The Implications of a Qualitative Study on the Decision of African Americans to Earn Computer Science Degrees for the Advancement of Career Choice and Ambition

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Abstract

According to Pearson (2002), fewer members of underrepresented groups work in STEM (science, technology, engineering, and mathematics) jobs. Among these marginalized groups, African Americans are included. Moore (2006), Pearson (2002), and J. F. L. Jackson, Charleston, George, and Gilbert (in press) all agree that more students majoring in computer science and other STEM fields would be good for the US economy. Using grounded theory, the author illuminates the experiences of African American undergraduate, graduate, and doctorate computer science students. Insights gained from this study have important implications for guiding participants into computer science degree programs and, more generally, for achieving their career aspirations. A heuristic strategy to expanding computer access was the product of the study.

Keywords; The following are some of the most important terms: expanding participation, African Americans, computer science, and universities.

Introduction

Among American scientists and technologists, white men predominate at the executive level (Moore, 2006). It is anticipated that initiatives to diversify the scientific workforce would not significantly alter the participation patterns of African Americans, who comprise fewer than 3% of STEM-related employment (Hrabowski & Pearson, 1993; Moore, 2006).

There are a number of challenges that African Americans face while trying to enter STEM occupations (Charleston & Jackson, 2011). African Americans are underrepresented in college admissions because, historically and now, they show stronger educational needs, and the K-12 education system often ignores them in comparison to White students (Ashby, 2006). This demographic's enrollment in primary and secondary schools despite a lack of Moore (2006), Graham (1997), and Charleston and Jackson (2011) all agree that a strong background in math and science is essential for future success in school and the workforce, especially in the STEM fields.

African American students face numerous challenges throughout their time in college, which contributes to the declining percentage of African American students pursuing degrees in science and engineering at the highest levels (American Council on Testing [ACT], 2006; Ashby, 2006; Graham, 1997). This qualitative study of African American men and women in computer science programs at the university level adds to the existing literature by shedding light on the experiences of those who face the historical and educational obstacles that have contributed to their underrepresentation and discourage their persistence in STEM-related fields. Its stated goal is to deconstruct the often-mysterious field of computer science by shedding light on how individuals with different degrees tackle it. Synopsis of the Article U.S. participation in STEM disciplines is at a record low right now. Ashby (2006) found no evidence of an increase in engineering and technology-related employment prior to 1994. Furthermore, there hasn't been a shortage of experts in this field since the 1950s (ACT, 2006). According to data conducted by Gilbert and Jackson (2007), college enrollment has increased overall, but there has been a decline in the number of students getting degrees in STEM fields. The American College Testing Association (ACT) found in 2006 that one reason for this decline is students' lack of readiness for STEM-based college-level coursework. The proliferation of technology on national, global, and economic scales is making preparation in STEM-related fields and the computing sciences increasingly important for increasing access to a knowledge-based and information-based workforce (ACT, 2006;Flowe
rs, Milner, & Moore, 2003; Gilbert & Jackson, 2007; Ma-ton, Hrabowski, & Schmitt, 2000; Moore, 2006).

The computing sciences have become an integral part of STEM education due to the widespread use of computers in modern American culture (Carver, 1994; J. F. L. Jackson, Charleston, George, & Gilbert, in press). U.S. scientific and technological expertise cannot be sourced only from White men if the country is to maintain its global competitiveness and fulfill labor market expectations (Gilbert & Jackson, 2007; J. F. L. Jack-son et al., in press). The United States government's affirmative action policies have not eliminated the underrepresentation of African Americans in STEM disciplines (Maton et al., 2000). The low number of African Americans who went on to pursue fields of study or careers related to computing science was found to be due, in part, to insufficient K-12 education, a lack of institutional encouragement, educational opportunities, and proper preparation (Margolis, Estrella, Goode, Holme, & Nao 2008). Although there is an increase in the availability of high-quality computers in underprivileged regions, they are often used for remedial reasons, and pupils of color make up a disproportionate share of these students. almost never motivate students to major in computer science or computer engineering (McAdoo, 1994; Margolis et al., 2003).Despite the fact that students fromallsocioeconomic ckgrounds re actively interacting with technology through various forms of media like music, video, graphic arts, and the Internet, there is a lack of effective teaching of the interdisciplinary connections between computing sciences and these activities. This is supported by previous research (Margolis et al., 2003). It is worth noting that the research by Margolis et al. (2003) supports the absence of technology-based course supplements that may attract students to computer science.

