A Qualitative Investigation on the Effectiveness of a Computing Identity Development Emailing List for African American Computer Scientists

Abstract— **This Research Full Paper presents a qualitative interview study on the effectiveness of a computing identity development listserv. The demand for diverse computing careers increases, yet African Americans continue to participate and succeed in computing fields proportionately less than their White and Asian counterparts. An individual's computing identity can influence their performance and willingness to participate. The African American PhDs in Computer Science Listserv is an email listserv created to increase and maintain members' sense of belonging, self-efficacy, and resilience in computing. Semi-structured interviews of graduate student, faculty, and industry professional members were conducted to investigate how effective the listserv was at increasing and maintaining computing identity. Findings include decision making processes for joining, duration and dosage of interaction members partake, maintenance of computing resilience, members' self-reflection, willingness to seek help, and attitudes towards computing. Recommendations were made about the listserv and if other African Americans in computing should join. Findings can be used to develop new approaches to supporting the computing identities of underrepresented groups. 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

The number of individuals obtaining Ph.D.in computing is rising due to the growing demand for professionals in computing over the last few decades. [1-4] However, the percentage of African Americans who pursue further computing education after undergrad is considerably lower than Asian and White Americans. According to the Computing Research Association (CRA), the number of Asian and White Ph.D. students increased while the percentage of African Americans who attain Ph.D. degrees in computing has remained around 1% for the last 20 years [2, 5]. In 2017, there were 1,588 reported Ph.D. degrees awarded to White American, Asian American, or Nonresident Ph.D. candidates in computing and only 18 for African Americans. [5]. Naturally, both current faculty and new hire rates for African Americans with PhDs remain under 2% [5]. As a result, African Americans remain underrepresented in computing fields posing negative threats to achievements. For example, African Americans tend to take longer to attain their degree [6]. Ebony McGee accounts this to African Americans dealing with societal issues and struggling with their sense of belongingness while attaining their degree leading to alienation and an "intense and perpetual state of awareness" [7]. These claims are not exclusive to students. African American professionals also struggle with a lack of recognition of achievements and feelings of separateness [8]. These feeling are often perpetuated by microaggressions, indirect discriminations against an underrepresented group which affords stressful situations and unpleasant events [9]. Studies suggest that African Americans are prone to isolation that is often generated by their academic or professional community. Developing a maladaptive computing identity leads to the high rates of attrition and lower performance of African American

professionals in computing [7]. It can also become a byproduct of low self-efficacy, an individual's belief in their ability to achieve their goals. These factors often result in the adaptation of resilience [7, 10].

A. Resilience as a Construct

Resilience is a contextualized construct describing an individual's ability to strive for success despite adversity [11-13]. Resilience is a trait that may be adopted in both academic and workplace settings. Academic resilience can increase the likelihood of educational success despite adversity. [12] Perseverance, adaptive-help-seeking, and positive emotional responses are qualities of resilience that are often concurrently used to build successful models.[12] Rod Warner and Kurt April describe a model for workplace resilience where professionals use "grounding" as the core structure for building resilience [11]. The model suggests that once professionals identify direction and meaning in their work, they can acquire additional methods for resilience.

B. African American Resilience in Computing

Research shows that are several factors that shape resilience. Many African Americans develop self-perceptive and performance identities in high-risk environments [13]. Coping mechanisms develop and this resilient identity carries throughout the many different contexts an African American would encounter throughout their career [13]. Many graduate school programs in computing and STEM have been suggested to lack support and a welcoming climate leading to Black students perceiving the programs and institutions to be racist, socially isolating, and insensitive to the unique needs and contexts of the Black experience [14, 15]. Black faculty instructing at research institutions and predominately white liberal arts institutions have reported feeling challenged about their legitimacy, feeling othered and isolated, being expected to handle diversity affairs, but also viewed mentorship and networking, particularly in sub-specialty fields to be beneficial [16, 17]. African Americans in industry careers describe stereotype threat, overwhelming pressures as well as the need to make a path for others and role modeling/mentorship [18].

