

**AN EXAMINATION OF THE FACTORS THAT INFLUENCE AFRICAN  
AMERICAN FEMALES TO PURSUE POSTSECONDARY AND SECONDARY  
INFORMATION COMMUNICATIONS TECHNOLOGY EDUCATION**

A Dissertation

by

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## **ABSTRACT**

In order for the United States to compete globally with other countries, it is vital that the United States diversify and increase the number of information communications technology professionals (ICT) if it is to remain internationally competitive. Therefore, the underrepresentation of various minority groups in ICT fields has developed into an issue of great concern for policy makers and as a result policy makers have urged researchers to search for plausible solutions to increase the number of ICT professionals. Upon investigation, researchers have discovered that African American women represent a population that can help increase the number of ICT professionals as well as diversify the field. However, research examining African American females in ICT education and careers is scarce. Therefore, the two studies enclosed in this dissertation are designed to examine the factors that influence African American females' decision to pursue both postsecondary and secondary education. As such, the first study enclosed in this dissertation is a qualitative study that examined the pre-college and college experiences of African American females who were pursuing an ICT major. The second study enclosed is a mixed methods study that examined the social factors that predict ICT course enrollment for African American females at the secondary educational level.

As a result of the phenomenological qualitative techniques implemented in study 1, the researcher concluded that the following pre-college experiences were influential in the participants' decision to pursue an ICT degree: (a) high school academic achievement, (b) the influence of family, and (c) ability to embrace challenges. In

addition, the following experiences were influential in the participants' perseverance as ICT majors: (a) desire to become a role model, (b) acknowledging vulnerabilities (c) resilience, and (d) racial identity awareness. As a result of the quantitative and qualitative techniques used in study 2, findings indicated that technology use and interest was the primary predictor of ICT course enrollment.

## **DEDICATION**

This dissertation is dedicated to my wonderful husband, Sean Wright, my parents Charles and Debra Thomas, my brother, Deon Thomas, my best friend, Sheniquia McAfee and the African American females that participated in this study. Without the love, help, and unconditional support of my support network and my participants willingness to participate and share their true stories this journey would have seemed impossible. I love you guys to the moon and back.

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## **NOMENCLATURE**

ICT	Information Communications Technology Education
PWI	Predominately White Institution

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## CHAPTER I

### INTRODUCTION AND LITERATURE REVIEW

Margolis and Fisher (2002), posed the question: “Why should it matter if the inventors, designers, and creators of computer technology are mostly male?” (p. 2). Now reflecting on this question, one may question should it really matter. However, according to the literature, it does matter; it matters significantly. Males alone cannot sustain the technology field. Eventually, the state of the United States economy will be comprised if the field of information communications technology (ICT) is not diversified. Past research documents that the cost to the economy for the exclusion of females and even ethnic minorities in the ICT workforce has been estimated at \$3 billion to \$4 billion per year in the Silicon Valley alone (Margolis & Fisher, 2002). Yet, for decades, despite the need to diversify the ICT workforce, the number of females and ethnic minority males pursuing ICT careers remains significantly low.

Furthermore, when taking a closer look at the need to diversify the ICT workforce, ethnic minority females represent a population that can bring new perspectives into the ICT field that are different from White females and different from ethnic minority males. Essentially, ethnic minority females’ unique backgrounds, cultural traditions, perspectives, and experiences could bring dramatically new approaches to the ICT field and could be applied to help solve complex technological problems (Ong, Wright, Espinosa, & Orfield, 2011). However, it is reported that ethnic minority females often fall through the cracks when it comes to science, technology,

engineering, and mathematics (STEM) education (Ong et al., 2011). In particular, literature demonstrates that African American females represent a culture that often falls through the crack when researching and promoting STEM education. Efforts to understand and change the disparities that exist within STEM disciplines for African American females have been minimal. As Coneal (2012) indicated the majority of the literature regarding African American females and their educational background is extrapolated from studies about White females.

As such, when beginning this review of literature it was discovered that there was a scarcity of literature on the underrepresentation of African American females in STEM education and the literature specifically pertaining to African American females pursuing ICT was almost non-existing. However, the literature is rich with various accounts of the underrepresentation of both females and racial/ethnic minorities at different levels of STEM education and has documented the factors that promote and hinder their enrollment and persistence in these particular fields that builds a solid formation for this review of literature. For example, Adya and Kaiser (2005) examined early determinants of career choices for middle and high school females and found three broad categories that influence adolescent females' decision to pursue ICT education and careers: social (e.g., family, peers, media), structural (e.g., the role of teachers and counselors, access to technology resources), and individual differences (e.g., personality traits). Likewise, in a synthesis of research on undergraduate and graduate ethnic minority women pursuing STEM degrees, Ong, Wright, Espinosa, and Orfield (2011) identified specific structural and individual factors that influenced ethnic minority

women's retention and persistence in STEM fields, including personal relationships, a sense of academic self, and individual agency and drive. The vast majority of the literature reviewed identified individual interests as well as familial, social, and school influences as influential factors. Therefore, because of the reoccurring evidence found in the literature, this review will focus on the key factors which includes structural, environmental, and individual factors that have emerged repeatedly throughout the literature. Accordingly, this review is divided into three primary sections.

First, this review of literature provides an overview of the underrepresentation of African American females in STEM courses and highlights past racial disparities in an effort to help the reader understand the historical context of the low rates of participation among minority students, specifically African Americans females in STEM education. It is necessary that the reader is informed of the past issues of underrepresentation and situated within the current condition of this phenomenon to fully understand the influences that contribute to African American females' intention to participate in ICT education. Second, this review of literature provides a synthesis of African American females' technology use and interests which includes the use of the Internet, social networking sites, video games, and mobile devices. The primary purpose of presenting a synthesis of African American females' technology use is to examine how African American females currently view and value technology media compared to other groups such as African American males and Anglo-American males and females. This review is conducted through the lens of the Values-Expectancy Theory, according to which both ability beliefs and values beliefs (perceptions of importance, usefulness, enjoyment, and

cost) influence academic and career choices (Downes & Looker, 2011). Research suggests that the value students place on technology and technology subjects is one of the key factors that influence students' plans to take ICT related subjects in secondary school. Zarrett and Malanchuk (2005) attested that the interaction of how much one values technology, one's perceived technology ability, and one's expectations for success in ICT fields may be the most logical conclusion as to why there are fewer females in ICT career fields. Finally, in closing, the third section of this review provides a comprehensive synthesis and analysis of the social and individual factors that have been identified as influential to African American females' intention to enroll in STEM courses. These include social factors such as parental and family involvement, peer relationships, school support, and media influence and specific individual factors such as academic self-concept, self-efficacy, and stereotype threat.

### **History of STEM Underrepresentation**

Historically racial disparities have persisted at every junction in the public education circuit and recent research suggests that racial disparities still continue to exist. Researchers argued that compared to other racial and ethnic groups there are significant differences in African Americans' overall academic exposure and experiences (Margolis, Estrella, Goode, Holme, & Noa, 2008; Ong et al., 2011). The literature suggests that issues of access and inequality have continuously challenged African American students' academic opportunities. According to Margolis, Estrella, Goode, Holme, and Noa (2008), throughout history, African American students have been consistently denied access to school facilities, resources, and critical learning

opportunities. For example, Darling-Hammond (2000) found in her study of the school experiences of African American and other ethnic minority students that schools that served large numbers of African American students were least likely to offer the kind of curriculum and teaching needed to meet college standards compared to schools that served predominantly Anglo-American populations. Similarly, Dixson and Rousseau (2005) documented that when it comes to public education, African American and Latino students are placed into the lowest academic tracks and afforded fewer educational opportunities than their Anglo-American peers. More recently Logan, Minca, and Adar (2012) documented the extent of educational disparities between public schools attended by Anglo-American and Asian students compared with those attended by African American, Hispanic, and Native American students. Results from their study indicated that African American and Hispanic students are more likely to attend schools with high levels of poverty and are of lower quality compared to schools attended by Anglo-American and Asian students. So, compared to other racial groups, for African American students, “the histories have been so different, the playing fields so uneven, the chasm so deep and wide, that people are living in two different worlds, receiving two different and very unequal types of educations, opportunities, and levels of knowledge” (Margolis et al., 2008, p. 3).

Research also indicated that for African American students, racial disparities are particularly found in the STEM education circuit (Darling-Hammond, 2000; Solorzano & Ornelas, 2004). For example, Darling-Hammond (2000) discovered that schools serving predominantly minority and poor populations offered fewer advanced STEM

courses and more remedial academic courses but provided smaller academic tracks and larger vocational programs for their minority students. Furthermore, additional findings from Darling-Hammond (2000) study also indicated that when high-minority, low-income schools offer any advanced STEM or college preparatory courses, they offer them to only a very tiny fraction of students. Likewise, in Margolis et al. (2008) study of the computer science educational landscape (who is or who is not learning computer science) of three Los Angeles public high schools, the researchers found that more high-level rigorous technology classes were offered in the school that had a high number of Anglo-American students but not offered in schools with a higher concentration of minority students.

Specifically, when it comes to enrollment in advanced ICT courses such as AP Computer Science, research data has shown that very few African American students enroll in these courses. Ethnic minority student enrollment data from the 2008-2009 school year and AP Computer Science participation data from the 2010 Computer Science exam illustrated that in light of the fact that an increasing percentage of high school students in many U.S. states are ethnic minority students, ethnic minority students are greatly underrepresented in AP Computer Science. For example, in the state of California where ethnic minority students represented 56% of the overall student enrollment in 2010, only 10% of ethnic minority students participated in AP Computer Science (Goode, 2011). Similarly, in the state of Texas where ethnic minority students represented 58% of the overall student enrollment, only 21% of those students participated in AP Computer Science (Goode, 2011).

Since the focus of this research is on African American adolescent females, it is also important to discuss the gender imbalance within K -12 computer science education. Goode (2007) noted that AP Computer Science is the most segregated AP course in terms of both race and gender. For instance, in 2011, the number of girls who took the AP Computer Science exam in relation to the number of boys who took the same exam represented a gender inequity which favored the latter. In fact, according to the data reported from College Board, the percentage of women who took the 2011 AP Computer Science exam was only 18.9% nationwide (Computer Science Teachers Association [CSTA], 2011). Also, data from 2005, denoted that out of 2788 California AP Computer Science exam takers who registered for AP Computer Science exam, only .2% were African-American females (Goode, 2007).

However, in spite of their low enrollment in advanced STEM courses, research has found that African American adolescent females are particularly interested in and engaged in STEM courses during their middle and high school years (Hanson, 2004; Hanson, 2007). Hanson's (2004) study of young African American females' science experiences from 8th grade through their early adult years demonstrated that young African American females possess considerable interest in science and are often more positive about science than their Anglo-American female counterparts. Similarly, Malcom and Malcom (2011) reported that ethnic minority females express a stronger interest in STEM fields and a greater intention to major in these fields in postsecondary study than do Anglo-American females.

## **Technology Use and Interest**

More than ever before, technology has a great presence in the everyday lives of America's youth. From online video games, the Internet, mobile computing devices, and social networking sites, today's youth is exposed and engulfed in technology media starting at very young ages. In fact, the literature suggests that American youth spend more time with technology media than any other single activity besides sleeping, with the average American eight – to –eighteen-year-old reporting more than six hours of daily media use (Roberts & Foehr, 2008). As stated by, Roberts and Foehr (2008), “with so many media and so much content available, it is not surprising that young people devote much of their time to media” (p. 13). Therefore, with the increase in technology use in schools, homes, and businesses and the ease of accessibility and portability that technology provides, one would assume that everyone would be motivated and interested in technology. However, several studies have examined and reported that the motives or reasons for using technology may differ based upon individual interests and demographic factors such as age, gender, and ethnicity (Graham & Smith, 2010; Kennedy, Wellman, & Klement, 2003; Roberts & Foehr, 2008).

### *Internet*

When it comes to Internet use, it is imperative that the term digital divide is first discussed. Originally, the term “digital divide” referred to technology access equality; the differences between the “haves” and “have nots” regarding access. Theoretically, in the late twentieth century, people were divided based upon their access to personal computers and various computer technologies such as the Internet. However, more

recently, the meaning of the term has changed. Now most Americans own personal computers and have access to broadband Internet connectivity. For example, in 2003, most American households had personal computers and some form of Internet access, and 62% of these households had one or more personal computers: reflecting a 6% increase from 2001 and a 54% increase from 1984 (Graham & Smith, 2010). According to a Pew Internet and American Life Project study, as of 2011, 88% of American adults owned a cell phone, 57% owned a laptop, 19% owned a tablet computer, and about six in ten adults went online wirelessly using one of those devices (Zickuhr & Smith, 2012). Essentially, computer and Internet access is becoming the rule rather than the exception in most American households (Graham & Smith, 2010). Therefore, because of this emerging technology phenomenon, the digital divide now refers to the gap in intensity and nature of ICT use. That is, researchers are now concerned with the differences in how the Internet is used, the intensity of use, and complexity of one's digital skills.

A review of research regarding the new "digital divide" suggests that a gender gap between those who use the Internet intensely and those who do not is almost non-existent. Past research suggested that there were considerable gender differences in the amount and type of Internet usage. Early Internet usage research reported that in comparison to males, females used the Internet less often and spent less time online (Kennedy et al., 2003). For example, during the 1990s, women were the reported minority regarding Internet usage. In 2000, a study determined that on the average, men spent five hours a week on the Internet using their home computer compared to women who spent an average of three hours a week (Kennedy et al., 2003). In 2002, men spent

an average of 125 days per year accessing digital libraries, newspapers, or magazines, compared to women who spent 88 days accessing similar data (Kennedy et al., 2003). However, with each year, the use and intensity of Internet use increases for women. For example, data from 2005 indicate that while men are more intense users and engage in a greater number of Internet uses compared to women, women are just as likely to be online as men (Fallows, 2005). An empirical study on the gender digital divide conducted from 2005 to 2008 found that when socio-economic variables were controlled for, women were actually more active users of the Internet than men (Hilbert, 2011).

In regards to race and the digital divide, the literature reports that African Americans use the Internet less intensely compared to other racial groups (Graham & Smith, 2010). Research assumes homogeneity within the African American population but the nature of Internet usage within the African American population is actually more complex than what most research studies report. In fact, research has found that there are different patterns of Internet use among African American males and females (Jackson et al., 2008b; Tolbert, Mossberger, King, & Miller, 2007). The percentage of African American females who use the Internet actually surpasses African American males. According to a 2005 Pew Internet and American Life Project study, 60% of African American adult females were reported to be Internet users compared to 50% of African American adult males (Fallows, 2005). Likewise, in a research study examining race and gender differences with regards to intensity and nature of technology use, contradicting to other studies, Jackson et al. (2008a) found that African American adolescent females, who averaged 12 years of age, were the most intense users of the

Internet and used the Internet more often than any other sub-population studied which included African American adolescent males, Anglo-American adolescent males, and Anglo-American adolescent females. Reportedly, African American adolescent females were most likely and African American adolescent males least likely to surf the Web, shop online, and search the Internet for a variety of information.

### *Social Networks*

Among the research concerning differences in Internet use, recently the mass appeal of social networking has become a popular topic of interest. Kuss and Griffiths (2011) report that of all Internet users, approximately one-third participate in social networking sites and ten percent of the total time spent online is spent on social networking sites. The literature indicates that this emerging global phenomenon is steadily rising in popularity among adolescents and young adults (Ahn, 2011; Kuss & Griffiths, 2011). In particular, social networking sites have become the primary source of online social interaction for female adolescents and young adult females. While early Internet studies found Internet users to be predominantly male, recent studies suggest that females are more likely to participate in social networking sites (Ahn, 2011). Data from a 2011 Pew Internet and the American Life Project survey, argued that young adult females between the ages of 18-29 are the power users of social networking sites such as Facebook, MySpace, Twitter, and LinkedIn (Madden & Zickuhr, 2011).

Existing research also suggested that social networking usage differs between cultures (Ahn, 2011). For example, in an investigation of American teen's use of social networking sites, Ahn (2011) discovered that race was a significant predictor of social

networking usage. More specifically, Ahn (2011) found that African American and Hispanic teens were 42% more likely to be social networking site users compared to their Anglo-American peers. Therefore, despite claims that Anglo-Americans use the Internet more often than African Americans, research demonstrated that African Americans were more active users of social networking sites. In fact, a recent Pew Internet Study and American Life Project survey reported that African Americans have the highest rate of Twitter usage (Smith & Brenner, 2012). Reportedly, more than one quarter of online African Americans (28%) use Twitter, with 13% of the population doing so on a typical day (Smith & Brenner, 2012).

As such, when considering the research findings regarding gender and race and social networking usage, it may be assumable that African American girls are the dominant users of social networking sites. However, because there is a scarcity of literature specially related to African American girls and social networking usage, it is difficult to provide actual evidence of this phenomenon. Studies of the digital divide and social networking sites have generally measured usage based upon gender or race but not the intersection of the two entities. Nevertheless, the aforementioned assumption is in accord with emerging research which shows that girls and African Americans are active users of social networking sites.

### *Video Games*

Given the increasing popularity of video games, researchers have examined the differences in use and intensity of video game play due to race and gender. For years, the video game market has consumed a large part of the entertainment and technology

industry. Video games are no longer just past-times for the idle consumer, but are complex technological structures that are affecting the way some live and operate from day to day. From the multiplicity of gaming platforms and genres, variations of social contexts of play, and the expanded functionality of gaming consoles (Bryce & Rutter, 2003), video games have become a diverse playground for people of all ages.

However, despite the efforts by game makers to diversify the video game industry; the gaming industry is primarily a male dominated industry. Video game play has traditionally been labeled a male pastime and reports in the literature have consistently indicated that males are the dominate consumers and players of video games. For example, in a study conducted by Jackson, Eye, Fitzgerald, Zhao, and Witt (2010) examining self-concept, self-esteem, gender, race, and information technology use, findings indicated that adolescent males regardless of race played videogames far more than adolescent females. Similarly, Jenson and Castell (2011) reported that 77 percent of adult males said they played video games at least once a week, while only 46 percent of adult females did so.

Recent research has confirmed that girls do actively participate in video game play and statistics show that “girl gamers” are growing in numbers. Inherently, adolescent females are playing video games even though they appear to be less visible in the game industry (Jenson & Castell, 2011). In fact, Lin (2010) found that adolescent females viewed playing video games appealing just as much as adolescent males. Furthermore, according to the Entertainment Software Association (ESA) Essential Facts and the Computer and Video Game Industry report of 2012, 47% of all video game

players are adult females and adult females over 18 years of age are one of the industry's fastest growing demographics (ESA, 2012). Such findings suggested that the typical gamer is no longer a young White male as early research proposed. As a matter of fact, Shaw (2012) found that gamers are a diverse group who may come from various minority groups depending on their race, gender, or sexuality.

However, what is interesting is that the “black girl gamer” seems not to exist. Upon a thorough literature search of African American adolescent females’ participation in video game play, there was no research on the subject. It seems as if, researchers and the video game industry have disregarded the importance of studying this particular population of gamers. This lack of research on African American adolescent females and video game play is an apparent gap in the literature that needs to be filled.

According to Shaw (2012), in all of the ESA reports since 2004, the only demographic data reported in relation to video game sales are age and gender. However, as an overall racial group, research has shown that African American children actively participate in video game play. Studies have even found that African American children played more video games than Anglo-American children (Rideout, Roberts, & Foehr, 2010; Richmond, Field, & Rich, 2007; Roberts, 2000). As of 2010, Rideout, Roberts, and Foehr found that when controlling for demographic factors such as age, parent education, or whether the child is from a single or two-parent family, African American and Hispanic youth played video games a half-hour more a day compared to Anglo-American youth. Further, in a study of racial and ethnic disparities in adolescent physical inactivity based upon neighborhood of residence, researchers found that despite

of place of residency, African American adolescent females and males had higher levels of inactivity (hours spent viewing television and playing video games) compared to Hispanic and Anglo-American adolescents (Richmond et al., 2007). These findings suggested that African Americans adolescent females participate in video game play although the extent in which African American adolescent females participate in video game play is not actually known or discussed within literature.

#### *Mobile Phone Use*

With the vast increase of mobile phone usage globally, research is now beginning to also investigate the intensity and effects of mobile phone use. Mobile phones are not just traditional communication devices anymore but are multi-dimensional electronic devices that have prompted an increase of media use by American youth. In 2010, eight to eighteen-year-olds spent an average of a half-hour a day talking on their mobile phones, averaged 49 minutes a day listening to, playing, or watching other media on their phones, and averaged a half a day text messaging (Smith, 2010). In that year, ethnic minority youth were the heaviest consumers of media content via mobile phones (Smith, 2010). Data from the Pew Internet & American Life Project Mobile Access report also indicated that ethnic minority Americans lead the way when it comes to mobile Internet access using handheld devices such as mobile phones (Smith, 2010).

Accordingly, a research study conducted by Jackson et al. (2010) found that African American adolescent females used mobile phone devices the most compared to African American adolescent males and Anglo-American adolescent males and females. The literature also reports through the adoption of high mobile phone usage, African

American females are taking full advantage of Internet access despite space and time constraints. For instance, Tolbert, Mossberger, King, and Miller (2007) found that a higher percentage of African American females use mobile phones to access the Internet more than the overall American population. In regards to intensity of mobile phone use, African American adolescent females are more likely to use mobile phone devices more intensely than Anglo-American adolescent females (Jackson et al., 2008b). That is, African American adolescent females will go beyond the basic calling or texting functions of mobile phone devices and will also use the Web browsers, cameras, and digital organizers that are integrated within the device. Thereby, mobile phone devices serve as gateways to technological resources for African American adolescent females.

In summary, the aforementioned findings suggest that African American adolescent females have some vested interest in technology and use it in their everyday lives. So given this, it seems as if more African Americans adolescent females would pursue ICT education. Yet, this is not the case. More research is needed to explore and thoroughly investigate the technology experiences of African American females and its' influence on African American females pursuit of ICT education and careers.

### **Influencing Factors**

Researchers have identified key factors that influence both females and African American's decision to pursue technology education (Adya & Kaiser, 2005; Gal-Ezer, Vilner, & Zur, 2008; Margolis et al., 2008). These factors generally fall into several different categories such as family values, academic exposure, and peer support. However, for African American females, their gender and ethnic identity present

additional experiences and factors that may affect their decision to pursue technology education. Therefore, the following section will examine the critical factors that exist due to the intersection of race and gender.

### *Family*

The African American family system is the central place in which African American adolescents receives messages about who they are becoming and can or cannot become in terms of education and career (Kerpelman, Shoffner, & Ross-Griffin, 2002). Therefore, family is perhaps the most significant and influential factor that encourages and motivates African American adolescent females' academic decisions (Hanson, 2007; Ong et al., 2011; Zarrett & Malanchuk, 2005). In an examination of literature on African American familial influences on STEM education, a number of researchers have confirmed that for most academically successful African American adolescent females pursuing STEM education, family is at the core of their upbringing and plays a powerful role in determining their future in STEM. After completing a study on the success of young African American females in science, Hanson (2007) declared, "It is the minority family that helps us understand the unexpected interest or engagement in science among young African American girls" (p. 6). Similarly, findings from Hrabowski, Maton, Greene, and Grief (2002) qualitative study of the families of young African American females majoring in science and engineering, demonstrated that parental or family support is a major reason that African American females are successful in STEM education.

Furthermore, research has suggested that as a result of the African American family structure and ideologies, African American adolescent females may exhibit androgynous gender roles, greater self-esteem, independence, assertiveness, and higher educational and occupational goals relative to adolescent females belonging to other racial groups (Hanson, 2007). Hanson (2004) noted that unlike other racial groups who stress marriage as source a mobility for their daughters, African American families often put a greater stress on education and pursuing non-traditional female careers (i.e. STEM careers) as their primary source of mobility and financial stability. However, what is interesting is that most studies that have examined the factors that influence adolescent females' enrollment in STEM courses discovered that families often deter adolescent females from STEM because of gender role expectations and socializations that favor males' achievement, interest, and attitude towards STEM (Crowley, Callanan, Tenebaum, & Allen, 2001; Farenga & Joyce, 1999; Hanson, 2007). With this is mind, it is important to note that the existing research concerning females may not apply to African American females. Many researchers do not consider the intersection of race and gender as an interaction effect that may cause research results to differ. Data from Zarrett and Malanchuk (2005) study of the social-psychological factors that influence youths' ICT occupational decisions, pointed to the importance of considering how trajectories of females' occupational choices may differ by the intersection of gender and race. Results from their study indicated that parental education does not predict ICT course and career aspirations for Anglo-American adolescent females but predicts the

pursuit of ICT career attainment for African American adolescent females and in fact becomes a significant influence (Zarrett & Malanchuk, 2005).

## **Parents**

To fully understand the influence that family has on African American females' academic decisions, researchers have specifically investigated the nature and degree of African American females' parental involvement and support. The amount of parental involvement that African American females may receive is frequently characterized throughout the literature as an impetus for their pursuit and persistence in STEM related courses and careers (Hanson, 2007; Hrabowski, Maton, Greene, & Grief, 2002; Russell & Atwater, 2005). Russell and Atwater (2005) stressed that the most critical factors often having an impact on the academic achievement of African American students is the degree of parental involvement and the level of parental expectations they encounter in the home environment. In their study of eight African American females and three African American male students who experienced success in high school and college science and mathematics courses, Russell and Atwater (2005) identified three primary tenets of parental influence that motivated the students to persist through the STEM pipeline throughout college: (a) encouragement, (b) acceptance, and (c) educational expectations. Also, consistent with Russell and Atwater (2005) findings, Hrabowski et al. (2002) discovered that parental influences such as a deep commitment to education, giving encouragement and support, instilling strong spiritual beliefs, consistently setting high expectations, and cultivating a belief in self were instrumental to raising academically successful African American daughters. Thus, the literature reviewed

suggested that both implicit (i.e., acceptance, strong spiritual beliefs) and explicit (i.e., encouragement, educational expectations) forms of parental influences are key factors to African American females' academic decisions and success.

Upon a thorough investigation on the parental influences on African American females' STEM decisions, the literature identified the African American mother as the most influential parent within the family structure. Numerous studies have accentuated the important role that African American mothers play in their children's academic and career decision making process as a vital source of influence and support (Bellisari, 1991; Hanson, 2007; Hrabowski, et al., 2002). For example, Hanson (2007) quantitative analyses on the influence of family on the success of young African American females pursuing science education found that compared to their father's influence, the females studied were more aware of their mother's positive influence as a factor that contributed to their success in science. In addition, across studies, specific maternal strategies such as establishing middle class values of hard work and responsibility, placing emphasis on education, supporting their daughters academically and emotionally, serving as mentors and role models, and reinforcing family values have been cited as highly influential on African American females' academic decisions (Hrabowski et al., 2002; Kerpelman et al., 2002).

It is also important to note that researchers have found that one of most important factors on African American females' future educational aspirations is the education acquired by their mothers. Throughout the literature, it is documented that an African American mother's academic accomplishments or lack thereof helps reinforce the

importance of persistence and academic success for her children. Specifically, Hrabowski et al. (2002) research demonstrated that African American mothers used their educational experiences whether good or bad as springboards to set high-achievement standards for their children. Also, past findings from Gruca, Ethington, and Pascarella (1988) study on a mother's and father's educational background as an influence on their daughter's gender atypical career attainment (e.g., engineering and ICT careers) highlighted the positive influence that African American mothers with a college education have on their daughters' academic and career decisions. In fact, Gruca et al. (1988) discovered that African American mothers were more influential than Anglo-American mothers in influencing their daughters to pursue gender atypical careers.

In regards to African American fathers, there is a prevailing negative assumption that African American fathers contribute little or nothing to the well-being of their families. However, a considerable amount of research has attributed the academic success of African American children to their father's influence. According to Hrabowski et al. (2002), African American fathers are an important part of the tapestry that produces academically successful African American females pursuing STEM education. For instance, researchers have concluded that an African American father's involvement motivates academic decisions and achievement, promotes better school performance, and assists with their child's cognitive development (Grantham & Henfield, 2011; Hrabowski et al., 2002; Maton & Hrabowski, 2004). Hrabowski et al. (2002) also stated that by becoming a counterweight to African American mothers, assuming a protective stance, and setting high academic standards, African American

fathers are a significant force in the upbringing of their daughters. In a qualitative study of the factors related to the academic achievement of African American students who were undergraduate STEM majors, Maton and Hrabowski (2004) found that the African American fathers who were present in their children's lives were very influential in their journey to outstanding academic achievement. One participant from the study stated, "Society does not portray Black men as being intelligent or being successful. My dad was an excellent role model of that successful figure" (p. 552).

### **Extended Family**

It is also important to note that in the African American community, "family support" of academic endeavors may also come from others outside the realm of the immediate family. The literature suggests that family support may include supportive networks of the immediate family, extended kin, and the community. For example, Hrabowski et al. (2002) found in their study of successful African American adolescent females pursuing STEM education that it was not a particular person but rather the entire family including siblings and cousins that encouraged the adolescent females to persist in STEM courses. In addition, numerous research studies have ascertained that African American grandmothers and aunts in particular are significantly influential to African American girls' STEM success (Bellisari, 1991; Hrabowski et al., 2002; Maton & Hrabowski, 2004).