Further, earlier research (MacLachlan, 2006) calls for further programs and activities to assist African American students in achieving success in STEM disciplines. Undergraduates enrolled in these programs will be well-prepared for STEM (science, technology, engineering, and mathematics) and computer science (CS) teaching and research positions. The percentage of African Americans holding the positions of assistant professor, associate professor, or full professor in computer science has never exceeded 2.0% since 1998. Furthermore, it has never been
more than 2% of computer science PhD graduates in any given year among African Americans throughout this same time range (J. F. L. Jackson, Charleston, et al., in press). In light of the fact that 12.9% of Americans are African American (U.S. Census Bureau, 2008), these figures need serious thought.

In 2005, the Broadening Participation in Computer project was established by the National Science Foundation to specifically target the underrepresentation in computer science. Among U.S. citizens and permanent residents, we want to raise the percentage of women, persons with disabilities, African Americans, Hispanics, American Indians, Native Hawaiians, Alaska Natives, and Pacific Islanders working in computer science. While the program's primary audience is college and university students, it does welcome projects from kids in middle school and high school as well. Within the current research on African American involvement in STEM fields, there is a dearth of information about the effectiveness of any computer science programs or interventions targeted at this group. Consequently, the purpose of this qualitative study was to gather the key factors that inspire such engagement in this domain. Furthermore, this study provided an opportunity for African American practitioners to discuss their reasons for choosing STEM and CS careers. Based on this rationale, the research aimed to determine: "What key factors contribute to African Americans pursuing degrees in computing science?" Insight about the educational journeys of African American computer scientists and the formative events that inspired a love of the field may be gleaned from the response to this question. Similarly, the replies highlight the consequences and possible solutions for promoting computer science education among African American youth.

Method

This qualitative research strategy went against the grain of most others by actively encouraging the development of hypotheses based on the collected data. Due to the lack of a prior theoretical framework, this study relied on grounded theory to create a heuristic model.Combining the two approaches is known as grounded theory. According to Glaser and Straus (1967) and Mason (1996), this kind of data collection is essential for comprehending, comparing, and following the development of the phenomena under investigation. An essential component of grounded theory methodology, this consistent comparative data analysis allows researchers to safely conduct analysis and theory generation inside the data themselves (Gla- ser & Strauss, 1967). The steps are as follows: (a) comparing and contrasting the relevant facts for each conceptual category, (b) integrating the categories and their qualities, (c) defining the evolving theory, and (d) composing the theory (Jorgensen, 1989).

Scott, Haworth, Conrad, and Neumann: The Quintet

There are four interconnected stages of grounded theory, according to (1993). As a result,In any multi-stage procedure, the initial step is to collect all the necessary data and sort it into different categories so that analysis can be done efficiently. These classifications represent the researcher's similar thoughts found via constant data comparison. Theorizing about the theoretical underpinnings of these new concepts is an early but necessary step for the researcher. Theoretical sampling is used in the second iteration to guide data collection while the researcher addresses gaps in the developing theory. The third iterative process involves developing a preliminary theory by refining important concepts and their connections further. At this point, the researcher is actively looking for proof that supports or refutes their key theories and assumptions. Also, this method lets you discard or replace ideas depending on how strong the evidence is. Conrad et al. (1993) state that after grounded theory's first three stages are finished, an integrated theory comes forth to provide theoretical saturation.

