (more than commercial buildings). When asked about pursuing architectural drafting versus jobs he does not want to do, Paul said:

> I'd be okay with doing blue-collar work. It's just that this [Architectural Drafting] is more what I want to do.
>
> - *Paul, High School Junior*

Paul was not asked about blue-collar work, but brought it up; within the interview, Paul indicated that most of his family did blue-collar work. Though Paul spoke of his interest in drafting and architecture, when asked what being an architectural drafter would give him, he replied with a

financial response. He commented, “Well, it’d be more money than we’re [his parents] making now, so that’s a big plus.” Again, Paul commented throughout the interview that he wanted to do architectural drafting because of his interest in it; Paul did not indicate he was choosing the career for money, though financial stability appeared to be a factor.

In comparison, Emily talked about her career as being something related to what she loves to do – read and throughout the interview talks of pursuing a career based primarily on her interests, so she is categorized under the career choice of *interest*. She specifically commented that finances were not a key factor in her decision-making process. Although she did not have a specific job title in mind, she had a specific work function in mind. She is currently volunteering at a job related to her interest. Her priority is to have a job that is fulfilling and to help people learn. In Emily’s words:

> I, like, I think that would be fulfilling to me, just to get to help people and to learn more. Um financially, I don’t know, I’m not too concerned as long as I can survive off of it.
>
> - *Emily, High School Junior*

Emily also expressed an interest in helping others do research with her career because of her interest in reading and doing research, but not necessarily about writing. Emily stated:

> Well, one aspect of like university libraries and um, other aspects of library science is you can help people do research, through historical documents and finding it on databases. And I think that would be really interesting. I’m really interested in research, just not the writing and presenting of it.
>
> - *Emily, High School Junior*

Debbie, like Emily and Paul chose a career based on interests. Throughout her interview, Debbie talked of both being good at and liking math and science classes because they are interesting and easy for her. Debbie’s primary reason for her career was i*nterest*; specifically, her

interest in problem solving as well as her liking math, science, and engineering classes. When specifically asked what it was about engineering that was causing her to choose it, she replied:

> It's [engineering] just the hands-on, like, it makes you think and it's just, that just interests me, like the problem-solving and stuff.
>
> - *Debbie, High School Junior*

Debbie's involvement in an extra-curricular robotics team and her engineering teacher strengthened her interest in engineering. Debbie also commented that she was in her third engineering class; she took intro to engineering and principles of engineering previously and did not like the teacher, but the current teacher was "great." Debbie was connected to the area and was very close to her family, her preference was to pursue her first two years of college locally and transfer to an engineering program at either UVA or Virginia Tech. When asked about jobs in the area for engineers, Debbie said she has not looked closely yet, but thought there were some. It is Debbie's interest in engineering, more than getting a local job (though she wants to stay local) that was causing her to pursue engineering.

Other than the primary career reason code, the six high school participants in the *interest* category have little in common. The participants have different courses they are interested in, different types of hobbies, and are all planning on a different type of career (as shown in Table 16). The following Appalachian region characteristics exist for the *interest* participants:

- Four of the six participants are CGA
- Two of the six are PFGC
- One of the six (Paul) commented on income being important; he is one of the two PFGC
- Four of the six want to remain local, these are the same four that are CGA

- A variety of future jobs are mentioned by the participants; from university librarian to engineer to missionary work; one of the two participants planning on engineering is included in this reason code grouping
- All types of counties are represented
- All size of schools are represented

Interest is a common reason cited in career choice literature for choosing a career goal (e.g., (Lent, Lopez Jr, Lopez, & Sheu, 2008)), yet only one-quarter of the participants in this study overall have interest as their reason for a career choice. Though only one-quarter of the participants are grouped under *interest*, it is the largest single career reason code. However, if the *critical incident* codes are grouped together, there are twice as many *critical incident* reasons for a career decision as *interest* (11 versus 6; out of 24 possible).

4.2.1.3 Delayed Decision

Three students, Greg, Samantha, and Jessica were coded as *delayed decision*. These participants had a variety of careers they were considering and all indicated they plan to choose their career later. The *delayed decision* participants plan to go to college, and they will use college as a chance to explore careers.

Samantha is an example of a *delayed decision*, she considered a couple of careers, and had a preferred college major, but not a preferred career. Samantha planned to major in biology because she liked the subject and there are many careers options with a biology background. Though Samantha liked the subject of biology, she was not intending to get a career in biology, and in fact, is unsure of what career she wants, so she was not grouped in the *interest* category (where students express an interest in a career, not just a subject). In addition to being unsure of her career choice, she was unsure of what school she would attend, but her first choice was a

private Ivy League school. She recognized this as a big deal and said, “I mean, I guess you have to shoot big.” She also applied to several in-state and out-of-state schools because she knew she may not get into her first choice. When asked to compare some of the possible job options she mentioned, and what kind of job she would like to get she replied:

> I mean, I know that I’m interested, but I’ve kind of left it to whenever I go to college I’ll decide from there, because I don’t really have a clue.
>
> - *Samantha, High School Senior*

When asked what she wanted a job to provide her, she replied she wants to do something she cares about, that was most important and that it was not about the money.

Like Samantha, Jessica planned to delay deciding what she wanted to do until she was in college. However, Jessica said she might pick something in a business field so she can be around people and math is her favorite subject, but she did not want to choose a career too early. Jessica commented that her father had changed careers, but that was not her reason for delaying her decision; she said that she did not want to get out of college and realize that she:

> [went] into something in college and think it’s right for me and then get out of college and be like, oh, no, this is not what I want to do.
>
> - *Jessica, High School Junior*

Finally, both Jessica and Greg talked about moving around after college and exploring. Greg, a junior, is still undecided on his career choice and talked about teaching (possibly a variety of subjects), the Peace Corps (for a variety of items such as building things, teaching, or missionary work). Greg was thinking about and visiting colleges (all small liberal arts colleges) and planned to narrow his career decision down once he was in college. Greg did not want to decide too early and limit his options. In addition, Greg wanted to explore the world and have, in his words:

> Just more world experience. You understand more about different culture and different kinds of people because it's all very different. (Pause) I feel like living in and growing up in a school where half the school wears boots and have heavy country accents, like I appreciate diversity more. If I had grown up with it I might not appreciate it so much and not want it so.
>
> *- Greg, High School Junior*

Within Greg's list of possible jobs are items such as the Peace Corps and teaching, but he talked of choosing a career that would allow him to be exposed to a variety of people including internationally so he can experience a variety of ethnic cultures.

The career reason of *delayed decision* was created to capture participants with a variety of possible careers still in consideration; as such, this group is different from what is often found in the literature. Research on career decisions is often related to specific careers (e.g., engineering, various science careers), factors affecting post-secondary education, deciding between the workforce, vocational, or post-secondary plans, or college student's persistence in their career goals (Ali & McWhirter, 2006; Chenoweth, 2004; Lent, Sheu, et al., 2008; Wettersten et al., 2005). Research is less frequent about high school students who were planning on college but undecided in a career choice, though Rowan-Kenyon, Perna, and Swan (2011) report that students waiting for college to make a decision are typically supported by their parents and typically from a high school with average or high socio-economic background and average or high student achievement. Therefore, it was unknown what combination of factors to expect with respect to the characteristics relative to the Appalachian region. The resulting factors for the *delayed* decision participants are:

- Only one of the three participants is a CGA
- None of the participants are PFGC

- None of the participants indicated job stability or income as important
- None of the participants plan to remain local after college
- All of the participants plan to attend a 4-yr college
- None of the participants know their career choice, a variety of options were provided
- All of the participants are from the same transitional county
- All of the participants are from the same high school

Though one of the *delayed decision* participants is CGA, these students do not follow the pattern of the other reason codes of being PFGC, staying local, or concerned about job stability and income. *Delayed decision* participants are the only group that is primarily not CGA, and all are not planning to remain local. With respect to education items, this is the only group where all of the participants have at least one parent with a 4-yr degree and all participants plan to start at a 4-yr college. This is also the only grouping that did not have a participant comment on the importance of job stability or income as important. These students attended the same high school, but where not the only students from that high school.

4.2.1.4 Unknown

The final code used for choosing a career field was *unknown*. *Unknown* captured the participants who listed several possible options with no favorite and no indication that they were purposely planning to delay a decision. The options provided from the participants are diverse and included comments about being open to additional, but unknown, careers. Kevin, Kyle, and Gary were the only three categorized as *unknown*. All three had similar stories about being unsure of a career goal, but Kevin appeared the most unknown as he indicated he had not thought about it much and was not sure what he might consider. Kyle and Gary listed a few options from which they expected to choose.

Kyle is currently taking an engineering class and likes the class. Kyle had considered engineering, but then saw some "higher level math" from a friend and did not think he could do the math. Kyle had recently added architecture to his list of possible jobs because architecture requires creativity and "probably uses geometry;" Kyle reported he excelled in geometry. Inconsistent with being an engineer or architect, Kyle mentioned wanting a golf scholarship and hoped to get one from a liberal arts college in the region that is known for its business program and which does not offer engineering or architecture. Throughout the interview, Kyle spoke of being an engineer or an architect. However, Kyle was considered unknown about his career plans based on comments about efforts to get a golf scholarship at a local liberal arts college, which would cause him to get a business degree. In discussing his career choices, Kyle said:

> Well, I was looking at engineering. Um, I'm sort of leaning away from engineering to architecture and it's really going to depend, I'm actually going to try to get a golf scholarship. …One of my best friends, and he's getting ready to go play at [*School*] and he's already talked to their golf coach about me, so he's looking at me. Things like that, so it's really going to depend where I get a college scholarship to, and I'm going to look at their curriculum and just the things they have and decide from there.

In talking about going to the liberal arts college, Kyle said:

> Well, they're mainly a, I'm not sure what they do, but I know they have a good business degree, so, I might actually get a business degree if I go down there, and just study what you could do.
>
> *- Kyle, High School Junior*

Kevin, like Kyle, was a junior. Kevin went to a small school in a rural county and his interests evolved around sports. When asked about possible careers, Kevin said he did not know yet, he knew he should be thinking about it, but had not. One of the several career fields Kevin

was considering was anything sports related. However, Kevin does not know what sports related career options may be interesting, or if he will even go into something sports related. Kevin wants to obtain a college degree so he can obtain what he referred to as a good job.

Gary was a senior at the time of the interview and *unknown* with regard to his career choice. Gary talked about being in a small circle of students at his school, because he was taking the harder courses such as dual credit biology and English, and had already taken dual credit calculus and Western Civilization. He mentioned engineering, architecture, doctor/medicine, and lawyer. He was moving away from engineering because his calculus class was harder than he expected. Reasons Gary considered the other fields included liking the subjects of biology and anatomy (for being a doctor), having an uncle who does architecture and finding that interesting to do in lieu of engineering, and receiving comments from people about being a good speaker and potentially being a good lawyer. He said he liked his business law class and lawyers make good pay and have benefits, but he does not know his choice yet. Gary talked of having several interests (doctor, lawyer, architect, and engineer), but since he is undecided on a career at this point, he was coded as *unknown*.

A summary of the factors for the *unknown* participants are provided below. Comments on how the factors agree with, or are unique from, the literature follow the factor summary. With respect to the factors relative to the Appalachian region:

- All three participants are CGA
- Only one participant is PFGC
- All three indicated job stability or income are important for their career choice
- One plans to remain local and the other two prefer to remain local, but indicated they may not be able to depending on their career choice

- Two plan to start at a 4-yr college, one (Kevin) does not know yet
- Two of the three have engineering and architecture as possible career choices
- All three live in different counties
- All three attend different high schools

Engineering career choice literature includes research on persistence through college (e.g., (Ohland et al., 2008)) and career paths as early career professionals in engineering (Winters, Matusovich, & Carrico, 2012). The engineering literature suggests that it is not surprising for students to change their intended field of study or career choice after high school. With respect to similarities with Appalachian literature on youth and career choices, all three participants prefer to remain local and job stability or income is a factor in their career decision.

4.2.1.5 High School Career Choice Reasons Summary

Within the high school participant sampling, some factors and patterns emerged as more salient than other factors. In addition, the factors and trends have a combination of agreeing with and countering the literature on career choice decisions. A summary of counts for the factors being tracked (or diversity of high, medium, low ratings) is shown in Table 18. The table is presented to provide a synopsis of how many participants in each career reason code agree with the factor. The quantitizing of the qualitative data is intended to provide clarity by providing a more precise meaning to the trends and patterns (Maxwell, 2010; Sandelowski et al., 2009).

