Undefeated - Black Collegiate Women in Volleyball and STEM

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Abstract

Representation and inclusion of Black women are important in science, technology, engineering, and mathematics career pathways and sports such as volleyball. Disparities in representation have an impact on women's median income, the quality of STEM-based solutions, and the diversity of women in leadership roles and continue pervasive narratives about who belongs in STEM. Athletics and STEM have been seen as vehicles to mobilize students economically and to develop their valuable lifelong skills such as time management, cross-cultural team-building, problem-solving, competitiveness, and resolve. In this qualitative study, the authors investigate the sports and STEM journeys of three Black women who are collegiate volleyball players. The theoretical framework is informed by intersectionality to understand the similarities between playing volleyball and pursuing a STEM degree at historically White institutions. One implication from this work is that with support at critical junctures and access points, more Black women can play sports at higher levels while also earning STEM degrees.

Keywords: Intersectionality; Black women student-athletes; volleyball; STEM education;

Introduction

In the 2020 Summer Olympics, the US women's volleyball team won its first Olympic gold medal with four Black women on the roster - Foluke Akinradewo Gunderson, Jordan Thompson, Haleigh Washington, and Chiaka Ogbogu. This accomplishment is noteworthy because though Black women have participated in Volleyball with exceptional accomplishments they often feel marginalized (Voepel, 2021). Sharon Clark, a Black woman who has a 30-year volleyball coaching tenure and who served as the first Black woman president of the American

Volleyball Coaches' Association, observed that volleyball is an expensive sport due to the need for precise training and access to courts (Voepel, 2021).

> *The kids who get through tend to be from more middle-class to upper-class families who come from schools where they have a good basis for the sport. For kids from schools that are high African American population or very diverse, we literally exclude them from the sport (Sharon Clark as cited in Voepel, 2021, para. 17).*

Unfortunately, the same exclusionary narrative exists for STEM pathways, which due to systemic racism also have historically privileged those communities with access to the resources to support early STEM exposure and learning (Calabrese Barton & Tan, 2018). Other similarities between STEM and sports include the shared emphasis on skill development, hours of individual practice to achieve mastery, failure, observing and correcting performance issues, and perseverance to meet goals (Pallis & McNitt-Gray, 2013).

Throughout history, women of color—including many influential African American women—have defied racial and gender inequalities to succeed in STEM. African American women such as Katherine Johnson, who performed the NASA calculations required for several space missions including the 1969 moon landing; Dr. Gladys West, responsible for the mathematics that led to the invention of the Global Positioning System (GPS); and Marian R. Croak, Vice President of Engineering at Google, who holds over 200 patents have persevered, by using their abilities and ideas, have made significant contributions to and discoveries in STEM (Maryville University, 2020; VentureWell, 2021). Throughout this article, we use both the terms "woman" and "female." We do not use the term "female" or "woman" to distinguish between sexual and gender identities. Additionally, we use the terms "Black" and "African American" interchangeably to refer to individuals who have origins from groups representing the African

diaspora. We adhere to the terminology used by the scholar or participant when examining existing scholarship or retelling a participant's narrative.

Although there has been significant progress in increasing the number of STEM degrees earned by minoritized people since 1977 (National Action Council for Minorities in Engineering, 2013), Black people earned about 13.6% of science and engineering degrees in 2018 (National Center for Science and Engineering Statistics, 2021). Understanding the barriers to access for people from underrepresented groups is critical to formulating an effective strategy for overcoming this underrepresentation (Office of Science and Technology Policy (OSTP), 2021). Barriers to Black women entering the engineering field are among the country's most critical problems. When considering their involvement in the US workforce, women are significantly underrepresented in professions such as computing and engineering (OTSP, 2018).

Disparities due to racism in America negatively impact representation, Black and Brown women's median income, the quality of STEM-based solutions developed, the diversity of women in leadership roles, and continue to undergird pervasive narratives about who belongs in STEM (McGee, 2021). Black women, including those who are student-athletes, have historically encountered double discrimination attributed to their gender and race (History.com Editors, 2010). Due to Title IX, federally financed educational institutions cannot legally discriminate against students or workers based on their gender. Men and women are to be treated equally in all fields, including athletics (History.com Editors, 2009). Yet discrimination has still taken place.

The participation patterns and statistics demonstrated in college and university athletic programs show the systematic racism and discrimination toward Black women (Staurowsky et al., 2015). According to the NCAA Race and Gender Demographics Database, for the 2020–21

academic year, 44% of student-athletes self-identified as being female, 5% self-identified as Black females, 30% self-identified as White females, and 9% self-identified as females from other races.

