Computing Resilient Identity Development and Maintenance of Black Americans Who Earned A Ph.D. in Computing

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***Abstract*— This Research Full Paper presents a qualitative interview and descriptive study on computing resilient identity development of African Americans who have earned a Ph.D. in a computing field. Low sense of belonging and self-efficacy contributes to low participation and performance of African Americans have lower participation and performance in computing as compared to their White and Asian counterparts. Computing identity including sense of belonging and self-efficacy contributes to this deficit. To increase African American successful representation in computing, resilience is explored to identify the support systems, challenges, and coping processes of African Americans who have earned a Ph.D. in computing. In-depth, semi-structured interviews of African American post-docs, faculty, and industry researchers in computing fields were implemented. Interviews were audio recorded and transcribed. Transcriptions were analyzed with a hybrid inductive-deductive qualitative content analysis. Surveys were employed to document participants' work resilience and personality to supplement the qualitative data. Results include the resilient identity development of participants by reciting background information, challenges and support systems in their respective employment, and how they react to such stressors and supports, and the productive they are while persevering. Findings from this work can be used to improve academia and industry conditions for African American professionals and to identify resources that were suggested to be pivotal in participants' resilient identity development within the computing field. This paper is in conjunction with other papers in an extended case study on resilient identity development in African American computer scientists.**

Keywords—computing identity, resilience, self-efficacy, sense of belonging, African Americans

I. INTRODUCTION

Despite the fact that black Americans encompass 13.2% of the U.S. population [1] their current representation in computing fields is not congruent [2]. This under-representation is clear in the not only in academic sectors of employment, but industry as well [2]. Prior research has indicated that the number of black faculty in computing has diminished while representation across other departments has generally increased [3].

Furthermore, data from an article published by Bloomberg News shows that among eight of the largest tech companies in the U.S., the percentage of black workers in technical jobs rose to 3.1 percent in 2017 from 2.5 percent in 2014 [4]. While these statistics show promise for blacks in computing, additional data shows that blacks make up only 7 percent of U.S. high-tech workforce, and just 3 percent of the total Silicon Valley workforce [5]. According to a report published in 2016 by Equal Employment Opportunity Commission, African Americans are substantially underrepresented in computing industry careers, while Asian and white counterparts are over represented [6]. While the number of blacks receiving STEM degrees is increasing [7, 8], this same representation is not reflected in the tech industry [9]. Furthermore, data from the Associated Press suggests that blacks in high salaried computing jobs are chronically underrepresented in comparison to whites [10] and blacks who do work in computing, earn less than their white counterparts [9].