Table 18. Summary of High School Career Reasons and Factors

Reason Choice Goal	# Participants	Student Preparedness	School Resource Level	Parent / Guardian Experience	CGA	PFGC	College	Remain Local	Income or Job Stability
CI - Behavior Altering	5	High & Med	High, Med, Low	High, Med, Low	5	4	mix	4	4
CI - Major life event	4	High, Med, Low	Med & Low	Low	4	4	mix	4	4
CI - Supportive	3	High & Med	Med & Low	High & Low	2	2	mix	1	2
ALL CI Reasons	12	High, Med, Low	High, Med, Low	High, Med, Low	11	10	mix	9	10
Delayed Decision	3	High & Med	High	High & Med	1	0	4-yr	0	0
Interest	6	High & Med	High, Med, Low	High, Med, Low	4	2	mix	4	1
Unknown	3	Med & Low	Med & Low	Med & Low	3	1	4-yr	3	3
TOTAL	24				19	13		16	14

Table 19. Summary of College Career Reasons and Factors

Reason Choice Goal	# Participants	Student Preparedness	School Resource Level	Parent / Guardian Experience	CGA	FGC	College	Remain Local	Income or job stability
CI - Behavior Altering	4	NA	High & Low	High, Med, Low	4	2	mix	4	1
Interest - Courses	3	NA	High, Med, Low	High & Low	2	1	mix	2	1
Interest - Hobbies	5	NA	High & Low	High, Med, Low	4	3	mix	3	3
TOTAL	12				10	6		9	5

Overall, the participants of this study have both similarities to and differences from the literature on Appalachian career choices and engineering as a career choice. Counter to expectations based on literature, the county economic level (Appalachian Regional Commission, FY 2010), school location, or school size did not show trends in the reasons for a career choice goal. These variables were tracked because of literature suggesting that a student's socio-economic status influences career decisions (Ali & Saunders, 2009), the that the size of a school can limit course offerings, and availability of teachers at small rural schools may be limited and teachers can influence career decision-making (Anderson, 2006). In addition, though the literature on Appalachia and statistical information on post-secondary education suggests not all students will go to college, all of the participants, except Lisa who enlisted in the military, plan to attend college immediately after high school. Research by Chenoweth (2004), involving Appalachian high school students, indicated that approximately one-third of the students would attend college though two-thirds of the students in his study planned on attending college. The fact that nearly 100% of my participants plan to go to college is a limitation of this study and is believed to be an artifact of sampling, as discussed in section 3.11. A final difference is based on research using the SCCT model which posits that interest is a key influence in career choice decision-making. Though *interest* was the largest single reason for students choosing their career, it was less influential than suggested by SCCT literature (Lent et al., 2005; Lent, Lopez Jr, et al., 2008; Lent, Sheu, et al., 2008). However, interest not being as influential as suggested by the model does agree with research on other underrepresented groups (Flores & O'Brien, 2002; Tang et al., 1999).

Similarities to Appalachian culture include the preference to remain local. All of the participants indicating a preference to remain local are CGAs and only 3 CGAs do not plan to

remain local; 16 of 19 (84%) CGAs of this study prefer to remain in their local area. In addition, none of the non-CGA participants planned to remain local.

4.2.2 Participant Preparedness

In addition to the findings relative to reasons and patterns in career choice, the participants had a variety of influences and factors relevant to their understanding of pursuing their career choice. Factors related to a student's *preparedness* for college is one such factor. As discussed in Chapter 3, coding for a participant's *preparedness* for college was inductively inferred based on a series of seven discrete factors that were assessed using the rubric shown in Table 11. The participant's *preparedness* for college (referred to as *preparedness* for simplicity) was evaluated for each participant and compared with the variables contained in Table 16. The level of *preparedness* did not align with career goals per se, but did align with other factors as described in this section. The high school student *preparedness* was based on a combination of the participant's story dealing with seven factors. As a reminder, the categories are:

1) High school courses preparing for college (e.g., dual enrollment courses, and why/if they help)
2) Finances associated with college
3) College application process (forms necessary, deadlines, and what information is looked at by colleges)
4) The type of college (e.g., their college of interest offers their degree area)
5) Major and level of degree for their career choice (e.g., advanced degree for pharmacy)
6) College expectations, what the student expects college to be like, especially compared to high school
7) Ability to connect the above influencing items into a coherent pathway to achieve the participant's career goals (versus comments about waiting for others to tell them)

Recall that each participant was evaluated using field notes, interview transcripts, and coding done in MAXQDA. This information was then used to evaluate each participant relative

to a rubric (Table 11) and the rating for each factor, by participant, is shown in Table 12. The patterns in the participants' *preparedness* that emerged offered further insights into factors that influence high school student career choices. The level of *preparedness* was analyzed in comparison to variables discussed in Appalachian and career choice literature (e.g., remaining local, parental education, county status, and school size), an assessment on *parental/guardian experience* and the school *resource level*, and the career goal reasons developed for this study, as shown in Table 20; Table 20 is an abbreviation and resorting of Table 16. Patterns were found in students' levels of *preparedness* relative to the school's *resource level* and the student's *parent/guardian experience* level, as illustrated in Figure 11. Variables that did not show a pattern included preparedness and county designation, job stability/income, or preference for starting at a 2-yr or 4-yr college. As shown by Figure 11, the participant's *preparedness* of high, medium, or low has distinctions based on parental and school resources. Figure 11 is a graphical representation of Table 20; the horizontal axis is each possibility of parent resource level and school resource level. The vertical axis is the count of occurrences. Thus, columns with no pink bars indicate no low student *preparedness* for that grouping. The remainder of this section discusses the patterns for the High, Medium, and Low *preparedness* categories with the variables previously mentioned.

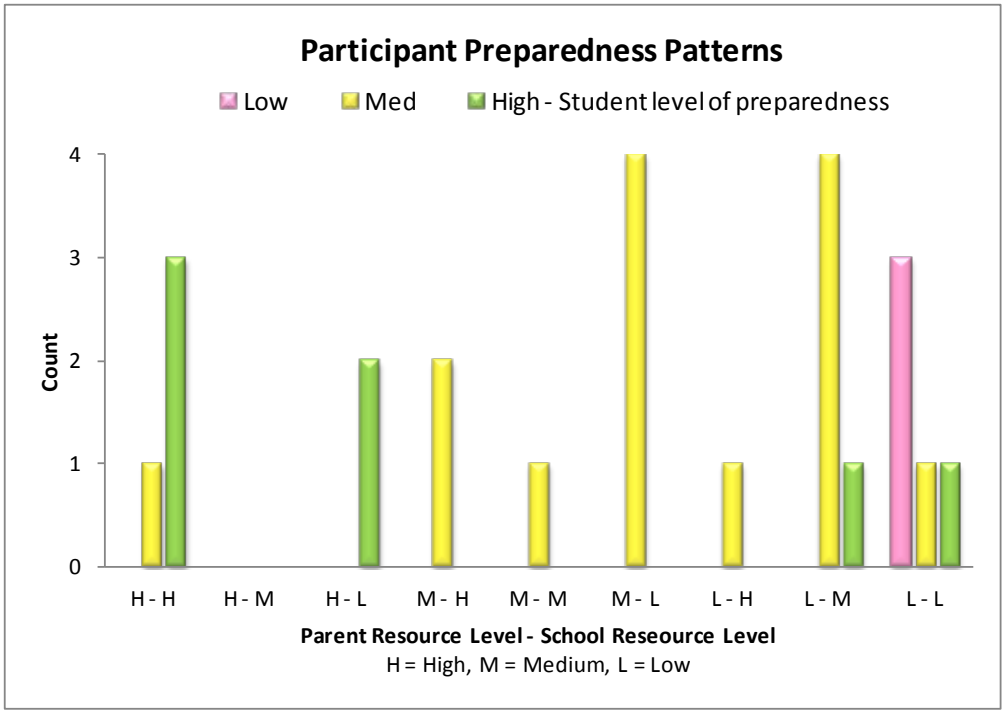

Figure 11. Relationship of Student Preparedness Toward a Career Goal

Table 20. Comparison of High School Student Participant Preparedness

Name	Student Preparedness Toward Goal	Parent / Guardian Experience	School Resource Level	CGA	PFGC	Stay Local	Stability / Income
Cathy	High	High	High	No	No	No	No
Emily	High	High	High	No	No	No	No
Jessica	High	High	High	No	No	No	No
Ashley	High	High	Low	No	No	No	No
Michelle	High	High	Low	Yes	No	Yes	Yes – Income
Brian	High	Low	Med	Yes	Yes	Yes	No
Lisa	High	Low	Low	Yes	Yes	No	No
Greg	Med	High	High	No	No	No	No
Fred	Med	Med	High	Yes	Yes	Yes	Yes – Stability
Samantha	Med	Med	High	Yes	No	No	No
Gary	Med	Med	Med	Yes	No	Yes	Yes – Income
Amy	Med	Med	Low	Yes	No	Yes	No
Debbie	Med	Med	Low	Yes	No	Yes	No
Hilary	Med	Med	Low	Yes	Yes	Yes	Yes – Income
Kyle	Med	Med	Low	Yes	No	Yes	Yes – Income
Paul	Med	Low	High	Yes	Yes	Yes	Yes – Income
Donna	Med	Low	Med	Yes	Yes	Yes	Yes – Stability
Karen	Med	Low	Med	Yes	Yes	Yes	Yes – Income
Laura	Med	Low	Med	Yes	Yes	Yes	No
Susan	Med	Low	Med	Yes	Yes	Yes	No
Josh	Med	Low	Low	Yes	Yes	No	Yes – Income
Kelly	Low	Low	Low	Yes	Yes	Yes	No
Kevin	Low	Low	Low	Yes	Yes	Yes	Yes – Stability
Rachel	Low	Low	Low	Yes	Yes	Yes	No

4.2.2.1 High Preparedness

With the exception of two participants (Brian and Lisa), a high level of student *preparedness* is associated with a high level of *parent experience*. As a reminder, *parent experience* is a combination of the parent's educational background and the parent's place of employment (i.e., their exposure to others with post-secondary education and knowledge of certain careers). An additional exception is Greg, who has a high level of *parent experience*, but Greg is medium student *preparedness*.

Brian was rated high even though his *parent experience* was not. Recall that Brian was categorized under *CI-major life event* and is pursuing pharmacy based on the impact from his mother's death. Brian's story was unique from others based on the way he spoke of the assistance he is receiving from his mom's former employer (credit given by Brian to the former employer), who has enabled Brian to know what high school classes to take, what colleges to apply to, and what is necessary to get into pharmacy school.

Similar to Brian, Lisa has a low *parent experience* level, but a high level of *preparedness*. Recall that Lisa was enlisted in the military and her next steps were known based on her action of being enlisted, thus Lisa's *preparedness* was high.

Greg, a junior, does not have a high level of *preparedness* although his parents have high experience. With regard to his reason for choosing a career, Greg was categorized under *delayed decision* meaning that he will wait until he gets to college to make a final decision. During the interview, Greg was unsure of the college application process and what degrees are needed for different jobs. Greg may show a higher understanding of what is needed as he focuses on a

career choice during his senior year and he may eventually have a higher level of *preparedness* before he graduates.

4.2.2.2 Low Preparedness

All three of the participants grouped as low *preparedness* had parents with low experience and low *school resource* levels. These students were also all CGA and PFGC. However, being CGA and PFGC are not distinguishing factors in themselves for having low *preparedness* as other students who were both CGA and PFGC were considered to have a medium or high (Lisa and Brian) level of *preparedness*. Lisa has both low *parent experience* and low *school resource* level, suggesting she should have a low *preparedness*. Recall, however, that Lisa has enlisted in the military and already knows her next several career steps. Note that the few participants rated as a low level of *preparedness* were from different schools, different school sizes, and in different counties. Finally, there was not a pattern with low *preparedness* and career choice reasons.

4.2.2.3 Medium Preparedness

Roughly, half of the participants were identified at a medium level of *preparedness*. These participants were combinations of low and medium levels of *parental experience* and *school resource* level. Three of the participants had a high school *resource level* and varying *parental experience* level. Greg was previously discussed and both Fred and Paul were rated medium, but Paul was considered "low" relative to knowledge of the degrees needed and colleges available for his intended degree. As an example, Paul was interested in architectural drafting and was considering a school in the Midwest based on information he received from the school after taking his SATs. Paul was asked if any schools in the region of the study offered architectural drafting and he said that they did not; however, through a subsequent internet

search I learned that Virginia Tech has a highly rated architectural drafting program. In addition, Paul was unsure of the process of transferring from a 2-yr college to a 4-yr college. Paul was at a school rated high for resources, but Paul is only at the school half days and attends the trade school the other half of the day. The participants grouped as medium level of *preparedness* are a mix of PFGC and not PFGC. The career goals are varied for the participants in the medium level of *preparedness*, as are the school sizes and county designations.

4.2.2.4 Student Preparedness Summary

As shown in Table 20, the rating of student *preparedness* and *parental experience* shows a pattern. This pattern is a better correlation than *preparedness* and parental education. That the parent's occupation improves the relationship between student *preparedness* and the parental influence is in agreement with Ali and Saunders (2006); they caution however, that the lack of experience with college exploration and application process by the majority of adults in Appalachia may result in a disadvantage for students gaining college admission. The level of *preparedness* also has trends with participants being first generation Appalachian (i.e. not CGA), PFGC, and plans to remain local. With respect to a high level of student *preparedness*, no participants, but Michelle, indicated job stability or income as important. Table 20 also highlights a pattern between the *parent experiences* and staying local, with a high *parent experience* resulting in a preference by students not to remain local. Participants with a high *parent experience* do not tend to indicate job stability or job income as a priority for them. One strong correlation was participants with a high *parent experience* are not CGA; in other words, participants with high *parent experience* are likely to be first generation Appalachians. In addition, high schools receiving outreach from colleges are patterned with student *preparedness*,

though to a lesser extent than *parent experience*. Items not associated with student *preparedness* are the ARC county designations, school size, and participant reason for career goal.