### *Peer Group*

Within the limited literature on African American females' STEM enrollment, peer groups are often cited as being highly influential to African American females'

STEM retention and persistence. Ong et al. (2011) asserted that for women of color pursuing STEM education, peer support networks are influential and critical to long-term student success. Furthermore, a number of researchers have reported that African American peer relationships are specifically related to academic motivation and achievement by becoming a positive source of social and emotional support (Horvat & Lewis, 2003; Hrabowski et al., 2002; Ong et al., 2011).

However, while researchers have found that African American peer relationships promote academic success, African American peer relationships have also been known to negatively influence academic decisions and achievements. Hrabowski et al. (2002) proclaimed, “For young African Americans, the negative influence of peers or lack of peer support for academic achievement is so strong that even when they are positively influenced by strong parenting, their academic performance still suffers” (p. 6). Harris and Marsh (2010) further suggested that many academically successful African American students compromise their achievement and minimize their intellectual competence in an effort to maintain certain peer relationships. For example, findings from Horvat and Lewis’s (2003) study of the importance of African American peer groups in managing academic success confirmed that African American students often downplay their academic accomplishments and censor themselves when they are with their less academically successful peers because of the pressures that arise from negative peer relationships. For this reason, this intentional downplay or minimization of academic accomplishments is referred throughout the literature as “camouflaging” (Harris & Marsh, 2010; Horvat & Lewis, 2003). Grantham and Ford (2003) noted that

when caught in this psychological and social-emotional tug-of-war (i.e., camouflaging), some African American students attempt to sabotage their achievement by procrastinating, failing to do assignments, exerting little effort, and refusing to be in gifted education and advanced level classes.

Several studies also suggested that African American peers groups have a tendency to discourage academic achievement and negatively characterize those who are high achieving as “acting White”. Acting white has been defined in the literature as partaking in certain activities or events that are stereotypically known to be “White” behaviors, including performing well in school. According to Harris and Marsh (2010), because academic achievement is considered a White domain, African American peer groups negotiate a social space that negatively sanctions high achievement and within these social spaces academic success is equated with acting White. For example, almost two-thirds of the young African American females that were interviewed for Hrabowski et al. (2002) study of successful young African American females pursuing STEM recounted incidents in which they were teased or felt alienated for exhibiting behaviors that were considered as White and were often called “nerd”, “White”, and “Oreo” by their peers. According to research, the unsolicited stress from negative peer relationships combined with the burden of acting White can be detrimental to African American females’ academic decisions and success.

#### *School Support*

The literature suggests that both positive and negative roles of teachers and counselors influence African American girls’ enrollment in ICT courses. Existing

research demonstrated that in K-12 educational settings, teachers and counselors are integral in stimulating students' interest in technology fields. In particular, school counselors have the important task of informing both students and parents about the potential opportunities that exist within STEM disciplines. The literature suggests that simply by informing and showcasing opportunities within ICT or other STEM-related courses, students' may be interested and motivated to participate in STEM courses. However, past research has concluded that counselors rarely inform girls of the technology courses that are offered and the benefits of taking such courses (Adya & Kaiser, 2005; Ray, Sormunen, & Harris, 1999; Turner, Bernt, & Pecora, 2002). According to Adya and Kaiser (2005), counselors tend to reflect a gender bias that directs girls towards traditional careers and boys to non-traditional careers. Similarly, Ray, Sormunen, and Harris (1999) suggested that educators are often influenced by socio-cultural assumptions about ICT careers and indirectly cause girls to steer away. For instance, Turner, Bernt, and Pecora (2002) found that for some women that were ICT professionals, teachers and academic administrators were very discouraging about their intention to pursue an ICT career. Specifically, 12% of the women that participated in their study mentioned that their high school counselors discouraged their pursuit of ICT education (Turner et al., 2002).

Furthermore, the literature reports that ineffectiveness of college counseling at the high school level is especially problematic for ethnic minority students. It is argued that high school guidance counselors are responsible for hindering African American students' educational aspirations (Gandara, 2001). Margolis et al. (2008) declared, "too

often, counselors (whether intentionally or not) reinforce messages that call into question the academic ability of students of color and their rightful place on an accelerated educational track” (p. 88). In addition, research has confirmed that racial stereotypes, whether they are positive or negative, become a hindrance in the academic advising process. A research study discovered that decisions about what courses students should take were generally based on ethnicity, social class, and gender assumptions held by counselors rather than the students’ actual intellectual capabilities (Margolis et al., 2003). An African American female participant from Margolis et al. (2008) study described their experience with school counselors as:

In Black classes when [counselors] come to classes that are filled with more minority kids or whatever, they tell them to go to SMC [Santa Monica Community College], but when they go to honors classes they tell you to go to UCLA [a major university]. (p. 88)

The literature suggests that instances such as the one previously described fosters the idea that ethnic minority students are incapable of performing above predetermined low-level expectations. According to Margolis et al. (2008), messages about minority students’ capabilities become so ingrained that it appears nearly impossible for minority students to make the decision to enroll in advanced or college preparatory courses.

Additionally, the literature suggests there are also counseling issues in regards to time spent on academic planning and counseling that may have an effect on African American girls’ academic decisions. According to Adya and Kaiser (2005), most high school counselors devote only a small percentage of their time on academic and

occupational counseling. The literature indicates that in many public education settings, high school counselors are frequently overwhelmed with a surplus of student caseloads and other various non-counseling activities (e.g., attending meetings) that in most instances counselors are unable to provide optimal academic counseling. Margolis et al. (2008) research study found that due to a high student-to-counselor ratio, the students who attended a predominantly minority high school in East Los Angeles had little interaction with their school counselors and were assigned classes by their counselors without discussing any of the students' future educational aspirations. Margolis et al. (2008) further discovered as of result of the high student-to-counselor ratio that it was virtually impossible for the school counselors to get to know all the students well enough to guide them toward optimal academic schedules.

Regarding teachers, Goode (2007) stated that if teachers are properly trained and are equipped with valuable resources, teachers can act as social change agents in broadening student participation in computing, especially for students who have been historically underrepresented in the field (i.e., females and ethnic minorities). Similarly, Darling-Hammond (2000) argued that having access to qualified teachers is one the most influential resources for increasing students' opportunities to learn and raising their achievement levels. Accordingly, the lack of qualified teachers who educate ethnic minorities has also been cited throughout the literature as a contributor to the low enrollment of African American girls in ICT courses. Several studies have uncovered that for students who were enrolled in STEM courses, students in high-minority and low-income schools were several times as likely to have unqualified teachers as those in

more affluent schools (Darling-Hammond, 2000; Margolis et al., 2008; Tate, 2008). Darling-Hammond (2000), for example, assessed the ways in which teacher qualifications were related to student achievement and documented that as many as 50% of science and mathematics teachers in critical high need areas lacked degrees in the field in which they teach and as a result, the teachers were less effective in producing significant student learning gains. Additionally, Margolis et al. (2008) found in their study of the educational experiences of students and teachers in three Los Angeles public high schools that the computer science teachers that taught at the predominately minority schools only had basic computer training and did not have the knowledge or the necessary professional development opportunities to support their computer science curriculum. Findings from this study further confirmed that teacher qualifications do in fact affect student participation in the courses they teach. Margolis et al. (2008) reported that after successfully implementing several summer professional development institutes for the untrained computer science teachers, female students tripled their computer science enrollment and African American students nearly doubled their enrollment.

Studies have also attributed females and ethnic minority students' lack of STEM course enrollment to teachers' low expectations and biased opinions of these particular populations of students' intellectual capabilities. It is even argued that teachers have the greatest impact on females' decisions about pursuing ICT education. The literature suggests that many teachers, often unknowingly, stereotype or judge students based upon their gender, appearance, or past experiences which cause students to eventually steer away from certain academic courses. In a review of literature on gender equity and ICT

education in primary and secondary education, Volman and Van Eck (2001) documented that teachers are depicted in the literature “as the carriers of ‘hidden messages’ about boys’ and girls’ capacity to work in IT” (p. 618). Examples of such hidden messages are documented as giving male students priority over female students in computer use (Volman & Van Eck, 2001), giving the impression that male students are inherently better with working with computers than girls (Adya & Kaiser, 2005), and creating assignments that are geared to stimulate interest for male students (Rowan & Lynch, 2011). Rowan and Lynch (2011) argued that attempts to improve girls’ participation rates in ICT courses might continue to falter unless teachers begin to debunk gender misconceptions and stimulate both male and female students’ ICT interest.

When it comes to ethnic minority students, the literature also suggests that teachers view minority students as low-performing and inherently incapable of attaining high levels of academic achievement (Margolis et al., 2008; Thompson, Warren, & Carter, 2004). According to Margolis et al. (2008), teachers’ expectations and belief systems of ethnic minority students contribute to a constrained academic curriculum that does not support the advancement of ethnic minority students. At one particular research site, Margolis et al. (2008) discovered that two Anglo-American teachers who taught high school Internet publishing to a group of underperforming minority students designed their courses in a basic, elementary way and taught low-level computer skills because of their deficit-based views and low expectations of their students. The researchers documented that instead of motivating students to learn more about technology or preparing students to take more advanced ICT courses, the two teachers’

negative beliefs about their students hindered their students' technological advancement (Margolis et al., 2008).

Further, Thompson, Warren, and Carter (2004) found that low teacher expectations of students' academic performance could result in self-fulfilling prophecies. The literature defined a self-fulfilling prophecy as a situation in which initially false beliefs become true (Madon, Jussim, & Eccles, 1997). According to some educational researchers, the self-fulfilling prophecy is a powerful and pervasive phenomenon in which a teacher's attitude, values, or beliefs may influence students' education and occupational opportunities by changing how students view themselves (Madon et al., 1997; Rosenthal & Jacobson, 1968). One of the most classic and controversial research studies of self-fulfilling prophecies was conducted by Rosenthal and Jacobson (1968). Through experimental research, Rosenthal and Jacobson (1968) explored the effects of teacher expectations by leading teachers to believe at the beginning of a school year that certain students could be expected to show considerable academic improvement during the school year. The teachers in the study assumed the predictions were based on intelligence tests that had been administered to the entire student body toward the end of the preceding school year. However, despite the teachers assumptions, the designated students had been chosen at random and not on the basis of testing. Astoundingly, the concluding results from the study indicated strongly that the students from whom teachers expected greater intellectual gains did indeed show such gains despite their initial academic ability and confirmed that teacher expectations does produces change in student achievement. In a more recent study of the power of self-fulfilling prophecies,

Madon, Jussim, and Eccles (1997) found that certain populations of students were more susceptible to self-fulfilling prophecies. More specifically, African American and low socio-economic students were found to be more susceptible to negative self-fulfilling prophecies and the most affected by their teacher low expectations resulting in low academic performances. Therefore, it is concluded from these findings that self-fulfilling prophecies can significantly influence African American girls' academic decisions and their ability to succeed in STEM courses.

It is also important to note that more research is needed to thoroughly investigate the influence of teachers on African American females' advancement in STEM academics. There is conflicting evidence that has indicated that teachers can also have a positive impact on African American girls' intention to pursue STEM academics (Ellington, 2006; Goode, 2007; Hrabowski et al., 2002). When interviewing mothers of academically successful African American females, Hrabowski et al. (2002) found that many mothers credited the success of their daughters to caring and supportive teachers. The mothers reported that most often it was a math or science teacher who was inspirational and absolutely essential to their daughters' success in STEM. Likewise, in a study of high-achieving African American students, Ellington (2006) found that access to supportive and encouraging teachers was critical to the students' early academic success. Participants reported that teachers encouraged them to enroll in a particular program, take a particular course and/or participate in a particular school project. Thus, as Goode (2007) states, "the advocacy and care of a single teacher can have a lasting impact on a student's life interests and pursuits" (p. 65).

## *Media*

With the power to depict and define how society operates from day to day, it is no surprise that both printed and electronic media may also have an influence on African American girls' academic decisions. Studies have shown that various media content can affect an individual's self-concept, attitude, and overall behavior (Sengupta, 2006). Research from a vast number of studies has demonstrated that media content assists in the formation and reinforcement of gender roles (Adya & Kaiser, 2005) and racial stereotypes (Dalisay & Tan, 2009). For example, Dalisay's and Tan's (2009) study on the effects of the positive and negative racial stereotypes that are disseminated by visual and electronic media concluded that media portrayals of specific racial groups affect one's perceptions about that specific group, and subsequently create stereotypes about other racial groups. According to Sengupta (2006), pervasive media images shape the reality of people and shape a person's idea of what society at large thinks is normal which in turns influence prejudices and unequal educational and occupational opportunities.

Existing research examining the media's influence of minority adolescents' development has also yielded important findings. In a quantitative study of race representations in the media, Sengupta (2006) explored the ways in which Anglo-American, African American, and East Asian women were portrayed in advertisements found in fashion magazines designed for adolescent girls. Results from the study indicated that women from different racial groups were represented in magazine advertisements in significantly different ways. For instance, African American women

were the group most often in clothing advertisements which tend to objectify and emphasize the body, whereas East Asian women were absent from both clothing and beauty advertisements but were significantly over-represented in advertisements for technology. As such, these findings contribute to the social stereotypes that African American women are hypersexual and sexually aggressive and East Asian women are hardworking, well-educated, and talented in math and science.

Particularly concerning African American girls, media content analyses have consistently confirmed that the media is saturated with stereotypical, hegemonic images of African American women which objectify African American women as sex symbols, gang members, and immoral (Hrabowski et al., 2002; Sengupta, 2006). Hrabowski et al. (2002) noted, “Rarely do the media focus on the success of young African American girls in school or of African American women in professional careers” (p. 3). Hrabowski et al. (2002) further stated that media images of African American women tend to be unflattering and even at times degrading and focus on a culture that is excessively influenced by glamour, sex, and violence. Therefore, it is concluded that because of the large lack of diversity of role models present in the media, many African American females are led to believe they are a population of uneducated and unintelligent women.

The literature also suggests that the media’s portrayals of technical professionals (i.e., nerdy and unappealing) may also dissuade girls as well as African Americans from pursuing technical careers. According to Adya and Kaiser (2005), images in computer magazines and the representations of women in textbooks and software serve to alienate

women further from technology. Similarly, an African American student from Margolis et al. (2008) study reported that the advertisements that have to do with technology are “geared toward white people with white actors” (p. 63) and according to the student, exhibit little relevance to his everyday life. Given these points, it appears that media portrayals of technologically-savvy individuals do more to create barriers of interest for African American girls than foster its development.

#### *Individual Factors*

Although several social and structural factors have been found to influence African American girls’ pursuit of advance technology education, existing research indicated that there are also various psychological factors that influence African American girls’ academic decisions. The literature suggests that African American girls’ academic decisions are often centered on their academic self-concept, self-efficacy, and overall confidence in their academic abilities (Ong et al., 2011). Inherently, the attitudes and beliefs of African American girls may be the cause of their own educational advancement or lack thereof.

Awad (2007) defined academic self-concept as a set of attitudes, beliefs, and perceptions held by students about their academic skill sets and performance. Previous research has confirmed that students’ academic self-concepts predict their high school STEM course enrollment (Simpkins & Davis-Kean, 2005). In particular, high levels of self-concepts in either math or science have been shown to increase the likelihood of pursuing a STEM career (Simpkins & Davis-Kean, 2005). Also among the relatively small amount of research that has investigated the relationship between African

American students' self-concepts and academic outcomes, Awad (2007) found that academic self-concept was a significant predictor of African Americans' academic ability and grade point average. Awad (2007) documented that the African American students who had positive attitudes toward school and their scholastic abilities performed better in their academic courses.

The literature regarding African American girls' academic experiences and outcomes also explores the concept of self-efficacy. Self-efficacy is defined as an individual's perception about his or her ability to successfully perform a given behavior or task. According to Bong and Skaalvik (2003), the conceptual difference between self-concept and self-efficacy is that "self-concept represents one's general perceptions of the self in a given domain of functioning, while self-efficacy represents one's general expectations and convictions of what they can accomplish in a given situation" (p. 5). Ong et al. (2011) documented in their review of literature that a strong relationship exists between academic self-efficacy and the choice of a STEM major for African American women. According to Bandura (1977), one's self-efficacy beliefs help determine the choices one makes, their effort in completing tasks, their persistence and perseverance when faced with difficulties, and the degree of anxiety or serenity one experiences as he or she engages the numerous tasks that comprise their life. Therefore, it is implied that the more efficacious African American girls feel, the more they persist in their current and future academic endeavors.

The research on academic self-efficacy among African American students is scant. However, among the few studies, several studies have documented a strong

relationship between academic self-efficacy, school performance and persistence, and future educational expectations for African American students (Jonson-Reid, Davis, Saunders, Williams, & Williams, 2005; Kerpelman, Eryigit, & Stephens, 2008; Saunders, Davis, Williams, & Williams, 2004). For example, in a study of associations of self-efficacy, ethnic identity, and parental support of future education orientation among 374 African American adolescents, Kerpelman, Eryigit, and Stephens (2008) found that self-efficacy, ethnic identity, and maternal support were the strongest predictors of future education orientation. Findings from the study demonstrated positive associations between academic self-efficacy and future educational aspirations (Kerpelman et al., 2008). Furthermore, beliefs about African American students' self-efficacy have been found to vary according by gender. Past research has also found that African American female students have significantly higher levels of academic self-efficacy than African American males (Saunders et al., 2004). Saunders, Davis, Williams, and Williams (2004) found in their study of the academic outcomes of 243 African American high school sophomores that higher grade point averages and stronger intentions to complete the current high school year were more strongly associated with greater academic self-efficacy for African American females than for African American males.

With respect to self-efficacy, computer self-efficacy has been studied by many researchers interested in students' technology education and career choices. Computer self-efficacy is defined in the literature as a judgment of one's capability to use a computer (Karsten, 2000). Previous research indicated that computer self-efficacy has

an influence on the development in computer skills, one's decision to use computers, expectations of success with computers, and one's computer course performance (Karsten, 2000). It is argued that students will be more likely to enroll in advanced technology courses if they perceive themselves as technologically literate and skilled and possess high levels of computer self-efficacy (Johnson, Stone, & Phillips, 2008). Past research on computer self-efficacy also argued that there are gender differences in regards to levels of computer self-efficacy. Researchers have found that men generally have higher levels of computer self-efficacy than women (Busch, 1995; Durndell & Haag, 2002). However, research concerning African American girls' and computer self-efficacy does not support these findings. In a study of the relations among ethnicity, gender, computer self-efficacy, and IT career intentions Johnson, Stone, and Phillips (2008) found that African American women and both African American and Anglo-American men had very similar levels of computer self-efficacy. Reportedly, Anglo-American women were found to have lower levels of computer self-efficacy than any other racial group.

An important psychological factor also worth noting is the role of racial identity. Racial identity refers to the extent to which people of color are aware of, understand, and value their racial background and heritage (Grantham & Ford, 2003). According to Grantham and Ford (2003), racial identity has a significant impact on African American students' academic achievement, motivation, and attitudes toward school. In Cokley and Chapman (2008) examination of the roles of ethnic identity, anti-White attitudes, and academic self-concept in achievement patterns of African American students attending a

historically Black university, a strong association was found between academic achievement and racial/ethnic identity among African American girls, such that having a sense of connection and pride in their ethnic group membership was related to positive feelings about school and positive self-perceptions concerning their academic ability. Likewise, in Hrawbowski et al. (2002) study of successful African American girls pursuing STEM, racial and gender identity was found to be an important influence on the participants' academic success. Hrawbowski et al. (2002) noted, "Mothers not only worked hard to define racial issues productively for their daughters, but they also talked to their daughters about their roles as women carrying on a heritage" (p. 34).

Also among the individual factors that affect African American girls' decision to enroll in advanced technology education is the influence of stereotype threat. Stereotype threat is defined in the literature as the "social-psychological threat arising from a situation or activity for which a negative stereotype about the actor's group applies" (Beasley & Fischer, 2012, p. 3). Specifically, it is the fear of the possibility that one might inadvertently confirm a negative stereotype about one's group. Extensive research on this phenomenon has suggested that stereotype threat increases the likelihood of school disengagement and decreases the degree of participation in various school subjects for those students who are aware that a negative stereotype exists about their identified group (Beasley & Fischer, 2012; Honora, 2003; Margolis et al., 2008). For example, students may avoid certain school activities and academic courses such as advanced STEM courses because of a fear of failure that is caused by stereotype threat. Honora (2003) explained that stereotype threat within the context of academia can lead

students to detach their sense of self-worth from academic success, rendering school achievement relatively unimportant and unobtainable.

Furthermore, the literature reports that the students who often experience or fall victim to stereotype threat are females or students who belong to an ethnic minority group. According to Steele (1997), for women and African Americans, the threat of negative stereotypes in academia can be sharply felt and, in several ways, hamper their academic achievement. The literature suggests that race and/or gender become a boundary to one's academic opportunities and experiences. Studies have documented how gender and race schemas and stereotyped expectations are detrimental to STEM academic and career pursuits of both females and various racial minorities. In a study of the effects of stereotype threat on the attrition of women and minorities from STEM majors, Beasley and Fischer (2012) found that stereotype threat had a significant positive effect on the likelihood of women, ethnic minorities, and even Anglo-American men leaving STEM majors. In particular, the researchers discovered that African American men and women as well as Anglo-American and Hispanic women's decisions to discontinue their STEM education were significantly influenced by stereotype threat (Beasley & Fischer, 2012).

In the case of African Americans, the literature also suggests that African Americans are the most vulnerable to stereotype threat (Steele, 1997). For example, Beasley and Fischer (2012) found that African American STEM majors had the highest group based measure of performance anxiety (i.e. the researchers' measure of stereotype threat) compared to any other racial group. Steele (1997) proposed that this increase of

stereotype threat for African Americans is due to past and ongoing sociocultural inequities (e.g. socioeconomic disadvantages and unequal educational opportunities) that African Americans as a racial group have endured in comparison to other racial groups. Margolis et al. (2008) further reported that for African American students, psychological vulnerabilities caused by stereotype threat are not “minor individual affairs but rather the result of collective actions and history with a wide reaching impact” (p. 87). Therefore, it is concluded that this vicious cycle caused by a history of intellectually inferiority and stereotype threat has created an extremely difficult task for African American students to overcome.

**CHAPTER II**

**THE EXPERIENCES OF AFRICAN AMERICAN FEMALES WHO HAVE  
DECIDED TO PURSUE AND PERSEVERE IN AN INFORMATION AND  
COMMUNICATIONS TECHNOLOGY MAJOR**

Computing has become part of the infrastructure of how we live, work, and communicate from day to day. New technologies are constantly invading and changing the dynamics of our society and technological landscape. Because of this, highly qualified individuals with new and innovative ideas are required to meet the needs of a diverse and evolving society. People of diverse backgrounds and experiences are needed to pursue technology education and careers in an effort to expand and improve current technological developments as well as create new revolutionary technology. According to Adya and Kaiser (2005), the more diverse the information communications technology (ICT) workplace and pool of ICT professionals (i.e., computer analysts, programmers, software engineers, computer managers, internet architects, and webmasters; Anderson, Lankshear, Timms, & Courtney, 2008), the more likely ICT solutions will meet society's new demands. However, the number of individuals who are pursuing ICT education (i.e., education that involve designing and developing software and hardware systems, providing technical support for computer and peripheral systems, and creating and managing network systems and databases; Anderson et al., 2008) and actually entering the ICT workforce upon degree completion is not meeting

the field's high demand (Adya & Kaiser, 2005; Goode, 2007; Van Der Vyver, Crabb, & Lane, 2004).

A solution to improve the low growth rate of highly-qualified ICT professionals that is suggested numerous times throughout the literature involves increasing the number of women and ethnic minorities pursuing ICT education (Adya & Kaiser, 2005; Goode, 2007; Rosson, Carroll, & Sinha, 2011). Women and ethnic minorities are severely underrepresented in ICT education and careers triggering a significant desire to allure these underrepresented populations to the ICT workforce. However, by focusing all of our attention on the underrepresentation of women and ethnic minorities and treating their underrepresentation as two separate entities, we are ignoring the underrepresented populations who are affected by both their race and gender such as African American females. The underrepresentation of African American females in ICT career fields is often overlooked and overshadowed. Ong et al. (2011) attested, "failure to advance the education of women of color and move them into productive science, technology, engineering, and mathematics (STEM) careers represents a failure of the United States to maximize our own talent pool at a moment when we can ill afford it – socially, technologically, or economically" (p. 173).

However, before we investigate the underrepresentation of African American females in ICT, we must first understand that the complex political and social context in which we live may impose challenges of both race and gender simultaneously for African American females. Yet, society often ignores these challenges as well as the uniqueness of the African American female; a unique individual who is vastly different

from an Anglo American female and an African American man. According to Settles (2006), African American females often rate equal importance on their identity as a female and their identity as an African American but their interdependent identity as an African American female is rated significantly more important than either their identity as a female or African American. Therefore, it is important that we consider, view, and assess African American females as a unique population in ICT education and careers instead of viewing their race or gender independently as two separate entities.

Moreover, when investigating the underrepresentation of African American females in ICT education, attention must also be given to those African American females who have decided to attend a predominately White institution (PWI), an institution of higher learning in which Whites account for 50% or greater of the student enrollment (Lent et al., 2005; Russell & Atwater, 2005). Literature suggests that African American students attending PWIs and pursuing degree programs such as ICT are often faced with overwhelming obstacles and racial barriers that may lead to degree failure simply because of the social and institutional environment of a PWI (Russell & Atwater, 2005). As a result, for African American females attending a PWI, ICT degree attainment and establishing a career in ICT becomes an arduous task to accomplish.

## **Review of Literature**

### *African American Females in ICT*

It is well known that Anglo American and Asian males dominate ICT education and careers (Adya & Kaiser, 2005). In comparison to the number of Anglo American and Asian men pursuing ICT related disciplines, only a relatively small number of ethnic

minority women have decided to pursue such fields and the ICT growth rate of these populations is steadily declining. For example, from 2001 to 2010, the percent of ethnic minority women receiving a bachelor's degree in an ICT related discipline declined from 12.2% to 6.8% (Hodari, Ong, Ko, & Kachchaf, 2014). The literature suggests that this decline in growth rate can be attributed to issues of academic access and inequality (Ong, 2011). Ong (2011) further suggested that ethnic minority women such as African American women do not pursue ICT education or fail to attain an ICT degree because recruitment and retention strategies have traditionally excluded the unique experiences of ethnic minority women. Reportedly, the programs or interventions that are designed to increase underrepresented minorities in ICT careers have been designed to assist Anglo American females and African American males, not the intersection of the two subpopulations.

Moreover, the phrase "double jeopardy" has been used in the literature to describe the duality of racial and gender discrimination that many African American females pursuing ICT related disciplines experience (Settles, 2006). Research has found that women who dually occupy the undervalued identities of female and non-Whiteness often experience challenges in ICT related disciplines that Anglo American women and ethnic minority men do not experience (Hodari et al., 2014). For example, Malcom, Hall, and Brown (1976) found that due to their racial and gender identities, minority women do not fit what is considered the norm in ICT and as a result, each factor of deviation from "normality" raises the costs of long-term success. So, as a group, ethnic minority women must pay a tremendous price for a career in such a field. Similarly,

findings from Ong (2011) also demonstrated that barriers of racism and sexism are highly pervasive in ICT environments and consequently cause ethnic minority women to experience these barriers in multiplicative ways.

#### *Factors that Influence the Decision to Pursue ICT Education*

From the few studies gathered throughout the literature, researchers have documented key factors that influence African American females to pursue ICT education and careers. These factors generally fall into five categories: (a) the influence of family, (b) academic experience, (c) positive academic environments, (d) technology exposure and experience, and (e) the influence of role models.

#### **Family**

Numerous researchers have documented the vital impact that African American families have on African American females' pursuit and persistence in STEM fields (Hanson, 2007; Hrabowski et al., 2002). Research studies have found that the amount of parental involvement, the level of parental expectations, and the degree of academic encouragement African American females encounter in their home environment have the most profound effects on African American females' academic success in STEM. Moreover, in a study about the success of African American females pursuing STEM education, Hanson (2007) proclaimed, "The African American family system, both historically and at present, displays a unique set of gender ideologies and interactions that might be a source of agency (and strong personalities) for young African American women despite race and gender structures that work against them" (p. 6). Researchers have also found that the cultural context from which many ethnic minority women

originate must counter the intergenerational beliefs about what females can or should do and simultaneously provide crucial academic support in academic areas where they are severely underrepresented due to race and gender (Hodari et al., 2014). Therefore, when it comes to the academic success of African American females in STEM fields such as ICT, many scholars argue that the African American family plays the most significant role in their success (Hanson, 2007; Hrabowski et al., 2002).

### **Academic Experience**

For African American females, past academic experiences can also be a significant influence on their academic and career decisions. According to Russell and Atwater (2005), adequate academic and career guidance during adolescence has a significant impact on African American students' choice of college major and contributes to their overall postsecondary STEM success. Furthermore, Coneal (2012) posited that African American students who have earned and maintained excellent grades and successfully completed challenging college preparatory STEM courses are considered prime candidates for postsecondary academic success and are the most suitable for a career in a STEM field. This statement is demonstrated by Hrabowski et al. (2002) who found in their study of successful African American women in STEM that the participants' pre-college academic preparation was a major factor that linked them to high levels of postsecondary STEM success. The researchers reported that the participants engaged in secondary academic activities such as enrolling in after-school STEM programs and specialized math and science courses. Reportedly, these activities

had long-term effects on their persistence and success as STEM majors (Hrabowski et al., 2002).