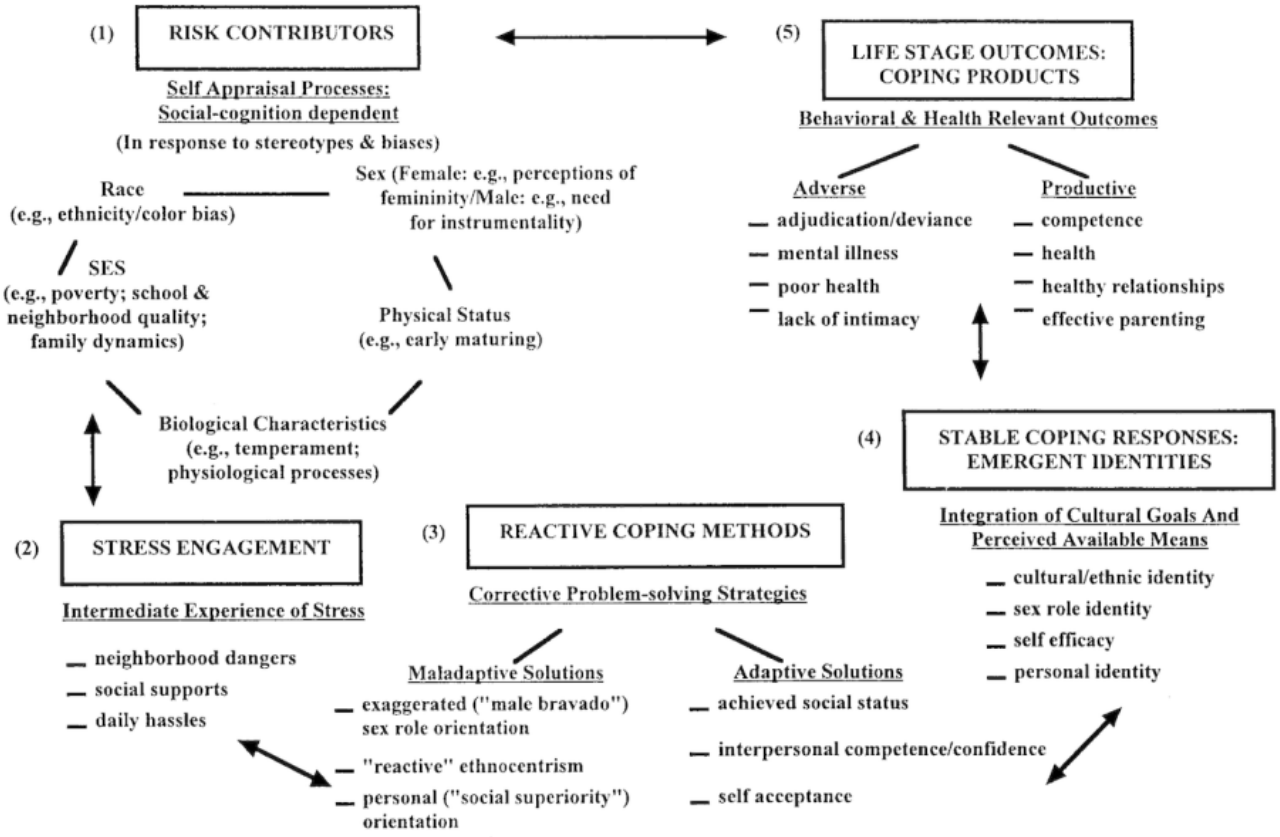

Fig. 1. PVEST model by Spencer et al., 1997.

A. PVEST Framework

It is suggested that developing an adaptive resilient identity can be an effective asset-based approach to narrowing this gap [11-13]. The Phenomenological Variant of Ecological Systems Theory (PVEST) describes the physical and social-cognitive aspects that contribute to resilient identity development of individuals with variant cultural contexts to the spaces they encounter [13]. PVEST consists of five processes that produce either adaptive or maladaptive resilient identities: 1) risk contributions; 2) stress engagement; 3) reactive coping methods; 4) emergent identities; and 5) coping products (see Figure 1). Risk contributions include the physical, behavioral, and socio-cognitive attributes individuals possess prior to encountering a new space or context such as race, socioeconomic status, personality, and sex. Stress engagement describes the encounter of a new space or context and the stressors they provide. Reactive coping methods describes how an individual reacts to such stressors, which may be in maladaptive or adaptive methods. Collective reactions to the stressor form stable coping responses, that emerge from internalized identities one has in relation to the space or context including cultural identity, sex role identity, self-efficacy, and personal identity. These identities manifest in social roles and behaviors and well as physical states of being which may be adverse or productive. It is theorized that through the use of adaptive reactive coping strategies, individuals can form adaptive resilient identities and productive social and physical products [13].

B. Black Risk Contributions, Computing Stress Engagement, and Professional Reactive Coping Methods

According to a research study by The PEW Research Center, Black computing professionals are notably most likely to say they have experienced discrimination in a current or previous job as compared to white, Asian, and Hispanic counterparts [14]. Over a third underrepresented minority faculty attributed race being a factor of hostile climates with sources being reported from deans, department chairs, colleagues, and students [15]. Black academic faculty members have challenges retaining their jobs and being considered for promotion [16, 17] Two factors that contribute to these hindrances include becoming overwhelmed with increased teaching and service loads as well as rigid expectations about regarding research and publications [17].

Sense of belonging is defined as how others view an individual as a computer scientist based on social norms or recognized by others of the same kind, which may influence how they perceive themselves as a computer scientist [18]. In some instances, African-Americans do not identify with computing as a social norm within their peer group, which may impose negative implications on career advancement [19]. Black faculty professionals at predominately white institutions often feel that they have a lack of support within their

institution [20-23]. While individually assessing personal support for Black faculty in computing, factors of this decrease may include the lack of mentorship and access to external collaborators that are usually afforded to their white and Asian counterparts [3]. This lack of support and mentorship is not only detrimental on the individual level but can also incite issues on the institutional level.