Grounded theory allows for data inspection, which allows research to be continually improved in light of emergent themes and ideas. Additionally, it informs onlookers of the study participants' concerns and nitpicks, which reveals access features that allow for incremental development (Glaser, 1999). With the use of continuous comparative procedure and grounded theory, researchers may stay flexible and steer clear of distractions that might undermine the study's credibility. The goals of this research aligned with those of the African American Researchers in Computer Science (AARCS) program, thus we approached one of their yearly conferences to conduct individual interviews with program members to gather qualitative data.

The study's overarching objective was to identify the factors that encourage and support computer science as a major among African American students. The researchers hoped their findings would shed insight on the challenges faced by successful African American computer scientists. to try to get people to pay attention to the consequences for fresh initiatives, policies, and teachings. This study's research subject and interview methodology both provided insight into the important factors that make computer science education worthwhile. The qualitative study helped to shed light on many issues, including (a) early computer exposure, (b) the K-12 and college curricula, (c) extracurricular programs and activities, (d) internships and job experiences, and (e) influential role models and positive peer pressure.

To fully understand the participants' computing-related experiences, we relied on in-depth interviews rather than quantitative methods, which would miss the essence of the phenomena we were studying (Glaser & Straus, 1967). Lincoln and Guba (1985) noted that a qualitative method helped researchers get a better understanding of the participants' viewpoints of their individual journeys to computer science degrees.

Becauseof how the research was structured, it was able to include a broad variety ofparticipant-science components'social, environmental,and educational connections. The interview method also necessitated a protocol instrument that provided room for maneuver when asking questions, which fostered an element of unplannedness. The ability to reliably retrieve data is another advantage of qualitative approach. A key component of any legitimate qualitative research is the collectingofthorough information, and all of these characteristics of the study's design made that possible.

Subjects Thirty-seven one-on-oneinterviewswere conducted, and each one was identical in structure.A30-45 minuteinterviewwas conductedwitheach participant in the sample. Undergraduates made up 22% of the interviewees,graduate students 48%, and researchers and professors with PhD degrees 30%. Furthermore, half of the participants attended or were enrolled in a school catering mostly to White students, while the other half attended institutions with a predominantly Black student body.Abstracting from the Data I analyzed the study's audio recordings, transcripts, and notes using a basic qualitative analysis approach (Miles & Huberman, 1994). I followed a six-stage procedure to develop theme categories from the collected data. The first step was to assignmultiple word codes to the transcribed interviews. The second step was to make notes about reflections and related observations in the right-hand margins. The third step was to examine the data for similar phrases, patterns, commonalities, and differences. The fourth step was to isolate these patterns and processes for the next round of data collection. The fifth step was to gradually expand a small set of generalizations that addressed database consistencies. Lastly, the sixth step was to confront these generalizations. This six-stage procedure was critical in developing theme categories from the collected data. linkages, and eight percent attended mostly Black schools. African Americans who had or were pursuing degrees in computer-related fields made up the whole sample, with an average age of 28.5 years (see to AppendicesA–D).

Families of the participants came from all walks of life and all levels of income. On the other hand, the majority of the participants were from homes where both parents worked. The majority of them also did not come from an IT background. Everyone who participated from two-parent households had a high level of education, regardless of their family's financial situation. Topics discovered via coding This paper's research relies heavily on open-source code. I was able to extract useful information from the data and organize it into comprehensible categories using first-level coding (A. C. Strauss & Corbin, 1990). Coding helped us to meaningfully dissect the interview material while maintaining the relationships between our themes (Miles & Huberman, 1994). It is possible to trace the roots of both categories and the reasoning behind them back to the encoding process. The pieces started to fit together and make sense. Theoretical ramifications ofmeaning-generating categories took shape, and relative patterns started to

