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Unfettering the ball and chain of gender discrimination: Gendered experiences of senior STEM women in Ghana

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Abstract: Gender disparities are rife in Ghana and its educational sector. Despite the plethora of research on gender disparities in Ghana's education system, there is no coverage on gender disparities in the Science, Technology, Engineering, and Mathematics (STEM) fields in Ghana. The paper's purpose of the article was to examine the experiences of successful STEM women in Ghana utilizing semi-structured interviews. Fifteen women in STEM in senior faculty ranks were interviewed. Although they faced gender discrimination, their socialization emanated from their parents and other family members who are STEM professionals. Their agency made them linchpins in their study groups, excelled in their studies, and they were assisted to progress on their STEM trajectories by their professors and other mentors. As faculty, their productivity soared and they have been psychologically empowering their protégés.

Subjects: Higher Education; School Leadership, Management & Administration; Education Policy & Politics

Keywords: gender discrimination; women; STEM; Ghana

ABOUT THE AUTHOR

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PUBLIC INTEREST STATEMENT

Gender disparities against women pervade all spheres of society including the male-dominated science and technology. Previous research studies on women in Science, Technology, Engineering, and Mathematics (STEM) have engrossed women from various STEM disciplines. This study focused on the gendered experiences of senior women academics and scientists in Ghana and sought to understand how they overcame the gender discrimination they faced. More so, their means of empowering existing and prospective women in STEM were also sought. They overcame gender discrimination due to the socialization in their STEM disciplines by their parents, other relatives, teachers, mates, and work colleagues and seniors. As a consequence they have been encouraging and mentoring existing and prospective women in STEM to face gender discrimination as a reality that can be overcome with the right psychological support and mindset.

1. Introduction

Women's roles in society's development are vital (UNDP, 2007; USAID, 1982). They play indispensable roles in poverty reduction through technological and scientific advancement (UNESCO, 2007). However, they are excluded in education, decision-making, and/or politics, etc. due to poverty, lack of education and aspects of their legal, institutional, political, and cultural environments (Bem, 1993; King & Hill, 1993; Morimoto, Zajicek, Hunt, & Lisnic, 2013; UNDP, 2007). Thus, there are inequalities stifling the progress of women in society as they struggle to achieve their identity in a male dominated society (UNDP, 2007). Gender inequality devalues well-being and is a form of injustice in most conceptions of equity or justice (Bucciarelli, Muratore, Odoardi, & Pagliari, 2011).

Internationally, efforts have been made to address the gender gap situation (UNDP, 2007) such as the United Nations Decade for Women (1976–1985), the 1985 Nairobi Forward-Looking Strategies for the Advancement of Women, the 1995 Fourth World Conference on Women in Beijing, among others (UNESCO, 2007). Despite all these international initiatives and interventions, gender inequalities are prevalent globally (Morimoto et al., 2013) and thus in Ghana (Ardayfio-Schandorf, 1995; Manuh, 1989) and its tertiary education sector for that matter (Atuahene & