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Intersectional Experiences of Black South African Female Doctoral Students in STEM: Participation, Success and Retention

Grace Ese-osa Idahosa  and Zamambo Mkhize 

abstract

One of the 12 critical areas for change highlighted in the Beijing Platform for Action (BPfA) is the education of girls and women, in particular the participation of women in Science, Technology, Engineering and Mathematics (STEM) disciplines. While South Africa has introduced several policies to address the low enrolment and graduation of women in STEM, African women continue to be under-represented in these disciplines. Furthermore, African women in STEM disciplines, a traditionally White male-dominated field, report facing intersectional oppressions linked to their race, gender, and class – which negatively impact both their progression and retention. In the South African context, this problem is exacerbated by the history of colonialism and apartheid which constructed African women as minors and continue to position them as outsiders within academia. Drawing on the experiences of 19 African female doctoral students at two universities in South Africa, and underpinned by the theory of intersectionality, this article critically interrogates the factors that influence the participation, progression, and retention of African female doctoral students in STEM fields. In so doing, the article reveals how interlocking systems of oppression continue to influence the progression and retention of women in STEM disciplines, thereby providing insight into the mechanisms that need to be altered and/or put in place to actively recruit African female doctoral students and retain them in academic positions.

keywords

transformation, institutional structure and culture, Science, Technology, Engineering and Mathematics (STEM), African women, intersectionality

The Context: The Beijing Platform for Action and Women in STEM in South African Universities

Since the United Nations (UN) world conferences in Mexico (1975), Copenhagen (1980), Nairobi (1985) and Beijing (1995), attaining equality in the access to and participation of women in education has been highlighted as central to attaining gender equality and women's agency (UN 1995; Department of Women, Youth and Persons with Disabilities

[DWYPD] 2020). The 1995 Beijing Declaration and Platform for Action (BPfA), in particular, highlights the education and training of women as central to attaining the “goals of equality, [sustainable] development, [economic growth] and peace” (UN 1995, p. 44). This includes women's access to education, particularly in science, mathematics, engineering, environmental science and technology fields, and the provision of necessary resources to enable women to become agents of change (UN 1995, p. 44).

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Some of the challenges affecting women and education highlighted in the BPfA, include: discrimination; biases and socio-cultural stereotypes about women's roles; inadequate sensitivity to gender issues in teaching and the curricula; early marriages; pregnancies; sexual harassment and lack of access to adequate resources; lack of gendered consciousness which sometimes work to affect a sense of self-esteem and belonging; and, the deprivation of girls' access to basic and higher education in science mathematics and technical training (UN 1995).

In proffering solutions to the outlined challenges, the BPfA set specific strategic objectives to ensure equal access to basic and advanced education in STEM fields and ensure women "take an active role in the technological and industrial development of their countries" (UN 1995, p. 46). It highlights the role of governments and other actors in realising women's equality and access to educational opportunities and notes the importance of training women in STEM fields to:

- Enhance employment opportunities.
- Enable women to take on an active role in economic, technical and industrial development.
- Ensure their progress into, and retention in, professional positions.
- Encourage the adoption of unbiased and sensitive curricula and teaching materials (UN 1995).

This article is, thus, focused on the challenges associated with the retention and progression of women in STEM fields, from doctoral studies to academic careers.

Specifically, strategic objective B.3, B.4 and B.5 of the BPfA seek to improve the access of women into science and technology fields ensure that women teachers, particularly in STEM fields, have access to "educational policy and decision making", and make provision for the funding of special programmes to advance opportunities for all women (UN 1995, p. 50). The BPfA further highlights several obligations that governments need to implement in order to achieve the goals set out in the Declaration. These include promoting gender mainstreaming in "all policies and programs so that, before decisions are taken, an analysis is made of the effects on

women and men, respectively", ensuring equal access to education; eliminating gender disparities; creating a gender-sensitive education system; and increase enrolment and retention by providing the necessary resources (UN 1995, p. 46).