Purpose

The purpose of this paper is to present qualitative findings from an investigation exploring three Black women's experiences in two historically White collegiate spaces—volleyball and STEM.

Review of Literature

This literature review section focuses on recent research concerning the experiences and perspectives of Black women in STEM and sports, which are both historically White spaces.

Several researchers have investigated the factors influencing students from minoritized communities, particularly African American students' educational access, college participation, and success. For instance, Carter-Francique et al. (2015) conducted a study to investigate the impact of social capital and social support on Black student-athlete's academic success at historically White institutions of higher education. The evidence suggests that their academic success depended on their interactions with faculty, i.e., their status as Black student-athletes encouraged both positive and negative interactions. Furthermore, their social networks, including their parents and extended relatives, offered appraisal, emotional, and instrumental support.

Research studies exploring Black women student-athletes often group them with their White female peers based on gender or their Black male colleagues on racial grounds, leading to Black women being ignored in sports research (Bruening, 2012). Previous studies have focused on STEM participation issues from the perspective of women and other minoritized groups, but few look at the intersection of gender and race (Ross & Godwin, 2015). Intersectionality denotes certain types of intersecting oppression, such as intersections of race and gender or sexuality and

nation, which highlights the combination of oppressive forces that work together to produce inequality (Collins, 2000). In addition, intersectionality effectively examines contemporary issues that show the limitations of a singular race- or gender-based approach (Hancock, 2007). For instance, Black female athletes have traditionally been subjected to racial and gender-based prejudices and stigmas regarding their participation in sports (Zenquis & Mwaniki, 2019). Sellers et al. (1997) investigated the college life experiences of African American women student-athletes and observed that they differed significantly from both White women student-athletes and African American men student-athletes. In terms of academic success, African American female student-athletes outperform White female student-athletes and have better GPAs than African American male student-athletes.

Brown (1995) examined the faculty and scientists' recommendations for applicants to the NSF Graduate Fellowship Program from 1976 to 1991. The data demonstrated that faculty/scientists' recommendations were significantly lower for women of color when compared to men of color and White women. In another study, researchers found that words and actions by faculty, peers, and family members have both positive and negative effects on marginalized women's experiences in STEM disciplines (Ong et al., 2011). Furthermore, Ross et al. (2021) investigated the engineering identity development of Black women engineers in the industry. They found that the confluence of familial support, informal learning opportunities, encouraging instructors, and an interest in math or related academic subjects all aided in developing participants' identities as Black women engineers.

A Morgan State study looked at the historical and cultural factors that affected black women's participation in sports from the standpoint of social identity theory (Jones, 2018). The findings revealed that cultural issues such as attitudes toward body image hampered Black

women's success. It discusses how African American women athletes have historically relied on the support of their communities to counteract racism and sexism and the coping mechanisms that Black female athletes use today.

Given the increased literature on students' identity and participation in sports and STEM education, there is still a need for a comprehensive review of studies focused on identity, particularly among Black women. This study focuses on Black women's experiences in two historically White spaces—volleyball and STEM disciplines. It provides insight into the experiences, perceptions, and challenges of Black women in the engineering and sports fields as they relate to their race and gender.

Theoretical Framework

To pursue our goals for this article, we chose one theory that enabled a research focus on the interplay of multiple identities and allowed us to resist the marginalization of Black women in professional and social spaces. Crenshaw's (1989, 1991) intersectionality theory allowed us to call out the non-monolithic experiences and vulnerabilities of Black women who have overlapping obligations in predominantly White spaces like volleyball and STEM. In 1989, Kimberlé Crenshaw introduced the term intersectionality intending to create more anti-racist and affirming spaces for Black women—with a particular focus on the legal arena (Carbado et al., 2013). She later added to the theory by calling attention to the additional burdens experienced by Black women who are from under-resourced communities and international countries. In this manuscript we report our investigation of the following research question:

What similarities, if any, are observed between the STEM and volleyball journeys of

Black female college student-athletes?

Methods

Positionality

When engaging in critical research, scholars must examine and make visible their stances, positioning, and possible intersections between their identities and those of the communities they are seeking to understand. With this in mind, the authors will briefly describe their positionalities. Author 1 is a U.S. Black American who has earned engineering degrees. She has also coached and played volleyball through the high school level in schools serving student-athletes in lower-middle-class communities and wealthy upper-class communities. Similar to the participants, she benefited from scholarships. To avoid "speaking for the data," Author 1 made efforts to bracket her existing biases and/or assumptions before analyzing the data.