In addition, black computing faculty at HBCUs are more likely to involve their undergraduate students in research as opposed to PWIs; there is still a lack of evidence as to why these faculty members involve more students and if support attributes to this engagement [24]. Alternatively, Black faculty at PWIs struggle at times with collaboration. Black faculty professionals at PWIs find it more challenging to collaborate with individuals with similar research interest especially if their research is minority-focused [17]. In computing, underrepresented minority-focused research is not as prevalent as other research topics, therefore resulting in a small number of professionals interested in this area. This poses a significant challenge for new faculty at PWIs in search of like-minded mentors. Many PWIs provide mentorship for new faculty, however; these programs are open to individuals from any background. Some PWIs also offer minority support programs but may lack the desire for culturally relevant traditions [17]. Consequently, some faculty at PWIs chose to self-mentor and collaborate with a small circle of individuals to pursue their research interest [17]. Black faculty members are particularly more responsive to personal support, but when not received, this could have an unfavorable effect on an individual's ability to form professional networks [15]. In return, Black faculty who have a proportionally larger network of external collaborators lead to extensive departmental resources and better ratios of productivity [15]. However, the ratio of external collaborators and internal collaborators within an institution are statistically lower.

As lack of a sense of belonging is continually evaluated, evidence shows that it manifests into poor self-efficacy, which is defined one's own judgement as to how well they can execute a required action based on a certain situation and work performance [25]. As a result, many black computing faculty and industry professionals do not have the same sense of job security as their colleagues [4, 7, 26]. Without a sense job security, it can be difficult to actively campaign for work climate change. However, there is currently no clear evidence on how lack of job security affects the identity of black computing faculty and industry professionals.

TABLE I. IDENTIFIED CODES AND DEFINITIONS

Code	Definition
Risk contributions	The physical, behavioral, and socio-cognitive attributes that individuals possess prior to encountering a new space or context.
Stress engagement	The encounter of a new space or context and the stressors this new space provides.
Reactive coping methods	Adaptive or maladaptive actions from the individual as he/she reacts to such stressors.
Emergent identities	Stable coping responses one has in relation to the space or context (i.e. cultural identity, sex role identity, self-efficacy, and personal identity)
Coping products	Adverse or productive social roles, behaviors, and physical states of being

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C. *Emergent Resilient Computing Identity*

Resilient identity development in computing fields can help bring a positive change to the marginalized performance of African Americans in computing. Resilience is noted as an individual's ability to overcome difficult problems, challenging situations, in the midst of adversity [13, 27]. This trait can have significant implications on one's advancement within an organization or institution. Resilience is not classified as a personality attribute but describes a dynamic process of positive adaptation despite significant challenges [28]. Resilient individuals are those that able to maintain an attitude of optimism and a mindset that is open to learning, which is critical to one's success [29] especially in field computing.

The theoretical construct of resilience, which has been evaluated and measured extensively in the social sciences [30], may provide a novel and astute paradigm to frame the discussion of the experiences of black computing faculty and industry professionals and how this concept can be used as an instrument for success amongst these professionals. In areas of computing within the academy where academic research and standards are continuously evolving, those who concurrently remain resilient thrive [31]. This is especially true amongst black faculty members and professionals in computing. As black faculty manage traditional roles and responsibilities in academia including research, lecturing, mentoring, etc., they also have to deal with external factors such as salary gaps, prejudice, and a lack of resources within their institution. Many black faculty professionals are accustomed to exhibiting resilience because they feel they have worked too hard to risk losing their position [15].

II. METHOD

In this work, rather than proposing a technical solution, we focused on further investigating factors that affect computing identity among Black ccomputing faculty and industry professionals. To identify factors related to this concept we conducted semi-structured interviews.

A. *Participants*

We recruited nine Black computing professionals to serve as participants for the study. Three participants were interns or early industry researchers, two were post-doctoral faculty researchers, were two were tenured faculty, one was an assistant faculty member, and one was a senior industry researcher. Two faculty members worked at historically Black Colleges and universities (HBCUs). Participant ages ranged from 22-54. No participants reported any disability. There were six females and three males. Participants were recruited by sending out a call for participation for volunteer computing professionals who have earned a Ph.D. in computing through the African Americans Ph.D.'s In Computer Science(AAPH.D.CS) email list. The AAPH.D.CS email list is a platform designed to foster the development of a virtual community of Ph.D.-level researchers, educators, and students who are African-American and other minority groups.