In South Africa, in response to the goals and objectives noted in the Beijing Declaration, several initiatives have been introduced to promote the participation, success and retention of women in STEM. For example, the 2030 National Development Plan (NDP) recognises the importance of good quality STEM education to increase the livelihood and opportunities of people, women included, of South Africa (Barrett et al. 2019). It should however be noted that while the NDP recognises the importance of certain policy outcomes, and the legislation only highlights certain needs, it does not specifically refer to women in STEM. The Employment Equity Act No. 55 of 1998 and the National Framework for Women's Empowerment and Gender Equality of 2001 also highlight the need for equity, equality and gender empowerment (Moletsane & Reddy 2011). The South African Reference Group (SARG), a sub-committee of the National Advisory Council on Innovation (NACI), now known as Science and Technology for Women (SET4W), was formed in 2003, to increase the number of women from previously disadvantaged groups in science fields, though it has yet to formulate policies that could be implemented. Similarly, the Department of Science and Technology (DoST) presents the South African Women in Science Awards (SAWiSA) which aims to recognise and reward excellence by women scientists and researchers, and profile them as role models for young female scientists (DoST 2019). SAWiSA scholarships, like the Albertina Sisulu Fellowships and TATA scholarships, which prioritise STEM disciplines, have also been offered at postgraduate levels. In terms of funding, agencies such as the National Research Foundation (NRF) have increased funds to foster Black women's recruitment into sciences.

Despite these policy and funding interventions, Black South African women remain underrepresented and marginalised in STEM. While some progress has been made regarding the inclusion of women in Higher Education Institutions (HEIs), the

recent Beijing +25 South Africa (SA) report on 'The progress made on the implementation of the Beijing Platform for Action', by the Department of Women, Youth, and Persons with Disability (DWYPD), notes the continued underrepresentation of women, particularly in male dominated fields of study, and the gendered pattern of inclusion (DWYPD 2019). Emphasising this skewed pattern of inclusion, literature on doctoral students in STEM reveals high dropout rates, especially for Black and female students (NACI 2009; Hurtado & Figueroa 2013). The Beijing +25 report further notes that while there have been rates of high female enrolment, this tends to be at undergraduate and diploma levels, while men tend to dominate at postgraduate levels (DWYPD 2019). Current statistics reveal that in 2018, of the total number of females enrolled in postgraduate studies, 24% were in Science Education and Technology (SET), compared to 38% of male enrolment in SET, indicating a 14% gender gap in SET enrolment across South Africa (Department of Higher Education [DoHE] 2018). These numbers become more skewed when considering race and gender alongside level of study. In 2018, of the total number of African women enrolled in SET disciplines 74.3% were in undergraduate levels, and only 15.07% at post-graduate diploma and honours levels, 8.16% at master's level, and 2.25% at doctoral levels (DoHE 2018). The figures reveal a slight increase in the percentage of African women post-graduate enrolment in the 10-year period between 2008 and 2018, where in 2008, 88% of those enrolled were at the undergraduate level, 5.49% at post-graduate diploma and honours levels, 5.47% at master's level and 0.99% at doctoral levels (DoHE 2008).

Graduation rates reveal a similar pattern. Despite the high graduation rate of women at undergraduate levels, with women representing 62.5% of graduates in SET disciplines, only 10% graduated at master's level and 2.1% at doctoral levels in 2018 (DoHE 2018). The statistics reveal the sharp attrition rate of women at post-graduate levels. What this shows is that attaining gender equality remains a challenge, where interlocking systems of oppression, including historical legacies (colonialism and apartheid), current contextual influences (neoliberalism) which

influences institutional cultures, structures, and practices, work to enact varying forms of exclusion depending on the individual's identity (race, class, gender, sexuality, ethnicity etc.) and positionality (student, lecturer etc.).