emerge. A. J. C. Strauss while J. This method might be used to further classify initial codes, according to R. Corbin's (1990) theory of pattern coding. Prime examples of grounded theory include the participants' experiences, as well as the patterns and thematic representations that follow (Glaser & Strauss, 1967). Lincoln and Guba (1985) and A. L. Strauss (1987) state that after enough regularity had established within the categories, meaning that all the episodes could be categorized rather easily, I ended the data collecting and analysis part of theresearch.With the use of the interview guide, I was able to conduct in-depth conversations with the participants on their backgrounds and perspectives on computers, spanning from their first encounters to the

ways in which they are employed today in the workplace and classroom. We extracted similarities from the interview transcripts and used them to create separate groups. The inductive emergence of themes outside of chronology demonstrates that I was careful not to presuppose the interconnectedness of the material before observation and analysis. Free and open-source software was heavily used in this study's analysis. To synthesise the data, I used first-level coding to extract relevant information and organize it into understandable categories (A. C. Strauss & Corbin, 1990). We found links between apparently unconnected topics by classifying our interview notes using codes (Miles & Huberman,1994).An explanation for the origins and rationale of categories may be found in the encoding process itself. After that, everything began to align and make sense. As the conceptual implications of the meaning-giving categories developed, relative patterns became apparent. Pattern coding, first proposed by A. J. C. Strauss while J. This approach may be used to further categorize main codes, according to R. Corbin (1990). Patterns and thematic representations derived from participants' experiences constitute grounded theory (Glaser & Strauss, 1967). Lincoln and Guba (1985) and A. L. Strauss (1987) concluded that data collection and analysis were complete after it became evident that enough regularity had developed within the categories to reasonably classify all the occurrences.

I had fruitful in-depth discussions with using the interviewguide.the individuals involved in relation to their lifetime experiences with computers, both in terms of exposure and use. Several categorieswere established from the interview transcripts based on the common features. I was careful not to assumethe interconnectedness of the material before seeing and analyzing it, as seen by the inductive development of themes outside of time. Using a qualitative research strategy, this study aimed to comprehend the educational and career paths of African American participants in the field of computer sciences. My complex racial, gender, socioeconomic, and educational identity impacted my interactions with participants and my interpretation of the data, thus I frequently reflected on myownpositionality. On top of that, I relied on quotable sections and theme analysis to bolster my very descriptive reporting of my results, which was informed by my use of inductive data approaches. Thevalidityand rustworthiness of the qualitative data collected in this study were guaranteed by using a naturalistic approach. Words like audibility, credibility, and fittingness in naturalistic inquiry refer to the reliability, internal validity, and exter-nal validity of measures and procedures, as opposed to the emphasis on validity in conventional empirical research (Guba & Lincoln, 1981). It is possible to demonstrate dependability in qualitative research by doing the same study under different settings. By encoding the raw data using naturalistic inquiry, I made it feasible for another researcher to not only grasp the made-up theories and motifs, but also to replicate my findings by checking the coded data for consistency.Consistent with naturalistic

inquiry, independent validation of the study's underlying structures validated the study's legitimacy. To rephrase, we made sure everything was consistent by constantly checking in with the people who took part in the study to see if there were any discrepancies. The meticulousness with which the individuals' experiences were examined further demonstrated persistent observation. Furthermore, we compared several data sources, such as digital audio recordings, physical transcriptions, researcher notes, and consultations with other researchers, to double-check our figures. All of the aforementioned methods—including extensive participation, consistent observation, and analysis of several data sets—form the basis of triangulation. It is standard practice to record interviews on audio or video for many reasons: comparing the results to other sources, conducting peer debriefings, revising working hypotheses as data is collected, discussing initial findings with research participants, etc. (Rudestam and Newton, 1992). Data for this research came mostly from in-depth interviews with study participants; triangulation was accomplished by verifying and corroboration of data, taking notes in the field, and clarifying participant categories and narratives. The structural validity of the research was supported in part by these actions.In an attempt to make this qualitative study more credible and genuine, I have tried to adhere to Wolcott's (1990) nine criteria.