African Americans develop coping identities based on the challenges and support systems accessible to them in their respective computing sub-fields and contexts. Sense of belonging is a perceived emotion of belonging to a group and a fundamental human motivator [19, 20]. African Americans have reported experiencing cultural loneliness and a lack of belongingness in computing Ph.D. their computing careers [15, 21, 22]. The lack of social belonging is often apparent amongst African Americans in underrepresented environments and can negatively affect the outcome of an individual's achievements [20].

Negative perceptions tend to lead to poor performance and pessimistic attitudes [12]. Self-efficacy is attained through mastery experiences, vicarious experiences, reducing personal stress, and verbal persuasion [10, 15]. A higher sense of efficacy results in better levels of motivations, greater lengths of perseverance, and higher amounts of effort exerted to complete a task. [15]. Literature suggests African Americans often have low or misaligned self-efficacy towards their computing works [23, 24].

C. Exploring Social Support for African American Resilience

Social support is an individual's perception of available resources in moments of hardship. Social support resources include mentors, peers, aide, feedback, and external relationships. When made available, resources can help to improve outlook towards the field. [13, 25] Social support is often offered by organizations, universities, or external support networks grounded with initiates to maintain positive relationships towards the field, reduce the turnover rate, and improve relationships external to the support. [25]. These coping identities manifest in the pursing and retention in computing careers [13].

This study examines a listserv developed to help its African American members maintain an adaptive resilient computing identity as they pursue a Ph.D. and professional computing ventures. The following research questions were investigated through both qualitative and quantitative methods: 1) how does participating in a listserv affect the maintenance of a strong computing identity in African Americans pursuing the PhDs in computing; 2) how do members experience the listserv; 3) and how can the emailing list be improved to help members better maintain a resilient computing identity.

II. Method

A. Participants

Twenty-one users of the African American PhDs in Computer Science (AAPHDCS) email list participated in this user experience study. Five users were Ph.D. candidates, four were interns or early industry professional researchers, four were graduate students, three were post-doctoral researchers, two were assistant faculty (one at a historically Black college (HBCU), one at a predominately white institution (PWI)), two were senior industry professional researchers, and one was a tenured faculty at an HBCU. All participants were Black, Afro-Caribbean, or African American, ages ranging from 22-54 year old. There were fourteen females and seven males. Participants were recruited by voluntary participation after sending a flyer through the email list.

B. AAPHDCS Email List

In 1996, Vernard Martin and Charles R. Hardnett were two African-American Georgia Institute of Technology PhDs students concerned with the relatively low numbers of African-Americans with PhDs in Computer Science. [26] At the time, African Americans were receiving Computer Science PhDs at a rate of one person per year, which made up less than one percent of the total PhDs earned that year in computer science. Thus, the pair designed and developed the African American PhDs in Computer Science (AAPHDCS) listserv. The listserv is an online virtual community aimed to cultivate a network of PhD-level researchers, educators, and students who are African-American in computer science. [26] The AAPHDCS mailing list now ran by Dr. Juan E. Gilbert, serves to foster personal relationships, encourage research collaboration,

This research was funded through the National Science Foundation (1818458).

maintain a sense of belongingness and resilience, and provide information about funding, news, and opportunities to its 468 members.

C. Procedure

Interested participants were sent an online survey consisting of two sections: 1) demographics and a 2) user experience assessment. The demographic section included questions about their career if their institution was an HBCU, and, if industry, what products did their institution produce. The 26-item User Experience Questionnaire (UEQ) was used for the user experience assessment section [27, 28]. Participants were tasked to rate their experience using the email list across the UEQ factors for user experience: attractiveness (overall impression), perspicuity (how easy is it to get familiar with the tool), efficiency (ability to complete tasks with tool), dependability (user's feeling of control and expectancy), stimulation (exciting and motivating), and novelty (creative and innovative). Average scores for each factor was rated for sufficiency: excellent (top 10% best possible results), good (top 10%-25%) above average (top 25%-50%), below average (bottom 25%-50%), bad (bottom 25%).

Following the survey, semi-structured interviews were conducted to uncover how effective participants believed the email list was at maintaining their resilient identity in computing as well as general questions on their user experience. The questions were determined by using academic and STEM resilient identity literature [12, 13]. The interviews were conducted virtually either by phone or video conferencing. The interviews were audio recorded and the recordings were transcribed.