Despite the promise of equality by the democratic government and the policy context which has provided some degree of demographic inclusion at the undergraduate level, institutional, structural, and cultural inequalities persist. The numbers of Black women in STEM disciplines remains low, with the number of women declining as they climb the academic ladder. The problem is exacerbated for Black women as their marginalisation is historically rooted in colonialism, apartheid and the neoliberal nature of the university. Blacks and women were treated as minors and the racial hierarchy implemented under apartheid further positioned Black women in South Africa at the bottom of the hierarchy in relation to other oppressed population groups, namely, Coloured and Indian people (Gouws 2017). Thus, the experience of Black women in STEM continues to be marked by dichotomies of exclusion and inclusion, superiority and inferiority.

The literature on doctoral students in STEM also reveals high dropout rates especially for Black and female students (NACI 2009; Hurtado & Figueroa 2013). The high attrition rate has been attributed to various factors such as exclusion and isolation in a male-dominated discipline, stereotypes, and lack of mentoring (Hurtado & Figueroa 2013). Those who persevere in this field are faced with various challenges in becoming successful. Research has also attributed the problem of retention and success to a lack of student-faculty interactions which leads to isolation or exclusion, and consequently to students dropping-out; and to conservative lecturers, who work to maintain the status quo by undermining the ability and knowledge of Black women (Nel & Meyer 2016). Structural, environmental, and societal factors, thus, intersect to make it difficult for Black women to enter into, have a sense of belonging in, and succeed in STEM disciplines. In examining the experiences of women in STEM disciplines, scholars have noted that it is marked with

frustrations, shock, anger, disappointment, resentment, anxiety, helplessness, hopelessness and fear (Hurtado & Figueroa 2013; Liccardo 2018) – and those who persevere are faced with various obstacles and challenges to the possibility of ever becoming successful.

Despite the existence of unique and intertwined differences in terms of context, race, and level of career differentiate women's experiences in STEM disciplines. This differentiation positions the value of examining the diverse and intersectional experiences of Black women at doctoral level to understand the factors that impact their specific progress, success, and retention. We critically interrogate the factors that influence the participation, success, and the decision of Black (South African) female doctoral students to pursue academic.

The article discusses how an intersection of institutional, disciplinary, cultural and interpersonal factors work to exclude Black women in STEM fields and may influence the decision not to pursue a postgraduate degree and/or an academic career. If identities are shaped by our experiences, then how people encounter institutionalised social structures demands more complex analysis – in this case of intersectional barriers in STEM education for Black women – particularly because Black women are often marginalised in STEM educational spaces and their experiences are also rendered invisible or insignificant (Tefera et al. 2018).

The Study: Intersectionality and Black Women in STEM

The Intersectional approach to analysis

The analytical approach employed in this study derives its grounding from an intersectional perspective to examine factors that affect the progress and retention of Black¹ South African women in STEM disciplines. The term intersectionality, coined by Kimberley Crenshaw (1989), has its roots in Black Feminist Thought, and describes the ways in which structures and processes relating to axes of difference, race, gender, class, ethnicity, sexuality, nationality, worked to oppress Black women in ways

that were different to those experienced by people in other oppressed categories (i.e. Black men or White women). These social categories are affirmed through social interrelationship in how people recognise each other, and yet are individually experienced (McMaster & Cook 2019). Seabrook (2019) notes that intersectionality is a specific feminist theory that interrogates both the ways that different identities combine to create unique and complex dynamics of oppression and power for individuals and communities as well as the broader social structures that sustain the marginalisation of certain identity positions (Carastathis 2014). The axes of difference are not merely descriptive but co-constitute each other (Slater & Liz 2018). Cho, Crenshaw and McCall (2013) contend that what makes an analysis intersectional is not the use of the term 'intersectionality' but its adoption of an intersectional way of thinking about the problem of sameness and difference and its relation to power (Collins 2019). Intersectionality theory focuses on three main areas: it questions the race/gender binary and argues for an understanding of multi-dimensions, which includes the ways in which race, gender, class identity and context, as well as other factors, affect experience (Nash 2008). Intersectionality also seeks to reveal the "racial variations within gender and the gendered variations within race through its attention to subjects whose identities contest race or gender categorization" (Nash 2008, pp. 2, 3). Intersectionality opens up the possibility for understanding the ways in which social positions (race, class, gender, sexuality, roles) shape and influence identity formations.