TABLE II. RESILIENT IDENTITY DEVELOPMENT PRIOR TO CAREER

Codes	Themes (most frequent)
Risk Contribution	
Personality growing up	shy; introvert; curious
Socioeconomic status	middle class
Stress Engagement	
Community challenges	no challenges; student peers did not value academia
Community social support	internship/summer programs; support at home; like-minded peers who valued academia; employer/mentor support
Daily hassles	Adult responsibilities delayed returning to school; lack of adequate resources/money; race stereotype threat
Reactive Coping Methods	
Plan for college	college always intended/assumed; influential Ph.D./career prep program
Stable Coping Response	
Computing sense of belonging	college & grad school shaped belongingness; college/grad school extracurricular shaped belongingness
Computing self-efficacy	strong teacher; not a coder; above average
Coping Product	
Outcomes formed	mentor/advisor; nontechnical teacher; researcher; manager/organizer

B. Procedure

Volunteer participants signed an informed consent form and completed an online survey. The online survey consisted of three components: 1) demographics; 2) personality assessment; and 3) resilience survey. The demographics section asked participants about their socioeconomic conditions growing up and currently as well as general information about their careers. The 60-item Big Five Inventory-2 (BFI-2) [32] was used to assess the personality of the participants. An adopted form of the 30-item Academic Resilience Scale (ARS-30) [27] was used to asses participants' workplace resilience.

Following the survey, a 60-90 minute semi-structured interview was scheduled for each of the participants to identify significant factors that influenced and continue to shape their resilient identity in the computing field. Interviews were conducted virtually via Google Hangouts. Our interview questions aimed at collecting data on resilience and computing identity among Black Computing Faculty professionals. During the interview, participants were asked questions about their cultural upbringing, how computers and information technology was experienced during their early development, why they chose to pursue a Ph.D. in computing, how resilient computing identity plays out on their day-to-day activities, and of their user experience using the AAPH.D.CS listserv (See appendix for full list of questions). Each interview lasted around 60-90 minutes. Interviews were audio-recorded and transcribed verbatim. Participants received a US \$100 amazon gift card as compensation.

C. Data Analysis

The demographic data was analyzed using descriptive statistics. The personality and workplace resilience data was analyzed following the instructions of the respective scales which follow specified descriptive statistics. The interview data was analyzed by using Fereday & Muir-Cochrane's hybrid inductive-deductive thematic analysis [33]. The PVEST model for resilient identity development was used to suggest codes for developing the code manual. Codes were created and defined to support the question about if they were to work in an alternate field such as academic or industry, would they have developed the same resilience (see Table 1). The two lead authors reviewed the defined codes to test the reliability of the defined codes. A few codes were synthesized and others were carefully redefined to better reflect the suggestions from PVEST and other literature. Themes were identified inductively from the transcribed data and connected with defined codes (first-order themes). A couple of new codes were created to catch elaborated details from participants. Themes were then legitimized into second-order themes which synthesizes first-order themes, address contradicting themes, and compares them with literature suggestions.

III. RESULTS

Participants came from middle class environments and had varying personalities growing up, namely introverted and curious (see Table 2): *"Very inquisitive. I was always into something. Probably kind of mild-mannered so I wasn't always the first to speak"*. Though there weren't many challenges in the communities they grew up in, a few participants did discuss how not all of their peers valued academia: *"there's a group of students who care, who are college bound, who are into academics and those who are not. And I just hung out with the kids who were on the college trip, and I was in all of that and I ignored the rest of them."*. Participants had support programs, mentors, and surrounded themselves with like-minded peers. Some participants discussed challenges of returning to school after their undergraduate degree due to everyday responsibilities. A few participants experienced mild stereotype threat: *"gender-imbalance"*; *"I feel like the professor discriminated against me because I was black one and two I was doing better than the next student"*. For many, college was assumed or mandated from their households, though some were influenced by career prep programs: *"In the beginning I mainly went because it was something you're supposed to do. You're supposed to get a degree. And then, as I thought more about what I wanted from my life, the flexibility or type of research I wanted to do I realized that computer science really did align."*; *"I did summer outreach stuff while I was in high school. I spent a summer at Tuskegee doing an engineering program."*. Furthermore, most participants discussed having strong academic belongingness and self-efficacy, particularly in teaching an advising, resulting in many of their career roles being an instructor, advisor, manager, organizer, and researcher: *"After I worked at Google and then I went back and worked at Google again. I felt I could go anywhere I wanted to go, to be honest"*; *"Yeah definitely, after I did that independent study, almost everything that I did with relation to computing involved graphics."*; *"I think in terms of my ability to be organized, work with students, mentor students and reinvent myself, I think that I would measure myself as above average in comparison to my peers. If I were to say, producing abundant research in a particular year, I would say I would be below average in terms of with my peers."*.