D. Data Analysis

The UEQ data was analyzed using the suggested descriptive statistics. Scores from the UEQ range from -3 (horribly bad) to 3 (extremely good), with scores between -0.8 and 0.8 being neutral. The interview data was analyzed using a hybrid inductive-deductive thematic analysis [29]. Literature on resilient identity provided suggestions for the code manual development of the email list effectiveness data, namely the Academic Resilience Scale [12]. Suggestions from the User Experience Questionnaire were used to develop user experience codes (see Table 1). The codes were reviewed by the two lead others to assess reliability; there were no additional required modifications for the code manual. Themes were inductively identified from transcribed data, in which a few new codes were determined. Themes were synthesized and reviewed by the two lead authors for reliability.

III. Results

TABLE II. IDENTIFIED CODES & DEFINITIONS

Codes	Definitions
Email List Discovery	Participants experience finding and joining the listserv along with their initial expectations of the listserv
Perseverance in Computing	Participants listserv experience with perseverance, working hard, and finding opportunities in computing.
Self-reflection and Help-Seeking	Participants willingness to self-reflect and seek help through means of the listserv
Views of the Computing field	Participants outlook of computing for African American professionals after being a part of the listserv community
User Experience of Email List	Participants' view of AAPHDCS listserv usability
Recommending the Email List	Individuals that participants would recommend the listserv to

A. Email List Discovery

Many participants joined the AAPHDCS listserv as a Ph.D. student and were added by a friend or peer: *"One of my fellow graduate students in the doctoral program, they suggested*". Some found out about the listserv through networking at a conference and were later asked to join. Others were unsure of how they joined due to how long they have been a part of the community: *"I don't even know if I joined it. I think somebody added me"*. Although some individuals did not have clear expectations of the listserv they were hopeful of its services. Others felt that the listserv would provide them information on articles, opportunities, events, and accomplishments for blacks in computing.

B. Perseverance

The mailing list helped participants maintain their perseverance with its motivational and supportive resources and its access to network and mentor connections: *"I think watching the levels that people hit has been motivating, because it lets me know that it's possible"*. However, not all participants agree that the listserv is a strong resource to help maintain perseverance in computing. The mailing list has helped participants receive opportunities and expand knowledge of computing roles, helping to shape many of the participants' career paths: *"It's just really, really crazy to me how much you don't know until you're at that point where you're like, oh wow, this is what everybody else knew that I didn't?"*.

C. Self-Reflection & Help-Seeking

The emailing list has also helped participants maintain positive self-reflection and help-seeking behaviors: *"you see other people doing things that are beneficial to the community, and you want to make your contribution as well"*; *"there's a weird sense of accountability"*; *"the other black student, who also felt very, very alone he told me. I mentioned to him that I was a part of this. And then I requested for him to be added. And so he found it to be beneficial. So, I mean, it's beneficial to me and to him"*. Congratulatory emails help promote the seeking of encouragement and help shape the evaluation and monitoring of their own achievements and efforts based on the success stories of others: *"Yeah, if you do something great, then they put it out there and everybody says congratulations"*;

"It is supportive and it's cool to see what everybody's doing". A few others believed participating in the mailing list has not substantially improved their self-reflective and help-seeking identities: *"Yeah. I know that I can go to that community and get help. It wouldn't be my first choice. My advisor"*.

D. Views of the Computing Field

Most participants believed the participating in AAPHDCS helped maintain positive emotions towards computing: *"posting more about what people are doing and about their specific research so that way I see people's accomplishments and what they're up to, but you can also learn responsible collaboration in our community"*. Participants reported that learning that others when through similar challenges and being aware of challenges they may not have experienced helped to reduce disappointment in their respective careers: *"It made me realize that what I'm going through isn't unique, and that it's just part of the journey"*. The listserv has not been most effective at reducing stress and anxiety in computing: *"When jobs come out, or opportunities come out, they don't often reflect something that I can do. That's when there is a form of discouragement"*; however allows an inclusive, safe space to vent leaving participants hopeful for the future of computing and their careers: *"I think it's a safe space that you can use to not just aimlessly vent, but like if I saw that there was an article about Facebook and how they're treating African American employees. And so, being able to say, look this is a problem. Express myself. I think that"*.