### **Academic Environment**

Research has found that African American females' academic environments can also be a significant influence on their pursuit and persistence in ICT related disciplines. Researchers have found that ICT academic environments such as Minority-Serving Institutions (MSIs; i.e., institutions of higher learning that serve minority populations) helps promote academic success for African American females in pursuit of an ICT degree. The literature illustrates that MSIs provide nurturing learning environments, faculty who believe in their students, and collaborative peer cultures that encourage and motivate African American females to persist in ICT (Leggon, 2003). Most importantly, Malcom et al. (1976) found that MSIs provide a support structure that lessens the burden of differentness for ethnic minority women and as a result, the need to prove one's ability in the face of low expectations of others is not as prevalent for ethnic minority women attending MSIs. As such, MSIs such as Historically Black Colleges and Universities (HBCUs) have a strong history of producing a disproportionate number of African American female ICT majors who are motivated to continue their education in ICT beyond an undergraduate degree (Ong, 2011).

### **Technology Background and Experience**

Although past research demonstrated that African American females are underexposed to technology in their upbringing (Ong, 2011), research also demonstrated that after being exposed to technology in an informal or formal academic environment,

African American females begin to have a vested interest in using and learning more about technology (Lopez & Schulte, 2002). For example, Leggon's (2003) research regarding ethnic minority women and ICT education and careers found that once ethnic minority women have an idea of what it is like to work in ICT fields on a daily basis through postsecondary introductory computing courses, they become interested in ICT and desire to take more ICT related courses. Leggon's (2003) research further demonstrated that the more comfortable and confident African American females are about their technical skills, the more likely they are to persist in their ICT major. Thus, it has been concluded from past research that if given the tools to build and develop confidence within ICT, African American females are driven to learn more and ultimately experience success within the field (Hodari et al., 2014; Leggon, 2003; Ong, 2011).

### **Role Models**

Among the literature on African American females' pursuing ICT related disciplines, role models are also cited as being influential to African American females' ICT pursuit and persistence. For many ethnic minority women, role models who are of the same race and sex are viewed as living examples of success and achievement (Hodari et al., 2014). Furthermore, research has found that ethnic minority female role models (a) assist women of color connect to disciplinary communities, (b) encourage females to pursue careers in ICT, (c) mentor in both academic and non-academic areas, and (d) empower academic success (Hodari et al., 2014). In Malcom et al.'s (1976) study of ethnic minority women pursuing a postsecondary STEM degree, the critical

need for role models at the collegiate level was emphasized by many of the women studied. The researchers found that when many of the women encountered professors who patronized and doubted their abilities, role models were there to encourage, counsel, and assist in their perseverance.

### *African Americans and PWIs*

Based upon research findings and a close examination of the role of the collegiate environment in students' postsecondary success, researchers have begun to direct special attention to the academic achievement of African American students attending PWIs. Studies have demonstrated that despite the increased enrollment of African American students attending PWIs, African American students do not persist and graduate at the same rate as their Anglo-American counterparts (Rodgers & Summers, 2008). Interestingly, in their study of the matriculation of African American students at PWIs, Lett and Wright (2003) found that approximately one-third to one-half of African American students received degrees from PWIs even when African American students were better prepared academically upon entrance than their Anglo American counterparts. Lett and Wright (2003) also found that in comparison to the African American students who attended historically Black universities (HBCUs), the attrition rate was significantly higher for the African American students attending PWIs than those who attended HBCUs.

Several research studies have pointed to a PWI's social and structural environment as the reason for the high attrition rates of African American students (Lett & Wright, 2003; Rodgers & Summers, 2008; Russell & Atwater, 2005). For example,

research demonstrated that African American students attending PWIs often face challenges that are inclusive of but not limited to: (a) alienation (b) isolation (c) racism (d) discrimination intimidation (e) and problems associated with acquiring adequate financial aide (Lett & Wright, 2003). Likewise, Russell and Atwater (2005) has found that African American students who attend a PWI often encounter a campus climate that is hostile and uninviting and many experience feelings of isolation and distrust that ignites a “culture shock” or difficulty adjusting socially. Additional research also found that provisions and policies provided to assist and promote student academic development at PWIs predominately help the academic achievement of Anglo American students yet the same provisions and policies in turn may limit African American students’ academic achievement (Rodgers & Summers, 2008). Therefore when faced with these difficult challenges and provisions and policies that are not designed to help African American students, African American students often leave PWIs failing to attain a postsecondary degree (Rodgers & Summers, 2008).

Currently, there are only a few amount of studies in the literature that have explored the experiences of African American females who are pursuing ICT education at a PWI. A phenomenological study devoted to understanding the experiences that have motivated African American females to pursue a major in which they are faced with social and institutional barriers by attending a PWI is much needed. As such, the purpose of this qualitative phenomenological inquiry is to explore the life experiences’ of African American females that have impacted their decisions to pursue and persevere in an ICT major at a PWI. The following research questions guide this study:

1. What are the pre-college experiences of African American females that have impacted their decision to pursue a postsecondary ICT degree at a predominately White institution?
2. What are the experiences of African American females that have helped them to persevere in their pursuit of a postsecondary ICT degree at a predominately White institution?

### **Methodology**

To address the research questions, this study employed a phenomenological qualitative design. Because the aim of this study was to gain a detailed and thorough description of the lived experiences of African American females pursuing an ICT degree, it was concluded that a phenomenological qualitative design was more appropriate for exploring the experiences that have impacted their decision to pursue a postsecondary ICT degree as well as exploring the experiences that have motivated their perseverance. As Creswell (1998) noted, phenomenology is a qualitative research methodology that is used to describe the meaning of the lived experiences for several individuals about the phenomenon under study. It is an attempt to understand empirical matters from the perspective of those being studied (Creswell, 1998). According to Van Manen (1984), phenomenology is not like any other research methodology, phenomenology “does not offer us the possibility of effective theory with which we can now explain and/or control the world but rather it offers us the possibility of plausible insight which brings us in more direct contact with the world” (p. 38).

Moreover, a phenomenological methodology was appropriate because it provided an in-depth insight into the journeys, experiences, and perspectives of African American females which is a rarity in the current literature. This design enabled the researcher to fully understand the dynamics and true experience of being an African American female student pursuing an ICT related discipline at a PWI. Similar to a study by Russell and Atwater (2005) who used a phenomenological methodology to explore the experiences of 11 African American undergraduate students pursuing a biology degree at a PWI. The researchers sought to determine how precollege experiences impacted the students' persistence through the science pipeline. Through the use of semi-structured interviews, participants described in detail their precollege and college experiences that led to their success in their science degree program.

Most importantly, a phenomenological methodology allowed for the discovery of themes and commonalities through the actual voices of African American females. The researcher was able to gather and analyze data such as the participants' emotions in a way quantitative data would not have been able to do. As Merriam (2002) explained, phenomenological designs have the benefit of providing a rich description of the phenomenon being studied and affords data that is more difficult to capture with quantitative research methods. As a result, the researcher was able to provide more than a simple description of the phenomenon under study but was able to provide an in-depth understanding of the participants' unique perspectives and the meanings attached to their experiences as ICT majors at a PWI.

### *Participants*

Purposeful sampling was used to select participants for this study. Merriam (2002) explained that the goal of purposeful sampling is to select information-rich cases that will illuminate the questions under study. As such, the sample of participants consisted of ten African American females who were in their junior or senior year in college and were pursuing an ICT related major such as Computer Engineering, Computer Science, Computer Engineering Technology, and Animation and Game Design. The participants were from seven different states and were enrolled in various PWIs from different regions of the country such as: (a) California Polytechnic State University, (b) Columbia University, (c) Evergreen State University, (d) Rice University, (e) Texas A&M University, (f) University of California Berkeley, and (g) University of Miami. Other potential participants were recruited for this study but were eliminated because they were enrolled at a HBCU instead of a PWI. It was important that each participant attended a PWI because African American females who are pursuing an ICT degree at a PWI may encounter racial stereotypes, and social and institutional barriers because of their race that may impact their pursuit and perseverance in a STEM major (Russell & Atwater, 2005). Therefore, to get a complete picture of the experiences of African American females pursuing an ICT degree, it was necessary to select participants from universities in which the most informative data could be gathered.

Eight of the ten participants were recruited in March of 2015 at an annual National Society of Black Engineers (NSBE) convention in Anaheim, California. At the

convention, the researcher was able to recruit eight of the participants at a computer programming competition hosted by NBSE and Google (see Appendix A for recruitment script). The other two participants were recruited through Facebook (see Appendix B for recruitment email). The researcher received the names of two potential participants from previous Computer Science majors and was able to email and recruit those participants through Facebook messenger services. Each participant that was recruited was required to sign a consent form prior to their interview (see Appendix C). A summary of the participants' background information can be found in Table 1. Pseudonyms were given to each participant and the university that they attended to preserve and protect confidentiality.

**Table 1 Participant Background Information**

Pseudonym	PWI Attended	Major	Current Year
Abbie	University A	Computer Science	Senior
Ann	University D	Computer Science	Senior
Danielle	University A	Computer Science	Junior
Jessica	University B	Computer Science	Junior
Lexi	University C	Computer Engineering Technology	Senior
Mary	University F	Animation and Game Design	Senior
Pam	University D	Computer Science	Junior
Stacey	University G	Computer Science	Junior
Tamara	University B	Computer Science	Junior
Taylor	University E	Computer Engineering	Junior

### *Data Collection*

DiCicco-Bloom and Crabtree (2006) presumed that for studies implementing phenomenological methodologies, qualitative semi-structured interviews encourage the interviewees to share rich descriptions of their life experiences regarding the phenomenon being study. For that reason, semi-structured interviews were implemented for this study. Interviews were conducted one-on-one involving the researcher and the participant. Since the participants lived in different regions of the country, the interviews took place via video-conferencing using audio-video conferencing software. Interviews took place at the convenience of the participants, each lasting approximately sixty minutes. Overall, the entire data collection process lasted approximately one month.

The interview protocol (see Appendix D) included opened ended questions regarding the following: (a) family background, (b) technology background and experience, (c) overall academic experience, (d) college experience, and (e) strategies for persistence. The questions were designed to ask each participant to describe various situations in which she has experienced the effects of being an African American female in their choice of major. Questions regarding participants' demographics were not added to the interview protocol. However, participants were required to complete a demographic questionnaire prior to their interview (see Appendix E).

### *Data Analysis*

As described by Creswell (1998), phenomenological data analysis proceeds through the methodology of reduction, the analysis of specific statements and themes,

and a search for all possible meanings. Accordingly, the researcher implemented the following data analysis steps for this qualitative phenomenology study. First, the researcher began with writing in a reflexive journal about her experience as being an African American female student pursuing a Computer Science degree. Phenomenology requires the researcher to write about her assumptions about the phenomenon being studied and then bracket these preconceptions. Then the researcher started the interview process. All interviews that were conducted were audiotaped and transcribed verbatim. During this process each participant was given a pseudonym to ensure privacy. Using Dedoose, an online qualitative analysis software system, significant statements were then extracted from each description, phrase, and sentence. Creswell (1998) defined this step as the horizontalization of data. Then the researcher grouped the extracted statements into meaning units and developed themes. The themes were organized and clustered based on commonalities between participants' experiences. Based upon the themes that emerged, the researcher wrote a textural description of what was experienced including verbatim examples of what influenced their decision and what happened in their pursuit of their degree. Proceeding this step, the researcher wrote a "structural" description about being an African American female in pursuit of an ICT degree. The structural description involved how the phenomenon was experienced; seeking all possible meanings, seeking divergent perspectives, and varying the frames of reference about the phenomenon (Creswell, 1998). Lastly, the researcher constructed an overall description of the meaning and the "essence" of being an African American female pursuing and persevering in an ICT degree at a PWI. Creswell (1998) wrote that

this stage is the goal of a phenomenology study, to reduce the textural and structural meanings of the experiences to a brief description that typifies the experiences of all the participants in the study.

Data saturation also occurred as a part of the data collection and analysis process. Data saturation entails continually interviewing new participants until the data is complete. Therefore, for the purpose of this study, data collection and analysis procedures ended once the researcher perceived that there was no more new information that could be learned as a result of interviewing more participants. Other strategies that were implemented to assist the researcher in verifying the accuracy of her research results and establishing a high standard of quality research included: (a) writing with rich and thick descriptions, (b) clarifying researcher bias, and (c) performing member checks.

## **Results**

As previously noted, phenomenology is designed to gain an understanding of the experience under investigation and provides the participants an opportunity to share their lived experiences (Merriam, 2002). Therefore, using the interview protocol that was developed the researcher was able to gain an in-depth look into the pre-college as well as the college experiences of the African American females who participated in this study. From the data collected and analyzed, six primary themes emerged. Three primary themes reflect the participants' pre-college experiences: (a) academic background, (b) family, and (c) challenges. Three primary themes reflect the experiences that have assisted in their perseverance as an ICT major: (a) desire to become a role model, (b) academic environment, and (c) race and gender.

### *Academic Background*

Based upon an analysis of interview data, two subthemes emerged regarding the participants' academic background: (a) high academic achievement and (b) ICT exposure.

#### **High Academic Achievement**

Students' academic performance in high school can affect their postsecondary decisions and can be an indicator of their postsecondary success. Often students who are academically successful in college attribute their success to their secondary academic achievement. As such, the first subtheme that emerged regarding participants' academic background was high academic achievement. From the data collected, it has been concluded that nine of ten participants was able to accomplish high academic achievement. In describing their high school experience, several participants recalled being a high academic achiever. In fact, because of their high academic abilities three of the participants were actually enrolled in high schools that focused on accelerated academic learning. Jessica described her high school as, "My high school actually started in the seventh grade and went through 12<sup>th</sup> grade. Everything was advanced. You had to take an exam to get in and depending on how you scored you were admitted to my school". Lexi enrolled into a magnet high school that focused on advanced STEM learning and described her school as, "The school was advanced and if you had an interest in engineering or any type of technology, it kind of really just helped you develop those skills". Moreover, Abbie mentioned that she attended an International Baccalaureate (IB) school where she was able to receive an IB diploma.

For those participants who did not attend an accelerated academic learning high school, results also demonstrated that several of the other participants enrolled in advanced academic courses and achieved academic success within these courses due to their academic abilities. Most of the participants described a secondary academic background that included advanced placement (AP) course and/or IB courses, courses that are considered challenging collegiate level courses. The following statement from Pam illuminates this finding, “It wasn't the best high school. It was a pretty decent high school in South Carolina. I did AP classes and I took a few IB classes because my school offered those programs”.

Therefore, based on the data gathered, nine of the ten participants studied could be described as high achieving students. Because of their academic abilities, they stood-out from among their peers and were able to achieve high academic honors. As Danielle shared about her high school experience at a small charter school in Los Angeles, “from eighth grade until I graduated, I was one of the leading people in my class. I graduated valedictorian of my class”. Similarly, as Pam spoke about her high school experience she disclosed that she graduated at the top of her South Carolina high school graduating class. Additionally, Taylor stated that in comparison to her high school peers she was “genius level”.

It is also important to mention that results also indicated that while in high school one out of the ten participant’s experienced academic difficulty specifically in the area of mathematics. During Mary’s interview, she explained, “I was never one for math. That is not my thing. School was not my thing, but something that I had to do if I wanted to

be well-rounded”. She furthered explained in her interview that she had a learning disability and stated, “I tend to get a lot of help and support for math. I also have a disability, so getting as much tutoring as possible is always something I do”. As such, to overcome her mathematics disability, Mary took the initiative to get help and support to make her goals academic and career goals attainable.

Overall, the education that the participants received during high school prepared them for postsecondary success. Their strong academic background and academic abilities gave them the opportunity to attend and successfully graduate from some of the best colleges from around the country.

### **ICT Exposure**

During the interview process, participants were asked to describe their ICT exposure prior to starting their degree. As a result, four participants cited examples of exposure to formal ICT academics while in middle and high school. For instance, at her prestigious Boston public high school, Jessica had the opportunity to take a Computer Science AP course. In that course, Jessica was able to learn intermediate Java programming concepts beyond the basic introductory level of programming. As Jessica described her Computer Science course, she stated, “that’s where I got my feet wet with computer science”. This type of formal ICT exposure can also be seen in Lexi’s recollection of her pre-college technology background:

I took programming courses, Auto CAD courses, design courses, and stuff like that. Throughout that, I really enjoyed the programming side of it, we had to take

Java programming one and two so I really enjoyed that and I thought that I could do well and have fun with some type of technology major.

Another participant, Tamara, talked about learning various computing related concepts and attending technology camps while in middle and high school. Tamara attributed these courses and camps to facilitating her interest in learning more about computer science. As she spoke, Tamara's passion and love for technology exuded through her voice as she reminisced about her past. Tamara stated:

From high school, no actually it started in middle school. So in middle school I actually started taking like desktop publishing, things like that and also my middle school was high technology program, so we were awarded laptops. It was the first year so everyone in the school had their own personal laptop and they taught us all the programs. We went through extensive training, every Microsoft program, different things and that's how I became so proficient on Microsoft and everything like that because I had been learning it since the seventh grade, in middle school. And so then, I took desktop publishing then I took the computer science course... Oh, I did a lot of summer camps too. Software engineering camp at U of H, Girls are Great engineering workshop at U of H. I did a lot of summer camps. So I was introduced to it and put on to pursue a degree in computer science by those camps actually.

However, despite having an interest in ICT, Mary's and Taylor's high schools did not offer any formal ICT academic courses. Therefore, to compensate for this lack of opportunity, these participants took the initiative to learn ICT related concepts outside

of their public school environment. Mary, for instance, grew up privileged and went to a prestigious high school in Washington. She had a huge interest in technology but had no opportunity to expand her interest and knowledge while attending high school. During her interview, Mary expressed frustration about the lack of opportunity to grow her computing knowledge in a formal academic high school setting. However, because of her privileged background, Mary was able to take ICT related courses outside of school.

Mary explained:

My high school didn't really offer any classes that pushed any STEM. There was no science clubs. There weren't any programming clubs or anything. If you really wanted to do it, you kind of had to look for it yourself, and sign up for it outside of school. That's kind of what I did. My high school didn't offer anything that would push anyone towards STEM-related fields.

Unfortunately, this lack of opportunity to learn ICT academics formally in a secondary environment was also the case for four other participants. However, for these four participants, exposure to technology did not occur until college. In contrast to the other participants, these four participants did not have a great interest in ICT prior to entering college. In fact, some participants had no idea that pursuing a challenging technology-rich career such as many ICT career fields entail was a plausible option. For instance, Ann, a computer science major attending University D, explained that she had no knowledge that computer science courses existed until she enrolled in college. Ann asserted:

I just decided to take a Python programming course because I needed a technology elective, I didn't know anything about the course but my advisor told me that it was a good class to take. After a couple of weeks into the course, to my surprise I ended up liking the course and decided that I would major in computer science.

Another participant, Abbie, also acknowledged she lacked technology exposure prior to college. Like others previously mentioned, her high school did not offer any advanced ICT courses. Even when she first entered college, she had no interest in pursuing an ICT related career and considered pursuing civil engineering. Abbie's decision to pursue computer science occurred after being exposed to the rigorous high-level ICT curriculum in college. Abbie explained that she found a liking towards computer science after taking a programming course her sophomore year in college. Abbie further explained that although she felt as if the curriculum was difficult, she loved the challenge that the computer science courses presented. Abbie recalled:

I had taken about two programming courses and I knew - it was something that I liked out of all of them [other majors], I wasn't really into the math side but I really liked the theory and I liked that it was tangible and it was one of the only courses that I fell on par with my peers because a lot of them came in having already taken calculus, taken physics, so this was one thing that almost everybody was learning from scratch. There was not that many people that have been coding since three years old. Even though I struggled, I was still able to do pretty okay.

It is also important to recognize that participants who lacked formal ICT exposure prior to entering college acknowledged that it was often difficult to learn the high level rigorous ICT college curriculum. For instance, despite the early exposure to technology by her father, Danielle did not have any formal ICT instruction. Danielle expressed, “it was just hard because I had to teach myself what I didn’t know to make it past my first programming course”. Therefore, to overcome the challenge of not having prior ICT exposure, the participants had to work harder than many of their academic peers, seek outside help from professors and in some instances as Danielle related, teach themselves ICT curriculum to maintain good grades and stay on par academically with their peers.

### *Family*

The influence of family was expressed as a major source of influence on the participants’ pre-college experiences for all ten African American females studied. Each participant attributed a great deal of their secondary academic success to their families though the amount and type of influence varied from participant to participant. Participants shared experiences that motivated them academically due to their parent’s high academic expectations, early exposure to ICT, and/or socio-economic status. From this three subthemes emerged: (a) high academic expectations, (b) pre-college technology exposure, and (c) motivation to earn a lucrative career.

### **High Academic Expectations**

Throughout the literature, the influence of family has been cited as being vital to African American females’ academic success. Therefore, when asked how their families

impact their academic decisions seven of the participants shared that their families always set high academic expectations for them. While being interviewed, Lexi shared that although her mother never attended college, her mother always pushed her to accomplish more for herself and never settle for anything less. Lexi explained:

My mom didn't have the chance to go to college she couldn't afford to and there were so many obstacles that distracted her from ever trying to go but she made sure that I went. She would always tell me you have to go to college. If you want to get ahead in life, college is a must. She would say, I don't care with you do. I will support you either way, but you must go to college.

In another interview, Jessica described how her father's career as an educator and academic expectations motivated her to succeed academically. Jessica discussed how her father always expected her and her siblings to bring home the best grades possible.

Well because my father was a teacher so education was an important factor in our household. My father always expected that we all go to school and do as best as we can. So it just also came easier for me to do well in school, because I already had in the back of my head from my upbringing that I had to do well.

Furthermore, it is important to mention that though all ten of the participants did not express that their families set high academic goals for them, results indicated that each participant's family positively encouraged them to pursue their academic goals. This encouragement was found to be an integral factor in their secondary and postsecondary academic success.

## **ICT Exposure**

Throughout the interview process, three participants also described how their parents were instrumental in exposing them to ICT related concepts. For example, in describing how she became interested in technology, Pam explained how her father was responsible for her interest in ICT. Pam stated, “My dad is actually interested in technology. He’s exposed me to a lot of technology from when I was really young, like about 2 years old”. Danielle also recalled her early interactions with technology started with her father who also pursued an ICT major in college. As a young girl, Danielle learned to create playlists and clean viruses off of her home computer with her father as her guide. Danielle further noted, “I had pretty much been around computers my whole life”. Yet, what is interesting is that Danielle was not an ICT major when she first entered college and did not have an interest in ICT. Danielle stated, “I actually ignored that [ICT background] when I originally first came to school, but I had pretty much been around computers my whole life given that’s what he [father] did”. However, the early ICT exposure Danielle received from her father eventually motivated her to pursue an ICT major.

For the other participants who did not receive early ICT exposure from their parents, they had to gain ICT knowledge from formal academic settings in either secondary or postsecondary environments.

## **Motivation to Earn a Lucrative Salary**

Several participants discussed how their families influenced their choice of college major because of the potential salaries that could be earned. Five of the

participants came from single parent homes and although five of the participants came from a two-parent household, three of the participants were daughters of immigrant parents who had at least one parent with a low paying job. For example, Jessica shared:

I am a daughter of Haitian immigrants. Both of my parents were born and raised in Haiti, and came over to the United States. They're both now U.S. citizens. My father is a teacher.....My mother is a nursing assistant whose highest education I would say is high school.

Therefore, in selecting a college or university and deciding on a college major, the potential salary and salary growth for that particular field was a significant influence on the participants' postsecondary decisions. That is, the participants wanted to ensure that their selected college major was going to lead to a lucrative career. However, what is interesting is that, most of the participants studied did not begin college as an ICT major. Four of the participants began as ICT majors but five of the other participants began as some other type of STEM major such as civil engineering, biochemistry, mathematics, and mechanical engineers with the exception of one participant who began as a pre-law student. Interestingly, each of these college majors can potentially lead students to a lucrative career. For example, Lexi stated:

I was looking up salaries and all types of stuff for computer engineering majors and at the time, Bill Gates was the richest man in the US, I can't remember if he was the richest man in the world but that influenced it too. I was like, well I enjoy it and if I come up with something awesome then the money will be there.

Tamara whose mother was once an oil and gas marketing executive took a big decline in pay to become a teacher recalled the financial struggles her mother endured when she was a child. Tamara described her family as a “hard-working, single parent, low income” family. As a result, Tamara’s mother pushed her to a career in ICT because of the financial benefits. As Tamara shared how she became interested in ICT, she stated:

Well first it came from my mom saying, 'Oh my God, technology, technology'. Telling me all the jobs go to the technology people in the company and how much money they make... and so as a kid I was into always into technology because my mom wanted me to learn programs on the computer for that reason.

In another instance, Abbie described how she questioned her decision to enroll in University A and wanted to make sure it was a good financial decision. After Abbie discussed her reservations with her father, her father shared the long-term financial benefits of majoring in an engineering discipline and influenced her decision to major in engineering. Abbie stated, “I didn’t really know if I should go to University A, I didn't know if it's going to pay back what I'm putting into it. So, my dad encouraged me to look into an engineering field.” Abbie later shared in her interview that her parents motivated her to have a lucrative career because, “they [her parents] always worked minimum wage jobs when they first came here and that's always something that they say, you cannot work like us”. In another instance, Ann, who was raised in a single parent household, discussed how she wanted to have a lucrative career to help provide for her family. Ann shared:

My mom always struggled as a single parent so she would always tell me to find a career so I wouldn't have to struggle like she did. After considering different careers first I thought about being a lawyer but then I realized that I could have a career in the technology industry and make a lot of money and I enjoy it then I can help my mom.

Therefore, results suggested that when six of the ten of the participants decided to change or select their major, an influencing factor in their decision was the promise of a lucrative career, and not their love and interest in ICT. They were motivated and attracted to the potential jobs and financial capital that could be gained by pursuing an ICT career. In addition, it was found that three out of the four participants who originally began college as ICT majors were also influenced by the potential salary of an ICT career. However, for one of the participants, Mary, who comes from a prestigious family, her love for technology and growing the field was more important than monetary gains. Mary's position could be due to the fact that Mary was accustomed to wealth and financial capital as a result of her mother's lucrative career.

### *Challenges*

Additional findings from this study illustrated that the participants embraced various challenges on their journey of becoming an ICT major. Throughout the interview process several of the participants explicitly stated that they welcome challenges. For instance, when asked to describe herself, Pam stated, "I like challenges and I like to think about things in a deeper sense." Other participants, implicitly described situations where they had to embrace challenges before they began their

pursuit of an ICT degree. While discussing her pre-college background, Abbie expressed how she embraced the challenge to attend University A. Abbie understood that there were going to be challenges in the pursuit of her degree and was willing to accept those challenges for her future career path. Abbie shared:

I knew I just didn't want to stay in that area, I didn't want to stay in the south. I wanted to go where I will grow and compete with people around the world, not just people in my city. That's what it felt like, it felt like most people there only learned about metro Atlanta and that's it. But, that's who you really compete with and so it [staying in Atlanta] just wasn't enough. I think it sort of served as motivation that I wanted to get away and really make sure I had a fair shot at doing what I wanted to do and that required me to go to a school that's recognized on a world level.

Another participant, Tamara, shared a similar story about embracing the challenge to attend University B. Tamara stated:

I told my mom that I had to get out of Texas and I wanted to go away really far and I actually didn't really know a lot about University B and I didn't know anybody else going there. But I was like, I don't care I will just go and see.

Furthermore, despite her learning disability and challenges of learning mathematics, Mary still embraced the challenge of pursuing an ICT major that is heavily integrated with advanced mathematical concepts. Mary explained:

I don't really like math. That's always been a challenge for me personally. I tend to get a lot of help and support for math. I also have a disability, so getting as much tutoring as possible is always something I do.

Two other participants described situations that entailed embracing the challenge of learning ICT related concepts on their own because the opportunity to learn ICT related concepts in a formal academic environment was non-existent. For instance, Taylor's high school did not offer any advanced ICT courses but she had a strong passion for technology and learning how various technological devices worked. As a result, Taylor decided to challenge herself and made learning ICT related concepts a top priority. In her interview, Taylor explained:

In high school I started playing around with jail-breaking Android devices or the equivalent, and getting into creating applications, and actually ended up breaking some tablets and some phones and fixing them; thankfully. I enjoyed spending hours and hours just doing that.

As such, results of this study demonstrated that all ten of the participants either implicitly or explicitly described themselves as people who like challenges or gave examples of challenges they had to embrace before they decided to attend their selected PWI or pursue an ICT major. Therefore, results implied that being able to embrace their challenges before entering college assisted in the participants' overall pursuit and success thus far as an ICT major.

### *Desire to Become a Role Model*

Upon hearing about the participants' experiences that has led them to pursue an ICT major and their motivation to persevere through the various challenges that were presented in their pursuit, it was discovered that many of the participants continued on their pursuit because they felt a responsibility to obtain an ICT degree for others. That is, for seven of the participants, their perseverance was motivated by becoming a role model for others. As such, the first theme that emerged that reflected the participants' college experience was desire to become a role model.