Participants described their careers (see Table 3). Participants reported having more confidence adjusting their careers for higher pay and stronger comfort: *"in terms of my personality and the way I see things as a professor, is that I'm reinvent myself and I can see how I can change my scope and*

my contributions as a computer science professor."; *"Of course, if it did not there's something's wrong. Yes, it did, I think I grew up a lot. I was juggling, foolishly, trying to get married, and go through graduate school, and then I was ... Some people still have the training wheels from parents? Once I left undergrad, it kind of was, they helped a little bit, but I wanted to stand up on my own two feet. So, I forced myself to grow up a lot more. And that experience forced me to grow up. So, I definitely changed."*. Participants described how their undergraduate experience and peers persuaded them to pursue a Ph.D. as well as influence from their parents, the desire to teach, the desire to challenge themselves, and the desire to expand their options in computing *"So, the honest answer? So honestly, I'm probably a glutton for punishment. It's like, if somebody says, this is as high as you can go in the mountaintop. It's like, I've got to go, I've got to touch that mountaintop, to say I did that. So, I'm like an OCD overachiever, I'm always looking for the next thing to conquer, You know that there's money to be made. So, for me, it's how do I take advantage of that in the best way possible for my field. I didn't think I wanted to be a programmer, and honestly when I graduated from my undergraduate degree I didn't really know what I wanted to do, so let me take this time to figure it out."*; *"It was peer pressure honestly."*; *"definitely wanted to teach at the college level"*. Participants selected a career goal primarily from pivoting from one they found less desirable or wanting to pursue a faculty position in order to actively mentor: *"can say that when I worked in industry, I was a very, very hard worker, but what I did notice is, I did think that, and I did feel that being an African American in industry was not for me,"*; *"When I was pursuing my masters, in my head, I knew that I would eventually leave industry to teach because I had one sole purpose and that was to increase the number of people of color in computer science"*.

Faculty generally worked with smaller course sizes (around 20 students) accompanied with research, student advisement, and department roles. Those in industry had varied careers in including consumer product programming and back-end communication support with varying company sizes and work environments. Most participants agreed that their work was generally not too demanding though time pressures may increase the demand: *"just from my experience, I mean yes, it's demanding but it's not impossible."*. Most participants faced no discrimination outside of mild ageism and getting confused as a students and rude customers. Participants generally had no work hostility; a few mentioned coworkers talking behind their backs and some hostility as a manger having to critique others' work and performance: *"When I was a leader, absolutely, absolutely. Now as a faculty, no. I've never had a confrontation as a faculty or somebody disrespectful or looked down on me or discriminated against me. But* [when I] *became a dean, it all changed. Even when I was a chair, there was a Caucasian man who worked under me, who was not producing. I had to do his evaluation and he actually told me I was discriminating against him"*.

In response, participants adaptively remained calm, humorous, well-disciplined, and resilient with variable work/life balance: *"think I have a pretty good work/life balance. I tend to do this thing where if I realize I have a little bit of additional free time, I kind of fill it up with more stuff."*. On the contrary, participants maladaptively felt work demands could sometimes cause them to be disrupted, overwhelmed, with poor communication, and hostility causing mild counter-hostility and avoidance: *"So, sometimes that can be disruptive or whatever and the other aspect of it that is a challenge is that we don't have a lot of documented processes and [processes] change a lot. So, any time you try to do something, you have to first figure out. 'Let me write that down. Let me make sure I understand.', and then you try to get clarification on, 'Okay, well', and nobody will answer your question."*; *"There are times when it just feels like a lot of work, there's just a lot of stuff that has to get done but, it gets done."*. Participants accessed support resources such as particular coworkers, mentors, participated in professional development programs