Finally, intersectionality moves beyond race and gender to consider the ways in which political milieus affect identity and individual experience. For example, processes like capitalism, colonialism, nationalism are incorporated into intersectional analysis (Levine-Rasky 2011). This conceptualisation enables the researcher to understand the legacy of exclusion, and in the South African context, the legacy of colonialism and apartheid, on multiple marginal subjects – and in so doing, avoids the problem of essentialism and exclusion of particular groups (see Nash 2008, p. 8). This approach thus enables an examination

of the patterns of inclusion/exclusion by taking into account the historical relations of power that shape the context, institutions and disciplines in which Black women are embedded (Dill & Zambrana 2009). Such situatedness not only enables the researchers to understand the experiences of Black female doctoral students in relation to their historical and social context, but also enables an understanding of the transformation process occurring within higher education institutions.

Methods and analysis

The study is situated within a critical research paradigm whose purpose is “to identify, contest and help resolve power imbalances” in society which contribute to “systemic inequalities and injustices” (Taylor & Medina 2013, p. 6). Informed by this paradigm, the study employed a qualitative research design. Semi-structured interviews were conducted with 19 participants in STEM fields at two merged universities in South Africa. The two universities were selected for their historical and contextual uniqueness. Both universities were born from the 2005 university merger and had to deal with the complexities associated with mergers in addition to dealing with the problem of transforming. Given the contextual particularities of both institutions, examining the experiences of black doctoral female students in STEM disciplines will provide insight into the prevailing institutional conditions that facilitated and inhibited participants’ access, progression and success within their disciplines.

A purposive sampling technique, aimed at identifying Black South African female doctoral students in STEM fields at the universities, was employed after obtaining ethical approval from both institutions (See Mason 2002; Seidman 2006). The interviews sought to understand participants’ (who were mostly first generation) experiences of being in STEM disciplines, as well as their interest in becoming academics. While we acknowledge the possibility of women in this category taking positions in industry (which seems to be the case currently), we question why there is less consideration of academic positions among participants. While the participants are considered success cases in terms of being at

the most advanced stages in their studies, the interviews explored participants’ location within the institutions and some of the enabling and limiting conditions they experience in the faculty and institution in terms of their participation, success, and the future decision to enter into academic careers. Examining these enabling and limiting conditions provide an avenue for understanding the motivating and demotivating factors that determine the decision to pursue STEM academic careers.

A thematic analysis of the data was employed using NVivo data analysis software (Bazeley & Richards 2000) to analyse how participants’ social positions intersected with the historical and current political milieu to impact their participation, success, and transition into academic careers. The data was coded for patterns in the experiences of participants to understand the factors that impacted the inclusion and retention of Black South African women in STEM fields (Saldaña 2009). In the next section, we discuss the findings and examine the structural, institutional, cultural, and interpersonal factors that have an impact on the inclusion and retention of Black women in STEM disciplines in South African Higher Education.

Findings and Discussion: The Problem of Inclusion, Progress and Retention

An intersectional approach is orientated toward analysing the mutually constitutive nature of relationships of power and inequality within social settings and how these shape group and individual identities. Consistent with the literature, the study participants cited an intersection of institutional, disciplinary, cultural and interpersonal factors as challenges impacting their success and progression in the field.

When asked if they would like to pursue academic careers, all but one participant refused, citing, in particular, hostile institutional environments. Participants also highlighted how male-dominated environments, departmental politics, social norms, stereotypes, discrimination, an absence of mentors and role-models, produced feelings of isolation, loneliness, and affected

their perception of belonging, often requiring them to prove themselves as capable and legitimate knowers within their disciplines. The narratives revealed how structural (institutional and disciplinary) factors like participants' socio-economic status intersected with their race, gender and age to situate them in complex marginal positions (Idahosa & Vincent 2014).

Structural and institutional factors

At a *structural level*, participant narratives reveal how an interlocking system of oppression linked to historical legacies of colonialism and apartheid (which are further complicated in merged institutions) and current neoliberal university formations (which informs competition and obligations for gratitude), intersect with their race, class, gender, and age to influence their inclusion, participation in, and success in STEM fields.