For the participants, becoming a role model encompassed a desire to motivate others to achieve academic success. Although the participants wanted to earn their ICT degree to fulfill self-satisfaction, a large portion of their perseverance was motivated by the welfare and interest of others. Several of the participants were first generation college students and for some, the oldest sibling in their household. They were viewed as role models in their families with the immense responsibility to guide others to thrive academically. As a result, they saw a bigger picture that included not just themselves but their family members. Ultimately, this awareness of the bigger picture became a motivating force in their perseverance. For instance, when having doubts about college and wanting to give up, Abbie remembered thinking about her younger siblings. Abbie spoke passionately about the need to be successful for them:

I needed to kind of master this hurdle because if I didn't get farther in school, if I didn't aim this high, it would sort of trickle down and affect my siblings and they would in turn not push themselves and go farther.

While discussing her experience as an ICT major at University C, Lexi also spoke about her need to push forward despite the challenges she endured because of her younger family members. Lexi asserted:

If I feel down or I'm not doing well or sometimes you have those feelings where you want to just give up or you're having a bad day or something, I'll think about my nieces and nephews and my little sisters and that will keep me motivated to keep going.

Another participant, Tamara also shared similar sentiments as Abbie and Tamara. When asked to describe how her family impacted her academic decisions, Tamara expressed, "I kind of feel like everyone's looking up to me. I'm the oldest grandchild so like all my little cousins are looking up to me. So I have to do well".

In a different manner, Mary, Danielle, and Ann also felt as if they had to become role models for other African American females. Because of the underrepresentation of African American females in ICT education and careers, they wanted to show other African American females that earning an ICT degree was attainable. They acknowledged the importance of influencing other African American females to continue in their pursuit of an ICT degree despite the disparities that exists within ICT fields. In her experience as being an African American female in pursuit of an ICT degree, Mary was often the only African American female in her animation and video game design courses. Mary recalled feeling isolated and alone while desiring someone she could relate to. As such, Mary felt that it was her responsibility to help populate her field with more African American females. So, when often faced with the realization

that she belonged to a very small population of people who shared the same race and gender as she, Mary continued despite her feelings of discomfort. Mary reported in her interview that “being a part of the industry and showing other young women of color that they can also do game design and gaming is worth it”. Ann shared similar comments about her responsibility to influence other African American females. Ann believed that if other African American females were aware of her academic success they would be inspired to obtain their own. Ann wanted to be an African American female that others in her major looked up to. Ann noted, “I have to show them [other African American female cohorts] that they can do it. If I can do it, then they can too”.

As such, accomplishing an ICT degree to become a role model for younger family members or other African American females became a driving force in seven of the participants’ desire to achieve an ICT degree. Their motivation to obtain an ICT degree was fueled by a desire to be a positive example for those waiting to follow in their footsteps. They were keenly aware that others were watching and waiting in the background for them to accomplish their academic goals so they had no other option than to persist. For the other three participants, results demonstrated that their persistence was fueled by their own individual satisfaction. They did not acknowledge any outside pressures or influences that made them feel as if they were accountable for attaining an ICT degree for the benefit of others. This sentiment is conveyed in Pam’s interview as she noted that her parents always stressed, “Do what makes you feel happy”.

### *Academic Environment*

Based upon an analysis of interview data, two subthemes emerged regarding the participants' academic environment: (a) journey of adversities and (b) vulnerabilities.

#### **Journey of Adversities**

It is well documented that African American females who attend a PWI may encounter various adversities that may prevent them from achieving their academic goals. Many studies have reported that African American females attending a PWI often times enter into a campus environment that is hostile, uninviting, and socially isolating. Therefore, given the adversities that an African American female may encounter at a PWI, it was important to hear how the participants perceived their college experience within their academic environment. Unsurprisingly, when asked about their college experience thus far, all ten participants agreed that majoring in an ICT major at a PWI was very challenging and used words such as rough, tough, and challenging to describe their college experience. Interestingly, five out of the ten participants interviewed stated "it has been a journey". For example, Lexi shared:

It has been very, I don't know the right word, interesting for sure, but it's been a journey. I started here in 2008 as a freshman, and it's now 2015 and I'm a graduating senior... It's been tough, there been some really tough times and then right now that I'm at the end of the road, I can look back and say I've made some bad decisions or I should have done this when I did this.

In another interview, Danielle described her journey as:

It's been a journey coming into college....I came in as I biochemistry major, so premed or pre-pharmacy track was the track that I was on, trying to take those classes. Actually, enrolling in the chemistry class that we have here, it's a weeder class, really discouraged me from pursuing medicine and anything science related given the difficulty of the class. I failed the class and I tried to take it again. Both times, I failed the class....I pretty much quit on that. Then I found a stronger liking towards computer science after taking that course last semester. That really uplifted where I was at about school because for a while I was like, I don't even know why I am here.

Yet, despite the adversities they encountered, it is also important to recognize that the participants were still able to persevere through their journeys. This statement is illustrated by Abbie and Ann, two participants who were faced with challenges but did not let their fears or academic deficits stand in their way of achieving success. Abbie, for instance, feared failure. Abbie believed she was taking such a big financial risk enrolling in such a prestigious university that she could not afford to fail. Abbie believed she could do it but there were so many things that she had to learn how to do on her own and being so far away from her family that sometimes she doubted herself. Abbie recalled that this was the first time that she actually had to struggle academically. However, Abbie still managed to persist. Abbie shared:

I struggled the most with being disciplined because I don't think I've ever really had to study math or science or anything while I was in high school but you do here. It's so easy to do well in high school and then you come here and it doesn't

matter how many hours you put in, if you're not studying the right way, you might not get a good grade. Figuring out how to study, figuring out how to balance my courses. Basic things, it took me years to really get through the stress and this is the first semester that I've kind of been the most mentally healthy because I figured out how to manage all those stresses.

Similar to Abbie, Ann struggled through some of her academic courses. Ann recalled times that she wanted to give up but did not. Ann further explained what she had to do in order to achieve academically.

It has been difficult but I could see the end coming, and this, right now it's smooth sailing but it wasn't always. It was definitely rough. I don't know, I don't even know where to start to explain how unmotivated I was at times, but I managed to somehow stay focused. I wanted to prove to myself that I could do it and looking at others around me seeing that they were able to achieve their goals, I knew that I could do it too. So, I would just lock myself in my room at times and study even though there were times I was definitely not motivated. I was just determined.

To help them overcome many of their adversities on their journey as ICT majors, the participants relied on the encouragement and help of faculty members, peers, student organizations, and/or religious organizations within their academic environments. Participants' descriptions of the influence of faculty members, peer groups, and/or student organizations shed light on the critical need for a strong support system for African American females attending a PWI. For instance, when describing her college

experience, Lexi described how a few of the faculty members at University C took a personal interest in her academic success. Lexi noted that their hands-on approach, on-going support, and guidance encouraged her to persevere. Lexi's general impression of her professors was described as:

I will say the professors here, I feel like they paid more attention to you if you're a minority student. I mean, maybe it's just because you look different than everybody else in the class, but I've always felt like my professors have been very open and helpful, if I need help or if I go in their office they'll say, if I missed class, they'll, hey I saw you weren't in class is everything okay? Do you understand everything? So that's been a real advantage to being a minority student.

Similarly, Pam and Stacey discussed the vital influence faculty members had in their perseverance. They explained that various faculty members went beyond their basic job duties to make sure that they accomplished their academic goals. However, it is important to recognize that one participant, Tamara, noted during her interview that due to a large student body at her PWI, it was difficult to develop a relationship with her professors and as a result was discouraged about asking for help in this type of environment. Consequently, this lack of faculty support caused Tamara to depend on her academic peer group for assistance with her coursework.

Many of the other participants also discussed the vitality of having a peer group at their PWI who shared their views and understood their perspectives. Both academic and social peer groups consisting of other African Americans were shown to have a

significant influence on the participants' perseverance as well as their emotional well-being. As Taylor's remarks illustrated, a social peer group consisting of other African American students who Taylor became acquainted with when she first arrived at University E was essential to her perseverance. Taylor stated, "I have a community of people who are not necessarily engineering students but who are students that I'm friends with and we keep each other encouraged." In addition, because Taylor was able to find friends outside of her academic department, Taylor would often turn to them when she wanted a mental escape from the difficulties of being a computer engineering major. As such, these friends would allow Taylor to "simply be herself". Taylor the potential engineer would become non-existent in this peer group.

An academic peer group consisting of other African American females was discovered to be highly influential in Danielle's perseverance as an ICT major at University A. Danielle attributed a great deal of her academic success to the assistance she received from her African American female computer science peers. Unlike some of the other participants, Danielle was able to form a cohort of other African American female computer science majors who attended her university and all started their pursuit of an ICT degree at the same time. Danielle explained:

I actually have a relatively large cohort of other Black women that are taking classes with me. Being able to rely on them and do work with them has been really great. They've really helped me out in terms of doing the major.

As such, both academic and social peer groups that were formed as a result of their academic environment were described by all of the participants as being a positive

influence throughout their college experience. These peers groups offered support, encouragement, motivation, academic assistance, and sometimes an occasional escape from reality. Because of these groups, the goal of becoming an ICT major became more attainable.

Moreover, student organizations became an integral part of eight of the participants' support network. Throughout the data collection process, participants acknowledged the support they received from student organizations on their college campus as impactful in their learning and development as African American female college students attending PWIs. In particular, the National Science of Black Engineers (NSBE), a student organization that supports the academic and professional success of African American engineering students and professionals, was specifically noted by most of the participants as a significant source of support. Inherently, NSBE afforded them the opportunity to grow academically and form relationships that provided emotional support and promoted academic success. For example, Abbie recalled the support she received from the NSBE organization on her campus. Abbie explained how she would go to her fellow NSBE members for motivation and assistance with coursework when she had trouble completing assignments. Abbie stated:

The National Society of Black Engineers, everybody in the organization is engineers so they have been through those struggles, the fundamental courses calculus, physics, all that stuff, everybody has gone through that so they know how it is to take those courses and to be in the position that you're in. So they offer guidance and encouragement.

In Jessica's case, NSBE was very influential to her academic success as a computer science major. When Jessica was asked how she was able to overcome the challenges of being a computer science major, Jessica expressed:

I also try to reach out to my NSBE network. There are computer science majors that may not go to my school. They are more likely that not to have had some similar coursework and be able to help me out in that aspect.

Also intertwined in the midst of their support network within their academic environment, religious organizations became a great entity of support for Lexi. During her interview, Lexi discussed how she often relied on her church community to help her navigate towards her goals. Lexi also discussed how her church offered her guidance when she experienced difficult times on her journey as ICT major. Lexi recalled:

As I grown up and grown older, I'll say I have really gotten in touch with God. So my religion really, really helps me. When I'm struggling, I'll just pray and I go to church ... so that helps me. I have a community of people who are not necessarily engineering students who I attend church with and we keep each other encouraged.

As evident in the above illustrations, there were times when all ten of the participants were challenged either academically or emotionally during their journey as ICT majors. In some instances, they were faced with impediments that sometimes deterred them from accomplishing their goals and influenced them to give up. However, in spite of it all, they were still able to sustain in their pursuit of an ICT degree with the help of various sources of support within their academic environment. They had a goal

to accomplish and were focused on the opportunities that existed beyond their lives as college students. They viewed their collegiate journey as a mere stepping stone leading into their future.

### **Vulnerability**

For the context of this study, vulnerability encompasses experiences that may lead one to question their ability or cause one to exhibit weakness. As such, throughout the interview process, statements were shared that conveyed vulnerability. For instance, Lexi acknowledged the vulnerability she felt when she first began University C. Internally, Lexi felt like she was not good enough to attend University C. In addition, Lexi believed that her family's socio-economic status made her feel as if she was not as adequately prepared for success as her academic peers. Lexi shared:

I feel like I'm different or sometimes I feel like they were, or students in my major and at the university were more privileged I would say, like growing up or coming up, they had more advantages. Some of these students have taken AP exams, and taken computer programming classes and had laptops and everything since they were little kids, but as I said I had six siblings so in my home we didn't even have Internet until probably when I left for college, maybe 2010 we got internet at home. And we didn't have laptops as kids and all this type of stuff, so coming from my background, I felt like I was at a disadvantage already.... So that's what's going on in my head, not to say I was getting that feeling from everybody else, but those were the things I felt.

Likewise, Taylor discussed how vulnerable she felt regarding her academic background when she began University E. Taylor recalled “I felt like a lot of people, especially in my major, had an advantage over me. They had already programmed, completed apps, and knew Java, and I didn't even know what C++ was.”

Participants’ descriptions of their ICT academic environments also illustrated that their vulnerability was intensified in situations where they felt alienated because of their race. After experiencing a tough first semester as an ICT major at University C, Tamara felt as if she made a mistake by attending University C.

This school also doesn't have that many people of color pursuing technology degrees, so it's hard to find people to help you study, and hard for you to talk to people in classes... Sometimes I feel like being here I made a bad decision because I don't feel like I belong. The classes are so hard and the kids are so smart here, I know I got in, but sometimes I just don't feel like I am at their level and they seem to be very much together and understanding everything.

Accordingly, as the participants acknowledged their vulnerabilities they realized that they could not continue their pursuit without assistance. For example, in acknowledging her vulnerability, Abbie realized that she could not succeed without the help of outside sources. Abbie shared in her interview:

A lot of students come to University A having done really well their entire lives and they don't realize that it's not something you can accomplish all by yourself for the most part. You are going to need to have people around you and support you emotionally.

In a subsequent interview, Stacey shared how she wanted to give up and often shared her feelings of failure with her mother. Stacey stated, “My mom supports me 110%. She always encourages me, even when I’m feeling down. When I feel like I can’t handle this major. She tells me yes you can. She just encourages me to pursue it”. Further along in her interview, Stacey recalled having a conversation with one of her professors; again acknowledging her vulnerability. Stacey stated:

Last quarter actually, I wasn’t doing too well in one of my computer science classes, and I just wanted to give up. I talked to one of my teachers about it and my teacher, he said, “No don’t give up. That’s just the easy way out.” He told me that I’m doing better than what I think I am.

At the conclusion of the study, results demonstrated that all ten participants acknowledged that they had vulnerabilities and by acknowledging their vulnerabilities the participants were able to let their guards down, put their pride aside, and let their challenges be seen. As a result of this act of acknowledgement, others were able to provide the academic and emotional support the participants needed to be successful in their pursuit on an ICT degree.

#### *Race and Gender*

By attending a PWI and pursuing a field that is highly dominated by White and Asian men, statements regarding race and gender surfaced throughout the data collection process. Therefore, the fourth theme that emerged regarding the participants college experience was race and gender.

## **Race**

Given their racial status as African Americans at a PWI, several participants acknowledged that their racial status posed challenges in their pursuit of their degree attainment. For instance, throughout the interview process, some of the participants recalled feeling a sense of dejection in many of their ICT courses because of their racial status. In describing how her experience would be different if she was not African American, Jessica asserted:

I would say probably in classes I would be more inclined to speak up more and ask questions. I feel like those who dominate conversations in my classrooms aren't Black students. As far as me asking questions in class, I myself, sometimes shy away from asking questions just so I don't want to seem like I am always asking questions. I would just feel a lot more comfortable in the class to ask questions and do different things. I wouldn't be so worried about how that part looks.

Ann had similar feelings as Jessica about being an African American in her ICT courses. With sadness in her voice, she stated:

When I walk into a classroom and I'm the only Black person in class, I automatically feel left out. It seems as if everyone is judging me and questioning if I belong in class. Then I begin to doubt myself before I even get a feel of the class. So, I put extra pressure on myself to make sure I don't look like the dumb Black person in class that doesn't belong.

## **Gender**

In regards to gender, several participants noted that females were significantly underrepresented in their ICT major on their particular college campus. Participants expressed that they would often feel a high level of discomfort due to this male-dominated environment. In a discussion about her feelings about being a female in her ICT courses, Ann talked about how she would often get frustrated during open class discussions in her ICT courses. Ann believed many people doubted her abilities as a female and as a result, felt invisible in many of her ICT courses which were surrounded by males; male professors teaching predominately male students. Ann stated:

It is unexpected for me to succeed as a female. It's like three females in my class. In a lot of my classes there are about forty people so you see the teachers will be a little more inclined to say "Hey he's got the answer".

Jessica expressed similar sentiments. Jessica believed that many people in her major were bias towards males. From Jessica's perspective, it seemed as if her collegiate environment recognized the superiority of males compare to females. Jessica explained that many people doubted her academic capabilities as a female because of this environment. Jessica spoke openly about her frustration concerning this noticeable gender bias.

I think it's surprising how we're [females] considerably underestimated, especially because I meet so many powerful women who are doing just amazing things and to think that some people find it surprising that we could actually be

good at such a major. It's really surprising to know that people feel that way. It's kind of frustrating.

As Abbie's comments illustrated, issues regarding gender bias caused her to minimize her femininity. During her interview, Abbie discussed how she changed the way she dressed to not bring any unnecessary attention to herself because she was a female.

Abbie explained:

Being at University A, I've tried to analyze myself to see what kind of impact it [her gender] has made. I know I definitely started dressing differently just because you don't want to have any differentiating qualities other than your mind. I remember just times not bringing attention to, like if you have curves you don't really want to bring attention to that because that's going to take away from the fact that you're also another student that's learning, you don't want to distract the males. There's so many males around you, so you don't want to have something other than your mind being discussed about you.

### **Race Versus Gender**

When considering race and gender, it was concluded that the participants in this study placed a bigger emphasis on their racial status as African Americans than their gender status as females. Their racial status proved to be one of the greatest challenges in their pursuit of an ICT degree. Some attribute the presence of these challenges to their decision to attend a PWI which triggered a more heightened awareness of their racial status. For example, Abbie, an African American female, who previously attended a racially diverse high school and now attended a PWI where there were only a

few African Americans in attendance was caught off guard by the lack of African American students who attended her PWI. When Abbie was asked about how she felt about being an African American female attending a PWI. Abbie proclaimed, “I feel like being at University A has made me a lot more aware of my race rather than my gender”. In a subsequent interview, Pam shared a similar response to the question “How do you feel about being an African American pursuing your choice of majors”. Pam shared:

That one is a little bit more visible because there are only two others [African Americans] in our year. There's two more, I believe, in the senior level. We're very, very small, so that's a little bit harder because sometimes you have to worry about being the only one. There's not a lot of exposure and there's not a lot of people to connect with. Sometimes when you come up with a situation, you're in a tough spot because you're the only one in that group as a black person. You're just like, "Aaah”.

### **The Duality of Race and Gender**

There were a few times throughout the interview process where the participants expressed challenges due to the duality of their race and gender. For example, in a discussion about how it feels to pursue animation and game design, Mary recalled feelings of intimidation because she was always the only African American female in class. Mary stated, “Whenever I visit any gaming studio or animation studio, I don’t see many women or people of color. It’s kind of a little bit intimidating”. Similarly, Stacey reflected on feelings of intimidation because she was an African American female in an

environment that was composed of predominately White males. Stacey noted how people would just stop and stare at her because of her presence in the room. Stacey stated, “At first it was intimidating [being a Black female] because when I first walked into my first Computer Science class, people literally just stopped and stared at me. I was like, *Okay this is kind of weird* [emphasis added]”. In Tamara’s interview, we candidly discussed her feelings of being a female in her major. Similar to other participants, Tamara also had feelings of frustration and felt intimidated by the males in her major. However, what was interesting was that Tamara acknowledged that she was comfortable with males in general but was particularly uncomfortable with the White males in her major. Tamara asserted:

Guys don't faze me. I definitely feel as though I'm just as good as them, if not better than them. So that part doesn't really affect me as much because I know my worth and I know that a lot of times when guys are talking and they don't really understand what they're talking about. I've always had a lot of guy friends, so being around guys doesn't really bother me that much; it's more so being around White men all the time that bothers me the most.

Accordingly, the above narratives illustrated that the participants faced undue and unavoidable challenges because of their race, gender, and the intersection of the two.

### **Discussion**

The purpose of this study was to explore the pre-college experiences and college experiences of African American females who are pursuing an ICT degree at a PWI. This study employed a qualitative methodology in an effort to understand the true

essence of the experiences of the ten African American females who were purposefully sampled for this study. Through the use of in-depth interviews, the researcher was able to hear their actual voices as they relived their experiences as African American females in pursuit of an ICT degree. Interview data was then analyzed and themes were developed that provided an understanding of the ten participants' lived experiences and meaning of their shared personal narratives. Please note that the findings of this study reflects the experiences of the African American females who participated in this study and may not be applicable to all African American females in pursuit of an ICT degree. Each African American female in pursuit of an ICT degree will have her own unique experiences that have impacted her pursuit and perseverance.

Research question one asked "What are the pre-college experiences of African American females that have impacted their decision to pursue an ICT degree at a PWI?" Findings of this study suggested that the decision to pursue an ICT degree was based primarily upon experiences that involved the participants' high school academic achievement, the influence of family, and their ability to embrace challenges. Experiences that have been reported throughout the literature such as early ICT exposure and the presence of African American female ICT mentors appeared to be less influential in their decision to pursue an ICT major.

According to Margolis et al. (2008), powerful secondary academic learning opportunities that demand students advance their knowledge beyond the basic required academic coursework are important to students who pursue ICT majors. Similarly, prior research noted that students who pursue ICT fields are expected to have a strong

secondary academic background with an emphasis on math and science to successfully prepare for the academic rigor that is incorporated in ICT intensive coursework (Margolis et al., 2008; Riegle-Crumb & King, 2010). As such, the research findings produced in this study support prior research that suggested students who pursue STEM majors often encounter high expectations and enriched classroom experiences as well as more advanced academic courses prior to college (Russell & Atwater, 2005). In particular, the findings of this study show that nine of the participants had academic abilities that promoted advanced academic learning before entering college. These nine participants either attended an academically advanced high school or enrolled in a variety of advanced academic courses such as AP and IB courses while attending high school. Two of the participants even had the opportunity to take a Computer Science AP course while attending high school. In addition, findings suggested that the participants' high school academic background had a significant impact on their postsecondary achievement. Seemingly, this type of advanced learning adequately prepared the participants for postsecondary academics. This finding is consistent with other studies (Freeman, 1997; Hrabowski et al., 2002) that demonstrated African American students' high school environment and performance within this environment is paramount to African American students' postsecondary success.

Unlike the other nine participants, one participant did not experience an advanced high school academic background. In fact, she had an academic disability and experienced difficulty with mathematics. Yet despite her academically challenged background, she did not let her disability stop her from pursuing an ICT major.

The results also suggested that the African American females who participated in this study experienced a home environment that had a significant influence on their postsecondary academic decisions. All of the African American females studied experienced a supportive family network that encouraged them throughout their academic endeavors. More specifically, high academic expectations enforced by seven of the participants' parents pushed them to obtain high levels of academic success. Participants expressed that their parents viewed education as a vital entity that helps promote long term success so they were expected to thrive academically. This finding is consistent with research that has found that African American students who have parents who set high expectations for academic achievement are more likely to have high achievement orientation and academic success (Hrabowski et al., 2002; Russell & Atwater, 2005).

Results of this study also indicated that the parents of the participants also motivated their daughters to earn a lucrative salary. As such, this source of motivation became an influential factor in their decision to pursue an ICT degree. Most of the participants came from a low to middle-class socio-economic background in which their parents worked hard but often struggled financially. Five of the African American females who participated in this study came from a single-parent household and three of the participants are daughters of immigrant parents who worked low-income jobs. Therefore, many of the parents could not afford their daughters some of life luxuries that many take for granted such as having home Internet access. As one participant shared "I come from a hard-working family, single-parent, low-income home." As such, the

participants' were often encouraged by their parents to acquire a degree that affords a lucrative salary so that one day they will be financially stable and secure. This finding is consistent with Hanson (2004) who explained that minority families provide considerable encouragement to their daughters and place an emphasis on education as a source of mobility. However, this research is contrary to past research that documented a poor academic path that is engulfed in an array of academic challenges for low income African American students (Gutman & McLoyd, 2000). These families instead motivated their daughters to succeed beyond their educational and occupational levels in an effort to earn a lucrative salary.

Overall, by setting high expectations for their daughters and motivating them to have a lucrative career, the participants' parents led them on a positive academic pathway that was different from their own. That is, the parents of the African American females studied did not want their daughters to follow in their footsteps and experience the same financial hardships they experienced. This finding adds to the body of research on African American females in pursuit of an ICT career by showing the importance of parental influence that is implicitly expressed by being "living examples" for their daughters. For six of the participants, their parents were living examples of what is to like live with financial difficulties or as some would say in the African American community "to struggle". As a result, most of the participants had a desire to surpass their parents' educational and occupational accomplishments or lack thereof. Alternatively, for two participants, their parents were living examples of occupational "success". For instance, Mary witnessed the benefits of her mothers' lucrative

engineering career, so she had a desire to obtain the same occupational success. In another instance, Danielle's decision to pursue an ICT major was primarily based upon her father's ICT career; a living example of ICT career attainment and success.

All of the African American females who participated in this study demonstrated that they were not constrained by the outcome of failure but willing to take risks in an effort to move forward to the next phase in their life or accomplish an arduous task. For instance, some participants took risks on their postsecondary academic choices (i.e., institution's geographical location and being able to handle the climate of a PWI), one participant risked failing because of academic disabilities, and one participant took risks in breaking various technological devices in an effort to learn ICT related concepts.

Accordingly, this research suggest that by allowing themselves to take risks and embrace their challenges, the participants were able to grow academically and as individuals.

This was an unexpected finding because prior research on African American females tend to focus on African American females' ability to cope with the dual challenge of being an African American and a female (Winkle-Wagner, 2015). Therefore, this research extends past research to suggest that not only are African American females able to cope with challenges but they also embrace challenges. In the literature, coping refers to efforts made to manage a situation that one deems stressful or tax's one personal resources, and focuses on risk management once a challenge arises (Pearlin & Schooler, 1978). Thus, coping can viewed as reactive; an action that occurs after one is confronted with a challenge. However, this study does not suggest that the African American females who participated in this study were merely being reactive and coping

with a challenge but rather suggests that the participants welcomed challenges. The participants viewed their challenges as opportunities for progression leading them into their future endeavors.

Moreover, it is also important to note that experiences involving early ICT technology exposure were not as influential in the participants' decision to pursue an ICT degree in comparison to experiences that involved the participants' high school academic achievement, the influence of family, and their ability to embrace challenges. Data demonstrated that precollege ITC exposure was influential in five of the participants' decision to pursue an ICT degree. Contrary to the previous finding that illustrated that nine of the ten participants were exposed to advanced secondary education prior to beginning their pursuit of an ICT degree, only five of the participants had ICT related exposure prior to beginning their pursuit of an ICT degree. These five participants engaged in technology related activities such as enrolling in secondary computer programming courses, joining robotics clubs, attending summer computer science camps, and learning advanced software installation and hardware repair. As such, these activities fostered an interest in an ICT major for these participants and provided them with an advanced technological academic foundation before entering college. This finding is consistent with prior research that suggested prior experience with computing and secondary high-level computing courses empower students to obtain a postsecondary advanced computing degree (Margolis et al., 2003). For the other five participants, formal ICT exposure to technology did not occur until college. Opportunities to learn ICT related concepts were non-existent or one's interest had yet to

be ignited prior to entering college. In fact, some participants had no idea that pursuing an ICT career was an option and began college as other majors. Therefore, it was concluded that precollege ICT exposure is not a major determinant of African American females' decisions to pursue an ICT degree. African American females can still pursue an ICT degree and experience success within the major despite having prior ICT exposure.

Other experiences that involve the influence of an African American female role model or mentor that have been cited in literature as being influential in African American females' decision to pursue ICT were also found to be less influential for the participants studied. Only two of the ten participants discussed having a role model/mentor before attending college that helped to promote an interest in ICT. Instead, acts of love and academic encouragement from the participants' mothers and fathers provided the participants with the necessary encouragement to pursue their selected postsecondary degree.

Research question two asks "What are the experiences of African American females that have helped them to persevere in their pursuit of a postsecondary ICT degree at a predominately White institution?" Findings of this study suggested that the African American females pursuing an ICT degree at a PWI that participated in this study were able to persevere through the challenges due to experiences that included a desire to become a role model, acknowledging their vulnerabilities, resilience, and racial identity awareness. Experiences that have been previously discussed in the literature

that involve the participants' academic environment appeared to be less influential in their perseverance as ICT majors.

A driving force in the persistence of the African American females studied was a need to motivate others to pursue their academic goals. Past research focused on the importance of role models/mentors in the perseverance of African American females in STEM (Hodari et al., 2014; Hrabowski et al., 2002). However, for this study, the participants' perseverance was motivated by their own role as role models. Essentially, the participants took on the responsibility of becoming a role model for others. Interestingly, seven of the African American females studied felt an obligation to achieve academic success in an effort to become a role model for their younger siblings and other African-American females. Through these experiences, they viewed themselves as role models for others to follow in their academic footsteps. Their experiences and perseverance through the challenges of being an African American female pursuing an ICT degree was motivated by unselfishness that focused beyond self. Accordingly, Patton (2009) recognized that many African American females feel as if they have a responsibility to provide a pathway for other African American females in an effort to help other African American females overcome the dual-edge burdens of race and gender. Thus, being able to receive an ICT degree from a PWI was not only for their personal satisfaction and future career opportunities but obtaining an ICT degree was also for the benefit of other African Americans. As such, this research extends past research to illuminate the importance of African American females taking on the

responsibility of becoming role models for other African Americans and the positive effect this role has on their perseverance.