E. User Experience & User Recommendations

Results from the UEQ suggests participants viewed the listserv as relatively attractive (M=1.62, SD=0.95), clear (M=1.63, SD=1.21), efficient (M=1.11, SD=0.73), dependable (M=1.39, SD=0.75), and stimulating (M=1.49, SD=1.36). Participants rated the novelty (M=0.25, SD=1.92) of the system as neutral (see Fig. 1).

During the interviews, pre-professionals reported having minimal interactions with the listserv. Most individuals had passive interactions with the listserv and either rarely or never posted: *"I usually just read emails from it. I've never posted anything"*. Participants also found some email threads to be annoying due to receiving several emails of different users responding to one message. The listserv met expectations of attraction for most users as it fits the model of an email. Participants thought the listserv was basic but felt that attractiveness was enhanced through participation amongst the users: *"I think the participants make it attractive"*. However, many participants felt that the system was outdated and could be cleaned up by reducing the number of long email threads and provide methods to archive important issues.

Participants thought that the listserv was simple and clear, easy to navigate, fast, efficient, and consistent: *"it's probably the fastest way and easiest way to get it out"*; *"I think it's an efficient method of getting, like, the hot topics out to people"*; *"I mean I did learn about this study through the listserv, right?"*.

The listserv community was dependable as most participants felt that they never received spam emails: *"I think it's pretty dependable. I haven't had any issues with it"*. People usually respond to messages on the listserv and emails can be referenced past the messages for verification.: *"The people I've reached out to, I think out of maybe five or six individuals, only one hasn't responded"*.

The nature of the topics are stimulating and consistent enough to maintain users' attention: *"people write, people, you know, people say things on there. So, I think it's engaging"*; *"I go there to get my fix of what's happening within the industry for blacks in computing"*. The content of the emails is targeted towards the user (an African American within computing). Comparatively, the listserv was reportedly not as engaging as other chat-based services: *"when I compare it to a group meeting or a chat-based interface, I wouldn't say it's as engaging as those, but for what it's doing I'd say it's very engaging"*.

The community of African Americans with PhDs in computing is novel however the actual listserv is basic in nature and contains no unique attributes: *"I think it's original because it cancels, or provides service to a niche of the computing community"*; *"to have that many black PhDs in computer science in one location communicating... I think that's where the novelty lies"*.

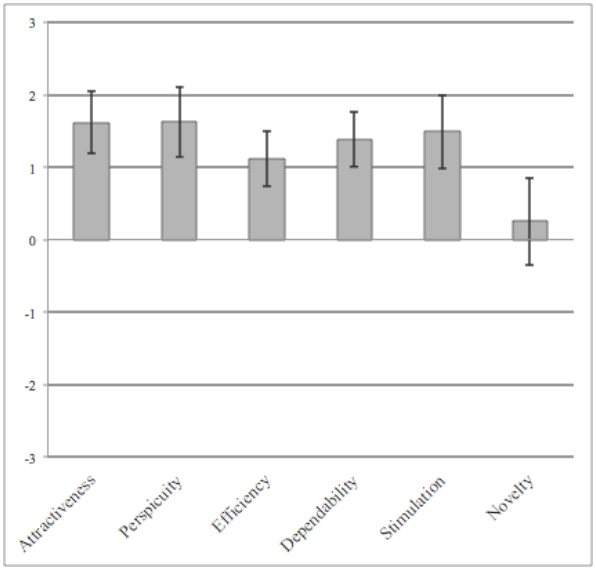

Fig. 1. User Experience Questionnaire Averages

Users generally experience positive significant moments, including personal congratulatory messages, attaining connections and opportunities through the email list, or viewing other's success that is shared through the listserv: *"When I did something great and it was communicated out. That was significant. It happens when you catch a ball, or a proposal, or you got a job"*; *"Information of successes. So when I started to look into who was involved, that was an epiphany moment. There's some great people doing great things involved in this list serve"*; *"I've become familiar with professors in the community through the Listserv"*.