Switch roles every so often. I tried to set up a gathering with the intended participants.

relaxed; I focused on the material; I raised my hand when necessary, etc.1. Be careful to record important details. I tried very hard to record everyone's precise words and deeds as they happened in order to avoid any confusion.Write at a young age. I began writing early so that I could see problems with the data or procedures more easily.(3) Let the viewers make their own judgment. Seeking input from others on primary data allowed me to try to expand the breadth of my observations and judgments.

4 Describe everything that happened in detail. I have tried to consider the likelihood of contradictions and the consequences of different interpretations, even if I do not detail every contradiction.And lastly, always be 100% honest. I tried not to let my own prejudices show throughout the qualitative part of the research.Seek feedback. To make sure the study's ideas and presentation weren't over-or under-developed, I actively solicited feedback at every stage.7. Reach a state of balance. It was my intention to record a statistically valid cross-section of occurrences so as not to overemphasize any one category.

Give your work a final polish. My goal in creating this paper was to make sure it was coherent and well-thought-out.

My goal in conducting this research was to address these nine issues in a legitimate and credible way by documenting and presenting facts. Results By analyzing the different types of data collected in this study, we were able to determine the following categorical themes that contributed to degree completion in computing science fields: (a) early exposure and engagement with computers and computing, (b) positive interaction and computing socialization, (c) factors that galvanized

interestincomputing sciences, and(d)important considerationsfor ccupational decision-making in computing careers. Keeping in mind that notalldatacanbe cleanlyTopics emergedduringour vestigation that did not neatly fit into any one category.

The Benefits of Beginning Your Computing Career Early

The individuals' varied initial experiences with computers were shared by everyone. Most people's first to computers was in elementary school, when they were about 6–11 years old, but they seldom had a strong interest in them beyond that. The average amount of time that participants had been around computers before they began using them often was six years. A child's early exposure to computers was greatly influenced by school exposure and parental purchasing. The term "classroom exposure" was omitted as some of the pupils whose schools provided them with computer literacy did not have personal computers but rather shared a limited number of machines throughout the whole school. When questioned about her first encounter with computers, one female graduate student had a similar sentiment: During elementary school, only the most intelligent students were granted access to the antiquated machines. It was a private club. Before my father bought the family computer, I hadn't really considered how useful a computer would be, but now I understand how important they are.

There was a lot of consistency in the manner of the introduction to computers across all schools, even if the grades and levels of involvement varied greatly. Such initial remedial contacts did not pique the interest of disadvantaged kids in computers any more, in line with previous results. These kinds of early engagement also showed that people had been exposed to computers at home. The three main uses of computers in the early days were word processing and keyboarding, instructional video games, and schooling. Given that the participants deemed these activities tedious and uninteresting, it is reasonable to classify them as remedial involvement. computer science. The following notions are shown by this assertion made by a female graduate student participant:

AGatewaydesktop computer was purchased by my family while I was a middle schooler. I typed up papers on it rather often, but that was about it. It was an isolated incident that occurred before I began to type papers, create PowerPoint presentations, and engage in other similar activities in high school. Performing the duty. Despite having opportunities to learn about and practice computing via class projects and activities, many students failed to develop a lifelong passion for the subject. These assignments failed to showcase the computer's adaptability and capacity, and they were framed more as chores than as chances. Students also said that they were often given computer time to play games, which might indicate that gaming had a significant role in their first exposure to computers in the classroom. A lack of engagement and motivation to learn more about computers plagued the participants. The following comment from a female doctorate student suggests the usage of terminology to hint at these assertions, although they are not generally asserted explicitly. "We used computers to complete math programs for about three hours a week while I was in middle school," she says. No more than a few online games and puzzles. No matter how my mom got a computer for the house, I had zero say in the matter. Even with simple applications like word processing, students who began using computers at an early age were able to swiftly advance to more advanced usage. Standardized test scores and general academic engagement were higher among elementary school students whose families had access to personal computers. Using computers for more complicated activities at an earlier age, namely by third grade, had a greater impact in this regard. The great majority of participants lacked background in advanced computer skills like programming and coding before starting college. Those who were able to do so did so via their high school's mandated science and technology classes, extracurricular activities focused on these fields, and/or their own personal networks of friends and family. A few of the people we spoke to have formal training in computer science.