LZ5: I think the culture still has a lot of [historically White] elements, you know [this university] was [historically White] before it became [this university], I think it still has got a lot of those elements.

RZ9: ... it is not always the case, sometimes the environment is too harsh that people cannot ... you need to have thick skin, some people feel like, no I am not going to stand for this, I already have my undergraduate or I already have my Masters, why would I continue in the same place.

LZ5 and RZ9's narratives reveal the intersection and mutual constitution of historical legacies, neoliberal tendencies, race and gender which works to exclude them. These participants cited the harsh institutional environment and, in particular, the White culture of the university as a factor that may influence the decision not to pursue an academic career. LZ5 attributes this to historical legacies of apartheid and colonialism which positioned Women and Blacks as minors, alongside neoliberal tendencies which foreground, competition, commodification and efficiency (Berg, Huijbens & Larsen 2016). This is consistent with the argument by Liccardo (2018) on the position of Black South African women in STEM, which holds the institutional culture and practices marked by

marginalisation of Black people and their positioning as minors, responsible (Nkomo 2011). The twin legacies of colonialism, and apartheid, entwined with the neoliberal university culture, work together to influence the positionality and experience of women in STEM (Borum & Walker 2012). Furthermore, the neoliberal nature of the university, revealed in the legislative promotion of gender equality which sits in tension with an inherently white, patriarchal and heteronormative culture, deepens the exclusion of those positioned as not belonging. Thus, as LZ5 and RZ9 note, the harsh environments of Universities (linked to historical legacies and the neoliberal shift), ensures that those who enter feel unwelcomed, having to develop a 'thick skin', while those who are unwilling to accept the structural formations and exclusionary nature of HEI's in SA, choose to opt out.

The structural problem of apartheid, colonial legacies, and neoliberalism also plays out at an *institutional level* and is revealed in the perceived lack of institutional will to include Black women into STEM fields, as is evident in the following narrative.

BC3: ... when you look at this place, all the professors are men, there is no woman. Where are the women? I do not know, I do not see it, if we have only one black woman as a lecturer, ... is [it] likely to have another one, do you think there will be ...? I do not know but I do not see it ... I do not see it. They should have started long ago hiring even if it is from outside but there is nothing. The last person they hired was white, as a lecturer but that one was also a student here, she studied here as well, then they hired her ... It is actually a disadvantage, compete equal and go in equal. Now they will feel like, we did XXX a favour.

BC3's narrative reveals an intersection between institutional ethos, historical legacies and the impact of neoliberal policies on the perpetuation of inequalities along race, class, and gendered lines. BC3 notes how an interlocking system of racialised and gendered institutional will (which privileges the inclusion of white and male bodies) work to ensure the exclusion of Black women. When Black women are

included, the very same structure, works to ensure they feel indebted to it. The structural violence inherent in the neoliberal practice of competition, thus produces the Black Female student as an individual who needs to show gratitude for being included, thus, producing anxiety, stress and pressure. As NN08 and LZ5 put it:

NN08: Maybe I am talking out of stress and pressure and saying I am out of here.

LZ5: I am supposed to be writing now, the financial stress has been difficult, so I would say those are the challenges.

NN08 and LZ5's narrative reveals the decision to leave (i.e., attrition) as a response to the interlocking systems of oppression, impacting the success and retention of Black women in the discipline. Stress referred to here is not just mental and emotional, it is also financial, as LZ5 notes, and impacts the retention and success of those occupying race, classed and gendered positions in the field. Stress becomes a concept for understanding how an interlocking system of historical legacies and neoliberal policies influences raced, classed, and gendered structures to ensure that Black women from working-class backgrounds find it difficult to succeed in STEM fields. The neoliberal focus on merit, effort and competition, thus, exacerbates inequalities as these are not sensitive to how historical legacies influence participation, success and inclusion.