4.3. Influences for Choosing Engineering versus Other Careers

This section contains findings related to the second sub research question: How do the reasons for choosing engineering as a career choice compare with other career choice reasons for high school students in Central Appalachia? To make the comparison, the reasons and factors associated with high school participants interested in engineering were documented. Next, the reasons and factors for participants not interested in engineering were documented and a "side by side" comparison made. Four participants (Debbie, Ashley, Kyle, and Gary) are planning on or considering engineering, the remaining 20 participants are not considering engineering.

4.3.1 Engineering Career Goal Reason

Four high school participants are considering pursuing engineering degrees based on *interest* (Debbie), *CI-supportive* (Ashley), and *unknown* (Gary and Kyle). Debbie, Ashley and Kyle go to schools that offer engineering classes at the schools. Gary has not had any engineering interventions through the school system. Gary also indicated he did not know any engineers and did not think any worked in the town where he went to school. Both Gary and Kyle indicated they are moving away from engineering as a career choice because of the advanced math. In contrast, both Ashley and Debbie commented on liking math as well as their engineering classes.

The summary of other factors associated with the participants considering an engineering career are provided below, along with their agreement with, or uniqueness from, existing literature.

- 2 of the 24 participants are planning on an engineering career and another 2 are considering engineering (they are classified as *unknown*)
- 2 of the 3 *unknown* participants are considering engineering
- Reasons for choosing engineering are
    - *CI – supportive* (Ashley)
    - *Interest* (Debbie)
    - *Unknown* (Gary and Kyle; engineering is included in list of possible careers)
- 3 of 4 participants considering engineering have, or are, taking an engineering course
- 4 of 4 have at least one parent with a 4-yr degree
- 3 of 4 are CGA
- 3 of 4 prefer to remain local (the one non-CGA plans to move)

Interest as a career choice reason matches literature on engineering as a career choice (Lent, Sheu, et al., 2008). For this study, one of the two participants was categorized under *interest* (Debbie) and the other was categorized under *CI-supportive*, where a teacher introduced Ashley to engineering to support Ashley's interests. For the participants of this study, and for all of the career reason groups, it was atypical for all participants to have at least one parent with a college degree (i.e., participants are not PFGC). In addition, research of Appalachian youth and the case study demographics for this research; suggest it is atypical for all participants of a career type to have at least one parent with a 4-yr degree.

4.3.2 Comparison between engineering and non engineering career choices

When considering the factors contributing to engineering and non-engineering career choice goals, there are similarities and differences. The comparison is summarized in Table 21. In Table 21, the middle column is information relative to the high school participants not

indicating engineering as a possible career (i.e. 20 of the participants). The 'Agreement' column in Table 21 is '+' for similarity of engineering and not engineering and '–' for a difference between engineering and not engineering. With regard to similarities, the number of continuing generation Appalachian (CGA) participants among the students planning on or considering engineering as those not planning on engineering are comparable. Second, most participants want to remain local across both groups; the overall participant ratio is 2/3 and the engineering ratio is ¾, but the engineering sample is only four people. Therefore, the majority of both groups is used to determine there is a similarity for remaining local. Several differences emerged between the two groups. Both Debbie and Ashley had an interest in an engineering type career (though Ashley chose engineering bases on a *CI-supportive* reason). Discounting participants who have not made a career decision yet (i.e., *delayed decision* and *unknown*), the trend is participants planning on engineering have an *interest*-related career reason. Conversely, participants not planning on engineering are more diverse in their reasons. For example, a career in social work includes *CI-major life event* and careers in the medical field are not from *interest* or *CI-supportive*, but are from either *CI-major life event* or *CI-behavior altering*. In addition, the participants planning on engineering are likely to have exposure to engineering. The participants planning on engineering are more likely to have a parent with a 4-yr college degree than the overall participant mix; all of the potential engineering participants have at least one parent with a 4-yr degree (though none are 4-yr engineering degrees).

Table 21. Factors Contributing to Engineering vs Non-Engineering Career Choice

Category	Considering Engineering	Comparative Points Other than Engineering	Agreement
Remaining Local	3 of 4 prefer to remain local	2/3 prefer to remain local	+
CGA	3 of 4 are CGA	Ratio approximately equal to those considering engineering	+
Reasons for Engineering	Interest & CI-Supportive	CI-Major Life Event CI-Behavior Altering Delayed Decision	- - -
Taking an Engineering Course	3 of 4 taking an engineering course	Majority unfamiliar with engineering Majority have not taken engineering Majority do not have engineering in their high school	- - -
Parental Education	All have a parent with a 4-yr degree	Half of participants are PFGC	-
Parental Experience	High & Medium only	Contains high, medium, and low	-
Job Stability / Job Income	males income is important & females it is not	No pattern between males and females Just over half did not indicate income or stability as important	- +

4.4. College Engineering Participant Reasons and Factors to Choose Engineering

This section addresses the third sub research question on college engineering students' reasons for choosing engineering as a career. The college engineering participants provided reflections on why and how they chose engineering, as well as on their career decision-making process. The college students are from the same region as the high school students and include some of the same high schools. The college students also include a combination of CGA, FGC, school resource levels, and parental experiences. The reasons the college students gave for choosing engineering were condensed into three codes: critical incident – behavior altering; interest/courses; and interest/ hobby. Table 17 shows the student matrix along with the Appalachian and STEM characteristics identified.

4.4.1 Critical Incident – Behavior Altering

The *CI-behavior altering* for college students is the same reason code as for the high school participants. Four of the participants commented on an event or person that caused them to change their intended path to engineering. Three of the four participants listed a person as the critical incident, but unlike the high school participants, only one was a parent (Mark). The other two (Richard and Sharon) listed a friend and a high school career coach. The fourth participant listed an engineering/science based television show. All of the participants in this category were CGA and they were split with respect to being FGC. Only Richard was attending a 2-yr college. Richard was also the only married college student and had geographical restrictions due to stepchildren.

Richard's critical incident was an acquaintance he met while in the Navy. The acquaintance was enlisted but had a mechanical engineering degree and got Richard "started" on engineering. Prior to joining the Navy, Richard was bagging groceries in his hometown. Richard joined the Navy because of enlistment money he could get and because he had realized he needed to do more than bag groceries. Richard's dad had worked in the coalmines and Richard spoke of the ups and downs of that work as well as the physical toll it had on his dad and explained that neither his dad nor he wanted to work in the mines.

Sharon was one of the three college females interviewed and her path to engineering was helped by persistent encouragement from a career coach (in Virginia, career coaches are community college employees who are based part time in high schools to support high school students with their careers) while she was in high school. Sharon was considering a math major,

but did not know what she would do with a math major besides teach. Sharon knew nothing about engineering. As Sharon recounted:

> And then they encouraged engineering; they're like, 'yeah you should try engineering with your math skills and your science skills that would probably be a good career choice.' Because we had a career coach too and that's what she encouraged a little bit. They're like, 'you want to go to Tech? You should try engineering.' So that's how I think I got into the whole engineering path.
>
> - *Sharon, Engineering College Junior*

Though the comments were supportive in the sense of trying to help Sharon, she changed her career choice from a math degree and teaching to engineering, resulting in Sharon having a *CI-behavior altering* career choice reason. Sharon was not labeled as supportive even though engineering supports her interest in math and science because she had already chosen a career to use her interest in math and science and the recommendations caused her to change her career goal. Sharon is an example of a college student with a secondary career reason (*CI-supportive*).

Trends for the four participants within the *CI-behavior altering* reason include:

- All 4 are CGA
- 2 of 4 are FGC
- All 4 want to remain local after college
- 1 of 4 commented on job stability and income as important; he is the only participant at a 2-yr college for this reason code

4.4.2 Interests – Courses

Unlike the codes applied for high school students, *interest* codes were broken into two categories for college students. *Interest-courses* was separated from *interests-hobbies* for the

college students because the participants distinguished between their academic math and science interests moving them toward engineering versus a hobby interesting them in engineering. The high school participants made no such distinction between hobbies and classes. In fact, few high school students talk about hobbies relating to their career goals. Three of the college participants cited an interest in high school courses as their reason for choosing engineering, Marie, Jacob, and Hannah. Each participant had a unique combination of CGA and FGC. Likewise, they had diverse schooling; Marie was home schooled, Jacob went to a large high school that offered "engineering calculus," and Hannah went to a large high school in a different county that offered "early bird" engineering courses at the trade school. For Hannah the trade school was 10-minutes from her high school.

For Marie, she knew she wanted to do something related to math, science (e.g., physics and chemistry), and to have a technical job. While in high school, Marie looked into careers where she could combine her interests and engineering appeared to meet her requirements. As Marie said:

> I got the course plan and started looking at it and it's got your core math classes, and it's got your physics, and it's got your chemistry. And even if I didn't know if I wanted to do engineering, I was like, well, I'm probably, there's a, like a 95% chance I'm going to do something technical.
>
> - *Marie, Engineering College Sophomore*

As a sophomore, Marie is pleased with her decision to pursue engineering, a decision that was reinforced after a summer internship as an engineer at a local company. Marie is enrolled at a 2-yr college and plans to remain local after completing her 4-yr engineering degree.

Interests-courses aligns with literature on engineering as a career choice and general career choice literature (e.g., (Jacobs, 1998; Lent et al., 2005). Other factors showed both trends and variance by the participants in *interest-courses*:

- 2 of 3 are CGA, want to remain local, and are attending a 2-yr college
- 1 of 3 (Jacob) is not CGA, does not want to remain local, and is attending a 4-yr college
- 1 of 3 is FGC
- 1 of 3 commented on income being important

4.4.3 Interests – Hobbies

Nearly half of the college participants cited hobbies as their main reason for pursuing engineering. Several of the engineering students commented on working on cars or motorcycles and that spawning their interest in engineering. But, other students such as Tyler and Dave, cited hobbies different than cars. Tyler worked with his dad doing mechanical work and carpentry and decided he was already on track to being an engineer. Tyler also commented that both of his parents, though "factory workers," worked around engineers or helped solve problems like an engineer. In addition, Tyler liked the idea of being the person to walk up to a problem and solve it. Tyler explained his reason as follows:

> I did a lot of carpentry and uh, machining work actually and I did just a tiny bit of welding, this was all at home not like in a club or anything like that. …(Dad's) a journeyman machinist, journeyman toolmaker, so he had mills and lays and saws and everything at home and that's what he did as hobbies, so naturally, when I was young, I just went with him and did that and working with my hands became pretty much my biggest hobby other than sports. Uh, I guess that's the biggest outside thing that I did that led me towards being an engineer because I just felt like, well, it's, you know, you're kind of already on track.

- Tyler, College Sophomore in Engineering

Like Tyler, Shane liked to take things apart and fix them. Shane told several stories of hands-on projects that contributed to his interest in engineering including working with and racing dirt bikes, working with an engineer on a solar powered greenhouse, and projects with his grandfather. Shane credits his grandfather, who worked in the coalmines, with being smart enough to be an engineer, but not having the formal training. Shane tells this story about fixing a phone:

> I was wanting to know what went on inside a telephone, he [Shane's grandfather] would find an old one or go buy one or something and we would take it apart and he would kind of help me figure out how everything worked.
>
> *- Shane, College Freshman in Engineering*

Five college participants were categorized under *interest-hobbies*. *Interest-hobbies* had the most participants of the three college reason codes. The participants have a variety of factors, but one common trend is that the participants who are not FGC are the only participants who do not want to remain local and who did not comment on stability or income as being an important career decision factor. Other factors in *interest-hobbies* are:

- 4 of 5 are CGA
- 3 of 5 are PFGC
- 2 of 5 participants are at a 2-yr college
- 3 of 5 participants plan to remain local after college
- 3 of 5 mentioned income of job stability as important

Having an interest in hobbies related to engineering prior to choosing engineering as a career aligns with literature on engineering as a career choice and general career choice literature (e.g., (Jacobs, 1998; Lent et al., 2005).

4.4.4 College Engineering Career Choice Compared to Appalachian Region

Twelve participants who are enrolled in an engineering program and attended high school in the case study region of this research were included in this section. Table 17 is a summary of the characteristics of the participants and Table 19 provides a summary by career reason. This section provides a summary comparison of the three career reasons (*CI-behavior altering, interest-courses,* and *interest-hobbies*). Examples of literature that my findings agree with, are in addition to, or are unique from are also given.