TABLE II. IDENTIFIED RESILIENT IDENTITY THEMES

Codes	Themes
Email List Discovery	
Finding the Listserv	Suggested by friend/peer; Unsure; Networking at a conference; Word to mouth
Joining the listserv	Added by friend/peer; Asked to join
Expectations	Unsure, yet trusting; Information hub; Opportunities for black computing; Events for black computing; Articles; Accomplishments of blacks in computing; Mentoring
Perseverance in Computing	
Maintenance	Motivational; Provides support/resources; Some emails helpful, not all; Has not; Provides connections: Helps learn computing roles; Learn about past
Motivation to Work Harder	Computing challenges; Not particularly harder; Provided mentors who motivate; Others do beneficial works; Challenges to help;
Providing feedback to improve work	Connections made through listserv provide feedback; Create a pipeline for students; it hasn't
Shaping career plans	Received opportunity from listserv; Expands knowledge of career paths; Helped shape goals; Shout-outs/recognition; No, it's academic focused; It hasn't
Self-reflection and Seeking help	
Maintenance	Knowing there is a community I can directly seek help; not the first choice for help-seeking; It hasn't; Sense of accountability; Provides a voice to express what you're going through; Helps mitigate loneliness; Realized how small the field is; Wish the listserv could help more; The door is open, but haven't;
Seeking encouragement	Peers congratulate shout out; Send in info when I did something great for a shout out; Provided opportunities
Persuading to try different ways to approach work	Has not; Better understanding of academic world
Monitoring and evaluating achievements and efforts	Cool to see others' achievements; Has not
Views of the Computing field	
Maintaining positive emotions	Community of great work; inspiring general; Showcases ways to get involved; Sense of belonging/escapism; Motivational shout-outs; Has not
Reducing disappointment	Learning others went through the same challenges; Reading the work of members; More aware of problems
Reducing stress or anxiety	Has not; increased; Inclusiveness; Safe space to vent
Outlook on the future of computing	Hopeful
User Experience of *Email List*	
Experiences	Reading email; Sometimes respond; Don't use; Don't post Annoying; Need to be concise; Outdated/obsolete; Easy to use; Uses interface that I already use; Poor format
Attractiveness	Basic email; Attractive enough; participation enhances attraction; Congratulatory emails
Unattractiveness	Outdated; Long emails; Archiving issues
Simplicity and clarity	Simple; Clear; Maneuvering; Attachments
Unclear	Depends on what you're looking for; Digging through archives
Efficiency	Efficient; Fast and easy; Unsure; Mobile accessible; Major topics; Consistency; Learned of this study
Inefficiency	Challenging to see simply what's going on; Constant emails; Disorganized
Dependability	Very dependable; Know it's not spam; Credible members/operators; People respond; Can access past messages; Finding opportunities outside of university
Unreliable	Nothing
Stimulation	Neutral; Very; Topics that are discussed; Consistency; Relatively active; When people congratulate; Targeted content
Disengaging	Not very stimulating; Familiar with more engaging interfaces
Novelty	Niche community; Its novel
Unoriginal	It's a basic email; not novel; Nothing unique about the technology; Unoriginal delivery/format
Significant moments	Was shouted out before; Friends are on the listserv; Success stories; Network; This study; None; Networking; Creates validity
Recommending the *Email List*	
African American graduate student	Yes
African American faculty member	Yes; No
African American industry professional	Yes; Maybe/depends; Mainly for academia; If more opportunities for industry

Participants would recommend other African American graduate students or faculty to join the listserv. Participants would recommend the listserv to industry professionals depending on their interest in academia and if there were most industry-related opportunities on the listserv: *"yes, you have good information on there and it's not all about doctoral students, but then it is heavily placed on getting your next position that is related to academia"*; *"if there were more opportunities being placed on there that were industry, then I would put it out there to my industry friend*".

IV. Discussion

Though entry and exposure to the mailing list varied, very few described their rationale for joining was due to challenges to mitigate low sense of belonging or increase self-efficacy and resilience [13][19]. Alternatively, networking, mentoring, and having a source of information for accomplishments all help to strengthen sense of belonging, self-efficacy and resilient identity [13-15].