called for more participation, while several students were dissatisfied with their high school's limited offerings. Upon entering college, the majority of students demonstrated a marked increase in their interest in computers. Before attending university, many of these pupils had never used a computer. The majority of these students thus entered college completely unprepared in the area of computer science. Students who were on the fence regarding computer science as an undergraduate or who were considering pursuing graduate degrees eventually changed their opinions. Computing and Positive Socialization The decision to study computer science was influenced by many respondents' talks with friends and relatives. While previous studies in the STEM fields have shown negative social influences that discourage underrepresented groups from continuing their education and careers in computing, this study found that participants mostly described social interactions that helped them in these areas (ACT, 2006; Gilbert, Jack-son, George, Charleston, & Daniels, 2007; Moore, 2006). While most interviewees boasted about their impressive computing accomplishments, it didn't imply they hadn't faced social challenges. One common thread in these reviews was a reminiscence of less-than-desirable aspects of working with computers in the past.

A number of participants cited their parents, teachers, mentors, classmates, and friends as major influences in their choice to take computer science more seriously, while others cited their own inherent interest. These individuals either pursued computer science as a major or provided substantial funding to those who did. Peer modeling or positive peer impact, parental care, and mentorship emerged as three main themes derived from these positive social interactions and computer socialization. It was critical to have supportive peer influence or role modeling when it came to computer persistence. The educational pipeline that supports the computer sciences, relevant concepts and constructs, and participants were exposed to all of this. People were interested in the research because of all of these things. A female faculty member's comment lends credence to the results of positive peer pressure and impact: We were a tight-knit group of five (including myself) and we discovered even more things to do, including putting different "tweaks" into our operating systems (during the days of "Windows '95" and "Windows '98") and making our own supplemental materials. I made a lifelong friend in college. Our competition over who could do better on the computer was incessant. As we determine what new equipment to acquire, it's a mix of competitiveness and sustenance.

For those who expressed an interest in computer science, friends were an important source of support. When it came to computers, many of the respondents' contemporaries were more experienced and engaged with more advanced systems. The participants' peers often persuaded them to change their undergraduate major from mathematics or a related subject to computer science. Graduate student reveals that a friend has been instructing her in C++ programming. The next semester, I enrolled in a basic computer science course. Applied mathematics was my undergraduate major. My best friend strongly suggested that I give the [Computing and Robotics] Olympiad a go. I went in search of the conditioned stimuli teacher and gave them my name. Even though I had a stronger background in mathematics, I would often sit and observe her code because of how proficient she was. Things that didn't exist before were appearing because of her. My initial impression upon sitting down for my computer science course was, "OK, I might actually want to do this."

Parentalcarealso ignificantly improved positive social connections. principally via starting and completing an undergraduatedegree program at an accredited college or institution.Atypical expression of these good social relationships was the financial, academic, and moral support of others. It was found that the majority of these innovations begin with the purchase of a computer and continue with the development of computer literacy via tangible goods like software and hardware. Furthermore, many parents were shown to formally or informally promote or financially support their children's pursuit of computer-related knowledge (e.g., programming lessons).