Two of the three reason codes for choosing engineering are based on interest, which is consistent with literature on reasons for career choices including engineering (Lent, Sheu, et al., 2008; Morgan et al., 2001). The interest category were subdivided as interest for course work (school related) and for hobbies (not school related) to distinguish the two different learning experiences. In addition, the majority of the participants knew about engineering prior to applying to college for engineering. Exposure to engineering included four from a large high school who took a Governor's school engineering course, one who took early bird engineering at a trade school (Hannah), one who took an engineering course at his high school (Shane), and one participant (Nicholas) whose father was an engineer (he also took a governor's school engineering course). Two of the participants (Mark and Sharon) indicated they did not know about engineering until they were applying for college.

Relative to Appalachian culture, only one of ten CGA participants indicated a preference not to stay in the region. Three of the CGA participants volunteered a preference to remain in the

region, but they would move if necessary to work as an engineer. One of the "prefers to remain local" participants, Tyler, commented he would try to return to the area if his first engineering job was not local. Both of the non-CGA participants plan to look for jobs in other areas, both indicated they liked where they went to high school, but want to explore new areas.

Half of the college participants are FGC, this is less than the demographics for the case study region suggest. However, literature on career choice for Appalachian youth, and in general, indicate that parental education correlates to post-secondary education aspirations (e.g., (Chenoweth, 2004; Irvin et al., 2012)), suggesting participants in college are more likely to be non-FCG. Likewise, five of the six FGC participants who are also CGA commented that they did not want to work factory jobs or in the coalmines based on their parent's experience or advice (e.g., Richard, Bob, Hannah, Tyler, and Shane).

4.5. Comparison of High School and College Engineering Participants

This section pertains to the fourth sub research question for comparing factors influencing high school students toward engineering with college engineering students' factors for choosing engineering as a career choice. The comparison is with the four high school students who are planning on, or considering engineering with the 12 college engineering participants. All of the participants being compared are from the case study region, with the combination of counties and high schools both overlapping and being different, yet none of the students are from a distressed county. The college participants include at least one person from each school represented by the four high school participants. The comparison is based on the characteristics associated with engineering as a career choice and as Appalachian cultural characteristics. The findings are grouped into four sections; career choice reason, exposure to engineering, being CGA, and desire to remain local and/or importance of income and job

stability and is summarized in Table 22. These groupings cover items common within the literature for engineering career choice (e.g., interest being related to goals for students in engineering, (Lent et al., 2005)) as well as the finding of participants being CGA or not and their preference to remain local. The agreement column is a + for positive agreement trend between the college participants and high school participants and a – to highlight differences between the college and high school participants.

Table 22. Comparison College vs High School Participants

Category	College Participants	High School Participants	Agreement
Career Choice Reason	• Majority interest related	• Interest related for the 2 planning on engineering	+
		• Few students cited interest as a reason	-
	• Hobbies outside of school important	• Hobbies outside of school not a factor	-
Engineering Exposure	• Majority knew of Engineering	• Few knew about engineering	-
Local Jobs & CGA	• CGA did not want to work in factory or mines	• CGA tended to cite job stability & income; gender independent	+
	• Majority CGA want to remain local	• Majority CGA want to remain local	+
	• Non-CGA plan to leave area	• Non-CGA plan to leave area	+
Parent Education	• About half are FGC	• About 2/3 PFGC overall participants	-
		• None planning on Engr are PFGC	-

The comparison between college engineering students and high school students in the case study region shows a commonality of interest as a career choice reason for pursuing engineering, regardless of being in high school or college. However, the high school participants in general are not categorized with interest as a career choice reason. In addition, the participants pursuing or planning to pursue engineering are more likely to have at least one parent with a college degree than the high school participants overall. Another difference is knowing about

engineering as a career choice, thought the majority of high school participants indicated they were unfamiliar with engineering, the majority of college engineering students knew about engineering prior to choosing it for their career choice. A final difference in the college versus high school comparison is the parental education. All of the high school students considering engineering have at least one parent with a 4-yr degree, 100%. Half of college students have at least one parent with a 4-yr degree, which is greater than the overall average for the high school students, but less than for the high school students considering engineering.

4.6. SCCT and Emergent Career Goal Codes

Although SCCT was the framework that guided this study, the final career choice reason codes and factors, presented in Table 16 and Table 17, do not strictly adhere to and are not differentiated by the SCCT constructs. Much of the Appalachian and career choice literature referenced in this study uses SCCT as a framework to organize and discuss the process and variables associated with students' career choice decision-making; and this study used SCCT particularly to guide the interview protocol and initial coding. However, findings from this study were not restricted to an association of timing (e.g., background or proximal environmental influences) as is often done with SCCT. As described in section 2.2, SCCT considers both external contextual influences and internal influences. The external influences include environmental influences that are background and proximal as well as learning experiences (all separate boxes in SCCT), while internal influences include a person's interest. Economic, cultural, and geographic factors discussed in Chapter 2 could be considered as external factors, however, these external factors can also be associated with one or more of the SCCT constructs depending on the timing of the experience. Thus, to use the SCCT constructs as modeled by (Lent et al., 2000) would require additional codes to sub-divide the factors as background or

proximal. As an example, the importance of job stability can be a background influence if the participant has been exposed to family job insecurity for years; the preference for job stability can be proximal if the family (or town) employment situation recently changed due to lay-offs or a plant closing in the town. Likewise, for the college participants, job stability preference can change as they progress through the SCCT model's cycle of choice actions (e.g., going to college) feedback in as a learning experience as they begin thinking about their goal of getting a job as an engineer.

During my analysis for the participants in this case study, the importance of timing (e.g., background or proximal) did not emerge as salient. As the interviews were coded and quotes within the codes reviewed, a consolidation of codes surfaced that did not require a separation based on being background or proximal environmental influences. For example, Ashley and Donna are both listed under *CI-Supportive*, but Ashley's experience occurred prior to high school and Donna's experience occurred in high school.

The choice reason codes (six for high school participants and three for college participants) were differentiated by reason, and not sub-divided by proximal or distal relative to their proximity in timing to a participant's career choice decision. By differentiating relative to the reason regardless of timing, fewer total codes were needed to represent the 24 high school and 12 college engineering student participants. Because the participants were from a diverse sampling, as discussed in Chapter 3, and the point of redundancy was reached, the reason codes are representative of the population and timing (distal versus proximal) was not an influence. With respect to *preparedness*, the timing of a participant acquiring information used in the preparedness rubric was not considered. The basis of high medium or low scoring for *preparedness* was predicated on what the participant knew at the time of the interview, not when

the information was learned. In addition, other contextual factors such as CGA, PFGC, and staying local were not distinguished as proximal or background. The contextual factors of CGA, PFGC, and staying local could be coded as a background environmental influence, but there are occasions (e.g., Sharon, a sophomore in college) where the PFGC changes proximal to a career choice decision. For example, using SCCT, a participant whose parent completed college while the participant was deciding on college would be a proximal influence, whereas a participant whose parent completed college years earlier would be a background influence. For this exploratory research, developing the comparisons between the primary reason codes and establishing patterns among the other influencing factors was of importance, and the findings indicate the timing of those factors is not as important.

Figure 12 illustrates how my emergent codes for career goal reasons compare with the SCCT model. The emergent code names used in my dissertation are contained in the parallelogram boxes. As a reminder, the final codes for high school career choice reasons group under four main headings; critical incident (*major life event*, *supportive*, or *behavior altering*), interests, unknown, and purposely delayed. The reasons for grouping several SCCT constructs together in Figure 12 are provided below.

1) The *critical incidence* items were not predicated on being a proximal or distal construct and may fit into contextual affordances, outcome expectations, or person inputs, thus those SCCT constructs were grouped together to pair them with the *critical incident* code. Learning experiences were not included in this grouping, but were connected with a double-headed arrow to show that learning experiences can influence *critical incidents* and *critical incidents* can become learning experiences.
2) *Interests* aligned with the SCCT construct of interests.

3) The *unknown* code was for students who indicated multiple possible careers with no plan for when they will make their career choice decision. The *unknown* code is positioned on the SCCT model in a manner to depict that the participant was still processing information, doing mini-cycles, to aide in eventually choosing a career goal.
4) The *delayed decision* theme is for students who know that they plan to make a decision at a later, but pre-defined time. Primarily, these students indicated a preference to decide once in college and after having taken some college classes to help them decide if they like a particular career choice. Thus, *delayed decision* participants indicated a preference to gain more learning experiences before making their career choice decision. Learning experiences were kept as a stand-alone construct to show its importance with the *delayed decision* code.

The finding from this research is that the participants of this case study region (Central Appalachian counties of Southwest Virginia) chose career goals based on critical incidences at a higher rate, and interest at a lower rate, than is typically reported in the literature, resulting in the full SCCT model not being ideal for this population. Critical incidents spanned across the distal background contextual affordances and the proximal environmental contextual affordances and accounted for half of the salient reasons high school participants choose their career goal. Using the category of critical incidents also highlighted its importance compared to interest, which was the salient reason for the college students in this study to choose engineering. Though critical incidents are not common within the Appalachian career choice or STEM career choice literature, the importance of them in the context of the Central Appalachian region of this case study emerged as a finding.

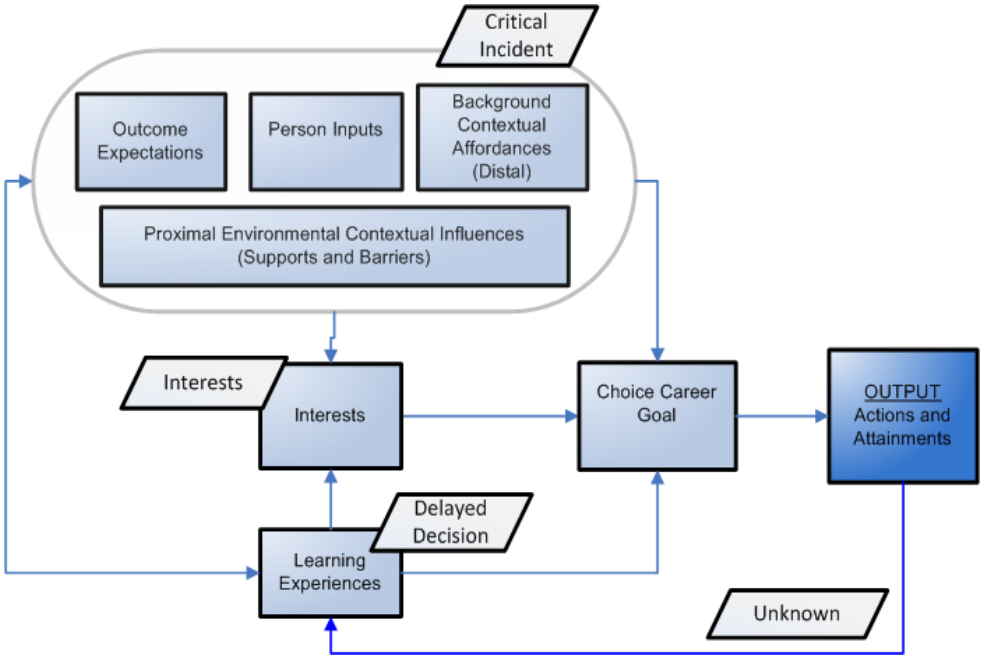

Figure 12. Career Goal Reason Codes & SCCT

4.7. Summary

The purpose of my research was to answer the question: "How are Central Appalachian high school students influenced as they choose their career goals, especially with respect to engineering?" and four sub research questions were developed to answer this overarching question. The codebook developed (Table 10), when used in conjunction with the Appalachian characteristics contained in Table 9 and the influence of preparedness in Table 12, provided the information necessary to answer the sub research questions. Table 16 (high school participants) and Table 17 (college participants) summarize, by participant, the factors influencing Appalachian students within the ten counties of this case study. In addition, the diversity of the participant sampling allowed both a comparison of contextual characteristics to reveal patterns showing a case study region that is both consistent with and divergent from the literature.

Results revealed that about half of the Central Appalachian high school students were influenced by a critical incident. The majority of these participants were CGA and PFGC. The

incident had one of three effects: to change their course of career choice, define it, or support it. Interests played a role in influencing about a quarter of the high school participants and included a variety of backgrounds and school locations. The remaining high school participants had not chosen a career path yet, by design (purposely delayed) or being unsure (Unknown). The factors of PFGC, CGA, wanting to stay local, and importance of job income/ stability influenced reasons for career goals, and student preparedness to achieve the goals were compared within each reason code and overall. In addition, how the SCCT model constructs, which were used to guide the interview protocol and initial coding, relate to the final career goal reason codes was analyzed; the importance of timing of an influence was found not to be salient for this case study.

Conclusions based on these findings are presented in Chapter 5, including answering my overarching research question based on the findings of this chapter. Implications of the findings relative research and practice are also included in Chapter 5 as are the contributions of this research and recommendations for future work.