TABLE III. RESILIENT IDENTITY MAINTENANCE DURING CAREER

Codes	Themes (most frequent)
Risk Contribution	
Personality change	confident; better management skills; reinvented self
Socioeconomic status	upper middle; middle
Ph.D. choice	persuaded by undergrad peers; generally persuaded in undergrad; persuaded by parents; wanted to expand options in CS
Career path	***Faculty***: to mentor; felt out of place in industry; industry work felt repetitive. ***Industry***: wanted higher pay; offered a position prior to earning Ph.D.
Faculty school choice	***PWI***: worked close. ***HBCU***: goal since undergrad; stumbled upon job opening
Stress Engagement	
Work environment	***Faculty***: teach 1 class; small school size; 20 students per class; exciting and supportive; only black faculty in department. ***Industry***: fast growing company; public start-up; work from home; moderate size company
Daily commitments	student advisement; teaching; research; paper/book writing and revision; other smaller roles
Work & research demand	not too demanding; demanding; time pressures
Discrimination	none; mild favoritism; customers on phone; mild assumptions; managing men as a woman; mild misjudgment of authority by looking young
Hostility	none; coworkers talking behind back; result of critiquing coworkers' work
Reactive Coping Methods	
Go-to support resources	***Adaptive***: certain coworkers; mentor; professional development programs/workshops; conferences/conventions. ***Maladaptive***: none, work independently; have not pursued support programs
Healthy communication	***Adaptive***: yes/try to make healthy communication; regular meetings
Reaction to work demand	***Adaptive***: calm, time consuming. ***Maladaptive***: disrupting, poor communication, undocumented processes, frustrating; overwhelming
Reaction to hostility	***Adaptive***: jokingly irritated; M***aladaptive***: slightly hostile; fearful and avoidant to criticize
Work/life balance	***Adaptive***; good/well-disciplined; challenging/working to strengthen; varies
Stable Coping Products	
HBCU/Diverse identity	no difference; less favoritism; more culturally-centered, more friendly
PWI/less diverse identity	no difference; less social; less relatable; less work support; more established research network; students more experienced; demand for diversity inclusion

and workshops, and tried to maintain regular, healthy communication: *"I try to make it* [communication] *healthy"*.

Many participants believed there would be no substantial difference in their situations if they taught at an HBCU vs a PWI (and vice versa) or at more diverse company vs a less diverse company (and vice versa). Some notable variances suggested diverse companies and HBCUs would show less favoritism, be friendlier, and be more culturally-centered: *"general, I feel like when I work with a lot of guys, it's not as friendly of an atmosphere. I don't know if that's because they don't know how to talk to ladies or they don't know how to talk to women but sometimes it just feels a little halted and a little still but when you have other female coworkers, there are a lot of experiences that you go through that are similar to experiences they've gone through"*; . It was also suggested that PWIs and less diverse companies would consist of stronger established research networks, more experienced students and personnel, and have stronger explicit demands for diversity and inclusion: *"Well for one, I think the things that depending on the school, that prepares it so the students might be a little bit higher, just because most students, the students we're getting don't necessarily have any experience with computing when they come, whereas at PWIs they have a more rigorous criteria for acceptance, that's what I want to say, so their students are expected to have some experience. And so, in classes right now, I haven't had to spend more time getting students up to speed, whereas I would probably have to do loads of that at PWIs."*; *"I'm at an HBCU, I have some students, we share a common experience, being black, and being women. So, while our experience isn't completely alike, I have some commonalities with them, so I don't have to spend as much time, I guess I don't have to be as sensitive and, I want to say changing how I engage with them. I think that would be very different at a PWI. You have to take more care with your diversity and inclusion efforts inside the classroom"*.

TABLE IV. PERSONALITY COPING PRODUCT

Personality Type	Mean (SD)
Extraversion (Sociability, Assertiveness, Energy level)	39.02% (5.23%)
Agreeableness (Compassion, Respectfulness, Trust)	68.66% (7.57%)
Conscientiousness (Organization, Productiveness, Responsibility)	63.92% (10.55%)
Negative Emotionality (Anxiety, Depression, Emotional Volatility)	46.78% (4.62%)
Open-Mindedness (Intellectual Curiosity, Aesthetic Sensitivities, Creative Imagination)	60.80% (8.40%)

Participant experiences lead to varying coping products in personality and resilience. Only one participant was below middle class (working class) prior to pursuing undergraduate education. Common personality attributes were measured to give a deeper insight to resilient development (see Table 3). As it was expected that personalities varied: on average participants were 39.02% extroverted (M=30.74, SD=2.51), 68.66% agreeable (M=44.95, SD=3.63), 63.92% conscientious (M=42.68, SD=5.07), 46.78% negative with emotion (M=34.45, SD=2.21), and 60.80% open-minded (M=41.18, SD=4.03).