Author 2 identifies as a married straight Black/African-American man and person of faith. He is an engineering professor who has been a research mentor to several student-athletes from the women's volleyball team. Growing up in a middle-class household, he played sports such as track, basketball, baseball, and bowling while being raised by college-educated parents who once played varsity volleyball and baseball in high school. He participated in a pre-college STEM summer program that came with a tuition-based scholarship to his undergraduate institution.

Author 3 is an international graduate student who acknowledges that his background may be different from the participants in this study. He is an Indian male pursuing graduate studies in the United States. His research allows him to learn about the nuances of American history and culture. He specifically has a research focus on engaging in engineering education research to understand, expose, and take action on educational inequities.

Participants Description

To recruit all three of the participants in this study, the research team used purposive sampling—Black women who played college volleyball and majored in a science, technology, engineering, or math (STEM) field—and convenience sampling—access to two STEM-focused universities. Two of the participants self-identified as Black and African-American, while one participant selected Black and Caribbean. Two of the Black women were pursuing a science major while the other participant was pursuing an engineering degree. Two of the participants were 19-year-old sophomores or second-year student-athletes, and the other participant was a 20-year-old junior or third-year student-athlete. Table 1 contains demographic characteristics for each participant—where "First-Gen." accounts for students being first-generation college graduates and "SES" represents their socioeconomic status.

Table 1. Demographic characteristics for Alice, Courtney, and Tierra

Pseudonym	Ethnicity (Black)	Major (Field)	Class Rank	Age	First-Gen.	SES
Alice	Caribbean	Engineering	Junior	20	Yes	Upper lower class
Courtney	African-American	Science	Sophomore	19	No	Upper middle-class
Tierra	African-American	Science	Sophomore	19	No	Middle-class

Location—University Context

The three Black women who participated in this study are from two similar private, mid-sized, historically White, STEM-focused universities (in the Southeast and Southwest of the

U.S.). The most popular majors at both schools are in engineering. At one of the schools, athletic

teams compete in the National Association of Intercollegiate Athletics (NAIA), while the other

school has recently transitioned to Division II of the National Collegiate Athletic Association

(NCAA). Members of the women's volleyball teams are offered partial and full athletic

scholarships.

Data Collection

For triangulation of data and process validity (Walther et al., 2013), participants gave

written consent to an electronic demographic questionnaire and in-depth, semi-structured, one-

on-one interviews (Kvale, 1996). We designed interview questions to prompt participant

responses that provided thick, rich descriptions of their experiences (Guba & Lincoln, 1981). To

establish process reliability (Walther et al., 2013), interviewers initially prompted participants to

share details about their backgrounds (e.g., families, K–12 schools, schoolmates, neighborhoods,

neighbors, sports teams, etc.). Subsequent questions allowed participants to provide

chronological details ranging from the past to expectations of the future. Overall, the interview

protocol consisted of questions eliciting information about participants' backgrounds and

experiences in sports and STEM, along with their career aspirations, readiness, and expected

earnings. To craft interview questions, the authors used their awareness of the relevant literature.

Analysis

The interpretative phenomenological analysis (IPA) framework guided our analysis. It is

appropriate for this research study because it is concerned with understanding the lived

experiences of the research participants and how the participants make sense of those

experiences (Pietkiewicz & Smith, 2014). IPA has served as a research methodology in previous

engineering education studies that focused on identity development (Huff et al., 2018) and the

identity development of Black women in engineering (Ross et al., 2021). Through IPA-informed analysis, the participants' own words were identified as themes, and we could systematically identify overlap between the themes and the theoretical framework. Author 1 was primarily responsible for analyzing the data. She was not present during the data collection process conducted by Author 2 et al. In order to familiarize herself with the data, she first listened to each interview without notetaking to focus fully on each participant's words. After listening to the audio recordings, she then read each transcript closely multiple times. Each pass had a particular focus. The first focus was on *what* was being said, and then in the following read, there was a narrowed focus on *how experiences were described* (i.e., metaphors, repeated words, expressions). Then, she moved from notes and observations of the transcripts to themes, seeking to identify potential relationships between themes and clustering them. A concept map was made for each participant, where major clustering themes served as nodes with sub-theme branches that included a line number to the supporting excerpt from the interview transcript. See Table 2 for an example of how IPA was applied to an interview excerpt.