Chapter 5. Discussion and Conclusion

5. 1. Introduction

The discussion contained in this chapter draws on my findings and the current literature to answer my overall dissertation research question. I discuss what I found in the data as well as what I did not find in the data, but expected to find, based on current literature. Based on my findings, I include implications for both practice and research. My recommendations for practice include consideration for the Appalachian culture of the case study region. For example, relating students' preferences to remain local to possible careers, such as engineering, and for interactions or project based activities to be contextually relevant to the region. With respect to the research implications, I provide specific recommendations for the next steps for the ECC project as well as broader consideration of using the SCCT model. Next, how my research contributes to the literature, for example by expanding what is known about Appalachian high school students' career goals, especially with respect to engineering, is provided. Finally, I provide recommendations for future work to continue expanding our understanding of engineering as a career choice in Appalachia.

5. 2. Answering the Research Question

Recall that the purpose of this research was 1) to explore salient reasons students in the Central Appalachian region choose a career, and 2) to describe the factors, particularly ones unique to the region, that influence students during this process. There are many possible reasons for a student to make a career choice and many possible factors that influence the career choice and goals. However, I was able to consolidate information in the data collected and within the scope of this research project to answer my overarching research question: *How are Central*

Appalachian high school students influenced as they choose their career goals, especially with respect to engineering? At a high level, the results showed:

- Six career choice goal reasons were demonstrated by high school participants. The reasons include three critical incident reasons (*major life event*, *behavior altering*, or *supportive*), one *interest* reason, and two reasons related to not having a career choice goal decided (*delayed decision* and *unknown)*. Though there is some commonality with career choice literature (e.g., *interest*), the overall combination of reasons demonstrated in my sample is unique from career choice literature on Appalachian youth and engineering as a career choice, particularly with regard to the salience of critical incidents.
- Salient contextual factors potentially influencing high school participants include a combination of background and environmental factors and personal preferences. Family background factors include parental education and being from the region (CGA). Salient participant preferences include remaining in the area and the importance of job stability or income. Finally, the participant's level of *preparedness* for college patterned with *parental experience* and *school resources*. How family background factors compared to participant preferences agreed with expectations from Appalachian literature. However, some of the participants had backgrounds different from expected based on the Appalachian literature, i.e., non-CGA and non-PFCG.
- Differences were observed between high school participants planning on engineering and high school participants not considering engineering. Participants planning on engineering had an interest-related reason (either coded as *interest* or *CI-supportive*) and are not PFGC; whereas those considering other careers were more likely to have one of

the three *critical incidents* reasons influence them rather than *interest*. In addition, though the number of participants planning on or considering engineering is small (4), none of them are PFGC, yet based on the participant sampling, an expectation of half would be non-PFGC.

- The level of high school student *preparedness* for college is distinguishable based on a parent's educational attainment and place of employment (aka *parental experience*). Parental education and occupation are common factors in existing literature to predict college attendance expectations. A subtle, but important, distinction with my research is that I used place of employment along with parental educational attainment, which allows for a refinement of *parental experience* of particular careers and the college process. For example, a parent working as a secretary at a doctor's office can have experience on the requirements for pursuing a medical career even though the parent did not pursue a medical career.
- Three career choice reasons emerged for college participants. Two of the reasons related to *interest* (*interest-courses* and *interest-hobbies*) and the third was the critical incident reason of *CI-behavior altering*. The career choice reasons agreed with expectations from the literature on engineering as a career choice.
- The career choice reasons for college engineering participants varied from the general high school participants' reasons in the following ways: college engineering participants were more likely to follow an *interest* reason for their career choice and more likely to have at least one parent with a college degree.
- Career choice factors for engineering were similar between college engineering participants and high school participants planning on or considering engineering in terms

of an *interest*-related reason, exposure to engineering as a career choice, and parental educational attainment.

In combination, the results showed:

- 23 of 24 high school participants plan to go to college with the remaining participant enlisted in the military
- 19 of 24 high school participants are CGA and 16 of them prefer to remain in the area, but none of the five non-CGA plan to remain in the area
- 10 of 12 college engineering participants are CGA and 9 prefer to remain in the area, but neither of the two non-CGA plan to remain in the area
- One-quarter of the high school participants chose a career goal based on an interest, but two-thirds of the college engineering participants have interest as their career goal reason
- 15 of 16 participants (high school and college) who have critical incidents codes for their career choice reason are CGA (Ashley is the only exception)
- 7 of 14 participants with a medium level of preparedness also had a medium level of parental experience and 6 of 14 had a low level of parental experience (the remaining participant, Greg, had a high level of parental experience) and the mixture of PFGC or not PFGC was also nearly split (8 PFGC, 6 non-PFGC)

In summary, the results for this case highlight the importance of considering choice reasons of interest versus other reasons, PFGC versus not PFGC, and the level of student preparedness. Most importantly, all of these items also have trends with students (and their family) being from the region (CGA) or new to the region (non-CGA). As discussed in the following paragraphs, these results both agree with and differ from existing literature on Appalachian career choices and literature on STEM and engineering as a career choice.

Although literature on Appalachia purports the importance of family as part of the culture (Ali & McWhirter, 2006; Bennett, 2008; Sarnoff, 2003; Tang & Russ, 2007), the separation of being CGA or not is not typically denoted or used in the discussion of findings. Yet, for this case, the distinction of being CGA trends with wanting to remain in the region. High school participants Cathy, Emily, Jessica, Ashley, and Greg are not CGA and do not have a preference to remain in the region. Not being CGA also trended with the participants' parents having a post secondary education, the high school participants having a high preparedness for college, and the participants not reporting job stability or income as important. Because the patterns related to salient factors are different for CGA and non-CGA participants, it is important to consider this distinction when conducting research in and reporting findings relative to Appalachia. Being CGA and desiring to stay in the region can have profound implications for career choices as discussed in later sections.

Although both Appalachian and STEM literature for career choice reasons report interest as a primary reason behind career choices (Lent, Lopez Jr, et al., 2008; Morgan et al., 2001), literature specific to underrepresented groups also report the importance of cultural factors in determining career choices (Flores & O'Brien, 2002; Tang et al., 1999). In this research, I was particularly interested in reasons for high school students' career choices relative to engineering. I was also interested in contextual, or cultural, factors influencing the participants. For my case study, only two high school participants, Debbie and Ashley, have a career goal of being an engineer and both have an *interest*-related reason for pursuing engineering. This is similar to the majority of the college engineering students who also have an *interest* reason for pursuing engineering. In addition, Debbie, who is CGA, wants to remain in the area (including for college) and Ashley, who is not CGA, plans to leave the area (including for college). Relative to

a desire to pursue engineering, the CGA and remaining local trends match the trends within the sample population overall.

In addition to comparing the students interested in engineering as a career choice, it was also important to consider career choice reasons and factors associated with those not choosing engineering to understand similarities and differences. Comparing all of the high school students with a specified career choice (i.e., not considering unknown or delayed decision), none of the critical incident reasons of *major life event* or *behavior altering* resulted in engineering as a career choice. In addition, none of the college engineering participants noted a *CI-major life event* causing them to choose engineering, but four did have *CI-behavior altering* reasons. Finally, all of the high school participants considering engineering have at least one parent with a four-year degree, but that is true for only half of the high school participant population of this study.

A variety of ways participants spoke of being prepared for college and pursuing their degrees emerged from the interview data; understanding this variance and the factors influencing the variance are important with respect to understanding career choice decision-making (Ali & Saunders, 2006; Irvin et al., 2012). With respect to a student's *preparedness* for college, trends did not emerge based on career choice, but trends did emerge based on a combination of the parent's educational attainment and place of employment. The place of employment, not occupation was used based on my findings that some participants cited their parent's knowledge of a career or of college based on experiences at work, and not necessarily, based on their parent's career path. This distinction allows for participants, such as Hilary, a CGA and PFGC, to have a medium level of *preparedness*; Hilary's mother works as a secretary in a medical office allowing information on pursuing a medical career to be known. The added knowledge improved

Hillary's understanding of colleges to attend and courses to take in high school, but she is still unsure of some facets college expectations and the application process.

5. 3. Implications

The results of my research have implications for both practice and research. Implications for practice (particularly for outreach activities in the area) include the necessity of collaborating with the schools and local businesses by presenting the findings of this research to assist in introducing engineering as a career choice. Research implications involve the use of the SCCT model in an exploratory, qualitative manner and support for the remainder of the ECC grant.

5.3.1 Practice

With respect to implementation, my research suggests it is important to introduce engineering to Appalachia in a culturally responsible manner and provide opportunities for students to explore an interest in engineering. Introducing engineering in the case study region (Central Appalachia portion of Virginia) must be tailored to factors relevant to the students and people of the region. Therefore, presenting engineering as a possible career choice should emphasize engineering as one of many career possibilities and not for everyone. Consideration for critical incidents people experience, availability of local jobs, and students' preferences are important. It is important to collaborate with key stakeholders (e.g., schools and businesses) for developing and implementing engineering interventions to improve the connections between the interventions and the students' perspectives.

In particular, for the region of this study, agreement with current literature on Appalachian career choice exists and includes the strength of family, remaining local, and the impact of job availability in Central Appalachia (Ali & Saunders, 2009; Bennett, 2008; Seufert & Carrozza, 2004). Recall that many of the high school participants reported not being familiar

with engineering and not knowing any engineers, as reported in Table 21. Therefore, informing students about engineering and the need for engineers in the region is important, and should done in a responsible manner that respects family; discusses the ability to remaining local; and includes the impact of local job availability, job stability, and job income. To address the impact and availability of local jobs and income, collaboration with local companies and government agencies should occur.

A partnership between local businesses and educational facilities (high schools and colleges) to aide in presenting engineering as a possible career choice is recommended. Several possible methods of collaboration could occur including via the final phase of the ECC project (see Appendix A). An example of collaboration is a marketing approach for engineering jobs that are in the region and what type of work the engineers do on a day-to-day basis. Using local examples will help to put engineering in context for the residents of the region as well as support the existence of engineering as a career choice. Coordinating this information with other engineering intervention exposure, such as interventions mentioned by the participants (e.g., Project Lead the Way (PLTW) classes, First Lego League (FLL), Governor school classes, etc), will provide additional engineering related learning experiences for students. In addition, because of the importance of family and parental experience to students' career choices, inclusion of engineering interventions or exposure to parents is also recommended. Examples include inviting parents to discussions on engineering as a career choice and to attend engineering interventions in which their child participates.

Results from this study include *interest* as a reason for choosing engineering as a career choice, which agrees with existing literature on engineering as a career choice and persistence in engineering (Lent et al., 2003; Lent et al., 2005; Lent, Lopez Jr, et al., 2008). Recall that both

Ashley and Debbie knew of engineering and the majority of college engineering students knew about engineering prior to choosing it as a career choice, suggesting that providing information on engineering (exposure to engineering) is important to support students in their ability to make informed career choice decisions. Consideration of what is necessary to develop an interest in engineering should be researched. However, though interest is important, it is not sufficient as a single indicator of career choice. Recall that not all students who indicated having some knowledge of engineering or indicating they enjoyed an engineering class are planning on an engineering career.

In addition to not choosing engineering, at least two, Kyle and Gary, were moving away from engineering because of difficulty with math. This is consistent with national reports such as "Changing the Conversation" (Changing the Conversation: Messages for Improving Public Understanding of Engineering, 2008) which suggest that engineering suffers from an image problem of being a difficult career path. Therefore, when introducing engineering as a possible career choice, realistic expectations and benefits of engineering should be presented, and not just a promotion of engineering for the sake of promoting engineering.

5.3.2 Research

Research implications are provided for two areas, 1) broad implications from the use of exploratory qualitative research guided by the SCCT model and 2) implications for the ECC project. The implications, based on the SCCT framework and qualitative research, include general comments based on findings from this research and considerations reported by others who research underrepresented groups. Information on how this qualitative research supports the ECC project is provided to specifically relate how my findings support that project. Note that this

section discusses implications for the ECC project and the future work section contains recommendations for the case study region and is not necessarily limited to the ECC project.

5.3.2.1 SCCT Model and Qualitative Research

Lent and Brown's (1994) SCCT model and their measurement guide (Lent et. al., 2006) provided an organized theoretical framework which assisted in this research. The constructs within the framework and related literature were an excellent starting point for assisting with wording for the research questions, developing the protocols, and initial analysis of the data. As stated by Yin, the goal of the theory in case study research is "to have a sufficient blueprint for the study" (Yin, 2009, p. 36) and essentially, SCCT fulfilled that purpose in this research. However, the SCCT framework had limitations in applicability for my research; in particular, two limitations involve the proposition that choice goals are predominantly influenced by interests and self-efficacy (Lent et al., 2001).