For this study, vulnerability was defined as experiences that may lead one to question their ability or cause one to exhibit weakness. Therefore, for some, displaying one's vulnerabilities indicates a sign of weakness that limits their success. For example, work on African American college students and stereotype vulnerability found that African American students were more likely to be affected by stereotype vulnerability than Anglo-American students and as a result the African American students' academic self-efficacy was found to be negatively affected by their vulnerability (Aronson & Inzlicht, 2004). However, results of this study demonstrated that being vulnerable and exhibiting one's imperfections and flaws may instead lead one to academic success. Specifically, results indicated that by acknowledging their vulnerabilities, all of the African American females who participated in this study were able to persevere through the challenges in their academic environment. Throughout their pursuit of an ICT degree, the participants encountered challenges as a result of their socio-economic status, race, and/or academic ability that caused them to be vulnerable. Yet, instead of letting their vulnerabilities impair their pursuit, the participants acknowledged their vulnerabilities and audaciously labored through these challenges to attain to their goal. This was an unexpected finding because being vulnerable is often viewed negatively that consequently produces negative outcomes for the individual displaying such vulnerability. However, this was not the case for this study; being vulnerable promoted academic growth. Brown (2010) confirmed this statement, she discovered that

vulnerability is the birthplace of belonging, courage, and creativity, and the cornerstone of confidence. Moreover, by acknowledging their vulnerabilities and accepting that they were not able to continue in their pursuit on an ICT degree alone, the participants were able to seek support from family members, peers, professors, religious groups, and student organizations. As a result, these sources of support were able to assist the participants in their pursuit either academically or emotionally. As Brown (2010) noted, being vulnerable is being able to share our struggles and stories with others from whom we trust. Most importantly, this finding adds to the body of research on the perseverance of African American females in pursuit of an ICT career by showing the importance of African Americans females being able to acknowledge their vulnerabilities in academic climates where they are more susceptible to academic, gender, and/or race challenges.

Five out of the ten participants described their college experience as an ICT major as a journey; a journey that was laden with adversities. Others' described their college experience as rough, difficult, and/or challenging. Furthermore, instances of adversity were conveyed by all ten participants that often times led to failure and even caused many of them to change majors, retake courses, or for one participant change universities which resulted in a delay of degree attainment. Yet, despite their adversities, the participants were resilient. The Webster dictionary defines resilience as the ability to recover readily from adversity. As such, results demonstrated that when faced with adversities as ICT majors, the participants were still able to work towards their goal of earning an ICT degree. Their ability to continue on their pursuit against the challenges of being an African American at a PWI and academic failures, and for some

disadvantaged academically because of early ICT exposure stems from their resilience. Historically, when marginalized groups such as African American females experience academic success, research has found that their resilience contributed to their success and their accounts of beating the odds against racism and sexism (O'Connor, 2002; Winkle-Wagner, 2015). Thus, this study supports past research that has found that African American women have shown remarkable resilience with regards to educational mobility at PWIs (O'Connor, 2002) and extends it to African American females pursuing ICT degrees at PWIs.

It also important to discuss the vital role that the participants' support networks within their academic environment played in their resilience. Many studies demonstrated the importance of having a strong support network to assist females and racial minorities in hostile and uninviting STEM environments (Hrabowski et al., 2002; Margolis & Fisher, 2002; Ong et al., 2010). For example, Ong et al. (2010) wrote, "Women of color seek out academic and personal support vigorously and with serious intent. These relationships serve to bolster their confidence and learning in STEM majors as well as their determination to graduate" (p. 185). Thus, similar to past research, the results of this study also demonstrated the vitality of support networks for the African American females that participated in this study. According to the findings of this study, the participants experienced support networks that bolstered their resilience. These support networks were composed of peer groups, college faculty, academic organizations, and church communities.

Furthermore, failure was not an option for most of the participants studied. As such, their personal drive to succeed was an influencing factor in their perseverance as ICT majors. Although the participants were aware of the challenges and the racial disparities that existed within their collegiate environment and academic major, their personal desire to obtain their ICT degree allowed them to sustain in their pursuit. Notably, one participant recalled, “I realized I’m worth the investment”. Six other participants also shared the same sentiment as they continued in their pursuit of an ICT degree. However, it is important to note that several participants did not initially begin their pursuit believing they belonged or were capable of accomplishing such a challenging goal as an African American female at a PWI. There were times when the participants wanted to give up, but at some point in their pursuit their personal desire to succeed prevailed over their feelings of defeat. For two of the participants, their personal desire to succeed occurred after taking their first postsecondary computer programming course. Ong et al. (2010) attested that part of this inner personal desire to succeed relates to how women of color tap into their racial /ethnic identities. Researchers found that when African American women tap into their racial identity they are more likely to have a more positive sense of self and develop a feeling of inner satisfaction about being an African American (Ajibade, Hook, Utsey, Davis, & Tongeren, 2015). This feeling of inner satisfaction in turn leads to a better psychological well-being that helps buffer against the damaging effects of racism (Ajibade et al., 2015). Thus, based on the findings of the study it is concluded that being aware and

acknowledging their racial identity also assisted in the participants' perseverance as ICT majors at a PWI.

For the context of this study, racial identity is defined as the extent to which people of color are aware of, understand, and value their racial background and heritage (Gratham & Ford, 2003). Research indicated that racial identity has a significant impact on African American students' academic achievement, motivation, and attitudes toward school (Grantham & Ford, 2003). In a study of study of successful African American girls pursuing STEM academics, Hrawbowski et al. (2002) discovered that racial and gender identity was a significant influence on the participants' academic success. Alternatively, racelessness is described as the desire to minimize cultural connections and is often times adopted by high achieving African American students to improve their success in school (Robinson & Ward, 1991). According to Robinson and Ward (1991), racelessness promotes self-alienation and encourages both psychological and physical separation from the broader African American community. As the findings demonstrated, the African American females who participated in this studied were often situated in environments where they were underrepresented and isolated due to their racial status but instead of employing racelessness or disregarding the racial issues within their academic environment, the African American females who participated in this study embraced their racial identity. This awareness of their racial identity was evident from the organizations that they joined (i.e., NSBE) and the peer groups they amalgamated with. Please note that the finding regarding NSBE may be due to participant recruitment efforts that took place at a NSBE convention; eight out of the ten

participants were recruited at a NSBE conference. However, past research demonstrated that participation in STEM related clubs may help women of color feel more connected to the STEM community by monitoring and facilitating positive academic support and providing role models/mentors that students may not find elsewhere (Espinosa, 2011).

Moreover, it is vital to discuss that findings of this study also illustrated that the experiences of African American females in ICT education are unique and differs from Anglo-American females and African American males. That is, Anglo American females only have to endure barriers due to their gender and African American males only have to endure barriers due to their race. Yet, the African American females in this study had to endure barriers of both gender and race in their pursuit of an ICT degree. The participants noted challenges that occurred due to their racial identity as an African American and gender identity as a female. As three participants explained, being in environment as an African American female with predominately males and specifically Anglo American males at a PWI made their pursuit of an ICT degree very challenging. However, it was also noted from the data gathered, in their academic environments the participants were more aware of their racial identity rather than their gender identity as a female. Although gender was pervasive throughout the research findings, it was typically considered as an afterthought to race. The literature suggests that this may be due to the construction of gender in the African American community (Hanson, 2004). For instance, Hanson (2004) directed this assertion to the construction of gender in the African American community as being congruent and not at odds with the personal characteristics needed for success in STEM: high self-esteem, independence,

assertiveness, and high educational and occupational goals. Interestingly, historical analyses have suggested that the tradition of male dominance in White families in the United States has not been replicated in African American families. Therefore, it is suggested that this lack of male dominance in the African American household contribute to greater self-esteem, independence, and assertiveness as well as high educational and occupational expectations among young African American women (Hanson, 2004).

Nevertheless, the participants' academic environment proved to be a negative influence on their perseverance as ICT majors at a PWI. Despite the studies that have found that the academic environment was paramount to ethnic minority women's academic success (Espinosa, 2011), nine out of the ten participants expressed that their postsecondary academic environment was often isolating and unwelcoming. This finding may be attributed to the participants' enrollment at a PWI which has been known to be hostile and uninviting to African American students. Although, it is also important to mention that one participant described her PWI's environment as "amazing" and "welcoming". This may be due to the size of the student body at her PWI which had a smaller student body in comparison to the PWIs that the other participants attended.

### **Implications**

Although this study is limited by a small qualitative study, these results reflect the actual experiences of the ten African American females who are actually pursuing an ICT degree and may be applied to promote interest or help support other African American females in ICT. Therefore, based upon the results of this study, it is essential

that African American families provide encouragement and set high expectations for their daughters that will help their academic development and foster high levels of academic achievement. Also it is important that African American parents work on developing their daughters' overall self-esteem and confidence. This would help in building a strong emotional foundation for their daughters that will allow them to be uninhibited by the fear of failure and embrace their challenges head-on. They would have the confidence to succeed despite the circumstance. In addition, by building their self-esteem as African American females, their daughters will feel more connected to their gender and racial identity which has been found to promote overall ICT success for ethnic minority women.

Results also re-emphasize the importance of promoting high secondary academic achievement to assist African American females' in their postsecondary decisions and academic success within ICT disciplines. It is essential that African American females are provided the opportunity to take rigorous and advanced academic courses like AP and IB courses that will provide them with a solid academic foundation that can assist in their secondary as well as postsecondary academic success. However, in lieu of academic challenges, strategies that can be used to achieve high academic achievement include seeking help from teachers, peers, and tutors, and acknowledging one's academic vulnerabilities. For example, when faced with academic challenges, African American girls should be taught that it is okay to ask for help and let their fears or deficiencies be known so their parents, teachers, or peers may assist them in overcoming these deficiencies.

Furthermore, given the positive feedback about NSBE and the role it played in the participants' perseverance, it is suggested that African American females pursuing ICT degrees should participate in minority focused student organizations that would help promote a sense of community at their PWI as well as provide academic and social support to assist them in their pursuit in of an ICT degree. Also, encouraging African American females to seek academic peer support from peers who share the same sex and race as well as peer support outside of their academic majors through entities such as religious communities may be paramount to their resilience and overall emotional well-being.

### **Limitations**

One limitation of this study is that its findings are not generalizable. The findings of the study only reflect the experiences of the ten African American females that participated in this study and cannot be used to generate a theory that explains the decision to pursue ICT academics and the persistence within this field for all African American females.

A second limitation to this study is the researcher presence during the interview process. Due to the data collection process in qualitative research, the participants' may have experienced discomfort while being interviewed which ultimately may have affected the participants' responses.

Another limitation to this study is the diversity of ICT majors studied. Most of the study participants were computer science majors so the findings of this study predominately reflect the perspectives of African American females who are computer

science majors. As such, African American females who are pursuing other ICT majors should be studied.

### **Recommendations for Future Research**

First, given the lack of literature on African American females pursuing ICT academics, additional studies that specifically study African American females in pursuit of ICT degrees are needed to fully understand their experiences in this male dominated field. Furthermore, conducting more research with this special population of students and hearing their experiences through their actual voices will increase the body of literature regarding African American females in STEM. This area of research requires additional investigation because too little remains known about this special population of students. Recommended topics include in-depth research on the influence of family on African American females' decision to pursue postsecondary ICT academics, a comparative study of collegiate environments, the impact of K-12 ICT academics, and African American females who were unable to persist as an ICT major at a PWI.

A comparative study concerning the experiences of African American females attending a PWI in comparison to the experiences of African American females attending a Historically Black College and University (HBCU) is needed. The ten females studied all attended a PWI where race was an overwhelming obstacle they had to overcome. However, for African American females attending an HBCU, race issues are non-existent and one less obstacle to overcome. As such, a study of this nature should be conducted to investigate the influence of the collegiate environment on the perseverance of African American females pursuing ICT degrees. Moreover, exploring

the historical significance of HBCUs and the strategies that these institutions employ to support in the academic development of African American students could be very useful to PWIs in regards to the recruitment and sustainability of African American ICT majors.

Another question that could be addressed in future research is: what impact does K-12 ICT academics have on African American females' decision to pursue postsecondary ICT academics? Further investigation is needed to specifically identify strategies that will help K-12 educators promote ICT education for African American females in an effort to motivate African American females to pursue postsecondary ICT academics. In addition, by studying the impact that K-12 ICT academics have on African American females' decision to pursue ICT academics, findings would provide insight on how prior ICT knowledge impacts the persistence of students pursuing ICT majors regardless of race or gender.

Lastly, it is also important to conduct a study that would investigate African American females who were unable to persist as an ICT major. Many of the African American females that were studied recalled times where they wanted to give up and pursue other disciplines yet they somehow still were able to persist through their adversities. However, for some African American females, this is not the case. Hence, it is important to also study those who were unable to overcome the challenging demands of pursuing an ICT major at a PWI. It is extremely important that researchers recognize and address the specific challenges that this particular population of students were unable to defeat. As such, these findings would provide insight for educators,

parents, as well as student organizations that promote STEM learning for African American students and serve as a guide for these entities in an effort to ensure other African American females are able to persist and surmount the challenges of pursuing an ICT degree.

### **Conclusion**

The ten African American females studied gave insight into their lives to help us understand the factors that influenced their decision to pursue postsecondary ICT academics and how they were able to persevere through the challenges in a field from which they have been historically underrepresented due to their race and gender. Although additional research is needed to fully understand the trajectories of African American females pursuing an ICT degree, the findings of this research supports exiting research on African American females in pursuit of a STEM degree and their persistence within these fields. In particular, family, secondary academic background, and their ability to embrace challenges were determined to influence the ten African American females studied to pursue an ICT degree. Moreover, their desire to become role models, acknowledgement of vulnerabilities, resilience, and an awareness of their racial identity helped them persevere through their academic challenges.

Overall, this research represents only a small piece of the puzzle regarding African American females in ICT. As previously mentioned, there is a long way to go before we can truly understand the academic and lived experiences of African American females in this field. However, it is the intention of the researcher to bring awareness to the issue of underrepresentation of African American females in ICT academics and

careers and the challenges they face. Inherently, we must do all that we can do to shed light on the underrepresentation of this special population of students and promote more research in this area. Most importantly, because we are at a time where advanced technology innovations dominate how we live and work, increasing and diversifying the number of ICT professionals is a global phenomenon that everyone at all levels of society must recognize.

**CHAPTER III**

**EXAMINING THE FACTORS THAT INFLUENCE AFRICAN AMERICAN  
ADOLESCENT FEMALES TO PURSUE SECONDARY INFORMATION  
COMMUNICATIONS TECHNOLOGY EDUCATION**

High school is a critical time in the lives of adolescents when it comes to making academic decisions about their future. The academic decisions that adolescents make while attending high school can have lasting effects on their postsecondary academic success and even their future career choices. According to Van Der Vyver, Crabb, and Lane (2004) academic subjects chosen in the final two years of high school have a strong influence on the overall career choices of students and the choices they make about their postsecondary education. Furthermore, past research has found that students who make the decision to take rigorous academic courses in high school are more prepared for college and are more likely to obtain a college degree (Tyson, Lee, Borman, & Hanson, 2007). For this reason, students must seize every opportunity to advance their academic growth while in high school in an effort to adequately prepare for academic success beyond secondary education.

Moreover, the recurring evidence concerning the importance of taking advanced STEM courses in high school for students pursuing postsecondary STEM education is overwhelming. For example, a research study conducted by Crisp, Nora, and Taggart (2009) demonstrated that a student's achievement in secondary advanced STEM academic subjects was related to positive STEM outcomes at the postsecondary level.

The literature indicates that while in high school, students begin to narrow their academic interests and those students who have strong interests in STEM begin to orientate more towards advanced STEM academics and careers at this particular stage of their academic development. Often, by the time students enter college, they have already decided whether or not to pursue a STEM major, with this decision being primarily based on earlier success in secondary STEM subjects. Tyson, Lee, Borman, and Hanson (2007) argued that the pathway to a successful STEM career must include high school STEM academics, a successful transition to higher education, completion of a baccalaureate degree in a STEM major, successful school to work transition, and workforce participation. Therefore, it is implied that if students do not complete each component of the STEM career pathway, students are diminishing their chances of having a successful STEM career.

Accordingly, when it comes to the importance of students pursuing a career field in a STEM area such as Information Communications Technology (ICT; careers that include the work of computer analysts, programmers, software engineers, computer managers, internet architects, and webmasters; Anderson et al., 2008), existing literature demonstrates that high school is a critical time to spark interest and influence students to pursue ICT careers. The literature advocates that before students begin their pursuit of an ICT career, it is imperative that students gain exposure to the rigorous curriculum that high school ICT courses (i.e., courses that teach computer programming, web mastering, graphic design, or computer networking) entail before entering college and deciding on an ICT major. Yet, many students are deciding not to enroll in high school ICT courses

and are not motivated to pursue ICT majors. According to several researchers, there has been a significant decline in the number of students electing to pursue postsecondary ICT education contrary to the popularity of technology and students' frequent use of technology (Downes & Looker, 2011; Van Der Vyver et al., 2004). Considering this, politicians and policymakers have become increasingly worried about the overall decline in interest, as well as expertise in ICT in the United States, fearful that America will lose its innovative edge (Margolis et al., 2008). Even more, the small number of students enrolling in ICT degree programs indicates serious skills shortages for the United States economy and the United States ability to compete globally with other countries in the future. For reasons such as these, researchers propose that policy makers address the challenge of low participation rates starting with secondary ICT education, the beginning of the ICT pipeline (Downes & Looker, 2011; Margolis et al., 2008; Van Der Vyver et al., 2004).

Seemingly, researchers have made concerted efforts to find ways to increase specific populations in ICT education such as females and ethnic minorities because of their low rates of participation due to documented gender or racial disparities within this field. However, research investigating the underrepresentation of females and ethnic minorities in high school ICT education and even ICT careers does not focus on the underrepresentation of ethnic minority females who are underrepresented due to both race and gender such as African American females despite the vital need to also increase their presence in ICT education and careers. Ong et al. (2011) proclaimed that the absence of ethnic minority women such as African American women in STEM careers

represent “tremendous untapped human capital and could further provide a much-needed force for sustaining America’s economic vitality” (p. 173). Furthermore, the limited amount of research specifically investigating African American females creates an issue of inequality that overlooks the potential of African American females in both ICT education and careers. So, the question of whom or what helps African American females in their pursuit of ICT education and careers cause great concern and demonstrates that a problem exists in the ICT pipeline.

### **Review of Literature**

For years, there has been both a racial and gender divide in secondary ICT education. Past literature documents that the ratio of females and African Americans pursuing both secondary and postsecondary ICT education is relatively low compared to the number of White and Asian males pursuing ICT education (Adya & Kaiser, 2005; Lader & Vandegrift, 2011; Margolis et al., 2008). For example, data from a 2010 Taulbee report showed that in the United States, African Americans (4.4%) and women (11.1%) represent only a minute portion of bachelor’s degree recipients in ICT fields (Lader & Vandegrift, 2011) compared to the 2010 U.S. census data where 12.6% of African Americans and 50.8% of women represent the U.S. general population (Howden & Meyer, 2011; Humes, Jones, & Ramirez, 2010). As a result of low documented participation rates of females and ethnic minorities such as the previous example, many researchers have investigated the extent to which different factors affect female and ethnic minority students’ participation in ICT. Among the factors that have been investigated, researchers have found that factors such as the influence of parents, peers,

teachers/counselors, and media, as well as students' use of technology and interest are very influential in underrepresented students' decision to pursue secondary ICT education. As such, this review of literature discussed these factors as they relate to both females and ethnic minorities; two groups that African American females are members of.

### *Parents*

There are numerous reports in the literature that indicate parents are highly influential in shaping and supporting underrepresented students' ICT academic and career aspirations (Adya & Kaiser, 2005; Margolis et al., 2008; Margolis & Fisher, 2002). For instance, researchers have discovered in their investigation of females and ethnic minorities pursuing ICT education that parents' expectations and assumptions have a weighty influence on students' academic decisions especially in regards to ICT education (Margolis et al., 2008; Margolis & Fisher, 2002). Reportedly, parental influence has the biggest impact on adolescent females' decision to pursue ICT education (Adya & Kaiser, 2005; Smyth & Darmody, 2009). Kekelis, Ancheta, and Heber (2005) for example, found that an adolescent female's interest in computers and careers in ICT is tied to her parent's positive opinion of technology and their high expectations for her success in the field. However, there is also research that confirms that parental influences can also steer adolescent females away from ICT related subjects. It is found that gender expectations imposed by parents may dampen females' interest in computing (Adya & Kaiser, 2005; Margolis & Fisher, 2002). Past research from Margolis and Fisher (2002) study demonstrated that parents often impart their

enthusiasm for computers more towards their sons rather than their daughters and as a result, young males developed an early interest with working with computers whereas adolescent females' interest in computing became muted and never have the opportunity to ignite (Margolis & Fisher, 2002). However, this finding may no longer be the case. As a result of the recent growing ubiquity of technology, females may now be expected to pursue technology education and careers altering past parental views about females in ICT.

For African American students, Russell and Atwater (2005) documented that the most critical factors often having an impact on the academic achievement of African American students in STEM is the degree of parental involvement and the level of parental expectations they encounter in the home environment. In particular, parental income and educational levels have also been found to be influential in the participation rates of African American students pursuing ICT academics. Research conducted by Margolis et al. (2008) discovered that students who had parents who were engineers, worked in the computing industry, or had access to material resources available at home were more likely to take ICT related courses and succeed in such courses. Yet, previous research has illustrated that African American students often do not have parents who have obtained high levels of STEM success or do not have parents who are able to provide the material resources needed to help advance their child's computing knowledge (Gruca, Ethington, & Pascarella, 1988; Margolis et al., 2008). Considering this, it has been found that African American students sometimes become discouraged from pursuing ICT academics (Margolis et al., 2008).

## *Peers*

Many researchers contend that peer groups have a strong power in influencing the types of courses that high school students take and their success within the courses. As such, Margolis et al. (2008) posited that a peer learning community is vital in sparking, facilitating, and nurturing students' interest in learning more about computing. Particularly, regarding adolescent females, the literature suggests that compared to males, during females' adolescent and post-adolescent stages of life, positive peer influences are often observed to have a great impact on their ICT self-concept, self-efficacy and academic experiences (Adya & Kaiser, 2005). In addition, the literature on African American students and the influence of peers suggest that positive peers groups foster and create a culture of academic success in STEM for African American students (Hrabowski et al., 2002).

However, despite the literature that has found that peer groups may positively influence underrepresented students to pursue ICT education, there is also literature that demonstrates peer groups may have a negative influence on females and African American students' decision to pursue ICT education. Reportedly, the negative effects of peer groups for females in ICT courses have manifested in feelings of isolation and alienation (Margolis & Fisher, 2002), a loss of self-confidence (Margolis & Fisher, 2002; Van Der Vyver et al., 2004), and discouragement of academic success (Margolis et al., 2008). Several researchers also posit that there are only a few females in ICT education because females often lose confidence and feel isolated in ICT classroom environments because females perceive their peers (mostly males) as doing better than

them with much less effort (Downes & Looker, 2011; Margolis & Fisher, 2002). Other researchers posit that because of peer groups, females remove themselves from ICT environments out of fear of being called a nerd or geek by their peers (Gal-Ezer et al., 2008). Margolis and Fisher (2002) further discovered that in comparison to males, the geek myth was vastly more damaging to females pursuing ICT academics than boys pursuing the same academic subjects. Similarly, findings from Harris and Marsh (2010) demonstrate that many academically successful African American students compromise their achievement and minimize their intellectual competence in high achieving academic environments such as ICT environments because of their peer networks. Therefore, in the absence of a positive supportive peer network, females and African American students may be unmotivated to pursue advanced academics such as ICT.

#### *Teachers and Counselors*

The judgments that teachers and counselors make and the encouragement or lack thereof to take certain courses also influence females and African American students' decisions to pursue ICT academics. Darling-Hammond (2000) asserted that having access to qualified teachers is one the most influential resources for broadening underrepresented students' opportunities to learn and raising their achievement levels. Reports throughout the literature even suggest that when properly trained and equipped with valuable resources, teachers become valuable social change agents in increasing student participation in ICT, especially for students who have been historically underrepresented in the field (i.e., females and ethnic minorities; Darling-Hammond, 2000; Goode, 2007; Margolis et al., 2008). As Margolis and Fisher (2002) reported,

teachers and counselors are critically important for influencing and identifying female students who would be successful in ICT and in many cases, teachers and counselors may be the single source of academic support for African American students pursuing ICT academics (Margolis et al., 2008).

On the contrary, other research demonstrates that examples of gender and racial biases from teachers and counselors have been found to be obvious in many classroom environments and that it deters females and African American students from pursuing ICT education (Goode, 2007; Rowan & Lynch, 2011). A line of research suggests that the assumption that technology and other STEM related subjects is for White or Asian male students is often reinforced by teachers and counselors (Adya & Kaiser, 2005; Margolis et al., 2008; Margolis & Fisher, 2002). Seemingly, teachers and counselors look primarily to White and Asian male students to have a flair and interest for computing rather than female and African American students. For example, Margolis and Fisher (2002) reported that teachers and counselors often look for female students who “look like boys and whose interest in computing mimics boys” (p. 48). Therefore, teachers’ and counselors’ vision of what ICT is and who can succeed at it often drives females and African American students away from ICT academics.

### *Media*

Past literature demonstrates that the media adolescents view may influence students’ academic decisions. However, prior research primarily focuses on the negative influence media may have on females and African American students’ decision to pursue ICT academics (Margolis et al., 2008; Margolis & Fisher, 2002). For example,

researchers have found that media outlets reinforce gender stereotypes that primarily focus on females' physical image than on motivating career choices and as a result, females want to conform to these images in response to the social pressures encouraged by the media (Adya & Kaiser, 2005; Milke, 1999). Furthermore, the images that adolescent females frequently see in the media are not of women who are computer professionals making great strides in their profession but rather women who society views as feminine, beautiful, and perfect in appearance especially in regards to body, hair, and clothes; someone who is only focused on their physical appearance (Adya & Kaiser, 2005; Milke, 1999). Yet, when women are portrayed as computer professionals, they are often portrayed as nerdy and physically unappealing. Sadly, it seems as if society is teaching adolescent females to focus on their physical image rather than the intellectual ability. Therefore, when it comes time for females to make academic or career decisions in regards to ICT, many females feel as if ICT professionals do not meet the societal norm of the perfect woman they often see in the media and opt out of these types of courses that portray women who are physically unappealing.

In addition, the literature investigating the influence of media on African American students has suggested that portrayals of African Americans in the media are also often found to be negative and reinforce negative racial stereotypes. As such, it has been concluded that the negative racial stereotypes of African Americans that are abundant in today's media assist in creating barriers that prevent many African American students' academic success. Margolis et al. (2008) further reported that minority students are critical consumers of a wide range of media which by large lack a

diversity of positive role models. According to Margolis et al. (2008) this lack of role models found in the media can be a significant factor in African Americans' decisions about whether or not to pursue ICT education.

### *Technology Use and Interest*

Recent attention has focused on the influence of students' technology use and interest in choosing ICT courses. Researchers have found access to technology and students' technology use is instrumental in students' decision to pursue ICT academics (Turner et al., 2002; Zarrett & Malanchuck, 2005). For instance, women in ICT careers cite access to a computer and frequent computer use was a strong influence in their decision to pursue a career in ICT (Turner et al., 2002). In addition, Zarrett and Malanchuck (2005) discovered that females' use of technology and perception of technology ability was the only determinant of White female students' decision to pursue an ICT career.

For African American students, the literature on the influence of students' technology use and interest in choosing ICT education focuses on exposure and access to technology resources. Several scholars report that African American students are not often exposed to advance STEM education like ICT in their home environment nor exposed in various academic environments (Gandara, 2001; Goode, 2007; Margolis et al., 2008). Consequently, in response to their lack of exposure, African American students are not interested in acquiring computing knowledge taught in ICT courses and fail to enroll in such courses. In addition, research conducted by Margolis et al. (2008) discovered that African American students may not have access to viable resources to

assist them in their pursuit of ICT education. It is reported that African American students often attend schools that are overcrowded, house old and limited technology, and possess unqualified teachers (Goode, 2007; Margolis et al., 2008). Even in the home environment, it is reported that African American students may only have limited access to technology that is often found to be insufficient and out-of-date (Graham & Smith, 2010). For example, Margolis et al., (2008) found that students who were of African American, American Indian, and Hispanic descent, and who had family incomes below \$35,000 relied more heavily on computer access and access to the Internet from school than on access from any other single location compared to their White counterparts. Therefore, issues of exposure and limited and insufficient access to technological resources for African American students' in both their home and academics environment can also be seen as a driving force that discourages African Americans to pursue ICT education.

#### *African American Females and ICT Education*

As previously mentioned, most of the research investigating underrepresented groups in ICT education focused on gender differences or differences due to race; two separate entities. However, what happens when these two separate entities intersect? Does the previously discussed literature concerning the factors that influence females or ethnic minorities' decision to pursue ICT education influence African American females? Interestingly, researchers have discovered that research targeted to assist females in STEM disproportionately benefit White females, and research targeted to assist ethnic minorities in STEM mainly benefit ethnic minority males (Ong et al.,

2011). Inherently, when it comes to research, race and gender are often addressed in isolation and the voices of women of color such as African Americans are unheard (Ong et al., 2011). Farinde and Lewis (2012) stated “whether consciously or unconsciously, the engrained perceptions, beliefs, and popular depictions of African American women, past and present, have led many to either overlook or discount their contributions and capabilities in STEM areas” (p. 422).