Along with peer modeling and parental nurture, mentoring

brought people into touch with the computer world while also providing a good social experience, both of which contributed to their degree.results for participants. Studyparticipants often mentioned how they would have dropped out of their computer science programs if it weren't for the involvement of a mentor, highlighting the importance of mentoring in terms of participants' goals for the greatest levels of degree achievement in computing sciences. Many of the interviewees' mentors were the people who introduced them formally to the subject of computer sciences by putting them in touch with faculty and graduate students in the field. Because of the intersection- ality and direct association between mathematics and computers, participants' interests in mathematics sometimes sparked unique types of computing- related mentoring. The following quote from a male faculty member is illustrative of the way in which mentoring encourages computing-related degree completion: Someone was hacking into these [computer] systems, and my supervisor caught on to it. Asked me whether I had attended class that day. To paraphrase, "Keep trying to get in [the computer systems] and tell me when I can't." He offered me books and encouraged me to enroll in a computer science program, telling me that he could not reveal the identity of the young hacker. He guided me in my early years. He [myMy adviser and mentor in graduate school arranged for my financial support and provided tokens for public transit. He made sure I could show up and do my thing. He was great overall, but there were times when he had to stand up to folks outside of his division. Impulsive Elements in the Computer Sciences Several participantshighlighted several features and qualities of the computing sciences that they find intriguing. Most of the participants got started with computers because of the Internet, visuals, or games. Their interest in computers grew in tandem with the depth of their knowledge of the subject. Four key characteristics of computing were regarded most common, despite numerous individuals

claimingextremely specialized interestsconnectedto computers, such as artificial intelligenceand programming. computerscience's(a)adaptability/interdisciplinary character, (b) its dynamic nature, (c) its emphasisonaddressing problems, and (d) its value in facilitating human-computer interactionAs they made analogies between computers and other sectors of work, several participants remarked on the allure of the subject. Respondents to the survey said they were drawn to computers because they believed it would open doors to other fields of study and because its malleability made it unlikely that they would ever become bored with the field. Participants were happy to report that they could pursue whatever hobby they wanted thanks to computers. Because of this adaptability, professionalsmay move freely across fields, expanding their potential career options. Basically, I can give everything a go, a female professor said. What "it" is, I can figure out. How can I make a living doing what I enjoy? With a graduate degree in a hard science.

Because of its ubiquitous nature, computers is difficult to pin down; its breadth means that its practitioners may specialize in almost anything while still finding satisfying work. It is also interesting to notice that several respondents highlighted the dynamic nature of computers as a driving force for their interest in the field. In discussing why they chose to work in the field of computers, several respondents mentioned their insatiable appetite for knowledge and how excited they were by the prospect of working with cutting-edge technology. As a result, the potential for education generally and its practical applications stands out as a defining feature of the computer sciences. One of the female professors suggested, You can perform a wide range of things. There is always more to learn, and I believe that those of us with advanced degrees (or those working toward them) recognize this. Our passion is towards education. We like learning new things very much. And unlike many other professions, you can advance in this one. Since there is always a new facet of it (computing science) coming out or something that is already out that you haven't, you know, had an opportunity to get to know, you may learn as quickly or as slowly as you choose. So it's a whole universe that you can explore if you want to. Participants did report enjoying the challenge of solving problems, but they were far more enthusiastic about the rewards they reaped from their efforts. mary school years through college. Computing-relatedcohort building describes the formation of a group of individuals collectively pursuing computing sciences throughout their educa- tional trajectory.Knowledge of the interdisci- plinary nature of computing involves informing individuals of the connection between comput- ing sciences andotherdisciplines. ultifacetedmentorship refers to sustained

mentoringfroman dividualwith a vast knowledge of the field of computing throughout the educational and vocational trajectory.

Earlyadvancedengagementwithcomputersandcomputing.

The findings of this study revealed that early exposure to computers alone did not facilitate further interest in com- puters for the majority of the participants. Fur- thermore, remedial engagement with computerssuch as word processing, playing games, and non– computing-related class assignments didlittle to spark the interest of participants. What did spark their interest in computing was ad- vanced engagement in the form of program- ming, hardware installation, and information creation (i.e., creating games). Because this ad- vanced exposure facilitated further interest in computing sciences, it is necessary to expose students to these and other types of advanced engagement with computing during their pri- mary years or as early as possible. This engage-ment serves to facilitate the desire to learn moreabout computers.