Beyond the intersection of race, class, and gender, NN08 further highlights the intersection between age - and race and gender. She notes feeling undermined by the other races because she is Black and young. Similar sentiments are echoed by BC3.

NN08: [In this institution] people are not friendly ... some are Indian and White, so they have that tendency to look down on you. Especially young females. The other races undermine us, [it] is a combination, Black and being young as well.

BC3: Because I am older, I can tell them to do anything. I do not know if a younger person can survive, I do not know.

While much current research on age and intersectionality focuses on the elderly (see

Krekula 2007), NN08 and BC3's narrative reveal how young Black women may experience specific forms of discrimination as a result of the knowledge hierarchy. An interlocking system of sexism, classism, racism and ageism points to ways in which some Black and young women in STEM disciplines experience triple forms of marginalisation. Double standards and double binds are entailed in the expert/authority juxtaposition with participants' age and is one of the many different layers of discrimination experienced by Black women in the STEM field.

Socio-cultural factors

A finding of this study is that socio-cultural factors, such as racialised and gendered preferences, work to limit the participation and success of Black women in STEM. These preferences, revealed in the gendered division of labour and gendered social and cultural expectations, negatively influence the participation of women in STEM fields as they have to navigate and balance multiple gendered roles and responsibilities. This is evident in the following narratives.

YZ19: I grew up in the era where nursing and teaching were the only professions that were in reach for Black women. But I was the type of a person who never wanted to fail at anything.

RZ9: I am going to get this PhD ... I am going to get this without having to listen to all the negativity because it is believed that Black females cannot ... because we have a lot of students that go up to Master's, it is either they leave between their Master's [or] they have not submitted, so there is that stigma attached which has got [us] stuck [here] that we don't go any further. I want to prove that wrong, I believe that we are not meant to be pregnant only and be in the kitchen, we can actually do much more.

The Beijing +25 report notes the persistence of gender stereotypes as one major reason for the continued inequality in access and retention of women in postgraduate fields (DWYPD 2019). Stereotypes by fellow students and lecturers, based on gender, and race, affect Black female doctoral students' success and in turn, their opportunities for

advancement (UN Educational, Scientific and Cultural Organization [UNESCO] 2011). The reproduction of the public/private divide revealed in Black girls being socialised to believe that the only available options for them are in occupations of care and service to others such as, teaching and nursing is limiting as it subconsciously reinforces the notion that Black girls are best suited for non-intellectual and domestic work. The construction of Black women as teachers and nurses also points to a gendered cultural socialisation and division of labour that limits the career paths available to women and attaches a stigma to those who defy such norms, as NN08 narrates.

NN08: They feel academia is a way of holding you back. At our age, society says you are not married, you don't have a child, you have been studying since I don't know when. So Black females run away from academia because they want to fit into their communities and environments which says a Black woman by this age should be married with three kids and a husband. So, if you are [doing] a PhD and you are focused on your work... you [become] isolated from the rest of the females in your community.

Evident in NN08's narrative is the intersection between socio-cultural norms, age, race and gender. Where Black women pursuing their doctoral degrees in STEM disciplines continue to receive discouraging messages such as 'when will they stop studying and get married, have children, build a home ...?' as NN08 narrates. While their advancement to doctoral levels reveals their agency, these messages are a constant reminder that these women are rebelling against their socio-cultural designated identity of being wives and mothers in service to their husband and children. These messages could, at best, be interpreted as a reminder for women not to veer too far from their constructed roles or face the consequences of being ostracised from their communities. At worst, these messages are there to "hold women back" as NN08 notes, as the messages actively encourage women, not to be ambitious, have aspirations and be high achievers.

When women deploy their agency and break these barriers, they are made to feel like outsiders or, even worse, sometimes actively encouraged by their lecturers and peers to quit. MJ7 and MN13 narrate:

MJ7: The thing is they make you feel [like] you do not belong in the space because I was the only lady who was doing [Science] with them in class, I am the only lady who managed to pull through. So, there was always a lot of stress from the boys [saying] that, why are you doing [Science], you will not make, no one makes it there ... So the third-year modules, the guys were saying, MJ7, why are you doing this, you will not make it. To me it was like, if I prove these people wrong, they will get it that we women can actually do more, ... better than them because others are left behind, they had to repeat the course.