Though not the reason for joining, many participants admitted to the listserv helping them to abate feelings of loneliness. The listserv provided access to a relatable community facing similar adversity suggesting that sense of belonging amongst Africans Americans in computing is strengthens within groups of people who share common unpleasant experiences [21][22][15]. Participants also suggested that the listserv facilitates vicarious experiences through congratulatory emails which allow for individuals to view peer success and therefore increasing their self-efficacy and become more resilient [15].

The AAPHDCS listserv enabled participants to find opportunities specifically curated for African Americans in computing, build their professional networks, and gain African American mentors. Participants acquired positive attitudes due to resources suggesting that social support increases levels of optimism which to some has manifested and produced more focus and successful performances in computing [23][24]. Findings suggest that participants were also able to gain feedback through resources acquired from the listserv.

Average UEQ scores ranged between 1.63 and 0.25. No scores reached above 2, which indicates that there were more typical and less extreme opinions [27]. AAPHDCS, according to its members, is an attractive mailing list with goal-directed quality. However, the non-goal directed hedonic quality aspects (stimulation and novelty) presented more neutral findings. A few participants suggested other chat services such as Slack or even producing an app just for AAPHDCS to allow for better control over information visibility and interaction.

A. Limitations

One limitation of this study is the small sample size for the UEQ. It is recognized that the small sample may not be representative of the general population of the AAPHDCS members; however, the data collected in this study can still be used to investigate and directly draw conclusions from typical users of the listserv. Furthermore, the dosage was not measured explicitly. No validated interrater reliability rubric was used during the thematic analysis process, however, the analysis was completed and checked by the two lead authors.

V. Conclusion

This study used qualitative interviews with graduate students, faculty professionals, and industry professionals to investigate an African American Ph.D. computing identity listserv. Data collected from participants provides useful understanding for evaluation of effective methods of resilience. Our results suggest that African American computing identity can be effectively maintained by establishing a perceived sense of community belongingness, enabling optimistic outlooks and facilitating self-efficacy. These factors often converge and are contingent on the environment but can be used to build an effective model of resilience. Future studies can use this information to design support systems to allow healthy communication and a safe space for underrepresented minorities within technical careers.

Acknowledgment

We would like to thank Dr. Juan E. Gilbert and all AAPHDCS email list members who participated in this study.

References

[1] Data Tables. (2017). Retrieved from https://ncses.nsf.gov/pubs/nsf19301/data

[2] D. Kozen & S. Zweben, "1996-1997 CRA Taulbee Survey: Undergrad Enrollments Keep Booming, Grad Enrollments Holding Their Own." Computing Research News, 1998, pp. 4-8.

[3] Bureau of Labor Statistics, Fastest Growing Occupations, United States Department of Labor, 2018.

[4] Field of degree: Minorities. 2019. Retrieved from https://ncses.nsf.gov/pubs/nsf19304/digest/field-of-degree-minorities#digest-blacks-or-african-americans

[5] S. Zweben & B. Bizot, "2017 CRA Taulbee Survey". Computing Research News, 30(5), 2018, pp. 1-47.

[6] K.L. Zeiser & A.R. Berger. "How long does it take? STEM PhD completion for underrepresented minorities." 2012.

[7] E. Mcgee, "Devalued Black and Latino Racial Identities: A By-Product of STEM College Culture?". American Educational Research Journal. 53. 2016, pp. 1626-1662. 10.3102/0002831216676572.

[8] J. T. DeCuir-Gunby & N. W. Gunby Jr, "Racial microaggressions in the workplace: A critical race analysis of the experiences of African American educators." Urban Education, 51(4), 2016, pp. 390-414.

[9] K. R. Malone & G. Barabino. "Narrations of race in STEM research settings: Identity formation and its discontents". Science Education, 93(3), 2009, pp. 485-510.

[10] A. Malik, "Efficacy, hope, optimism and resilience at workplace–positive organizational behavior". International Journal of Scientific and Research Publications, 3(10), 2013, pp. 1-4.