First, the SCCT framework uses directional arrows to connect constructs and suggest paths students follow as they negotiate a career choice goal although many of these relationships have been proven (e.g., (Ali & Saunders, 2006)), I found the constructs and sequencing too limiting for my qualitative research. Qualitative research is advantageous in determining why a person traverses a path without limiting the possible reasons or restricting the sequencing of events. Based on existing literature and the SCCT model, the finding that participants, such as Fred and Michelle, changed their career path from an *interest* reason to one based on the goal of more stability or income could have been missed if strict adherence to the SCCT model and or only a quantitative survey with limited answer choices was conducted. Likewise, students with a *CI-major life event* that were subsequently supported in their choice, such as Brian, may have been characterized with a career reason of *interest* and the importance of the *CI-major life event*

not captured. Support for the claim that strict adherence to the model can result in missing contextually or culturally relevant factors also includes research by Trenor et al. (2008), who conducted a survey using SCCT constructs to research statistical relationships between ethnicity and being female relative to perceptions of engineering and engineering persistence. The quantitative results did not discern ethnicity-based differences for barriers or a sense of belonging, though previous literature suggested such differences exist. The addition of a qualitative interview allowed Trenor et al. (2008) to acquire refined information, including concrete examples of barriers and belongingness, which was subsequently compared to the survey questions. As discussed by Trenor et al. (2008), the qualitative data revealed additional themes and provided more in-depth understanding of influences (the "why") than was possible with the quantitative survey. As part of the larger exploratory mixed methods ECC project (as discussed in Appendix A), this research provides qualitative insight prior to the quantitative survey in an effort to reveal pertinent factors and obtain concrete factors to address with the research questions. Therefore, the importance of items such as *critical incident* reasons for career choice decision-making can be incorporated into the larger ECC project.

A second limitation of the SCCT model for my study is that the model depiction and pathway analysis data suggests interests are a strong component of career goal development and literature involving both college and high school students reporting key factors also cite interest as a leading reason for work plans (Jacobs, 1998; Lent, Lopez Jr, et al., 2008; Morgan et al., 2001; Turner et al., 2004). The findings of my research showed that the majority of college engineering participants reflected on *interest* (*hobbies* or *courses*) as their reason for choosing engineering. However, *interest* of the career choice was not a primary factor for over half the high school participants in my study. My findings are similar to those from a study of another

underrepresented group in higher education, Mexican Americans. A quantitative study by Flores and O'Brien (2002), considered traditional and non-traditional careers for Mexican-American high school females. They noted a similar limitation with the SCCT model with regard to interest not having as strong an influence on career decisions as other factors, such as confidence. As an outcome, the authors speculate that Mexican American females may not have options for choosing a career based on interest (Flores & O'Brien, 2002). In addition, Lent et al. (2001) recommended future research of diverse cultures to understand better the affect of culture on career choice decision-making. Lent et al. (2001) reference work by Tang et al. (1999) involving Asian Americans and the importance of acculturation in addition to family background, socio-economic status, self-efficacy and interest. The findings by Tang et al. (1999) included that interest was less of a career choice influence than family involvement and acculturation for college students. Within the Appalachian culture, and as found in this case study region, a preference to remain local and a connectedness with family exists. In addition, the importance of critical incidences, as related to family situations, may be more important or more strongly related than, interest as a reason for a career choice.

SCCT was useful in designing this study, as it helped identify factors to consider, and was useful as a lens for analysis but, for the population of this study, it was not used as a strict template. That is not to say that SCCT is not useful for qualitative research and in fact other researchers have successfully used SCCT in qualitative research concerning career choices, e.g., longitudinal qualitative research of early career professionals by Winters (2012). Instead, the findings from my study confirm that the model may not function in exactly the same way in different settings, i.e., for underrepresented groups interest may be less prominent. Therefore, researchers should be careful in straight applications of the model and resulting research tools,

such as surveys, across research contexts. Future work on the differences between research parameters such as time (e.g., longitudinal versus quasi-longitudinal), participants (e.g., college versus high school), and culture (e.g., Appalachian (underrepresented) versus non-Appalachian) is suggested to improve our understanding of the functionality of SCCT in the context of underrepresented populations.

5.3.2.2 ECC Project

One of the planned outcomes of this research was to support the ECC research project, in particular by 1) gaining insight into the case study region with respect to factors influencing Appalachian youth with respect to their career goals, 2) recommending considerations for survey questions, and 3) providing insight for a framework to assist with engineering interventions in the region.

With respect to the uniqueness of the case study region, the tables included in Chapter 4 provide participant and reason code information. The summary tables in Chapter 4 also demonstrate that the case study region and participants have both common factors compared to Appalachia and diversity within the case study region for some variables. The main factors that associate with the common cultural themes of Appalachia (family and remaining local) include being CGA, job income/stability importance, and types of local jobs available. The factors that diversify the participants include the actual career choice and reason codes, and student preparedness, reason codes, and parental experience. The factors and patterns learned from this research will help in developing a survey for a wider range of participants from the region.

The interview protocols used for this research were of a sound design and able to obtain culturally relevant information for the participants of this case study region. From the interview data, several areas of particular interest for the survey were learned. Key questions to include in a

survey relate to critical incidences, being CGA, the combination of parental education and their employment, and support their school receives (if any) from colleges. For parental employment, it is important to know where the parent works, not just the type of job. For example, knowing a parent is a secretary is helpful, but knowing the person is a secretary at a doctor's office or at a college is even more meaningful because it provides context for the parent's job. In terms of support from colleges, questions related to colleges providing tutoring, mentoring programs, career days, and field trips should be asked in a survey. In addition, information on college degrees available from colleges participants are interested in attending should be asked; this data can then be compared to student career choices.

As discussed in Appendix A, the ECC project has three phases and the third phase is developing a model for engineering interventions. This research produced findings related to reasons why participants chose the career goal they did, and explored students' preparedness for college. As engineering intervention models are developed, incorporation of the preparedness information is critical. Research on persistence in engineering (e.g., (Ohland et al., 2008)) shows that not all students persist, therefore, responsible interventions need to address students' knowledge of college selection, college application process, and expectations of college once enrolled. Additionally, research on persistence of other underrepresented groups, such as underrepresented by ethnicity or being FCG, and research on intervention techniques (e.g., (Tsui, 2007)) should be reviewed for applicability with Appalachian students. Tsui (2007) recommends several strategies of strategic interventions to improve diversity in STEM fields. Though they focus on college students, interventions such as mentoring, tutoring, career counseling and awareness, as well as workshops and seminars may have applicability at the high school level. Regardless of the intervention form, factors pertinent for Appalachian students within this study;

being CGA, family influence, wanting to remain local, importance of job stability or income, and preparedness for college, must be considered in the intervention design.

5.3.3 Summary

Additional research is necessary to increase our knowledge of career choices in Appalachia so that recommendations for engineering interventions are effective; likewise studying the outcomes of interventions will support future research needs. For instance, interest was a career choice reason for one-quarter of the high school participants (6 participants) and critical incidents of a *major life event* and *behavior altering* had nearly as many participants (5 and 4, respectively). Therefore, when introducing engineering as a possible career choice, research involving expectations, values, and persistence in engineering (e.g., (Aschbacher, Li, & Roth, 2010; Fralick, Kearn, Thompson, & Lyons, 2009; Matusovich, Streveler, & Miller, 2010)), along with research involving the affects of culture (e.g., (Flores & O'Brien, 2002; Tang et al., 1999)) should be included. For example, Matusovich et al. (2010) found in their qualitative, longitudinal investigation that interest plays a role in college students continued choices to pursue engineering across all four years but engineering as consistent with sense of self was a more important factor. Flores and O'Brien (2002) distinguished differences in traditional and nontraditional career choices of Mexican American females and found varying agreement with SCCT and nontraditional career interests. Therefore, the importance of interest should be considered; however, based on this exploratory research and other literature on choosing and persisting in engineering, cultural and personal factors should also be considered.

5. 4. Contributions

It is, perhaps, easier to generalize than to individualize. Though research on "Appalachia" can be found for different cases, it is often bounded and generalized at a global level of

"Appalachia," or is specific to a school or county. My research was unique in two ways: 1) it was an exploratory qualitative project and 2) it compared and contrasted educational, personal background, county, and school information using nine counties in Southwest Virginia resulting in sufficient detail to compare and contrast a variety of factors that influence high school students as they establish career goals. My research also assisted in development of interview protocols and a critique of SCCT for use with this underrepresented case study group. The results of my research show the importance of not generalizing "Appalachia" as a homogenous region and the importance of considering the interactions of several factors when discussing reasons for career choice goals. Because of the factors, influences, and patterns that emerged from this research, a better understanding of reasons why Appalachian high school students make career choice decisions exists.

The results of my dissertation meet the purpose and needs contained in my proposal. The data provided insight into influences that mattered to high school students and insight why students have different influencers. As an exploratory research project, it was not the intent to determine causal relationships, and it is not the intent to conclude why critical incidents were the salient influencer for some students versus why interests were for other students. It was the intent to explore patterns and produce influencing themes and recommendations to the stakeholders.

My research discovered patterns within the region, the value of which were possible due to the diversity of participants, boundary of the case study, and the qualitative nature of the research. Gaps of knowing about engineering and engineering jobs in the region and the importance of being a continuing generation Appalachian were revealed. Furthermore, the research showed that the particular county of inhabitance and school of attendance were not as salient as the participant's background, combination of parental education and parental place of

employment (a.k.a. parental experience), and school resources. In addition to answering the research question on factors influencing Appalachian students, the data provides information to support the development of survey questions for the ECC project on Barriers to Engineering as a Career Choice by Appalachian Students.

Current literature points to the importance of parental education and student interests as key measures for determining a student's career choice and STEM literature often links interests in math and sciences (subjects) and interventions as key influencers (Ali & Saunders, 2009; Flores & O'Brien, 2002; Turner et al., 2004). However, my research revealed that career decisions are patterned with a student's family background (first generation college (FGC) and continuing generation Appalachian (CGA)) and the parent's job location, not just the parent's level of education.

The use of qualitative interviews to answer the research question was valuable because it allowed the emergence and identification of different levels of events and interactions with people that may not have been captured in a survey. Moreover, the interviews revealed reasons influencing high school and college participants as they make their career choice decisions that are not often discussed. The final interview protocols (included in Appendix E through Appendix G) are of sufficient depth to be meaningful for research in the Appalachian region; transfer of these protocols to other underrepresented groups can occur if consideration for cultural and economic conditions is made.

A final contribution is the discussion pertaining to the SCCT model. Though the SCCT model was beneficial to this research, my research questions were not focused on the timing (e.g., as proximal or distal) of the career choice decision-making and thus combining several SCCT constructs allowed the importance of critical incidences to emerge. Future research should

consider the impact of critical incidences as career choice factors for students in high school versus students in college and the role (if any) interest may play.

5. 5. Future Work

Three areas of future work are recommended; 1) follow some of the participants as they continue to pursue their career goals, 2) expand the participant sample to fill gaps cited, and 3) continue to research critical incidence reasons.

I recommend adding a true longitudinal component to this study such that the high school students are interviewed one year from now to determine if they are enrolled in college then, again, later in college. Longitudinal research allows the participants' stories and rationale for making career decisions to be compared over time. By researching participants' plans over time, the saliency of influencing factors can be understood better. Longitudinal research allows for comparison of reason codes and preparedness with persistence of the original career choice. Thus, any changes in career choice, the reason for the change, and associated educational and job opportunities, can be researched and the results incorporated into career choice interventions.

In addition to adding a longitudinal component, I recommend the addition of participants to fill gaps of students planning on entering the workforce direct from high school and interviewing college engineering students from a distressed county. As exploratory research, hearing the reasons for students entering the workforce directly is important. Ali and McWhirter (2006) used quantitative measures to evaluate factors predicting the relationship of post secondary trajectories of college (bachelor's or professional degrees), entering the workforce, or vocational technical training for rural high school students in Appalachia. They recommend that because of the variety of factors influencing college versus workforce or vocational training, an understanding of the reasons behind the aspirations is necessary to support interventions related

to college or non-college tracks for students. It is noteworthy that five of 12 college engineering students cited an interest in a hobby as their reason for pursuing engineering. The hobbies cited included items such as working on cars, motorcycles, robots, and a general fixing of items. Based on those findings, it is particularly important to research students interested in vocational technical training or entering the workforce directly from high school.

The importance of critical incidences in this case study region warrants additional research. Research of other underrepresented groups (e.g., (Flores & O'Brien, 2002; Gibbons & Borders, 2010; Trenor et al., 2008)) should be compared in the research to help determine what causes critical incidences to be a primary reasons for a career choice and, longer term, if the critical incidents remain salient factors. The long-term consideration includes both persistence in the career choice and if the reason for the career choice remains the same. In addition, reasons for any non-persistence should be studied. These longer-term considerations can be researched via a longitudinal study. Understanding how and why critical incidences play a prominent role for this case study will help structure career-choice interventions.

Finally, future work based on this research includes me providing feedback of the findings to the case study community. As noted throughout this document, participants from several high schools, colleges, and businesses provided their time to assist with this research and feedback to these high schools, colleges, and businesses should occur. Discussing the findings with the community provides me an opportunity to discuss future collaborations with high schools, colleges, and businesses in the region, as discussed in section 5.3.1.