MN13: And then also [for] some lecturers or some people in the department, maybe post-undergrad ... there was that preference [for] males. You could see that our department was dominated by males more than females. Because it was considered what we were doing was hard. Specifically, in the labs that were very methodological, like the guys that did biochemistry, sequencing [etc.], all these things that were considered a bit harder were more male dominated.

Deeply ingrained preferences of conservative lecturers and students, who work to maintain the status quo, based on the belief that science is a male-dominated discipline, undermine the ability of Black women in STEM to succeed (Bodrum & Walker 2012). As respondents MJ7 and MN13 note, bias and prejudice by lecturers and peers negatively affect their academic experience and potential to succeed. The response from lecturers and peers is linked to the perception that Black women are less competent compared to their male counterparts (Hurtado & Figueroa 2013). As a result, their roles, contributions, ability, accomplishments are undervalued.

The accounts of participants in this study, thus far, provides further evidence that patriarchy and male dominance continue to influence gender inequality in STEM and the society (UNESCO 2011). It

has demonstrated how women are socialised into traditional gender roles embedded in cultural beliefs, influenced by patriarchy. Although the policy frameworks advocate gender equality, the culture of discouraging girls in hard sciences and encouraging them to marry and have children still exists. Women are, thus, under pressure to meet these goals and are stigmatised when they do not fulfil these expectations, thus intensifying the pressure of balancing work and life. Despite an enabling policy framework, socio-cultural assumptions, alongside structural issues (discussed above), and interpersonal factors (discussed below) continue to influence the participation, progression, success and retention of Black doctoral students in academic careers.

Interpersonal factors

In addition to structural, institutional, and personal factors, participants noted interpersonal issues (an intersection of identity and belonging) as a factor that limits participation, progression, success and retention. PC1 and BZ3 note how assumptions about their race and gender works to limit their agency, sense of self, and entrench their exclusion within their disciplines.

PC1: ... there are certain times where you would just feel this thing ... that these people do not want you here or you are wasting their time, or they think you are wasting their time. One professor even told me ... I failed a test in Honours and then the person just told me that all I have is a pretty face and it was a White old man. You try not to let it get to you because you will be depressed if you just sit there and think about what somebody else thinks about you.

BZ3: The thing is, we can come up with all the ideas that we want but there is nothing much that we can do about it. And also, I think we are still discriminated against as women. I believe we are still discriminated against and there is not much that we can do about it, especially Black women. Even if they hire you, they will show you discrimination ... they will show you that you still do not know anything. Such things also become a disadvantage for us because if I am going to be put in a place because they are doing

me a favour, they want women to come in, especially Black women, and then you are there and they are like, she is here but she is not even performing, even where they are supposed to give you support, now you look like the stupid one, whereas in general, they must give you support, but because you are a woman, it will work against you. The fact that you came in as a Black woman and now you want support whereas for anyone, they would have given that support.

These narratives reveal how an intersection of identity and belonging works to impact the progression, success, and retention of participants. They show how subtle and overt institutional and societal practices, revealed in hostile, derogatory attitudes and micro-aggressions from peers, supervisors and faculty members, exacerbates Black women's sense of not belonging. These attitudes, born out of the historical positioning of Blacks and women as minors and intellectual inferiors with no capacity to make a significant contribution to the global knowledge economy, ensure that STEM fields, thus, continue to be a white and masculine dominated field with White males viewed as the legitimate intellectual leaders and purveyors of knowledge. This implies that those who do not fit within this norm are not welcomed, making the field hostile and even dangerous for them. This is evident in PC1 being called "a pretty face". Such positioning and designation devalues her intelligence and capability as a legitimate knower. The reference to a pretty face points to the sexualised nature of harassment and discrimination that Black women experience within HEI's.