Table 2. Examples of developing emerging themes

Original Text	Exploratory Comments	Emerging themes
Interviewer: Okay. Um, on the form we also asked if you played a collegiate sport? Can you please describe why you have played this sport in college? Alice: Um, I played volleyball because uh mainly I like it and then also like it helps with paying for my academics in college. Interviewer: Okay. And can you describe how the scholarship influenced your decision even more with your... Alice: Um, there was like more of a combination of the scholarship and then also um like what my college has to offer compared to the other colleges.	Likes volleyball Volleyball (VB) provides access for college through scholarships Interested in STEM majors	VB is an important part of identity STEM identity

Findings

In this conference paper, we highlight three major themes that emerged across the three cases and highlight sample representative excerpts for each theme. Our emphasis is to identify those themes that represented the similarities between STEM experiences and volleyball. Ross et al. (2021) described and enacted a similar approach in their study on Black women in engineering. This section will provide insights into the interplay between the participants' intersectional identities and *how* the theoretical framework helped explain their experiences. Overall, we noted a similar trend. For both volleyball and STEM, early exposure allowed the participants to develop confidence and maintain interest in the topics—even if they later changed career interests within STEM disciplines. The participants were asked to describe their pre-college exposure to STEM and volleyball. Some sample responses follow:

> *"Um, I joined like Boys and Girls Club because I like the robotics club because my friend was in it and then I realized that like, like every [inaudible 00:16:01] really more engineering or [inaudible 00:16:03] like uh, more towards the STEM classes, like, like more [inaudible 00:16:09] wanted to do like chemistry or like a science then like we had a lot of great programs for it. But then like out of the entire school, like we had like 3,000 students and they'd only offered like one physics class and so it was really hard to get into."* (Alice, lines 373–378)

> *"Oh, I took I think a year, one year I took a gifted course for math….I didn't really like being closed off from everybody else."* (Tierra, lines 140, 148)

The participants described the impact of early STEM learning memories and experiences. When well facilitated, these often gave them access to a supportive community and increased their STEM aspirations; however, if poorly designed (or non-existent), they led to decreased interest in that particular career pathway. The participants attribute STEM and volleyball participation to their own interests and their family and friends' recommendations and encouragement. Furthermore, continuing to play volleyball through college provided scholarship

funds for all three participants and created access to a college STEM education that would have

been challenging for at least two of them to obtain otherwise:

> *"Yeah. I started playing volleyball in, I think, fifth grade it was, like, offered at school and, so, like, all my friends were doing it. We were all like, doing it as a fun thing to do together." (Courtney, lines 166, 171–172)*

> *"It was just to keep me busy. Um, it just gave me, like, a sub-group to be a part of and, um, um, yeah, I think it's... I remember I moved from one place in my... It was all in the same district and I moved from one school to the other and, um, I was like, well, I don't know anybody here so I was like I should play a sport and my mom told me about volleyball so I ended up playing volleyball." (Tierra, lines 152–156)*

The common themes of doing fun things with friends highlights the importance of

identifying with a sub-group of friends to share experiences, which continues, deepens, and

reemerges in their current-day college narratives. This is most evident in the participants'

accounts of their parents' influence on decision-making and the support that sports team

members, coaches, and staff can ideally provide to their team. Intersectionality scholarship

suggests that we should pay close attention to how their pre-college and college STEM learning

experiences were structured to better understand how each participant perceived herself, her

STEM abilities, and her desire to remain in a STEM career pathway. After being asked about the

effect of gender stereotyping on her sports and STEM aspirations, Tierra describes how her

volleyball team at her first college did not feel like the family that it should have been:

> *"I've never felt stereotyped or, like, discriminated against when it came to the sport of volleyball. I just played it...Like, volleyball is such a heavy Caucasian sport, like, it's, I think, another reason I left was just because it was, like, the diversity was just kinda, kind of pathetic. So, I, that also played into it. There wasn't that many people that looked like me... 'Cause, like, your team is, like, your family and that's who you're usually with 90 percent of the time. I mean, there was one [Black] girl on the team, but it was kinda—me and her are still really good friends, but it's just kinda like her background is completely [different] to mine and it was just kind of, like, um, this is awkward." (Tierra, lines 368–370, 372–373, 377–379, 383, 387–390)*

Tierra continued in her same STEM major and transferred to another college and volleyball team that better met her expectations and needs—one where she could relate to more of her teammates. The women in this study demonstrated a resolve that allowed them to maintain their hopes and aspirations despite obstacles. For example, Tierra was determined to achieve her aspirations despite obstacles, as evident by her decision to join a more supportive volleyball program and maintain her STEM major. Alice provides additional evidence of resolve when describing how she is unaffected by stereotypes in STEM:

> *"I knew about being a girl and also being in the minority, I knew I wouldn't be seeing a lot of that in my major. And, especially the school I was going to, I knew that like the ratio would be really off … maybe sometimes I would be intimidated but it hasn't really changed anything for me [in terms of career aspirations]." (Alice, lines 523-526)*

Each participant was aware of the stereotypes (particularly in STEM), but they were undefeated in their ability and desire to meet their goals. All three women affirmed that stereotypes in neither STEM nor volleyball affected their aspirations.