Even more, the literature demonstrates that African American female students may face barriers in ICT environments that may affect their academic success due to the intersection of their race and gender. According to Farinde and Lewis (2012), race and gender, socially defined as physical and intellectual hindrances both create biases within STEM fields. Therefore, with barriers to endure due to their race combined with barriers due to their gender, African American adolescent females have a vast number of hurdles to overcome in their path to ICT success. And, sadly, African American adolescent females live in a society that continually “denigrates womanhood and blackness” (Robinson & Ward, 1991, p. 87). The literature reports that the schooling experiences and educational attainment of African American females becomes suppressed because they are often categorized and grouped together with their African American male peers, a group who has been historically discriminated against (Rollock, 2007) and also categorized and grouped together with Anglo-American females, a group that has been historically stereotyped as intellectually incapable of STEM success (Farinde & Lewis, 2012). Yet, their educational experiences may not necessarily be the same as these two groups. That is, African American females must endure challenges due to both their

race and gender which generates more barriers for them to overcome; creating educational experiences that are vastly different from African American males and Anglo-American females.

Thus, given the importance of increasing the number of students in the ICT education pipeline, it is vital that we specifically investigate the factors (i.e., influence of parents, peers, teachers/counselors, media, technology use and interest) that have been found in the literature focusing on the students who are underrepresented due to both race and gender, the African American female student. As such, the purpose of this mixed methods study is to explore the social factors that influence African American adolescent females' decision to pursue secondary ICT education as well as fill a gap in the literature regarding African American females in ICT education. Knowing and understanding these factors can assist researchers, educators, and African Americans parents with guiding African American adolescent females to pursue both secondary and postsecondary ICT education and careers. Therefore, the following research questions guided this study:

1. What factors (parents, peers, teachers and counselors, media, and technology use and interest) predict African American adolescent females' decision to enroll in an information communications technology course?
2. How do the factors that predict African American adolescent females' decision to enroll in an information communications technology course influence those decisions?

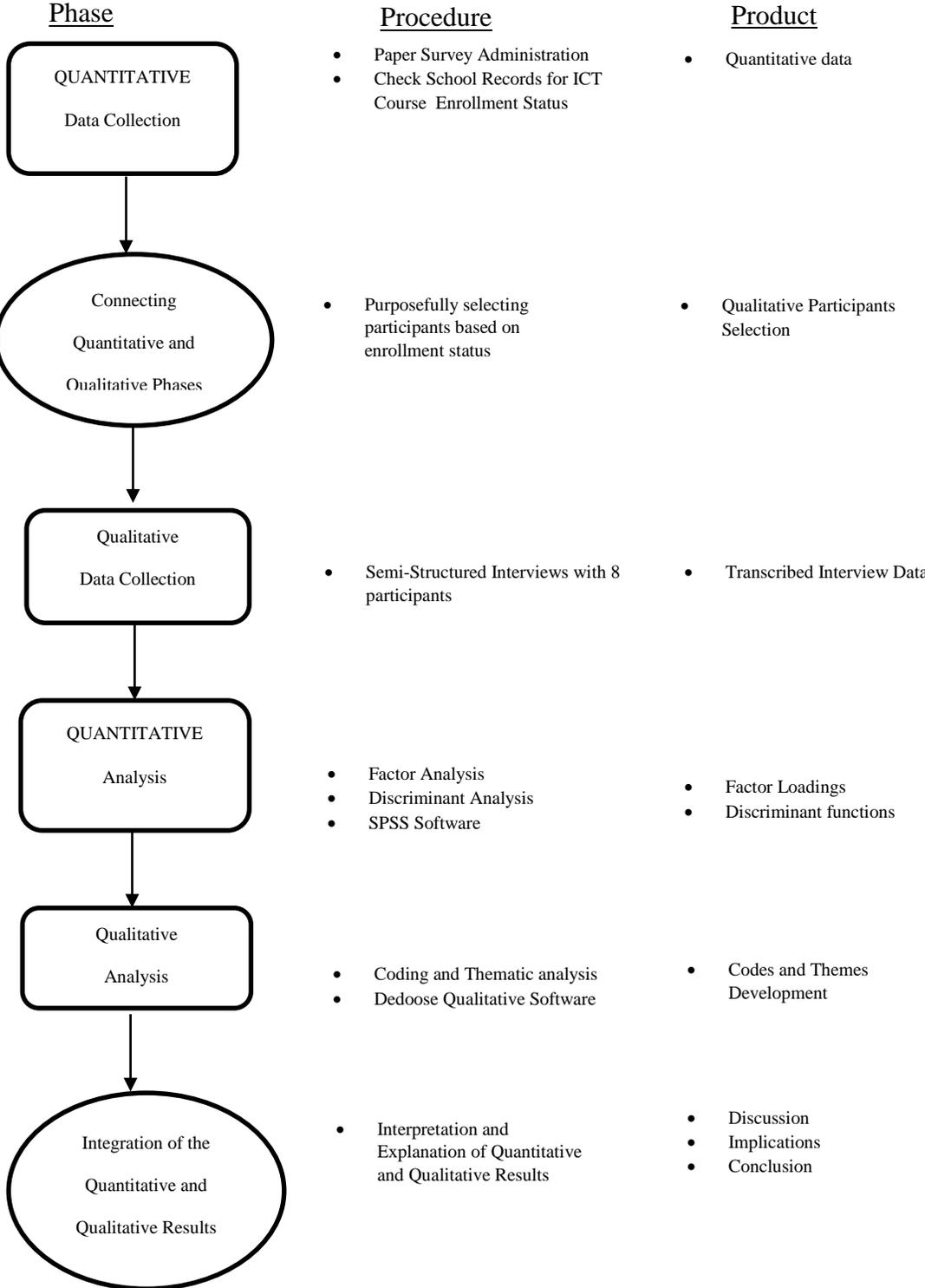
## **Methodology**

To best answer the research questions for this study, the researcher employed an explanatory sequential mixed methods design. Neither quantitative methods nor qualitative methods were adequate alone to completely answer the research questions. By using quantitative techniques, the researcher was able to quantify and analyze survey data to explain which social factors played a role in the participants' decision to pursue an ICT course. By employing qualitative techniques, the researcher was able to further explain the capacity of the influence that the factors identified in the quantitative survey had on the students' decision to enroll in an ICT course. In addition, qualitative techniques were used to gain a deeper insight about the life experiences that have been influential in the students' academic decision making process in regards to ICT education.

The purpose of using an explanatory mixed methods design for this study was for three primary reasons. First, through an intensive review of literature, the researcher was able to identify five factors that have been found to explain the underrepresentation of various minority groups in ICT education and thus, it is essential that these factors were quantitatively assessed to see how they specifically relate to adolescent African American females. Therefore, the quantitative phase of this study was designed to answer research question one. Second, the qualitative results were used to assist in explaining the quantitative results. By incorporating a qualitative design after the quantitative phase of the study, the researcher was able to obtain more detailed information about the factors explored. Lastly, by conducting the quantitative

component first, the researcher was able to purposefully select sample participants for the qualitative phase (i.e., those who enrolled in an ICT course and those who did not enroll in an ICT course) in an effort to get a more accurate account of the factors explored. As such, Figure 1 visualizes the researcher's explanatory sequential mixed methods design.

**Figure 1 Visualization of the Explanatory Sequential Mixed Methods Design Process (adapted from Ivankova, Creswell, & Stick, 2006)**



### *Participants*

For phase one of the study, fifty high school African American female students were voluntarily recruited to compose the quantitative sample. The sample consisted of 19 (38%) freshmen, 11 (22%) sophomores, and 20 (40%) juniors. The participants were between the ages of 14-18 and attended the same public high school in Houston, Texas. At the time of the study, the high school that was selected as the research site had a student body that consisted of more than 3,000 students that included students of diverse nationalities. The demographic make-up consisted of 15.9% African American, 42.2% Hispanic, 32.7% White, 0.3% Native American, and 6.6% Asian students. This particular high school was selected as the chosen research site because the school's overall demographics and the variety of offered ICT courses (i.e., Animation, Computer Science, Computer Science AP, Digital Interactive Media (DIM), and Web Mastering) provided for a more comprehensive research study.

For the qualitative phase of this study, phase two, eight students were selected from the quantitative sample. The qualitative sample consisted of two students who were classified as freshmen, three students who were classified as sophomores, and three students who were classified as juniors. The students were purposefully sampled to include students who have decided to enroll in an ICT course (enroller) and those who have not (non-enroller). The students for the qualitative phase were also selected through volunteer basis. Pseudonyms were given to each student to preserve and protect confidentiality as shown in Table 2.

**Table 2 Student Demographic Information**

Student	Pseudonyms	Classification	Enroller-Non Enroller
1	Allie	Freshman	Non-Enroller
2	Kellie	Sophomore	Non-Enroller
3	Katie	Sophomore	Enroller
4	Hailie	Junior	Non-Enroller
5	Sophie	Freshman	Enroller
6	Carlie	Junior	Non-Enroller
7	Maddie	Junior	Enroller
8	Jennie	Sophomore	Enroller

*Data Collection- Phase 1*

For the quantitative phase of the study, a paper and pencil survey (see Appendix F) containing 42 questions (27 of which employ a five point Likert scale, 8 of which require Yes/No answers and 8 of which are multiple choice) was created to investigate five constructs of interest: (1) parental influence, (2) peer influence, (3) teacher and counselor influence, (4) interest in technology, and (5) the influence of media. The survey was self-developed based upon a review of literature on the factors that influence students to pursue ICT education and careers. Some items in the survey were adapted from pre-existing surveys and since this topic is fairly new in the literature, the researcher had to also create original survey questions in an effort to most effectively assess the factors in the extent in which they were found and discussed in the literature.

The survey instrument contained only one question regarding students' demographic information. Students were only required to respond to a question regarding their current year in high school (e.g., freshman, sophomore, etc.)

The paper and pencil survey was administered during the Spring semester of 2015. Once parent permission was obtained (see Appendix C), students were given a survey to complete. A total of 53 parent permission forms were distributed to potential participants and 50 were returned. Student anonymity was ensured during the collection of survey data by using student identification numbers instead of their names. All survey data for the quantitative phase was collected within a four week period throughout April of 2015 and May of 2015. In addition, information regarding the student's Fall 2015 class schedule was collected at the end of the Spring 2015 semester to assist in the data analysis process.

#### *Data Analysis – Phase I*

The data analyzed for the quantitative phase of this study included a test of reliability, factor analysis, and a predictive discriminant analysis (PDA).

#### **Reliability**

After data collection, a test of reliability of the survey scales and items was performed using SPSS (a statistical software package). Subsequently, after conducting a test of reliability of the original survey instrument that included 42 questions, a low Cronbach's alpha ( $\alpha$ ) resulted in a modification of the original survey instrument and 15 items were not included in the data analysis process. Three of those items measured parental educational background and occupational background in ICT. Twelve of those

items measured student's technology use. Therefore, after removing those 15 items, the reliability of the survey instrument yielded a Cronbach's  $\alpha$  of .79 for 27 Likert scaled survey items that measured the subscales: (a) parents (b) peers (c) teachers and counselors (d) media and (e) technology use and interest. Table 3 provides the reliability estimates for each subscale.

**Table 3 Survey Scale Reliability Estimates for Quantitative Phase**

Subscale/Variable	Cronbach's $\alpha$	Number of Items
Parents	.70	4
Peers	.53	5
Teachers and Counselors	.50	4
Technology	.86	5
Media	.63	9

### **Factor Analysis**

To assess that the survey items were in fact measuring the specified variables a factor analysis was performed. According to Thompson (2004), a factor analysis can be used to ensure that items intended to measure a given dimension actually measure that dimension. Therefore, a factor analysis was used to examine if the survey questions actually load on the pre-defined factor specific to each question. The factor analysis consisted of five factors: (a) parental influence, (b) peer influence, (c) teachers and counselor influence, (d) media influence, and (e) technology use and interest.

### **Discriminant Analysis**

## **Discriminant Analysis**

A PDA was conducted using SPSS to examine the influences of predictor variables (i.e., parental influence, peer influence, teacher/counselor's influence, media influence, and technology use and interest) to the prediction of the decision to enroll in an ICT course for adolescent African American female students. The grouping variable was defined as enrollers and non-enrollers.

### *Data Collection- Phase 2*

For phase two of the study, qualitative phenomenological data analysis techniques were implemented to understand the unique perspective of an adolescent African American female high school student. According to Merriam (2002), phenomenology is designed to gain an understanding of the true essence of the phenomenon under investigation. As such, semi-structured interviews were conducted at the end of the Spring of 2015 semester using an interview protocol designed by the researcher (as shown in Appendix G) based upon the factors analyzed from phase one of this study in an effort to gain an in-depth understanding about the quantitative results. The interview protocol included 13 opened ended questions regarding the influence of the following factors: (a) parents, (b) peers, (c) teachers and counselors, (d) media, and (e) technology use and interest. Eight students were purposefully selected to participate in the interview data collection process. Interviews took place before and after school, each lasting approximately thirty minutes. Overall, the entire data collection process lasted approximately two weeks.

### *Data Analysis- Phase 2*

Each interviewed was audiotaped, transcribed verbatim, and uploaded to Dedoose (a qualitative online software program) to begin the analysis process. In Dedoose, significant statements were first extracted from the acquired transcriptions. Significant statements were extracted from the transcriptions that were deemed influential in the students' decision to enroll or not enroll in an ICT course. Meaning units were then developed from the significant statements. These meaning units were formulated based upon reading, and rereading, and reflecting upon the extracted significant statements (Creswell, 1998). From the meaning units, clusters of themes were formed based upon students' commonalities. According to Creswell (1998), these clusters represent themes that have emerged and are common to each of the students' descriptions. The researcher then proceeded to write a textural description of what was experienced followed by a structural description (i.e., a description that involves how the phenomenon was experienced) about an adolescent African American female's decision to enroll in an ICT course. Upon concluding the data analysis process, the researcher constructed an overall description of an adolescent African American female's decision to enroll an ICT course and the factors that influenced her decision. Also included in the phase two data analysis process was the process of data saturation. Guest, Bunce, and Johnson (2006) defined data saturation as the point when new information produces little or no change to the data or themes that has been previously observed. Thus, data collection and analysis procedures ended for this phase of the study once the researcher

recognized that there was no more new information that could be learned as a result of interviewing new participants.

## **Results**

This section presents the findings from the data analyses based on the study's research questions. This study was aimed at exploring the social factors that influence adolescent African American females' decision to pursue secondary ICT education through the use of an explanatory sequential mixed methods design. As previously noted, an explanatory sequential mixed methods design is characterized by the collection and analysis of quantitative data followed by the collection and analysis of qualitative data. The purpose of an explanatory sequential mixed methods design is to use qualitative results to assist in explaining and interpreting the findings of a quantitative study. Thus, by implementing an explanatory sequential mixed methods design the researcher began with quantitatively assessing five social factors (i.e., parents, peers, teachers and counselors, media, and technology use and interest) that were found to influence African American girls' ICT educational decisions then qualitatively assessed these five factors in an effort to obtain detail information about these factors. For the purpose of this study, quantitative data analyses and the interpretation of such results were used to answer research question one, and qualitative data analyses and the interpretation of such results were used to answer research question two.

### *Quantitative Results*

When addressing research question one – What factors predict African American adolescent females' decision to enroll in an ICT course, results from quantitative

statistical techniques implemented through SPSS were used to answer research question one.

### Factor Analysis

To begin the quantitative analysis, an explanatory factor analysis (EFA) was first conducted using SPSS to confirm that the survey items were measuring the construct that the survey items were intended to measure. The EFA involved a principal component analysis with rotation to the varimax criterion. Therefore, the initial EFA consisted of a five factor model that evaluated the factors: (a) parents, (b) peers, (c) teachers and counselors, (d) media, and (e) technology use and interest. Table 4 displays the results of the initial EFA.

**Table 4 Factor Pattern/Structure Coefficients**

Item Number	Survey Question	Factor				
		I	II	III	IV	V
1	My mom has a big influence on my decision to enroll in a technology class such as Animation, Digital Interactive Media (DIM), Computer Science, Computer Science AP, or Web Mastering.	.50	-.15	.07	.35	-.32
9	My dad has a big influence on my decision to enroll in a technology class such as Animation, Digital Interactive Media (DIM), Computer Science,	.78	-.13	-.04	-.15	.04

**Table 4 Continued**

Item Number	Survey Question	Factor				
		I	II	III	IV	V
	Computer Science AP, or Web Mastering.					
20	My mom encourages me to enroll in a technology course.	.70	- .05	.11	- .08	- 1.1
5	My dad encourages me to enroll in a technology course.	.69	.31	- .06	- .80	- .12
2	My friends believe that people who take courses such as Animation, DIM, Computer Science, Computer Science AP, or Web Mastering are nerdy.	- .15	.03	.18	.72	.11
8	I would follow my friends' advice about taking a technology course before I would follow my parents' advice.	.14	.11	.03	.56	- .13
10	Many of my close friends have taken classes such as Animation, DIM, Computer Science, Computer Science AP, or Web Mastering.	.17	.33	.39	.24	.44
17	My friends encourage me to enroll in a technology course.	.79	- .12	.04	.18	.15
22	My friends enjoy using computers.	.01	.82	.07	.13	- .02

**Table 4 Continued**

Item Number	Survey Question	Factor				
		I	II	III	IV	V
3	I want to have a career as a computer professional like the people I see and read about in magazines.	.56	-	.13	.64	-.18
6	I watch television at least 20 hours a week.	-.17	.08	.06	-.13	.58
7	I often see or read about African American girls portraying computer professionals in the magazines I read.	.26	-.19	.76	.13	-.16
13	I often read about African American girls portraying computer professionals in the books I read.	.13	.08	.90	-.03	-.01
14	I read magazines often.	-.01	.03	.72	.12	.36
15	I want to have a career as a computer professional like the people I read about in books.	.74	.04	.08	.24	-.03
18	I often see African American girls portrayed on television as computer professionals	-.06	.16	.84	-.21	-.06
26	I read books often.	.06	.12	-.06	-.01	.70
27	I want to have a career as a computer professional like the people I see on television.	.74	.20	.05	.35	.03

**Table 4 Continued**

Item Number	Survey Question	Factor				
		I	II	III	IV	V
4	My teachers told me computer classes are for boys.	.05	-.02	.37	-.55	-.03
24	My teachers encourage me to enroll in a technology course.	.66	.09	.17	-.18	-.27
21	My counselors told me computer classes are for boys.	.19	.39	-.10	-.22	-.24
12	My counselor encourages me to enroll in a technology course.	.67	.10	.09	.02	.10
11	I use a computer, at least occasionally while at school.	-.09	.77	-.12	-.12	.18
16	I access the Internet on a cell phone, tablet or other mobile device at least occasionally?	-.16	.81	.18	.14	-.05
19	I use the Internet or email, at least occasionally while at school.	.01	.77	-.02	.12	.36
23	I use the Internet or email, at least occasionally while at home.	-.05	.81	.07	-.06	.08
25	I use a computer, at least occasionally while at home	.10	.77	.02	.06	.06

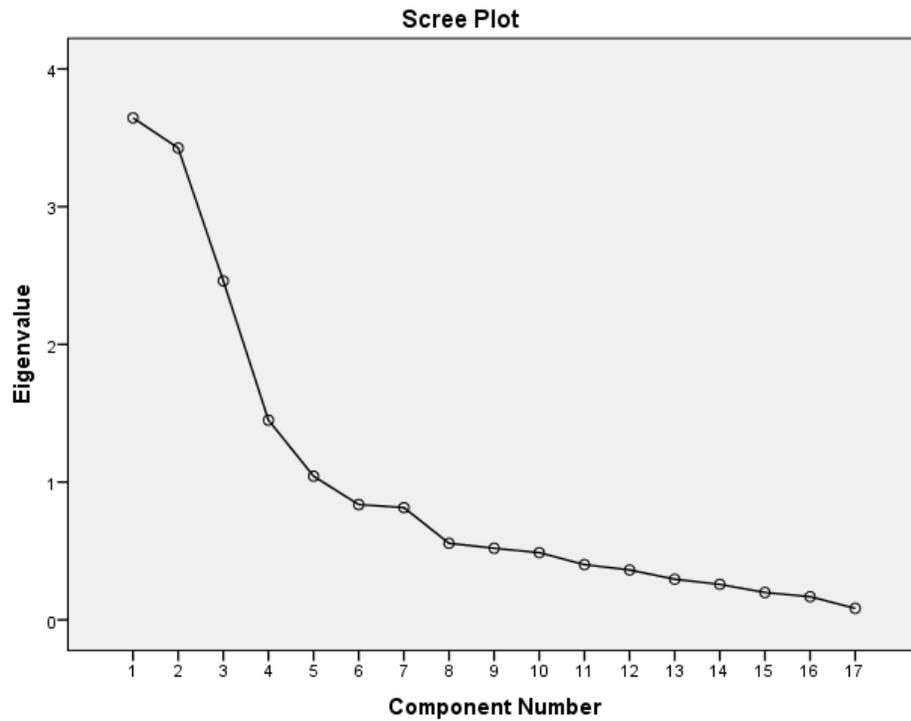
Results from the EFA indicate six survey items (i.e., items 1, 9, 20, 5, 24, and 12)

measuring the influence of parents and teachers and counselors loaded on factor I, five survey items (i.e., items 11, 16, 19, 23, and 25) measuring participants' technology interest loaded on factor II, four survey items (i.e., items 7, 13, 14, and 18) measuring media influence loaded on factor III, and two items (i.e., items 2 and 8) measuring the influence of peers loaded on factor IV. Results also indicated survey items that were

designed to measure the influence of peers, teachers and counselors, or media did not load on their proposed factors; three survey items (i.e., items 10, 17, and 22) did not load on the factor the influence of peers, two survey items (i.e., items 4 and 21) did not load on the factor the influence of teachers and counselors, and five survey items (i.e., items 3, 6, 15, 26, and 27 ) did not load on the factor the influence of media. Each of these items had a correlation value less than .5 with its proposed factor and was omitted from the EFA model. Moreover, results from the EFA suggested a single-factor for 6 of the survey items that initially were designed to measure two separate factors (the influence of parents and the influence of teachers and counselors). These six items included four survey items which measured the influence of parents and 2 survey items which measured the influence of teachers and counselors. As a result, these six items were combined to measure one factor, the influence of external authoritative figures, and the resulting EFA yielded a four factor model instead of a five factor model as initially designed.

After conducting another EFA in SPSS to confirm the new four factor model, results demonstrated that the new four factor model provided the best fit for the remaining 17 survey items. This factor solution is indicated by results from a scree test (Figure 2) with eigenvalues ranging from 3.64 to 1.44. Results indicate that this four factor solution accounted for 64% of the total variance.

**Figure 2 Scree Plot**



This four factor solution is also evident from the factor pattern/structure coefficients shown in Table 5. Thus, results from the EFA indicate five survey items (i.e., items 11, 16, 19, 23, and 25) measuring participants' technology interest saturating factor I, six survey items (i.e., items 1, 9, 20, 5, 24, and 12) measuring the influence of external authoritative figures saturating factor II, four survey items (i.e., items 7, 13, 14, and 18) measuring media influence saturating factor III, and two items (i.e., items 2 and 8) measuring the influence of peers saturating factor IV.

**Table 5 Varimax Rotated Pattern/Structure Coefficients**

Item	Question	Factor			
		I	II	III	IV
23	I use the Internet or email, at least occasionally while at home.	.82	-.02	.10	-.06
19	I use the Internet or email, at least occasionally while at school.	.82	-.03	-.03	.14
11	I use a computer, at least occasionally while at school.	.80	-.11	-.12	-.16
25	I use a computer, at least occasionally while at home	.81	.11	.05	.04
16	I access the Internet on a cell phone, tablet, or other mobile device at least occasionally.	.80	-.12	.16	.17
9	My dad has a big influence on my decision to enroll in a technology class such as Animation, Digital Interactive Media, Computer Science,	-.10	.77	-.03	-.08

**Table 5 Continued**

Item	Question	Factor			
		I	II	III	IV
	Computer Science AP, or Web mastering.				
5	My dad encourages me to enroll in a technology course.	.30	.74	-.07	.03
24	My teachers encourage me to enroll in a technology course.	.04	.74	.11	-.07
12	My counselor encourages me to enroll in a technology course.	-.06	.71	.07	.11
20	My mom encourages me to enroll in a technology course.	-.10	.68	.11	-.20
1	My mom has a big influence on my decision to enroll in a technology class such as Animation, Digital Interactive Media, Computer Science, Computer Science AP, or Web mastering.	-.21	.58	.08	.30

**Table 5 Continued**

Item	Question	Factor			
		I	II	III	IV
13	I often read about African American girls portraying computer professionals in the books I read.	.08	.16	.90	.00
18	I often see African American girls portrayed on television as computer professionals.	.14	-.04	.85	-.25
7	I often see or read about African American girls portraying computer professionals in the magazines I read.	-.20	.29	.77	.19
14	I read magazines often.	.08	-.07	.73	.19
8	I would follow my friends' advice about taking a technology course before I would follow my parents' advice.	.08	.15	-.03	.78
2	My friends believe that people who take courses such as Animation, DIM,	.03	-.21	.13	.72

**Table 5 Continued**

Item	Question	Factor			
		I	II	III	IV
	Computer Science, Computer Science AP, or Web Mastering are nerdy.				

Moreover, to ensure that the new scale external authoritative figure was reliable, the Cronbach's  $\alpha$  of the new scale was computed. Table 6 provides the reliability estimates for factor II, external authoritative figure resulting in a Cronbach's  $\alpha$  of .79.

**Table 6 Reliability Estimates for Factor External Authoritative Figures**

Item	Corrected Item Total Correlation	Cronbach's Alpha if Item Deleted
My mom has a big influence on my decision to enroll in a technology class such as Animation, Digital Interactive Media, Computer Science, Computer Science AP, or Web mastering.	.44	.79
My dad has a big influence on my decision to enroll in a technology class such as Animation, Digital Interactive Media, Computer Science, Computer Science AP, or Web mastering.	.61	.75
My mom encourages me to enroll in a technology course.	.55	.77
My dad encourages me to enroll in a technology course.	.54	.77
My counselor encourages me to enroll in a technology course.	.57	.76
My teachers encourage me to enroll in a technology course.	.62	.75

### **Predictive Discriminant Analysis**

In an effort to answer research question one, a predictive discriminant analysis (PDA) was performed using SPSS. To complete the PDA participants were assigned to one of two groups based upon their enrollment or lack thereof in an ICT course for the following school year (non-enroll or enroll). As a result, the dependent variable, decision to enroll for this PDA has been coded: (a) 0 = non-enroll, and (b) 1 = enroll.

In computing the discriminant analysis, the means and standard deviations for each measured variable according to group classification (non-enroll or enroll) was computed as shown in Table 7. In addition, Table 7 also displays the computed means and standard deviations for each measured variable as an overall group. As indicated in Table 7, students in the enroll group reported higher group means for variables: (a) technology use and interest, (b) influence of external authoritative figures, and (c) influence of peers on their decision to enroll in an ICT course than the students in the non-enroll group. Results from Table 7 indicate that the students in the non-enroll group reported a higher group mean on the variable influence of media on their decision to not enroll in an ICT course than the students in the enroll group.

**Table 7 Group Statistics**

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Group	Variable	Mean	Std. Deviation
Non Enroll	Technology	4.41	.71
	External Authoritative Figure	2.34	.84
	Media	2.53	1.08
	Peers	2.26	.84
Enroll	Technology	4.73	.46
	External Authoritative Figure	2.75	.97
	Media	2.16	.78
	Peers	2.57	1.16
Total	Technology	4.50	.66
	External Authoritative Figure	2.45	.89
	Media	2.43	1.01
	Peers	2.35	.94

---

In addition, classification coefficients as shown in Table 8 were computed in SPSS in an effort to create classification functions to determine which variables best discriminated between the two groups and prediction of future group membership.

**Table 8 Classification Function Coefficients**

Predictor	Variable	Group	
		Non- Enroll	Enroll
Technology	X1	10.49	11.39
External Authoritative Figure	X2	3.72	4.48
Media	X3	.93	.33
Peers	X4	2.17	2.60
(Constant)		-31.18	-39.79

As a result, the analysis yielded the following two linear functions:

$$\text{Non-Enroll} = -31.18 + (10.49 \times X1) + (3.72 \times X2) + (.93 \times X3) + (2.17 \times X4) \quad (1)$$

$$\text{Enroll} = -39.79 + (11.39 \times X1) + (4.48 \times X2) + (.33 \times X3) + (2.60 \times X4). \quad (2)$$

Based upon the resulting classification coefficients and functions the variable technology use and interest (11.39) contributed the most to the enroll function. The variable influence of external authoritative figures (4.48) had the second largest contribution to the enroll function followed by the variable influence of peers (2.60). The variable the influence of media had a low coefficient (.33) and contributed very little to the enroll function. Therefore, it was determined based upon the resulting classification coefficients that the variable technology interest contributed the most to student group discrimination.

Furthermore, a cross-validation analysis was also completed on the sample. The classification results demonstrate that 72.0% of the participants were correctly classified into their perspective groups, with 100% of the students identified as non-enrollers

correctly classified and 0% of the students in the enroll group correctly classified. Based upon classification results, all of the students that participated in this study were predicted to be in the non-enroll group. Classification results for the cross-validation are shown in Table 9. These classification results indicate limited predictive utility for the predictor variables because the classification hit rate of 72.0% could have also been achieved by not using predictor variables and simply predicting that no students would enroll; this strategy would result in 50 students predicted to not enroll, with 36 of those predictions being correct, and again yield a 72.0% classification accuracy.