BZ3 further notes how such attitudes and practices deter women in this position from seeking support to avoid confirmation of biases and stereotypes. When Black women are situated in historically white and masculinised spaces, there is an interplay of patriarchy, misogyny, and structural inequality which makes certain spaces, such as HEI's, extremely violent and dangerous for them (Butler 2018). This renders Black women's experiences in STEM invisible, misrecognised or dismissed at the structural, institutional, and interpersonal level. What is, significant is how such practices

produce feelings of depression, isolation, and loneliness, and raises issues of identity and belonging which then influences retention. Being a Black woman within masculine, White and heteronormative spaces, thus, undermines self-confidence and a legitimate sense of belonging as their intelligence and capabilities are constantly questioned. The study participants' accounts of their experiences of exclusion and isolation, thus, reveal the conditions that made it difficult for them to navigate their disciplines, and explains, to a large extent, the problems with participation, progression, success and retention.

Conclusion

A critical area of concern highlighted in the BPfA (UN 1995) and the Beijing +25 SA report, has been how to attain gender equality and ensure inclusion, progression, and retention of Black women, particularly within White and masculine dominated fields such as STEM. While there are initiatives and concerted efforts by public universities in South Africa to respond to (gender) transformation imperatives through the development of women in research and increasing the number of women in senior management, middle management, and the professoriate (see Zulu 2017, p. 212), these initiatives are rarely implemented and when they are, they do not consider the abrasive impact on belonging and gender identity of surviving in White male-dominated STEM disciplines. In this article, we discuss how some of the challenges affecting Black women in STEM such as micro-aggressions, macro assaults and hostile environments (linked to historical legacies and neoliberal tendencies), perpetuate race, gender, class, and age inequalities and has a debilitating impact on the Black woman's advancement within these disciplines.

The study finds that despite policy interventions, Black African women continue to face often invisible intersectional structural, cultural, and interpersonal challenges which make success and progress within them an Achillean effort. Factors such as socio-economic status (which intersects with race, gender and age), departmental politics and in-fighting, a lack of mentors and role models, social norms, stereotypes, and

discrimination created a unique and dynamic system of oppression for participants, leading to feelings of isolation, loneliness, and depression. Participant stories reveal how an intersection of power, social structures, cultures, and identity positions work to produce competition, obligations for gratitude and gendered and racialised socio-cultural preference, which in turn influences their inclusion, progression and retention. The implication is that interventions aimed at ameliorating these challenges must move beyond policymaking to implementation and in so doing, take into consideration, these intersectional forms of oppression if they are to promote inclusion, progression and retention of Black African women in these fields.

The narratives also reveal that the one size fits all approach adopted in redressing gender equality is problematic as experiences of women in STEM vary with race, context and level of career (Nel & Meyer 2016). While interventions put in place have made progress with regard to the structural and material challenges with including and retaining women, they remain ideological at best. As highlighted by the BPfA, and participants' accounts in this study, challenges abound with ensuring progression, retention and success of Black African women within STEM fields. It is clear from the narratives that approaches to inclusion will have to go beyond increasing enrollment. Ensuring retention for success will have to go beyond meeting the material needs of Black women in these fields. Subtle practices, located in socio-cultural preferences, point to the need for institutions to ensure that the inclusion process does not remain at the demographic level. Addressing both the overt and subtle challenges would mean ensuring that sensitivity to race, class, gender, and age issues are adequately addressed in teaching and the curricula as noted in the BPfA. Institutions must be cognisant of how assumptions based on identity influence who is included or excluded. This implies an awareness of the ways in which institutional practices may impact feelings of belonging which influences participation, success and retention. One way of addressing the subtle but pervasive institutional prejudice is to implement programmes to foster the development of

critical reflexive consciousness on how assumptions and stereotypes, not only deter women from enrolling into science and technology fields but also work to ensure that those who make it into the field do not succeed.


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Note

1. The term 'Black' represents African, Coloured and Indian individuals. These racial categories implemented during apartheid are used as a redress measure in post-apartheid South Africa. Within these categories, we focus on 'African' Women in STEM disciplines who are South African citizens.

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