[11] R. Warner & K. April, "Building personal resilience at work". Effective executive, 15(4), 2012, p. 53.

[12] S. Cassidy, "The Academic Resilience Scale (ARS-30): A new multidimensional construct measure". Frontiers in psychology, 7, 2016, p. 1787.

[13] M. B. Spencer, D. Dupree, & T. Hartmann, "A phenomenological variant of ecological systems theory (PVEST): A self-organization perspective in context". Development and psychopathology, 9(4), 1997, pp. 817-833.

[14] T. L. Strayhorn. "Factors influencing black males' preparation for college and success in STEM majors: A mixed methods study". Western Journal of Black Studies 39, 1 (Spring 2015), pp. 45-63.

[15] K. I. Maton, T. S. Beason, S. S. Godsay, M. R. Domingo, T. C. Bailey, S. Sun, & F. A. Hrabowski III, "Outcomes and processes in the Meyerhoff scholars program: STEM PhD completion, sense of community, perceived program benefit, science identity, and research self-efficacy". CBE—Life Sciences Education, 15(3), 2016, p. 48.

[16] R.S. Gold, Outsiders Within: African American Professors and their Experiences at Predominantly White Universities: A Narrative Interview Study (Doctoral Dissertation). 2018. Retrieved by UNC Carolina Digital Repository Database. https://cdr.lib.unc.edu/indexablecontent/uuid:92022b39-a158-4135-bf89-8f85b975c4ba

[17] D. A. Louis, G. J. Rawls, D. Jackson-Smith, G.A. Chambers, L.L. Phillips, & S. L. Louis, "Listening to our voices: Experiences of Black faculty at predominantly white research universities with microaggression". Journal of Black Studies, 47(5), 2016, pp. 454-474.

[18] C. Cain, & E. Trauth, "Theorizing the underrepresentation of Black males in information technology (IT)". Proceedings of 21st Annual Americas Conference on Information Systems, Puerto Rico, US: 2015, Association for Information Systems.

[19] G. M. Walton & G. L. Cohen. "A Question of Belonging: Race, Social Fit, and Achievement". Journal of Personality and Social Psychology 92, 1 (2007), 82–96. DOI:http://dx.doi.org/10.1037/0022-3514.92.1.82

[20] R. F. Baumeister & M. R. Leary, "The need to belong: desire for interpersonal attachments as a fundamental human motivation". Psychological bulletin, 117(3), 1995, p. 497.

[21] R. A. Friedman & B. Holtom, "The effects of network groups on minority employee turnover intentions". Human Resource Management: Published in Cooperation with the School of Business Administration, The University of Michigan and in alliance with the Society of Human Resources Management, 41(4), 2002, pp. 405-421.

[22] L. Whitfield-Harris. "The Workplace Environment for African-American Faculty Employed in Predominantly White Institutions". ABNF Journal, 27(2), 2016.

[23] R. Varma, "Making computer science minority-friendly," Communications of the ACM, vol. 49, no. 2, 2006, pp. 129-134.

[24] N. A. Ibe et al., "Reflections of a diversity, equity, and inclusion working group based on data from a national CS education program." Proceedings of the 49th ACM Technical Symposium on Computer Science Education. ACM, 2018.

[25] S. R. Maddi & D. M. Khoshaba. Resilience at work : how to succeed no matter what life throws at you. AMACOM Business & Economics, 2005.

[26] AAPHDCS. (n.d.). Retrieved March/April, 2019, from https://mailman.cc.gatech.edu/mailman/listinfo/aaphdcs

[27] M. Schrepp, A. Hinderks, & J. Thomaschewski. Applying the user experience questionnaire (UEQ) in different evaluation scenarios. In International Conference of Design, User Experience, and Usability, 2014, (pp. 383-392). Springer, Cham.

[28] A. Hinderks, M. Schrepp, F. J. Domínguez Mayo, M. J. Escalona, & J. Thomaschewski, J. "Developing a UX KPI based on the user experience questionnaire" Computer Standards & Interfaces, 2019.

[29] J. Fereday, & A. E. Muir-Cochrane, 2006. "Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development". International Journal of Qualitative Methods, 5(1), 2006.