5. 6. Concluding Remarks

Within the case study region of Southwest Virginia, several initiatives exist to promote higher education and STEM fields and there is a strong interest in such activities and in research

such as my project. As an indication of this interest, I received positive comments and interest for my study from the school superintendents, principals, and guidance counselors who provided their concurrence for me to conduct my study. Several high school students commented on being excited to be interviewed and to help in any way they could to improve what future students know about career choices. Likewise, the college and working engineers were all supportive of the research effort. Several college and working participants commented on wanting to support students who are in the process of making career decisions. As a resident of this region, I am not surprised by the willingness to help others. As mentioned in my bias statement, my purposeful study of this case study region was in part to support my intention to work with the schools, colleges, and higher education centers in this region to continue improving our understanding of STEM (especially engineering) career possibilities and ways to disseminate information about STEM. Currently, support includes working with STEM activities in the region and I hope future work will include collaboration of interventions based on findings from the ECC project. Prior to the intervention phase of the ECC project, I will seek ways to meet with schools (e.g., teachers and guidance counselors) to discuss my research findings and to discuss ways to use the information to assist with on-going career and STEM activities.

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Appendix A. Engineering as a Career Choice Grant

The research conducted for this dissertation was part of a larger NSF grant designed to "Understand the Barriers to Engineering as a Career Choice for Appalachian Youth," referred to as ECC for Appalachian youth (or simply ECC). The NSF Grant number is EEC-1232629. The planned outcome of the grant work includes a theoretical framework applicable to the Appalachian region to identify barriers and provide potential interventions to mitigate barriers to engineering. To accomplish the objective of the grant, a multi-year, multi-phase, mixed method study began in August of 2012. Phase one involved qualitative research, via interviews, to understand factors that influenced the career choices of high school students, college engineering students, and working engineers within the Central Appalachian regions of Virginia and Tennessee, especially with respect to a career in engineering. Emerging themes from phase one will inform a survey that will be disseminated to a wide participant base within the Appalachian region (Phase two). Phase three will use the results of the first two phases to develop a framework for action that is specific to the Appalachian region. The ECC research team includes Drs. Holly Matusovich and Marie Paretti, Ph.D. candidate, Mr. Matthew Boynton, and Cheryl Carrico.

As a whole, the ECC work considers motivation-related theories such as self-efficacy (Bandura, 1977), expectancy-value (Wigfield & Eccles, 2000), social cognitive career theory (Lent et al., 1994), and future possible selves (Markus & Nurius, 1986) as explanatory lenses. To address the breadth of the phase one scope, the team developed interview protocols for each participant group (i.e., high school, college, and working engineer) to collect data for analysis relative to the exploratory lenses mentioned above. Specifically for my dissertation, the SCCT

framework guided the interview data analysis. The research team will continue to analyze the data from different perspectives to satisfy the grant as a whole.

The grant study poses three key questions:

1. What factors influence the career choices of rural Appalachian students?

2. How do Appalachian students perceive and understand careers in engineering?

3. What barriers inhibit rural Appalachian students from pursuing careers in engineering?

These questions, and primarily the first question, guided the specific research questions of my dissertation. By integrating multiple motivation theory frameworks in a context of engineering education specific to Appalachian youth, the intellectual merit of the grant study provides contributions on three fronts: 1) research in engineering education, 2) motivation theory, and 3) Appalachian studies. In addition, the study broadens the view of "diversity" as it relates to the engineering workforce, by adding distinctions based on geographic regions within the U.S. (i.e., rural Appalachia). The ECC team intends to maximize their impact by establishing on-going partnership with and engaging K-16 educators as well as regional companies that employ engineers. In addition, dissemination of results will occur through conference proceedings, journal articles, and the partner network. Dissemination of results is intended to assist with converting findings to actionable practices and increased awareness. My dissertation work fits with the goal of the grant by providing insight into salient factors influencing students' career choices.

Appendix B. Pilot High School Protocol

1. Introduction –
   - Thank them for taking the time to interview. Ensure they understand the purpose of the interview. Ask if they have any questions before getting started. Verify it is ok to voice record. Verify we have a signed assent and consent forms.
   - Introduce the interview including interviewer, interviewee, date, time, and location.

2. What do you think are some of the unique things about growing up where you did?
   - What might be some of the advantages and disadvantages?
   - Can you tell me more about how that was an advantage/disadvantage or give me an example?

3. What do you think about high school?
   - What was your favorite part?
   - What was your least favorite part?
   - What do you wish was different?
     - Can you explain with an example how that would make things different?

4. Who are some of the key people who influenced you in your life and why?
   - If only school ask if any outside of school and vice versa

5. Of the adults you know, what kind of jobs do they have?

6. What type of activities interest you?
   - If only school ask if any outside of school and vice versa

7. What are your plans for after high school?
   - Depending on how they answer, follow-up with: Have you ever thought about engineering or technical jobs as a career choice for you or why are you thinking of engineering or a technical job?
   - Are you applying for college (why or why not)?

8. What do you want your job, or career, to provide you?

9. What type of job are you considering and why?

10. What are some of the things (or people) who are helping you to achieve your goals? Are there other things that are making it difficult or that you think are slowing you down?

11. I've come to the end of my question list. I want to give you time to talk; you have answered a bunch of questions. Is there anything else you want me to know?

12. Thank you very much for sharing your insights and experiences with us. Would you mind if we contact you again if we have questions about your responses?

Appendix C. Pilot College Participant Protocol

1. Introduction – thanking them for taking the time to interview. Ensure they understand the purpose of the interview. Ask if they have any questions before getting started. Verify it is ok to voice record. Verify we have a signed consent form.

2. What do you think about college so far?
    - What college are you attending,
    - What is your grade, and
    - What is your major?

3. What did you think about high school?
    - What was your favorite part?
    - What was your least favorite part?
    - What do you wish was different?
    - Can you explain with an example how that would make things different?

4. How did high school influence your choice to attend college?

5. Where did you grow up and what are some of the unique things about growing up where you did?
    - What might be some of the advantages and disadvantages?
    - Can you tell me more about how that was an advantage/disadvantage or give me an example?

6. Who are some of the key people who influenced you in your life and why?
    - If only school ask if any outside of school and vice versa

7. Of the adults you know, what kind of jobs do they have?

8. What type of activities interest you?
    - If only school ask if any outside of school and vice versa

9. What are your plans for after college?
    - Can you give an example of the type of job, including location, you want?

10. What do you want your job, or career, to provide you?

11. What type of job are you considering and why?

12. What are some of the things (or people) who are helping you to achieve what you want to do? Are there other things that are making it difficult or that you think are slowing you down?

13. I've come to the end of my question list. I want to give you time to talk. I have told you a little bit about the current study. You have answered a bunch of questions. Is there anything else you want me to know?

14. Thank you very much for sharing your insights and experiences with us. Would you mind if we contact you again if we have questions about your responses?

Appendix D. Pilot Working Engineer Protocol

1. Introduction – thanking them for taking the time to interview. Ensure they understand the purpose of the interview. Ask if they have any questions before getting started. Verify it is ok to voice record. Verify we have a signed consent form.
2. Whom do you work for and how are things going for you there? Tell me about what you do there.
    - What are your main responsibilities?
3. Reflecting back to high school, what do you think about high school?
    - What was your favorite part?
    - What was your least favorite part?
    - What do you wish was different?
        - Can you explain with an example how that would make things different?
4. Where did you grow up, and what do you think are some of the unique things about growing up where you did?
    - What were some of the advantages and disadvantages?
    - Can you tell me more about how that was an advantage/disadvantage or give me an example?
5. Who were some of the key people who influenced you and why?
    - Are these the same people whom you would have named while you were in high school, why?
    - If only school ask if any outside of school and vice versa
6. While you were in high school, what were your plans for after high school?
    - Depending on how they answer, follow-up with
        - Have you ever thought about engineering or technical jobs as a career choice or
        - Why are you thinking of engineering or a technical job?
7. What were some of your reasons for choosing the career you chose?
    - Can you give an example of reasons
8. What do you want your job, or career, to provide you?
9. What or who were some of the things (or people) who helped you to achieve what you wanted to do?
10. What were some of the things that made it difficult for you to achieve your goals?
11. What are some recommendations you would give to high school students about how to choose a career path?
    - What are some items they should consider?
    - What words of advice do you have for them?
12. I've come to the end of my question list. I want to give you time to talk. I have told you a little bit about the current study. You have answered a bunch of questions. Is there anything else you want me to know?
13. Thank you very much for sharing your insights and experiences with us. Would you mind if we contact you again if we have questions about your responses?

Appendix E. Final High School Protocol

1. Introduction –
    - Thank them for taking the time to interview. Ensure they understand the purpose of the interview is to learn about their thoughts and their participation will help to understand how students make career choices.
    - Ask if they have any questions before getting started.
    - Verify it is ok to voice record.
    - Verify we have a signed assent and consent forms.
    - Introduce the interview including interviewer, interviewee, date, time, and location.

Can we talk a little bit about what high school is like for you now…
Tell me a little bit about your high school experience

2. What year are you in school?

3. Tell me what high school is like for you…
    - What are your favorite part? Why?
    - What is your least favorite part? Why?
    - What do you wish was different?

    Note: Be sure to ask both sides, favorite and least favorite parts.

4. What are some of your interests?
    - If only school ask if any outside of school and vice versa
    - Why do those activities interest you?
    - How confident are you in those activities?
    - Move to general interests and expand beyond just a school discussion.

So we have talked about … I want to follow up on that and talk a little bit more about what it is like living in your community.

5. Tell me what it is like growing up here?
    - Family? Church? Neighborhood? Friends/Peers?
    - When you are not in school what do you do?
    - What are some of the advantages and disadvantages?
    - Can you tell me more about how [that] was an advantage/disadvantage or give me an example?

6. Who are some of the key people who influenced you in your life and why?
    - If only school ask if any outside of school and vice versa
    - What is an example of them being a role model?
    - Example in context

7. What kind of jobs do some of the adults you know have?
    - Can you give an example of what [person/job] is to make sure I understand that job?
    - Based on what you know about the jobs, which ones sound interesting to you and why?
    - Where do these adults work?
    - Educational attainment of these adults…

We have talked a lot about the present and what your life is like now…I would like to talk about the future…

8. What type of job are you considering? Why?
    - Ask them to describe the job…What about that is appealing to you?
    - Does the location of the job matter to you? Why?
    - How are people reacting to (just mentioned) job?
    - How confident are you in getting that type of job? Why?

9. Is there a job or a career that you wish you could pursue, but can't?
    - Depending on the answer, follow-up with: Have you ever thought about engineering or technical jobs as a career choice for you? or Why are you thinking of engineering or a technical job?
    - Why can't you?
    - What was your dream job when you were younger? Do you have a dream job now?
    - Is there a job you know you do Not want to have?

10. What are the next steps for you?
    - Are you excited about graduating from high school?
    - Are you ready to graduate high school?
    - Are you applying for college (why or why not)?
    - How confident are you in doing well in your next steps? Do you believe you will do well?

11. So, we have talked about your plans. Imagine yourself in 10 years…Describe what your life is going to be like?
    - Who do you want to be?
    - What do you want your job or career to provide?
    - What do you expect to become?
    - What is most exciting about your future?
    - What do you want to avoid?
    - What scares you most about the future?
    - If asked for clarification indicate it can be related to money, status, to be rewarding, reputation, allow you to live in a particular place or a particular way

    Without bounding/assuming what they may be, Investigate hoped for and feared future possible selves.

    Push people to be as clear and concrete as possible here.

12. How confident are you in your ability to get there? Why?

13. What are some of the things (or people) who are helping you to achieve what you want to do?
    - Are there other things that are making it difficult or that you think are slowing you down?
    - Supports and Difficulties

    Considering all of these things we have talked about today…

14. If you were asked to give advice to other students about high school, what would it be?

15. I've come to the end of my question list. I want to give you time to talk. You have answered a bunch of questions. Is there anything else you want me to know?

16. Thank you very much for sharing your insights and experiences with us. Would you mind if we contact you again if we have questions about your responses?

Appendix F. Final College Participant Protocol

Introduction – thanking them for taking the time to interview. Ensure they understand the purpose of the interview. Ask if they have any questions before getting started. Verify it is ok to voice record. Verify we have a signed consent form.

Can we talk a little bit about where you grew up…

1. Where did you grow up?
2. Tell me what it was like growing up there?
   a. Probes
      - Family? Church? Neighborhood? Friends/Peers?
      - What did you do outside of school?
      - What were some of the advantages and disadvantages of this area?
      - Tell me about your activities and interests growing up?
      - Can you tell me more about how [that] was an advantage/disadvantage or give me an example?
3. Who are some of the key people(adults and peers) who influenced you in your life and why?

   b. Purpose: Allow them to choose items they want to discuss. Learn something about their likes and dislikes of the area

4. What year are you in school? What is your major?

   Tell me a little bit about your college experience
5. How did you pick this college?
   - Were there some things about high school that influence your choice to attend college?
   - How did people react to your decision to go to college? To major in _____?
   - Geographic Location
   - Qualities of the school, Size, etc…

   b. Purpose: Get insights into the decision-making process

6. Tell me what college is like for you…
   - What are your favorite part? Why?
   - What is your least favorite part? Why?
   - What do you wish was different?

   b. Purpose: Move to general thoughts about school. Hopefully gain insight on thoughts about some classes and importance of school and areas of interest within school

   Note: Be sure to ask both sides, favorite and least favorite parts.