> *"Where I'm from [on the West Coast] there are a lot of different types of minorities in sports. Then, you do notice the difference in college but … everyone's from everywhere … we're all used to different people being on the court. We don't really say anything or notice anyone saying anything about the situation if that makes sense … I feel like everyone just sees everyone as a player and not like who they are at the moment … I think it makes me more comfortable … just like in sports, we're just all here to play the game so it's not a factor people notice, in my opinion." (Alice, lines, 236-242, 247-248, 260-261)*

Discussion

The purpose of this study was to investigate three Black women's experiences in two historically White collegiate spaces—volleyball and STEM. Specifically, we wanted to understand the role of their STEM and sports experiences from pre-college through college

through the lens of intersectionality. The findings revealed significant similarities between STEM and volleyball pathways. Specifically, early exposure increased and maintained their interest. These findings lend support to prior research that shows that Black middle school girls' early access points and hands-on learning enhance STEM identity development and interest (Ferreira, 2002; Riedinger & Taylor, 2016). The Whiteness of volleyball could be attributed to lack of access to such sports for Black women when they are young (Evans, 1998) and other barriers that prevent social and economic access (Staurowsky et al., 2015).

Regarding the theme of family, we found that both immediate family and volleyball teammates were considered as family. From an intersectionality perspective, it is critically important that Black women have systems of support in both STEM and volleyball. Our participants indicated that they are negatively affected by environments where cultural oppression is being reproduced in subtle or overt ways, where there is a lack of community, and where they have unfulfilled expectations. We also observed that the women greatly benefited from being on a volleyball team where everyone had shared goals and that provided them with skills that would benefit them beyond volleyball. These findings align with prior research that studied Black women in engineering and student-athletes who depended on positive and supportive interactions from individuals in their social networks (Carter-Francique et al., 2015).

The Whiteness of the spaces did not deter the participants' aspirations to persist. Furthermore, their experiences also indicated a sense of resolve. They were resolute to meet their academic and career goals despite any existing barriers, and they navigated their environments in ways that mitigated barriers and still allowed them to achieve on the court and in the classroom. Based on the literature, we know that Black women have been shown to respond differently from

White and Latina women to sexism and racism in STEM. In that, they demonstrate a better ability to navigate negative environments (Samuelson & Litzler, 2016).

The women in this study reported that stereotypes in STEM did not affect their career aspirations, though at least one woman vaguely described her awareness of racist or sexist instances. We are surprised that the three women in this study do not personally acknowledge the potential effects of -isms on their career or sports journeys. This could be explained by their rigorous schedules, which do not allow them to spend as much time in the classroom and on teams as other students. So, these participants may have been less impacted by racism or sexism or less aware of negative experiences that typically occur during group work or by faculty. This could be further investigated by expanding the study to include participants from additional colleges with volleyball and engineering programs. There is some evidence in the data to suggest that at least one of the participants could have been subconsciously affected by stereotypes, leading to lower mathematics confidence. This can be something we consider in the next iteration of this work.

Our research confirms that Black women in STEM and sports are undefeated. Meaning that they indeed have a strong ability to persevere and navigate historically White career pathways. However, the findings also indicate but that the academic and athletic institutions should intentionally support Black student-athletes. Future work could explore through a community cultural wealth lens these sources of support and how the women leverage such support.

Limitations

Some limitations to note in this study are the focus on only STEM-focused institutions, the focus on only two U.S. regions, and the inclusion of participants who were current student-

athletes at the time of participation. Meaning that these results must not be generalized to address the diverse journeys of all Black female STEM student-athletes and that these results may not generalize to other types of institutions or nations.

Implications

Implications of the study include support for early access to sports and STEM programming and support for those programs that intentionally include elements that provide opportunities for meaningful community-building experiences. These are shown to initiate and maintain the interest and participation of Black women in the long term.

Conclusions

Because athletics and STEM have both been leveraged as vehicles to mobilize students economically, we must also ensure that students have the proper support along their journeys. The findings of this work are significant as they provide much-needed insight into the various supports and strategies that Black women student-athletes utilized as they worked toward their career goals. In volleyball, each match includes at least 3 sets. A team can lose 1 or even 2 sets and still win the match. This was the case for the 2021 U.S Olympic team. They entered the Olympic finals undefeated, but they lost some sets along the way. In the same way, the women in this study shared stories of the importance of community, interest, and doing what it takes when they experienced "losing" moments. Yet, these women are *undefeated*. They demonstrated resolve as they used their identities and their STEM and volleyball experiences to work toward their goals.

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