Resilience was measured to determine participants current state of resilience at the workplace (see Table 4). As a percentage score, on average participants scored a 49.61% for perseverance (total: *M*=48.23, *SD*=2.98), 61.01% for reflecting adaptive help-seeking (total: *M*=35.85, *SD*=2.30), and for 60.86% negative affect and emotional response (total: *M*=27.69, *SD*=2.21).

Participant reported on suggested life stage outcomes metrics with an average 78.85% self-reported physical health (M=4.15, SD=0.80), 84.62% mental health (M=4.38, SD=0.50), 76.92% effective contribution in computing field (M=4.08, SD=0.86), and 76.92% computing competence (M=4.08, SD=0.86.

IV. DISCUSSION

Participants in less diverse companies and PWI mentioned that there was a lack of African Americans represented in their work [2, 5]. Representation, however, is not the only for a successful career [11, 12] as noted by these same participants believing their would be limited difference and perhaps even times less career success if they taught at an HBCU or worked at a more diverse company. Using the framework of PVEST [13], a multitude of factors were presented about computing g professionals' experiences with developing relatively adaptive resilient identities.

Interestingly, only two participants participant mentioned coming from challenging, socioeconomically poor environments, though money was not always heavily present for every opportunity. Though some participants had less than supportive peers [17] many found like-minded peers who helped motivated them to pursue a Ph.D. in computing. Most participants did not originally plan for a career in computer science specifically, but knew they were going to college and were often influenced during their undergraduate experience and in outreach programs in high school and through college.

Direct risk contributions such as workplace hostility and discrimination were very limited, unlike suggested from literature [14, 15]. Participants generally suggested they have a strong sense of belonging with their career choice. A few described situations where they did not have a strong sense of belonging and they pivoted to a new role. A few participants were new to their careers and were still getting comfortable. Most participants had go-to support resources of some sort, however, there were still a substantial amount that still felt in general they were alone or that they had to figure things out individually [15-23]. Many participants had mentors, but not in their actual place of employment, rather other mentors they have met throughout their careers [3].

HBCU faculty did in fact mention substantial advisement and mentoring duties [24] and less research and collaboration work [17]. Faculty participants researched topics varied, if any, so it is not clear if participant research topics were minority-focused and what support they received from it [17].

Self-efficacy ranged in participants. Some explicitly stated they were not a strong coder while others described themselves as above average. Relative strong self-efficacy led to resilience in varying daily commitments and work demands [25]. There

TABLE V. RESILIENCE COPING PRODUCTS

Academic Resilience Scale Factors	Mean (SD)
Perseverance	48.23 (2.98)
Reflecting and adaptive help-seeking	35.85 (2.30)
Negative affect and emotional response	27.69 (2.21)
Resilient Life Stage Outcomes	
Physically healthy	4.15 (0.80)
Mentally healthy	4.38 (0.50)
Effective contribution	4.08 (0.86)
Computing competence	4.08 (0.86)

were no mentions of having a lack of job security which contradicts literature [4, 7, 26]. Participants' adapted personalities from maintaining resilience in computing careers varied with average scores showing strengths in agreeableness, conscientiousness, and open-mindedness with low to moderate extroversion and negative emotionality [32]. Resilience remained moderate throughout with higher scores in reflective adaptive help-seeking and negative affect and emotional response [27]. This may imply the moderately strong need for support systems to maintain a healthy sense of belonging [20-23, 29-32].

A. Limitations

This mixed method study has a small sample size when using the quantitative results for anything generalizable. However, the quantitative data more so tell the story for the selected participants, knowing the results should vary. Additionally, the industry sector careers varied greatly and was challenging to determine themes from stress engagement.

V. CONCLUSION

This exploratory study gave insight to the common work experiences that Black computing professional face to determine a broad perspective of how adaptive resilient identity develops and is maintained. Findings can be used to inform and support Black computing students aspiring to obtain careers in the computer sciences and a graduate degree in computing. This study incorporates both HBCU, PWI, and industry experiences collectively. Further studies can more closely explore the nuances and factors that contribute to developing resilient identity for HBCUs, PWIs, and industry careers separately and more focused as well as incorporating more intersectionality with risk contributions including sex/gender, varied socioeconomic statues, and physical and mental ability.

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