So we have talked a little about where you are…Let's talk a little about how you came to pick this path…

7. How did you pick this major?
    - Were there some things about high school that influence your choice of this major?
    - Who were some of the people you know
    - Qualities of the school, Size, etc…
    - How did people react when they heard you want to be an engineer?

    b. Purpose: Get insights into the decision-making process

    So we have talked about … I want to follow up on that and talk a little bit more about what was like where you grew up.

8. *If people are already mentioned.*…You mentioned _____. Are there any other key people who influenced you in your life and why?
    a. Probes
        - If only school ask if any outside of school and vice versa
        - What is an example of them being a role model?

    b. Purpose: Understand whom they consider role models without restriction to a particular context for the role model

9. Growing up, what kind of jobs did some of the adults you know have?
    a. Probes
        - Can you give an example of what [person/job] is to make sure I understand that job?
        - Based on what you know about the jobs, which ones sound interesting to you and why?
        - Where do these adults work?
        - Educational attainment of these adults…

    Purpose: Understand what students' perceptions of various jobs are and which interest them.

    We have talked a lot about the past and present…I would like to talk about the future…

10. What type of job are you considering? Why?
    a. Probes
        - Ask them to describe the job…What about that is appealing to you?
        - Does the location of the job matter to you? Why?
        - How are people reacting to (just mentioned) job?
        - How confident are you in getting that type of job? Why?

Purpose: See if jobs or careers other than ones for whom they have a potential role model surface. Learn what influences interest in a job other than knowing someone with that type of job

11. Is there a job or a career that you wish you could pursue, but can't?
    a. Probe
        - Depending on how they answer, follow-up with: Have you ever thought about engineering or technical jobs as a career choice for you? or Why are you thinking of engineering or a technical job?
        - Why can't you?
        - What was your dream job when you were younger? Do you have a dream job now?
        - Is there a job you know you do not want to have?

    b. Purpose: Find a place to get them to talk about roads not taken.

12. What are the next steps for you?
    a. Probes
        - What are your plans for after college?
        - Personal or Professional…

    b. Purpose
        - Learn about the students planned career actions
        - Attempt to gain an understanding of the student's self-efficacy in terms of their career plans
        - Specifically see if they considered engineering
        - Connect goals to choices

13. So, we have talked about your plans. Imagine yourself in 10 years…Describe what your life is going to be like?
    a. Probes
        - Who do you want to be?
        - What do you want your job or career to provide?
        - What do you expect to become?
        - What is most exciting about your future?
        - What do you want to avoid?
        - What scares you most about the future?
        - If asked for clarification indicate it can be related to money, status, to be rewarding, reputation, allow you to live in a particular place or a particular way

    b. Purpose: Gain insight on outcome expectations – what they are and why they matter – without bounding/assuming what they may be/ Investigate hoped for and feared future possible selves.

        Note: Push people to be as clear and concrete as possible here.

14. How confident are you in your ability to get there? Why?

15. What are some of the things (or people) who are helping you to achieve what you want to do?

    a. Probe

    - Are there other things that are making it difficult or that you think are slowing you down?

    b. Purpose

    - Opportunity to learn more about supports and barriers
    - See what aspects of the student's life is brought out when they are asked about what they want to do (did they answer work related, hobby, family, helping others, etc)

Considering all of these things we have talked about today…

16. You've provided me with some great information. If you were asked to talk to some high school students, what advice would you give high school students concerning decisions about what to do after high school? How about advice while in high school?

    b. Purpose: look for areas they found most important and possibly insight into what they would do the same or different.

17. I've come to the end of my question list. I want to give you time to talk. I have told you a little bit about the current study. You have answered a bunch of questions. Is there anything else you want me to know?

    Thank you very much for sharing your insights and experiences with us. Would you mind if we contact you again if we have questions about your responses?

Appendix G. Final Working Engineer Protocol

1. Introduction – thanking them for taking the time to interview. Ensure they understand the purpose of the interview (*conducting research on academic choices and career choices of Appalachian youth*). Ask if they have any questions before getting started. Verify it is ok to voice record. Verify we have a signed consent form.
   Can we talk a little bit about what your job is like for you now…
   Tell me a little bit about your work experiences

2. Whom do you work for and how are things going for you there? Please tell me about what you do there.
   - What are your main responsibilities? How long have you worked there?
   - What is an example of a "typical" day?
   - What do you wish was different?
     Purpose: Ice breaker and gain information for future probes

3. Tell me a little bit about your career path – how did you get to this position?
   - Key steps along the way
   - Key decisions
   - Who were some of the key people who influenced you during your career and why?
   - What or who were some of the things (or people) who helped you to achieve what you wanted to do? What is an example of their actions that helped you?
   - Are these the same people whom you would have named while you were in high school, why?
   - If only school ask if any outside of school and vice versa
   - What are some examples that caused you to end up in engineering?
   - What motivated you to consider engineering?
   - How confident were you in becoming an engineer?
     Purpose: reveal significant items that influenced their career choice in context.

   So we have talked about … I want to follow up on that and talk a little bit more about what was like where you grew up.

4. Where did you grow up?

5. Tell me what it was like growing up there?
   b. Probes
      - Family? Church? Neighborhood? Friends/Peers?
      - What did you do outside of school?
      - What were some of the advantages and disadvantages of this area?
      - Tell me about your activities and interests growing up?
      - Can you tell me more about how [that] was an advantage/disadvantage or give me an example?

- How did people react to your decision to go to college? To major in X?

Purpose: Allow them to choose items they want to discuss. Learn something about their likes and dislikes of the area

6. *If people are already mentioned…*You mentioned _____. Are there any other key people who influenced you in your life and why?
   b. Probes
      - If only school ask if any outside of school and vice versa
      - What is an example of them being a role model?

      Purpose: Understand who they consider role models without restriction to a particular context for the role model

7. Growing up, what kind of jobs did some of the adults you know have?
   b. Probes
      - Can you give an example of what [person/job] is to make sure I understand that job?
      - Based on what you know about the jobs, which ones sound interesting to you and why?
      - Where do these adults work?
      - Educational attainment of these adults…

      Purpose: Insight into role models; may get distal or proximal background information

   Now I'd like you to think specifically about your high school experiences

8. When you were in high school, what did you imagine or envision for your future? What did you want your life to be like?
   b. Probes
      - Who did you want to be?
      - What did you want your job or career to provide?
      - What did you expect to become?
      - What was most exciting about your future?
      - What did you want to avoid?
      - What did you want to avoid becoming?
      - What scared you most about the future?
      - If asked for clarification indicate it can be related to money, status, to be rewarding, reputation, allow you to live in a particular place or a particular way
      - Where there jobs you knew you did not want – why?

      Encourage professionals to think back to high school to answer these questions. Probe professionals to discuss how their plans for the future changed as they progressed through college and career and how this aligns with where they are now.

Purpose: Investigate hoped for and feared future possible selves. Insight into their high school vision of the future

9. What did you want your job, or career, to provide you?
   - How about now, what are your expectations from your career?
   - How well do you think your plans happened?

Purpose: determine if their original outcome expectations remained the same.

10. While you were in high school, what were your plans for after high school?
    - Depending on how they answer, follow-up with questions about their career path – why and how it changed
      Purpose: insight into their career pathway choices

11. What were some of the things that made it difficult for you to achieve your goals?
    Purpose: specifically look for barriers; could be environmental or coping efficacy (Belief in ability to overcome barriers to achieve a desired performance).

12. What are some recommendations you would give to high school students about how to choose a career path?
    - What are some items they should consider?
    - What words of advice do you have for them?
      Purpose: What they think are the most important considerations/factors for making a career choice.

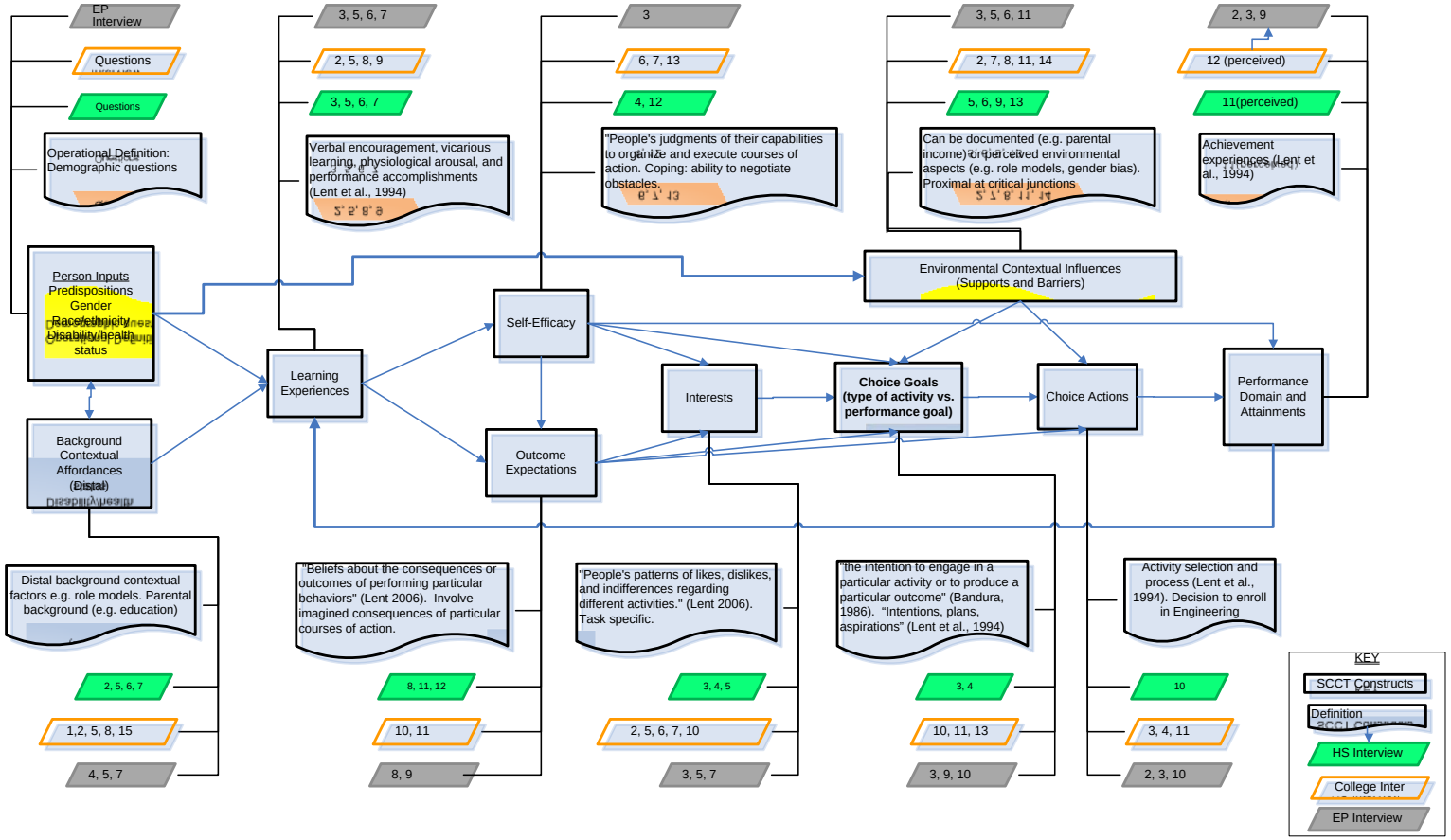
13. I've come to the end of my question list. You have answered a bunch of questions. Based on what we have talked about, do you have any other items or examples of about your career, career path, or thoughts for high school students you want to share?

14. Thank you very much for sharing your insights and experiences with us. Would you mind if we contact you again if we have questions about your responses?

Appendix H. Protocol Question Mapping to SCCT

How are Central Appalachian high school students influenced as they choose their career goals, especially with respect to engineering?

1) What are the salient reasons and factors Central Appalachian high school students give for choosing their career goal?
2) How do the reasons for choosing engineering as a career compare to other career choice reasons for Appalachian high school students?
3) What are the salient reasons college engineering students, who went to high school in Central Appalachia, give for choosing engineering as a career choice?
4) How do the reflective reasons for a career goal of college engineering students compare to high school students' prospective career choice reasons in Central Appalachia?



Appendix I. Interview Field Note Guide

H.S/College/Working — Interview Field Notes Sheet

ID # _____ Contact Date _____

Interview Site _____ Written by _Carrico _____

Planning to attend college	Engineering Career	Other
Community or 4-yr college	Intervention Activities:	

Key word capture

Barriers	Career goals	Expectation	Motivation for Engr. or career
Other Goals	Supports	Values	Learning Experiences

Career Aspirations - Planning/pursuing/doing

Interests and Self-efficacy and confidence in ability to complete plans
Background & Learning Experiences

Key Supports and Barriers (e.g. family, money, other...if possible note if it is a proximal or distal experience/factor)

Knowledge/skills believed needed

Main theme/salient points from Interview (home-school balance; current vs. future expectations; support & Barriers)

Interview Setting and person's "body language" – setting, clothing, etc