**Table 9 Classification Results**

		Predicted Group Membership		Total	
		Group	Non Enroll	Enroll	
Cross-validated	Count	Non-Enroll	36	0	36
		Enroll	14	0	14
	%	Non-Enroll	100.0	.0	100.0
		Enroll	100.0	.0	100.0

*Note.* 72.0% of cross-validated grouped cases correctly classified.

### *Qualitative Phase*

When addressing research question two- How do the factors that predict adolescent African American females' decision to enroll in an information communications technology course influence those decisions?; results from semi-structured interview data and phenomenological analyses were used to answer research question two. Based upon the data collected and the results of the quantitative data

collected in phase one, four themes were analyzed: technology use and interest, external authoritative figures, media, and peers.

### **Technology Use and Interest**

Findings from the quantitative analysis demonstrated that the students' technology use and interest in technology was the most significant predictor in their decision to enroll in an ICT course. Therefore, based upon the quantitative results the first theme that was analyzed for the qualitative analysis was technology use and interest. Within this theme, two subthemes emerged: (a) consumers of technology and (b) a desire to learn more.

#### *Consumers of Technology*

Results from the quantitative phase of the study suggested that frequent use of technology and having a vested interest in technology promotes ICT course enrollment for adolescent African American females. So, when asked about their use of computers and interest in technology during their interview, all eight of the students selected for phase two stated that they used computers in and out of school on a daily basis. In fact, seven of the students explicitly stated that they used technology "everyday". Even more, five of the eight students recalled using computers for both academic and leisure purposes. For instance, Maddie, a student who was in her junior year of high school at the time of the study stated, "I use them[computers] in school, at home, for homework assignments, basically every day." Similarly, Kellie, who was in her sophomore year of high school at the time of the study, reflected on her frequent use of technology and how her academic courses were becoming more inundated with technology as she progressed

through high school, “I’ve actually been using computers pretty often this year and I’m pretty sure I’ll be using them more and more as I get more into high school”. Overall all eight participants expressed a necessary use of technology which shaped how they lived from day to day.

### *Desire to Learn More*

Although all eight of the participants cited a frequent and necessary use of technology, only five of the students (four enrollers and 1 enroller) expressed a desire to advance their technical knowledge and learn beyond basic computer operational skills and word processing knowledge. For example, Katie expressed that her lack of experience with working with advanced software influenced her to take an advanced ICT course. During her interview, she stated, “Because I see how behind I am, I feel like I need to know more things about computers.” In a subsequent interview, Maddie, a student who developed a passion for computer programming and decided to enroll in an ICT course reflected on how her childhood computer use influenced her to learn more about computers and technology. She recalled, “I use to play, when I was little, computer games and all those kinds of things. So my mom was like, ‘Hey, one day you can learn how to make that’, so that influenced me to want to use computers and it gave me some sort of interest in making things like that.” Similarly, Jennie, who was beginning to learning programming on her own and was enthused about enrolling in an ICT course, explained that after she viewed some programming code her interest in computer programming really ignited. She explained, “Pretty much after I looked at some code, I just liked it. I thought it was cool, and so I started doing it and it was cool.”

In contrast, qualitative data also demonstrated that the other three students who were non-enrollers, were not motivated or inspired to advance their technological skills despite their frequent use of technology. Hence, when asked if her frequent use of technology motivated her to pursue a technology career or take a computer course, Carlie replied, “No, not at all.” In fact, two of the students reported that they did not like computers.

### **External Authoritative Figures**

Upon examination of the theme external authoritative figures, three subthemes emerged regarding the influence of external authoritative figures: (a) living examples, (b) encouragement, and (c) academic and career expectations.

#### *Living Examples*

Statements shared throughout the interview process highlighted that the parents of the students who were both enrollers and non-enrollers were role models impacting their daughters’ future academic and career choices. In particular, four of the students saw individuals in their home environments who were living examples of their future career choices. For instance, when discussing how her family impacted her academic decisions, Hailie stated, “They’re in business, I want to go into business, but not because they made me. I thought it was interesting and I could ask a lot of questions about it so it kind of followed a pattern”. As a result, Hailie didn’t see a need to enroll in an ICT course because she wanted to follow a business path like her parents. In another instance, Maddie, a student in her junior year of high school who had future career goals of being a computer scientist because she wanted to follow in the same career path as her

mother knew she needed to take an ICT course. She stated in her interview, “My mom works in computer science. She majored in computer science at Boston University. She works for M.D. Anderson as a Senior Software Developer. That's where I first got the interest of taking computer science courses.” Lastly, Carlie mentioned that she had a disabled sister and witnessed many physical therapists come in and out of their home. Thus, as a result of her home environment and being able to witness living examples of people who had an occupation in physical therapy, Carlie realized that she wanted to become a physical therapist and didn't see a need to take an ICT course.

### *Encouragement*

According to interview data, the parents as well as teachers and counselors served as a vital source of academic encouragement for the students studied. In regards to parents, all of the students related how their parents encouraged them to strive academically and supported their academic endeavors whether it involved ICT education or not. When asked to describe how her family supported her academic decisions, Jennie recounted, “My family is pretty influential in my education. My mom especially. She pretty much supports whatever I do but if she didn't like what I was doing I'd probably stop doing it”. In a subsequent interview, Sophie also articulated how her mother was influential in her academic decisions and encourages her to be independent. During her interview Sophie stated, “My mom influences me because she always wants me to put forth my best towards everything, even if I don't want to. She thinks I should learn to be independent is one of her main reasons.”

While Sophie and Jennie specifically noted that their mothers were a source of encouragement, Carlie and Maddie noted both of their parents encouraged their academic endeavors. For example, Carlie discussed how both of her parents encouraged and supported her in whatever she decided to do academically. Carlie passionately explained, “They’ll encourage me to do something that I want to do but if I don’t want to do it, then they will still support me.”

Additionally, Maddie expressed how both of her parents encouraged her to pursue STEM education in particular. She stated, “My mom definitely encourages me towards more STEM based programs. My dad too because he also works in a STEM field so they definitely encourage me to pursue majors and stuff that are related to that [STEM].”

When asked if their parents encouraged them to enroll in technology courses, interestingly four out of the eight students, three of whom were non-enrollers and one who was an enroller, recalled receiving verbal encouragement from their parents to take ICT courses. For example, when asked if her parents encouraged her to take computer courses, Allie recounted a conversation she had with her mother. Allie, a non-enroller, shared, “When I told her [mother] I was thinking about taking a computer course next year, she [her mother] thought it was a good idea to take them”. Hailie, also a non-enroller, recalled receiving encouragement from her dad about the importance of taking computer courses. She stated during her interview that “my dad tells me I should take them [computer courses] and have a bunch of skills. He wants me to go to Lone Star [community college] and take all those classes, too.” In another interview, Kellie, who was also a non-enroller reflected on the educational messages she frequently hears from

her mother about future career choices. She shared that her mother constantly encouraged her to take computer courses that will prepare her to have a career in STEM. She stated, “My mom always wants me to take anything dealing with engineering and computers especially if engineering has anything to do with it”.

Moreover, in regards to school personnel such as teachers and counselors and their role in the students’ ICT academic decisions, data demonstrated that teachers and counselors both implicitly and explicitly provided encouragement for two of the students who decided to enroll in an ICT course. For example, Katie described how her teacher implicitly encouraged her to pursue a STEM career path through the classroom activities her teacher uses for classroom instruction. Katie shared, “We do different labs and stuff in class. It helps me see different strategies that I would actually use like if I actually had a job so that influences me towards my career”. In other instance, another student who was an enroller discussed how the encouragement she received from her academic counselors was vital to her overall academic decisions and her decision to pursue an ICT course. This finding is highlighted by Sophie who spoke highly of her counselor and her counselor’s ability to assist her with making the right academic decisions. Sophie recalled, “My counselor always helps me, it's funny because she kind of knows me so she will tell me ‘you know you don't want to take this class, you know you might make a C’. She really knows what I should take and not take”. Even when asked if her counselor encouraged her to pursue an ICT course, Sophie shared that her academic counselor’s advice was paramount to her decision to actually enroll in an ICT course.

Sophie related, “She[counselor] told me to take a computer class because she felt that I would be good in the class and comfortable with the teacher”.

However, contrary to the previous finding that demonstrated that teachers and counselors were a source of encouragement, other findings alternatively demonstrated that teachers or counselors did not have any influence on six (two enrollers) of the students’ decisions to enroll in an ICT course. According to Kellie, “counselors will sometimes tell me about dual credit courses or upper level courses but they never share anything about computer courses”. In addition, when asked if their counselors or teachers encouraged them to take computer courses, Hailie and Maddie nonchalantly responded with “not really”. Hailie further added that “they honestly haven’t because I kind of have my stuff planned out and they just tell me, "Good to go." Maddie gave a similar response indicating that her counselor was excited about her academic choices but didn’t try to promote or spark her interest in ICT related subjects. Maddie stated, “When I told my counselor that I was going to take a computer science class she was excited for me because I was excited about it, not really the other way around”.

#### *Academic Expectations*

Interview data gathered also highlighted that the parents of two of the participants set high academic expectations for their daughters. While discussing the role of her family in her academic decisions, Kellie related how as a sophomore student she felt pressure from her parents to make the right academic decisions and succeed academically. Kellie reported “My parents are really hard and strict on me about school and career”. Yet, even with the expectation to perform well academically and take

advanced academic courses, Kellie was not expected to enroll in an ICT course.

Alternatively, Katie who also reported that her parents were influential in her academic decision and set high academic and career expectations expected to take an ICT course. She explained that because her parents were Nigerian they held academics at a higher standard than most African Americans. Katie stated, “They're always telling me I need to be a doctor or someone who had a prestigious career so I have to take as many advanced courses as I can so I don't have an option about taking a computer course”.

### **Peers**

In analyzing the third theme the influence of peers, two subthemes emerged that reflected the extent of peer influence on the students' decision to enroll in an ICT course: (a) impervious and (b) promoters.

#### *Impervious*

Most of the students interviewed noted that their peers were not influential in any of their academic decisions. In fact, in regards to their academic path, six of the eight students (4 non-enrollers and two enrollers) interviewed expressed a view that was impervious to the influence of their peers. That is, they were unaffected by the influence of their peers and were not afraid to set their own unique academic path that may have differed from their peers. Therefore, when asked if their friends influenced their academic decisions or what courses they should take students replied:

Most of the time, no. I take classes just because I want to. [Allie]

No, not really. My friends don't care if I take a computer course or not. [Kellie]

Not really. I mean if all my friends wanted to major in English or something, I probably wouldn't do that. I definitely like hearing their opinions but just because they want to major in something, I'm not going to do the same thing they do. [Maddie]

I don't care about what they say about what courses I should take. [Katie]

We really don't talk much about that so you can say my friends don't influence the classes I take or career plans. [Hailie]

I don't take classes because my friends take classes. [Sophie]

Therefore, as shown by these statements, six of the students were not influenced by their peers to pursue any particular academic path. These six individuals did not make academic decisions because of peer pressure or what was deemed popular among their peer groups.

#### *Promoters*

However, despite the fact that peer influence was insignificant to six of the students' academic decisions, two of the enrollers reported that their peers had a vital influence on their decision to enroll in an ICT course. Maddie's and Jennie's peer groups assisted in promoting their academic interest in STEM and ICT. As such, from the qualitative data gathered, Maddie's and Jennie's peer groups can be viewed as promoters of ICT course enrollment. For example, Maddie reported in her interview that "A lot of my friends want to go into like engineering and technology. They take a lot of advanced classes and AP classes. They also want to go into different STEM based programs and stuff in college". Maddie further reported that her friends thought it was a

good idea to take computer courses. She stated, “They [her friends] think that the advance classes may be hard but they like it and they find them interesting”. In a subsequent interview, Jennie held her friends in high regard. She noted that all of her friends were pretty smart. So when asked if her friends influenced her academic decision and career plans, Jennie stated, “Yes, they are all really smart and study a lot. We try to encourage each other to make good grades.” According to Jennie, her friends have also encouraged her to take technology and computer courses.

## **Media**

The fourth theme in the qualitative phase that was analyzed was media. Based upon collected qualitative data, two subthemes emerged: (a) social media role models and (b) for entertainment purposes only.

### *Social Media Role Models*

An investigation of interview data demonstrated that media had a minor influence on three of the students interviewed. In particular, the individuals who the students viewed and read about on various social media sites had an influence on three of the students’ career and lifestyle aspirations. This statement is demonstrated by Allie, a freshman student who is addicted to social media. In her interview, Allie noted that she is often inspired by the people and celebrities she views on Instagram. She stated, “sometimes I see people and celebrities on Instagram who I look up to. I try to accomplish some of the things I see them do but I don’t really see anyone that is really into computers on social media though.” Likewise, Carlie described how she loved to use Facebook, Instagram, and Twitter to see what is going on in the world and get ideas

from people. However, Carlie related that she was not often influenced academically by media. She explained, “Sometimes I see people on Instagram, and Twitter and I want to be like them but its more for social things not like for my career.” Thus, it is important to note that although Allie and Carlie acquired lifestyle inspirations through social media, social media did not influence their academic or career decisions. However, unlike Allie and Carlie, Maddie noted different sentiments about the influence of social media in her academic and career goals. In particular, Maddie noted that social media were influential in her decision to become a computer scientist. Maddie mentioned in her interview that she did not watch television very often but loves to read and use social media, “I don't really watch a lot of television so I don't really know about that but on the internet I read and see a lot of things about people who have careers in computer science and things like that, so that definitely influences me.”

*For Entertainment Purposes Only*

For the other five students, the media that they viewed had no influence on any of their lifestyle or academic decisions. These five students stated that they interacted with various media outlets but from the statements that they shared it was implied that they viewed these media outlets as sources of entertainments. For example, when asked if the media she viewed influenced her future career decisions. Sophie stated, “No. I don't use media to influence any of my decisions. Many of the things you see in the media is not real”. Similar to Sophie, Kellie's response to the same question was: “No, not really. I want to be a lawyer, and so since I know what I want to do that's just that. I

don't let other things I see influence me". As such, it was concluded that for the majority of the students interviewed, media is used only for entertainment purposes.

### **Discussion**

The underrepresentation of African American females in ICT education and careers has become a great concern that has educators, researchers, and policy makers searching for solutions to increase the number of African American females in the ICT pipeline. Therefore, through the use of a mixed methods explanatory design the goal of this study was to determine what social factors (i.e., the influence of parents, teachers and counselors, peers, media, and technology use and interest) were influential in adolescent African American females' decision to enroll in an ICT course and the extent of the influence of these particular factors. As a result, this study was divided into two phases. In the first phase of the study, the quantitative phase, five social factors were analyzed to determine what factors predicted ICT enrollment for the adolescent African American females that participated in this study. In the following qualitative phase, phase two, interview data was analyzed to see how the factors influenced the students' decision to enroll in an ICT course. However, it is first important to recognize that quantitative findings produced through the use of an EFA determined that there were only four factors being evaluated instead of five as originally proposed: (a) parents, (b) peers, (c) teachers and counselors, (d) media, and (e) technology use and interest. Quantitative findings demonstrated that the factors influence of parents and influence of teachers and counselors saturated one factor that represent one underlying factor: external authoritative figures. Therefore, for the PDA used to answer research question

one, what social factors (i.e. parents, peers, teachers and counselors, media, and technology use and interest) are influential in adolescent African American females' decision to enroll in an ICT course?; only four factors were analyzed: (a) external authoritative figures, (b) peers (c) media and (d) technology use and interest.

Findings from phase one suggested that the factor technology use and interest had the strongest contribution to the function that predicted ICT course enrollment for the students who participated in this study. This finding is interesting because qualitative findings study demonstrate that all of the students who participated in phase two of the study who were ICT courses enrollers as well as non-enrollers could be considered digital natives because of their daily high frequency technology usage. Prensky (2001) defined digital natives as people who have “spent their entire lives surrounded by and using computers, video games, digital music players, video cams, cell phones, and all the other toys and tools of the digital age” (p. 1). Yet, three out of the eight students who participated in phase two were not interested in advancing their knowledge despite their digital native status. Surprisingly, two of the students noted that they did not like to use computers. So despite the fact that all of the students used technology frequently, results demonstrated that all of the enrollers and one non-enroller had a desire to learn beyond the basics. Most of the enrollers developed a passion for learning more about advanced technology related concepts such as computer programming and interactive digital media that stemmed from early ICT exposure. Moreover, two of the students saw a future need to learn more about ICT related concepts because of their future career choices and as a result they had a vested interest

in learning advanced ICT related concepts. Alternatively, because of their future career choices that didn't involve ICT two of the non-enrollers had a low interest in acquiring more technological knowledge.

Quantitative findings from phase one of the study further suggested that the influence of external authoritative figures had an influence on the students' decision to enroll in an ICT course. Results from the linear function representing ICT course enrollment suggest that the factor the influence of external authoritative figures had a contribution to the function that predicted student's ICT course enrollment. However, when analyzing group means' the variable external authoritative figures had a low mean score for the enroll group that alternatively suggested that external authoritative figures had a minimal influence on the students' decision to enroll in an ICT course. Qualitative data gathered highlighted this point. When analyzing the qualitative data, qualitative data demonstrated that parents were living examples for their daughters, encouraged ICT academics, and held high academic and career expectations for the students studied. Yet the only facet of parental influence that positively contributed to ICT enrollment was living examples. Based upon an analysis of qualitative data, parents were found to be living examples of future career choices. Four of the students studied had academic and career aspirations as a result of their home environment and based their need to take an ICT course according to their career aspirations. As a result, two of the enrollers decided to enroll in an ICT course. However, qualitative results also demonstrated that parental encouragement seemed to have minimal to no influence on the students' decisions to take an ICT course. Although parents of the non-enrollers may have

encouraged their daughters to take an ICT course, this facet of influence was not impactful because the non-enrollers still did not have a desire to enroll in an ICT course. Additional qualitative findings also suggested parental academic expectations was not influential on the students studied. Expectations to take an ICT course was almost non-existent for the students who participated. Most of the parents of the students studied didn't impose high academic expectations for their daughters, only one student expressed that her parents had an expectation for her to take an ICT course and as a result she enrolled in an ICT course. The others students didn't express this same sentiment.

Furthermore, upon close examination of the qualitative data and the influence of external authoritative figures, data also suggested the influence of teachers or counselors wasn't as prominent. For instance, two of the enrollers reported that their teachers or counselors did not contribute to any of their academic decisions. Reportedly, teachers and counselors supported their academic decisions but did not directly encourage or guide them towards ICT course enrollment. This finding neither supports nor conflicts with past research on the influence of teachers and counselors on underrepresented populations in ICT because the influence of teachers and counselors was not reported as positive or negative. Seemingly teachers and counselors also had a minimal role in a majority of the students' overall academic decisions.

Quantitatively, peer influence was not a predictor of the students' decision to enroll in an ICT course. Results from the linear function representing ICT course enrollment suggest that the factor the influence of peers had a low contribution to the

function that predicted ICT course enrollment. The findings from the qualitative data collected suggested that peer influence was almost non-existent for the majority of the students' decision to enroll in an ICT course. Six of the eight students which include both enrollers and non-enrollers reported that their peers did not influence any of their academic decisions. In particular, the findings of the qualitative phase of this study illustrated that these six students were in fact impervious to their peer groups' academic decisions. These six students had their own individualized academic goals and made their academic decisions unaffected and free of peer influence. The quantitative and qualitative findings in this study are supported by literature that discusses the influence of peers in students' decisions to pursue ICT academics (Adya & Kaiser, 2005). As Adya and Kaiser (2005) argued that in the teen years, peer groups have more of an impact on social responsive behaviors such as fashion and a small impact on academic and career choice.

In the quantitative analysis, media did not influence students' decision to enroll in an ICT course. Results from the PDA representing ICT course enrollment suggest that the factor the influence of media had the lowest contribution to the function that predicted ICT course enrollment. This quantitative finding suggest that the influence of media had little to no influence in the students' academic decisions regarding ICT. In analyzing the qualitative data, for three of the students, the people whom they saw or read about on social media were viewed as role models that influenced various aspects of their lives. For one student in particular, individuals in the ICT industry and media depictions of individuals in the ICT industry displayed on social media stimulated a

positive connection to the ICT industry and inspired her to pursue a career in the ICT industry. As a result, this student was motivated to enroll in an ICT course. Additional results also show that the two other students were influenced socially by the individuals displayed on social media however these individuals influenced the students' lifestyle aspirations and physical images. This finding in particular echoes Adya and Kaiser (2005) who suggested that printed and electronic media may influence adolescent females' physical image rather than their choice of career and Muhammad and McArthur (2015) who suggest that adolescents are affected by popular culture and tailor their fashion, style, or slang to the music, media, and celebrities they listen to and watch.

Moreover, for five other students, findings demonstrate that media outlets were primarily viewed for entertainment purposes only. These five participants were able to separate the entertainment and in some instances unrealistic aspect of media from reality and did not let what they read or viewed in the media influence their everyday realities. More specifically, the identities of these five students were not formulated nor based upon the images or individuals they frequently viewed in the media. Therefore, as a result of both quantitative and qualitative findings it was concluded that media was not an influential factor in the students' decision to pursue ICT academics.

Overall, qualitative data demonstrated that at this stage in their lives, many of the students studied had already established their career goals. That is, six of the eight students had career aspirations that influenced their high school academic decisions. For example, students expressed that they had a desire to become a: (a) doctor, (b) physical therapist, (c) lawyer, (d) business professional, or (e) computer scientist. Therefore, the

eternal social factors examined in this study had little influence on their decision to enroll in an ICT course. Ultimately, the students' academic paths were set because they had predetermined career goals and were determined to attain their goals.

### **Implications**

Given the results of the study it important to focus attention on the underrepresentation of African American females in ICT and develop ways to increase their enrollment in ICT. First, results of this study indicate that it is essential that we begin to develop African American females' interest in ICT. Past research focused on access to technology, but given that most of the today's youth are digital natives and have access to technology at home and at school, we now need to focus on developing interest. Interventions such as after school programs and summer camps have been found to make a significant impact on increasing the population of adolescent African American females in STEM education. According to the literature, afterschool programs have become vital in increasing girls, low-income, and ethnic minority students' interest and exposure to STEM related topics (Tsui, 2007; Valla & Williams, 2012). Research shows, for example, that afterschool programs help to improve attitudes toward STEM fields and careers, increase students STEM knowledge and skills, and increase the likelihood of graduating high school and pursuing a STEM major in college (Dabney et al., 2012; Valla & Williams, 2012). Moreover, the research on the effectiveness of summer camps or programs designed to develop interest in ICT demonstrate a number of positive outcomes for both girls and ethnic minorities. The literature suggests that summer camps can offer girls and ethnic minorities a non-threatening and non-academic

environment for hands-on learning that is collaborative, informal, and personal (Valla & Williams, 2012; Yilmaz, Ren, Custer, & Coleman, 2010).

In addition to developing interest in ICT, results also suggest that African American parents who have ICT careers should serve as living examples for their daughters. However, many African American females may not have parents who have ICT careers. Therefore in the absence of parental ICT role models, parents should assist their daughters with finding ICT mentors and role models outside of their home environment. The literature suggests that when students are provided with mentors and role models, they get the opportunity to have individual help and encouragement from the one who is advising them, discuss misconceptions about the field they are pursuing, and develop interpersonal relationships with people they would otherwise not have known (Holmes, Redmond, Thomas, & High, 2012; Maton & Hrabowski, 2004; Ong et al., 2011).

Most importantly, results demonstrate that the implications that are designed to help increase the number of African American females in high school ICT education that are suggested in this study should begin before African American females begin high school. As such, it is highly recommended that African American females start their path to ICT academic prior to adolescence. Essentially, efforts to influence and expose African American females to ICT education should start in elementary and middle school before students begin to develop their future career goals.

## **Limitations**

There are a number of limitations to the current study. One limitation had to do with the generalizability of the findings. The findings that demonstrate 28% of the quantitative participants enrolled in an ICT course is not a good representation of what is reported in the literature concerning the population of African American females who are actually enrolled in ICT courses. In fact, the percentages that have been reported throughout the literature have been significantly lower in comparison. For example, a report from College Board suggest that only 0.89% percent of African American females participated in Computer Science AP (advanced placement) in 2013 (Ericson, 2014). That is, only 289 African American females were reported to be enrolled in Computer Science AP out of a reported total population of 29,555 Computer Science AP students nationally (Ericson, 2014). Therefore, caution must be taken when interpreting the quantitative results. Moreover, this limitation could be due to sample size. There were only a small number of African American females who attended the selected research site so participant recruitment was limited to a small sample of students. A larger sample size of students may have caused the quantitative results to be more reflective of the actual population of African American females in ICT education.

Another limitation is that the sample was drawn from adolescent African American females who attended a middle class public high school. Therefore, the factors of influence that predict ICT enrollment and the capacity of influence may differ for adolescents African American females who attend a low income or a more affluent public high school.

A third limitation of this study is the researcher presence during the interview process in phase two of this study. Because of the qualitative data collection process, the students' may have experienced discomfort while being interviewed by a teacher who currently worked at the school that they attended at the time of the study. The presence of an individual known to be an authoritative figure may have affected how the students responded to the interview questions.

### **Recommendations for Future Research**

Future studies are needed to investigate what specific after school or summer programs have been found to promote ICT interest for underrepresented students. In particular, researchers could investigate how selected programs are designed and implemented and what specific strategies are used to spark interest in ICT for this specific population of students. A study of this nature could help increase the number of adolescent African American females in ICT education because findings from this study illustrate that in adolescent African American females' interest in ICT interest has a weighty influence on their decision to enroll in an ICT course.

Future studies are also needed to explore African American females' early childhood technology use and experiences with technology. By exploring students' early childhood use and experiences, technology intervention programs can be implemented to help develop students' technology interest before students begin middle or high school. Moreover, information gathered could also help researchers identify early childhood factors that promote ICT education and how those factors of influence change as students develop into adolescence.

## **Conclusion**

This mixed methods study provided valuable information on the factors that influence adolescent African American females to pursue ICT education. Specifically, a high level of technology interest was found to play a significant role in the adolescent African American females' decision to enroll in an ICT course. On the contrary, the influence of external authoritative figures, peers, and media had a minimal influence of the students' decision to enroll in an ICT course. Hence, knowing and understanding these factors can assist researchers, educators, and African Americans parents in guiding and motivating adolescent African American females to pursue ICT education and eventually a career in ICT. As illustrated numerous times throughout the literature, adolescence is a critical time of identity formation where students begin to realize their capabilities and aspirations in life and questions of "who am I" and "what do I aspire to be" become vital in their academic decision making process. So, every effort should be made to ensure that adolescent African American females have the opportunity to pursue ICT education and are able to reach their full potential in this area. Ultimately, such efforts will help broaden the participation of adolescent African American females in the ICT pipeline as well as help close the gap of underrepresentation of African American females in secondary ICT education.

## **CHAPTER IV**

### **CONCLUSION**

This dissertation was designed to gain insight about African American females in secondary and postsecondary ICT education. Because of the growing concern about the number of individuals pursuing ICT education and careers, it was vital that a study was conducted that investigated the underrepresentation of a specific population of students such as African American females as they are introduced to ICT education at secondary and postsecondary levels. By conducting two studies of this nature, it was the goal of the researcher to expand the literature on this unique population of students while helping to increase the number of students in the ICT pipeline. Contrary to other research studies investigating minorities in ICT which have been designed to specifically investigate females or African Americans, the two studies enclosed in this dissertation allowed the unique experiences and viewpoints of African American females to be expressed and explored.

As such, the first study included in this dissertation investigated African American females who were pursuing ICT education at the postsecondary level in hopes of pursuing an ICT career. Ten African American females who lived in various regions of the country and also attended various PWIs from across the country were interviewed in an effort to gain knowledge about their pre-college experiences that lead them to pursue an ICT major at a PWI and their experiences that has aided in their perseverance thus far. Therefore, to fully understand their stories and experiences, qualitative

phenomenological data analysis techniques were used to analyze collected interview data.

From the pre-college experiences and college experiences related by each participant, the researcher was able to generate common themes from their personal stories. The following themes were identified consistently throughout the data collection and analysis process regarding the participants' pre-college experiences that lead to their pursuit of an ICT degree: (a) high school academic achievement, (b) the influence of family, and (c) ability to embrace challenges. In addition, the following themes regarding the participants' college experience were identified as essential to the participants' perseverance as ICT majors: (a) desire to become a role model, (b) acknowledging vulnerabilities (c) resilience, and (d) racial identity awareness.

With regards to the first theme, high school academic achievement, almost all the participants shared experiences that suggested that they were able to accomplish high secondary academic achievement. For instance, many of the participants shared that they attended accelerated learning high schools, enrolled in collegiate level courses, and/or graduated at the top of their high school classes. One participant even shared that she was the class valedictorian for her graduating class. From this data, it was concluded that almost all ten participants possessed a high cognitive aptitude that afforded them the opportunity to achieve advanced secondary academic success. Nonetheless, it is also important to note that there was only one instance that high academic achievement was not expressed. Only one participant shared that she had a learning disability and experienced academic difficulties while in high school. Yet, despite her academic

disability and lack of high secondary academic achievement she was still able to successfully pursue an ICT degree.