Advancedengagement introduces the pros-pect of creative possibilities. That is, once in- formation creation is accomplished, this fosters further interest in the limitless possibilities and functions of computers, and how the computer can aid students in bringing their ideas to frui- tion. It facilitates the opportunity for young African Americans to be owners of technolog- ical innovations, which in turn encourages themto pursue further education or knowledge re- lated tocomputers and computer technology.Advanced engagement in computing fosters sustained engagement. Remedial engagementsuch as word processing, keyboarding, and gaming does not facilitate sustained involve-ment. These remedial tasks lack the necessary intriguing elements of computing thatarepres-entin cedengagement. dvance engage- ment involves the element of creation, which invokes a recurring desire in African Americans to "do it again."Thecreationofa productthatsciences. Therefore, theseprogramsprovide nologicalincubation essential to degree at- tainment of African Americans n computing sciences.

Rigorous grounding in science and math- ematics. Many studies (e.g., Gilbert et al., 2007; Hrabowski & Pearson, 1993; Maton etal., 2000) cite the necessity of a solid foundationin mathematics and sciences in an effort to be adequately prepared for STEM occupations. As computing sciences have risen to the forefront of STEM fields, a strong background in math- ematics and science is necessary. Many retro- spectiveconsiderationspositedby the study participants suggested that they would have pursued additional and more advanced courses in preparationforthefieldofcomputingsci-ences.The directconnectionbetween mathe- matics and science and the field of computingsciences ecessitates significant aptitude in math and science, which must be attained throughout the educational trajectory. As such, a solid foundation in science and math fosters the decision to pursue the computing sciences among African Americans.

This phase merits robust K12 curricula in mathematics and sciences. African Americanstudent preparation is often representative of aninadequate educational system. Wherever pos- sible, supplementary education in science and math must be provided. This attainment cantake shape in extracurricular math-based pro- gramming, tutorial sessions, or robust or sup- plementary classes in school for science and mathematics. Many of the successful computing sciences participants in this study attended sci- ence and technology-based high schools thatenhanced their preparation for computing. However, many public schools do not ascribe tothese advanced reparatory systems. As such, the aforementioned alternatives must be applied to increase the likelihood of educational and occupational participation in computing sci- ences among African Americans.

Computing-related cohort building.

sciences is a field that requires so- cialization. That is, to be successful Computing in the field,it is necessary to become indoctrinated with its social and technical aspects. This is most effec-tively achieved through the formation of groups with individuals of comparable skill level who cannavigatethrough computing together. In these circles(e.g.,mandated computing labora-

Conclusion

Finding out what factors motivate African Americans to study computer science was the driving force for this study. Instead than focusing on individuals who left or were just starting out, this research examined the career pathways of existing and future computer scientists, which is a new way of looking at the topic of African Americans and their persistence in the industry. Thanks to this study, we can now articulate the experiences of African Americans at the highest occupational and educational levels in computing, as well as those in the undergraduate and graduate pipelines, and we can also apply a heuristic model that encouragesBlack Americans to pursue fields relatedto computerscience.Black mericans' decision to major in computer science was influenced by socially created settings, according to the study's key findings. Students' level of ambition and individuality were not significant predictors of their performance in college, but there were a few exceptions. However, the most illuminating aspect was the existence of encouraging social variables, which served to both ignite an early fascination with computer science and sustain that enthusiasmthroughout college. The study's original research question was, "What factors contribute to African Americans' pursuit of computing sciences degrees?" and by grouping these aspects into six main types, we may start to answer that issue. (a) plenty of opportunities for mentorship, (b) exposure to computers and computing both early on and in more advanced settings, (c) strong grounding in mathematics and the hard sciences, (d) making friends with people who share an interest in computers, (e) learning about the multidisciplinary nature of computing, and (f) access to a variety of technical resources.

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andJ.F. L. Jackson are now hard atwork on a publication. In this study, we surveyed students and professionals in the field to better understand whatdrivesAfrican American males to work in computer science. In reference