Regarding the influence of family, it was found that the participants' pre-college experiences included a home environment that had a vital influence on their choice of college major. Within their home environments, the parents set high academic expectations and encouraged academic success that would potentially lead their daughters to a lucrative career. Essentially, the parents viewed themselves as living examples for their daughters and had a desire for their daughters to exceed or follow their educational and career accomplishments. Thus, for many of the participants, acquiring an ICT degree would enable them to accomplish the academic and career goals imposed by their parents.

The third theme, embrace challenges, points to the fact that each participant allowed themselves to embrace challenges prior to their pursuit of an ICT degree. Participants related instances that prompted them to take on the challenge of: (a) moving across the country to attend college, (b) overcoming academic disabilities, or (c) learning ICT related concepts informally on their own. As a result, the participants were viewed as risk-takers. They embraced challenges and took risks on themselves in order to advance their academic growth and achieve their future occupational goals.

The first theme regarding the participants' perseverance as ICT majors was a desire to become a role model for others. When asked about their perseverance as ICT majors at a PWI, most of the participants shared that they were able to persevere through the challenges because they had a desire to become a role model for other African

Americans. They viewed themselves as role models who were setting a positive academic path for younger family members and/or other African American females who were in pursuit of an ICT degree. For that reason, the participants knew they couldn't give up; achieving an ICT degree was not only for their personal benefit but also the benefit of others.

The second theme regarding the participants' perseverance as ICT majors was acknowledging vulnerabilities. To varying degrees, the participants acknowledged various vulnerabilities that formed due to their socio-economic status, race, and/or academic ability. This particular finding was interesting because acknowledging one's vulnerabilities is stereotypically viewed as a negative character trait that implies weakness. However, in view of this study, acknowledging one's vulnerabilities became a positive component in the participants' perseverance as ICT majors. In particular, by displaying and acknowledging their vulnerabilities, the participants were able to receive academic or emotional support from family members, peers, professors, religious groups, and student organizations. Essentially these individuals became critical sources of support in the participants' perseverance as ICT majors.

The third theme regarding the participants' perseverance as ICT majors was resilience. As the participants shared their experiences, participants related instances where their resilience as African American females aided in their perseverance. Many of the participants described their experiences as ICT majors as a journey laden with adversities that challenged their resilience. For example, the participants shared experiences in which they had to be resilient against experiences that involved their

institutional environments, academic deficiencies, acts of racism or sexism, and in some instances acts of both racism and sexism. However, because of their willingness and ability to overcome their adversities activated by their resilience, the participants were able to persevere.

The last theme regarding the participants' perseverance as ICT majors was racial identity awareness. Despite the adversities that the participants experienced throughout their pursuit of an ICT degree, it was concluded that the participants had a personal desire to succeed. Inherently, this personal desire to succeed originated from their awareness and acknowledgement of their racial identity as African Americans. Throughout the interview process, the participants shared experiences in which they were the sole African American in their collegiate courses but instead of being ashamed or rejecting their racial identity, the participants embraced their racial identity. Ultimately, this awareness of their racial identity impelled their perseverance.

Nonetheless, a review of literature suggested that experiences that include the presence of role models and prior ICT exposure before starting college can be a vital influence on African American females' decision to pursue an ICT major; however, this was not the case for the first study. The findings of this study found these experiences as having a minimal influence on most of the participants' decision to pursue an ICT major. While additional findings from the literature suggested that African American females' academic environment may have a positive influence on their perseverance as ICT majors. Findings from this study also contradicted past research and it was concluded

that the participants' academic environment had a negative influence on their perseverance.

The second study included in this dissertation investigated African American females at the secondary level. An explanatory sequential mixed methods study was conducted to discover what factors (i.e., external authoritative figures, peers, media, and technology use and interest) were predictors of secondary ICT course enrollment for adolescent African American females and how those factors influenced their ICT enrollment decisions. Thus, this study was conducted in two phases; (a) a quantitative phase that examined paper and pencil survey data from 50 adolescent African American female high school students and (b) a qualitative phase that examined interview data from eight students purposefully selected from the quantitative sample.

For phase one, collected data was analyzed through the use of a PDA. As a result of the PDA, findings indicated that technology use and interest was the primary predictor of ICT course enrollment. Upon further investigation of student's technology use and interest in the qualitative phase, findings indicated that technology interest was the primary factor that separated the students who decided to enroll in an ICT course from those students who decided not to enroll in an ICT course. Data demonstrated that all eight students who participated in the qualitative phase were active technology users. However, the differences that occurred between the two groups of students involved students' technology interest. Overall, the students' who decided to enroll in an ICT course had an interest in developing and advancing their technological skills and as a result were motivated to enroll in an ICT course.

Based upon the resulting data from the PDA, the influence of external authoritative figures proved to be the second highest predictor of ICT course enrollment for the students who participated in the quantitative phase. Essentially, the influence of external authoritative figures included the influence of parents and school personnel such as teachers and counselors. The initial study design had the influence of parents and the influence of teachers and counselors as two separate measured variables. However, after conducting an EFA, the two variables proved to measure only one underlying factor, the influence of external authoritative figures. When examining the extent of the influence of external authoritative figures on the students' decision to enroll in an ICT course in the qualitative phase, it was found that external authoritative figures had minimal influence on the students' decision to enroll in ICT courses. Although, parents were viewed as role models who assisted in shaping their daughters academic and future career decisions, parental encouragement to enroll in an ICT course was ineffective on the students' studied.

With regards to the influence of peers, the resulting data from the PDA demonstrated that the influence of peers had a minimal influence on the students' decision to enroll in an ICT course. Therefore, when asked how their peers influenced their academics decisions during the qualitative phase, the qualitative findings coincided with the quantitative findings. Most of the students related that their peers had no influence on any of their academic decisions. Only two of the students related instances of peer influence on their decision to enroll in an ICT course. For these two students,

their peers were promoters of STEM and ICT education and positively influenced their decision to enroll in an ICT course.

Lastly, the resulting data from the PDA demonstrated that the influence of media contributed very little to the students' decision to enroll in an ICT course. In fact, it has the lowest contribution to the prediction equation of ICT course enrollment. When analyzing the extent of media influence on the students' decision to enroll in an ICT course in the qualitative phase, the influence of media proved to have an influence on only one student's decision to enroll in an ICT course. The inspiring images of individuals in the ICT industry on social media sites inspired her to enroll in an ICT course and eventually pursue an ICT career. Two other students were inspired by social media but were not inspired academically. The other six students viewed media as sources of entertainment and were also academically unaffected by what they read or saw in the media.

So, when examining the findings from both studies, several things can be concluded regarding African American females in ICT education. First, it has been concluded that parental influence is vital to African American females pursuing ICT education at both the secondary and postsecondary level. Each study pointed to the importance of parents being "living examples" for their daughters. Parents from both studies were reported to be living examples of career accomplishment and success or living examples of financial hardships and wanted their daughters to surpass their academic and career accomplishments. In addition, the participants from both studies reported that their parents were sources of encouragement who set high academic

expectations. Many of the participants from both study one and study two indicated that their parents encouraged them to excel academically but also placed an emphasis on high academic achievement. Essentially, their parents expected them to achieve academic success regardless of the educational or career avenue they pursued.

Moreover, having a vested interest in learning ICT related concepts proved to be influential in the pursuit of ICT education at both the secondary and postsecondary levels. Reportedly, a few of the participants from study one had prior formal and informal ICT exposure. As a result of this exposure, these participants had an opportunity to develop their ICT interest prior to college and were motivated to pursue an ICT degree. Likewise, data from study two demonstrated that the participants who decided to enroll in an ICT course had a vested interest in learning advanced ICT related concepts. That is, these participants had a desire to develop and advance their technological skills beyond basic word processing and Internet browsing and as a result they were motivated to enroll in an ICT course.

Now, the question is how can we use this research to increase the number of African American females in the ICT pipeline? Based upon the findings of these two studies, there are a number of suggestions that can be applied at both the secondary and postsecondary educational levels.

At the secondary level, it is suggested that African American females have the opportunity to take advanced academic courses like AP and IB courses that will help build their academic ability and become a foundation for postsecondary academic success. It is further suggested that in instances where African American females may

have academic deficiencies, schools and parents should seek out help from teachers, peers, and tutors to help build students' academic ability that will promote academic success in advanced academic courses. Most importantly, African American parents must play a vital role in building their daughters' academic ability. That is, African American parents must set high academic expectations while also providing academic encouragement that will help build their daughters' overall self-esteem and confidence to pursue advanced academic courses and ICT courses.

In addition to parents, other external authoritative figures at the secondary level such as teachers and counselors can also assist in increasing the number of African American females in ICT. It is suggested that teachers and counselors become advocates and encouragers of ICT education. Simply by teaching advanced ICT concepts and developing programs that teach students about the benefits of learning ICT related concepts, students may become interested in learning more about ICT. Furthermore, regarding developing interest, it is important that African American females enroll in after school programs and summer camps that focus on building underrepresented students' interest in ICT. Afterschool and summer programs designed for minority students have been known to increase student participation in STEM related fields by serving as non-threatening academic environments where students can learn traditional concepts in a variety of non-traditional ways.

At the postsecondary level once African American females make the decision to pursue an ICT major, it is suggested that African American females join organizations such as NSBE that are designed to promote a sense of community for African American

engineering students at both PWIs and HBCUs. Joining an organization such as NSBE will provide African American females in pursuit of an ICT degree with both academic and social support that will motivate them to persevere in their pursuit. It is further suggested that African American females pursuing an ICT major at a PWI find a support network that is composed of family, peers, professors, and/or individuals from their religious communities who can bolster their resilience and serve as a source of encouragement through times of adversities.

In conclusion, the research on African American females in ICT is new and fairly limited. Therefore, it is important to recognize that there are some research gaps pertaining to the two studies included in this dissertation. As such, more research should be conducted to get a complete picture of African American females in ICT education. For instance, the participants' socio-economic backgrounds from both studies were not thoroughly investigated so home environments and school environments may differ based upon income levels that may affect the level of parental and school influence for certain African American females in pursuit of ICT education. In another instance, there is a research gap pertaining to early childhood ICT experiences. The two studies presented here only focused on high school and collegiate experiences with technology and does not fully investigate participants' childhood experiences. As a result, future researchers should begin looking at African American females' technology use and interest as they begin elementary school and transform over time. Accordingly, as indicated by the aforementioned examples, more research is needed, to fully capture and

identify the nature and scope of this phenomenon of underrepresentation. As Ong et al. (2011) stated:

While it is promising that researchers are taking greater notice of the need to address the intersection of gender and race/ethnicity in STEM education and careers, there is a long way to go before we can truly understand the environments and experiences that promote or hinder the advancement of women of color in scientific and technical fields. (p. 197)

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**APPENDIX A**  
**RECRUITMENT SCRIPT**

Hello, my name is Shemesha Wright. I am a doctoral student in the Educational Psychology department at Texas A & M. I am conducting research on the factors that influence African American females to pursue advanced technology majors, and I am looking for African American females to participate in my study.

Are a junior or senior in Computer Engineering, Computer Science, Engineering Technology, and Management Information Systems.

Participants will be required to complete an interview that will last approximately 1 hour scheduled at their convenience regarding their academic major and their academic experiences. If you agree to participate then you will receive a \$25.00 gift card.

If you have any questions or would like to participate in this research I can be reached at meshat9@tamu.edu.

## **APPENDIX B**

### **RECRUITMENT EMAIL**

Hello I am a Ph. D. student at Texas A & M in the department of Educational Psychology and preparing to collect data for my doctoral dissertation. My dissertation research focuses on the experiences of African American women who are pursuing an advanced technology degree. The purpose of this dissertation is to explore the experiences that led African American women to pursue an advanced technology degree as well as explore the experiences that have helped them to sustain in their pursuit of the degree. My goal for the research study is to bring awareness of the underrepresentation of African American women in this field in an effort to help increase the enrollment of African American women pursuing postsecondary advanced technology degrees and that will eventually motivate them to pursue a career in this field.

Currently, I am in the process of recruiting African American female students to participate in my study. Participants will be required to complete an interview that will last approximately 1 to 2 hours scheduled at their convenience regarding their academic major and their academic experiences. Also, all participants who decide to participate will receive a \$25.00 Visa gift card for their time and participation. Therefore, if you are able to participate, please reply to this message. A follow-up message will be sent to schedule the actual interview. If you have any questions about the study, please feel free to reply back to this message. Thank you in advanced.

**APPENDIX C**  
**CONSENT FORM**

Project Title: Dissertation - The Experiences of African American Women Who Have Decided to Pursue and Persevere in an Information and Communications Technology Major

**You are invited to take part in a research study being conducted by Shemesha Thomas, a researcher from Texas A&M University. The information in this form is provided to help you decide whether or not to take part. If you decide to take part in the study, you will be asked to sign this consent form. If you decide you do not want to participate, there will be no penalty to you, and you will not lose any benefits you normally would have.**

**Why Is This Study Being Done?**

The purpose of this study is to explore the life experiences of African American women that have impacted their decisions to pursue and sustain in an advanced technology major. In addition, the findings from this study will also help to increase the literature on African American women pursuing a STEM field in general.

**Why Am I Being Asked To Be In This Study?**

You are being asked to be in this study because you are an African American female pursuing an advanced technology degree at a predominately White university.

**How Many People Will Be Asked To Be In This Study?**

Six people (participants) will be invited to participate in this study locally.

**What Are the Alternatives to being in this study?**

No, the alternative to being in the study is not to participate.

**What Will I Be Asked To Do In This Study?**

You will be asked to describe your experience as being an African American female pursuing an advanced technology degree during an interview. Your participation in this study will last up to two hours and includes 1 visit.

**Visit 1**

This visit will last about 2 hours. During this visit the researcher will ask questions that will allow you to describe your family and academic background or experiences.

**Will Photos, Video or Audio Recordings Be Made Of Me during the Study?**

The researchers will make an audio recording during the interview so that the researcher can later efficiently transcribe the interview for accurate results. If you do not give permission for the audio recording to be obtained, you cannot participate in this study.

\_\_\_\_\_ I give my permission for audio recordings to be made of me during my participation in this research study.

\_\_\_\_\_ I do not give my permission for audio recordings to be made of me during my participation in this research study.

**Are There Any Risks To Me?**

The things that you will be doing are no more risks than you would come across in everyday life.

**Will There Be Any Costs To Me?**

Aside from your time, there are no costs for taking part in the study.

**Will I Be Paid To Be In This Study?**

You will receive a \$25.00 gift card. Disbursement will occur after the interview. However, if you decide that you no longer want to interview or complete the interview than no payment may occur.

**Will Information From This Study Be Kept Private?**

The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely and only members of the researcher committee will have access to the records. Information about you will be stored in locked file cabinet and computer files protected with a password. This consent form will be filed securely in an official area.

People who have access to your information include the Principal Investigator and research study personnel. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) entities such as the Texas A&M University Human Subjects Protection Program may access your records to make sure the study is being run correctly and that information is collected properly.

Information about you and related to this study will be kept confidential to the extent permitted or required by law.

**Who may I Contact for More Information?**

You may contact the Principal Investigator, Susan Pedersen, Associate Professor, to tell her about a concern or complaint about this research at 979-458-1128 or [spedersen@tamu.edu](mailto:spedersen@tamu.edu).

For questions about your rights as a research participant; or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University

Human Subjects Protection Program office at (979) 458-4067 or [irb@tamu.edu](mailto:irb@tamu.edu).

**What if I Change My Mind About Participating?**

This research is voluntary and you have the choice whether or not to be in this research study. You may decide to not begin or to stop participating at any time. If you choose not to be in this study or stop being in the study, there will be no effect on your student status or relationship with Texas A&M University, etc.

**STATEMENT OF CONSENT**

**I agree to be in this study and know that I am not giving up any legal rights by signing this form. The procedures, risks, and benefits have been explained to me, and my questions have been answered. I know that new information about this research study will be provided to me as it becomes available and that the researcher will tell me if I must be removed from the study. I can ask more questions if I want. A copy of this entire consent form will be given to me.**

\_\_\_\_\_  
Participant's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Date

**INVESTIGATOR'S AFFIDAVIT:**

Either I have or my agent has carefully explained to the participant the nature of the above project. I hereby certify that to the best of my knowledge the person who signed this consent form was informed of the nature, demands, benefits, and risks involved in his/her participation.

\_\_\_\_\_  
Signature of Presenter

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Date

## APPENDIX D

### POSTSECONDARY QUALITATIVE INTERVIEW PROTOCOL

1. How would you describe yourself?
2. Tell me how did you decide to pursue a technology major?

**Follow-up Question**

Was there anything specific that helped you make your decision?

3. Tell me about your family background.

**Follow-up**

Describe how your family impacts your academic decision.

Can you describe how your family background has influenced your decision to pursue a technology major?

4. Tell me about your technology background.
5. Tell me about your academic background.
6. Describe your high school experience.

**Follow-up:**

What kind of classes did you take in high school?

What was your high school environment like?

7. How has your high school experience affected your decisions for college?

**Follow-up:**

Can you describe a specific situation?

8. Tell me about your college experience so far.

**Follow-up:**

Can you describe any challenges you may have had?

9. Thinking back over the course of your life what experiences have you encountered that you believe motivated you to pursue a technology degree

10. Tell me about your experience as being a technology major.

**Follow-up:**

Describe your biggest challenge as being a technology major?

How did you overcome this challenge?

11. How do you feel about being a female in your major?

**Follow-up:**

Do you feel as if your experience would be different if you were a male?  
Give an example.

12. How do you often feel about being an African American female pursuing a technology major?

**Follow-up:**

Do you feel as if your experience would be different if you were African American? Give an example.

13. How do you often feel about being an African American female pursuing a technology major?

**Follow-up:**

Can you describe any experience while pursuing your degree where you feel as if being an African American female has made a difference in achieving your degree?

14. Why do you believe you have been able to be successful in this major thus far?

15. I am interested in learning about why people major or don't major in technology, is there anything else that you would like to share that I haven't asked you about?

**APPENDIX E**

**POSTSECONDARY DEMOGRAPHIC QUESTIONNAIRE**

Name:

Major:

Minor:

Classification:

## APPENDIX F

### QUANTITATIVE SECONDARY STUDENT SURVEY

PARTICIPANT #:

**Student ID:**

**Please tell me about yourself**

**What is your grade? (Please Circle):**      Freshman                  Sophomore                  Junior

What is your mother's highest educational attainment?

- a. Graduate School (Master's or Doctorate)
- b. Bachelor's Degree
- c. Associate's Degree
- d. High School Diploma
- e. Some High School

What is your father's highest educational attainment?

- a. Graduate School (Master's or Doctorate)
- b. Bachelor's Degree
- c. Associate's Degree
- d. High School Diploma
- e. Some High School

Does one or both of your parents have a career in the computer industry?

- a. Mother
- b. Father
- c. Both
- d. Neither

PARTICIPANT# \_\_\_\_\_

**For each of the following questions, please circle the number on the scale that best represents your viewpoint.**

**5-STRONGLY AGREE 4-AGREE 3-UNCERTAIN 2-DISAGREE 1-STRONGLY DISAGREE**

	SA	A	U	D	SD
1. My mom has a big influence on my decision to enroll in a technology class such as Animation, Digital Interactive Media (DIM), Computer Science, Computer Science AP, or Web Mastering.	5	4	3	2	1
2. My friends believe that people who take courses such as Animation, DIM, Computer Science, or Web Mastering are nerdy.	5	4	3	2	1
3. I want to have a career as a computer professional like the people I see and read about in magazines.	5	4	3	2	1
4. My teachers told me computer classes are for boys.	5	4	3	2	1
5. My dad encourages me to enroll in a technology course.	5	4	3	2	1
6. I watch television at least 20 hours a week.	5	4	3	2	1
7. I often see or read about African American girls portraying computer professionals in the magazines I read.	5	4	3	2	1
8. I would follow my friends' advice about taking a technology course before I would follow my parents' advice.	5	4	3	2	1
9. My dad has a big influence on my decision to enroll in a technology class such as Animation, Digital Interactive Media (DIM), Computer Science, Computer Science AP, or Web Mastering.	5	4	3	2	1
10. Many of my close friends have taken classes such as Animation, Digital Interactive Media (DIM), Computer Science, Computer Science AP, or Web Mastering.	5	4	3	2	1
11. I use a computer, at least occasionally while at school.	5	4	3	2	1
12. My counselor encourages me to enroll in technology class.	5	4	3	2	1
13. I often read about African American girls portraying computer professionals in the books I read.	5	4	3	2	1
14. I read magazines often.	5	4	3	2	1
15. I want to have a career as a computer professional like the people I read about in books.	5	4	3	2	1
16. I access the Internet on a cell phone, tablet or other mobile device, at least occasionally?	5	4	3	2	1

17. My friends encourage me to enroll in a technology course.	5	4	3	2	1
18. I often see African American girls portrayed on television as computer professionals.	5	4	3	2	1
<b>5-STRONGLY AGREE 4-AGREE 3-UNCERTAIN 2-DISAGREE 1-STRONGLY DISAGREE</b>					
19. I use the Internet or email, at least occasionally while at school.	5	4	3	2	1
20. My mom encourages me to enroll in a technology course.	5	4	3	2	1
21. My counselors told me computer classes are for boys.	5	4	3	2	1
22. My friends enjoy using computers.	5	4	3	2	1
23. I use the Internet or email, at least occasionally while at home.	5	4	3	2	1
24. My teachers encourage me to enroll in a technology class.	5	4	3	2	1
25. I use a computer, at least occasionally while at home.	5	4	3	2	1
26. I read books often.	5	4	3	2	1
27. I want to have a career as a computer professional like the people I see on television.	5	4	3	2	1

**For each of the following questions, please circle answer: YES NO UNSURE**

28. Do you have a cell phone... an Android, or an iPhone, or other device that is also considered a cell phone?	YES	NO	UNSURE
29. Do you have a desktop or laptop computer at home?	YES	NO	UNSURE
30. Do you have access to desktop or laptop computer at school?	YES	NO	UNSURE
31. Do you have a tablet computer like an iPad, Samsung Galaxy, Motorola Xoom, or Kindle Fire?	YES	NO	UNSURE
32. Do you have access to a tablet computer like an iPad, Samsung Galaxy, Motorola Xoom, or Kindle Fire at home?	YES	NO	UNSURE
33. Is there a computer you can use at home?	YES	NO	UNSURE
34. Thinking about the computer you use most often, do your parents, siblings or other members of your family share that computer with you?	YES	NO	UNSURE
35. Do you plan on taking any of the following classes: Animation, Digital Interactive Media (DIM), Computer Science, Computer Science AP, or Web Mastering?	YES	NO	UNSURE

**36. About how many hours a day do you spend using a computer?**

\_\_\_\_\_

**37. About how many hours a day do you spend surfing the Internet?**

\_\_\_\_\_

**38. About how many hours a day do you spend using a cell phone?**

\_\_\_\_\_

**39. About how many hours a day do you spend playing video games?**

\_\_\_\_\_

## APPENDIX G

### PARENT PERMISSION FORM

Project Title: Dissertation - An Examination of the Factors that Influence African American Females to Pursue Secondary Information and Communication Technology Education

**You are invited to take part in a research study being conducted by Shemesha Thomas, a teacher in the Cy-Fair Independent School District and a researcher from Texas A&M University. The information in this form is provided to help you and your child decide whether or not to take part. If you decide to allow your child to take part in the study, you will be asked to sign this permission form. If you decide you do not want your child to participate, there will be no penalty to you or your child, and your child will not lose any benefits they normally would have.**

#### **Why Is This Study Being Done?**

The purpose of this study is to examine and explore the social factors that influence African American females' decision to pursue secondary advanced technology education. This study is aimed to illuminate the factors that influence African American academic decisions regarding technology education so that parents, teachers, and school administrators can provide students with the necessary assistance and encouragement to pursue advanced technology education and careers.

#### **Why is My Child Being Asked to Be in This Study?**

Your child is being asked to be in this study because your child is an African American female high student between the age of 14-18 and has the opportunity to take an advanced technology course.

#### **How Many People Will Be Asked To Be In This Study?**

120 people (participants) will be invited to participate in this study.

#### **What Are the Alternatives to being in this study?**

No, the alternative to being in the study is not to participate.

#### **What Will My Child Be Asked To Do In This Study?**

Your child will be asked to complete a survey and may be selected to complete an interview. Your child's participation in this study will last up to 10 minutes when completing the survey and an additional 30 minutes if selected to interview and include only 1 visit.

Visit 1 -Survey

This visit will last up to 10 minutes before or after school. During this visit the student will complete an online survey.

Visit 2 – Interview

This visit will last up to 30 minutes before or after school. During this visit the study will be asked to participate in an interview.

**Will Photos, Video or Audio Recordings Be Made Of My Child during the Study?**

If your child is selected to interview, the interviews will be audio recorded.

*Language for Optional recordings:*

The researchers will make an audio recording during the interview so that the researcher can later efficiently transcribe the interview for accurate results only if you and your child give permission to do so. Indicate your decision below by initialing in the space provided.

\_\_\_\_\_ I give permission for audio recordings to be made of my child during their participation in this research study.

\_\_\_\_\_ I do not give permission for audio recordings to be made of my child during their participation in this research study.

**Are There Any Risks To My Child?**

The things that your child will be doing are no more than risks than your child would come across in everyday life.

**Will There Be Any Costs To My Child?**

Aside from their time, there are no costs for taking part in the study.

**Will My Child Be Paid To Be In This Study?**

Your child will not be paid for being in this study.

**Will Information From This Study Be Kept Private?**

The records of this study will be kept private. No identifiers linking your child to this study will be included in any sort of report that might be published. Research records will be stored securely and only members of the researcher’s dissertation committee will have access to the records.

Information about your child will be stored in locked file cabinet and computer files protected with a password. This consent form will be filed securely in an official area.

Information about your child will be kept confidential to the extent permitted or required by law. People who have access to your information include the Principal Investigator, Shemesha Thomas and dissertation committee members. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) and entities such as

the Texas A&M University Human Subjects Protection Program may access your child's records to make sure the study is being run correctly and that information is collected properly.

Information about you and related to this study will be kept confidential to the extent permitted or required by law.

**Who may I Contact for More Information?**

You may contact the Principal Investigator , Susan Pedersen, Associate Professor, to tell her about a concern or complaint about this research at 979-458-1128 or [spedersen@tamu.edu](mailto:spedersen@tamu.edu).

For questions about your child's rights as a research participant; or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office at (979) 458-4067 or [irb@tamu.edu](mailto:irb@tamu.edu).

**What if I Change My Mind About Participating?**

This research is voluntary and you have the choice whether or not to allow your child to be in this research study. Your child may decide to not begin or to stop participating at any time. If they choose not to be in this study or stop being in the study, there will be no effect on their student status or relationship with Texas A&M University, etc.

**STATEMENT OF CONSENT**

**The procedures, risks, and benefits of this study have been told to me and I agree to allow my child to be in this study. My questions have been answered. I may ask more questions whenever I want. I do not give up any of my child's or my legal rights by signing this form. A copy of this consent form will be given to me.**

\_\_\_\_\_  
Child's Name

\_\_\_\_\_  
Parent/Legal Guardian Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Parent/Legal Guardian Signature

\_\_\_\_\_  
Date

**INVESTIGATOR'S AFFIDAVIT:**

Either I have or my agent has carefully explained to the parent the nature of the above project. I hereby certify that to the best of my knowledge the person who signed this

consent form was informed of the nature, demands, benefits, and risks involved in his/her participation.

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Signature of Presenter

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Date

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Printed Name

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Date

## APPENDIX H

### SECONDARY QUALITATIVE INTERVIEW PROTOCOL

1. How do you feel about taking advanced computer classes?

Follow-up Question

- a. Why do you feel that way?

2. Tell me about your family.

3. How does your family influence your decisions regarding school and future career plans?

Follow-up Questions

- a. Has anybody in your family talked about Black girls liking computers, taking an advanced computer class, or having a career in the computer industry?

- b. Describe how you feel about what they say.

4. Tell me how your family encourages or discourages you from taking an advanced computer class or having a career in the computer industry?

5. Tell me about your friends.

Follow-up Questions

- a. How does your friends influence your decisions regarding school and future career plans?

- b. Tell me about a specific conversation.

6. How do your friends feel about your decision to enroll/or not enroll in an advanced computer class?

Follow-up Question

- a. Why do they feel that way?
7. Tell me how your teachers and counselors influence your school decisions.
  8. Tell me how your teachers, school environment, and/or counselors influence your decision to enroll or not enroll in an advanced computer class?

Follow-up Question

- a. Describe a specific conversation that you had with your teachers or counselors about taking an advanced technology class?
9. Tell me about your use of computers.
  10. How does your use of computers or technology influence you to take an advanced technology class?
  11. Tell me about the different media you often view.
  12. Tell me how the different media you view influence your academic decisions.

Follow-up Questions

- a. How were/are you influenced, or not, by the media about liking computers, taking an advanced technology class, or having a career in the computer industry?
- b. Describe something specific you have seen that may have influenced your decision.

13. Tell me about any other experiences that you have had that has encouraged or discouraged you to enroll in an advanced technology class.
14. I am interested in learning about why people do or do not enroll in advanced technology classes so is there anything else that you would like to share that I haven't asked you about.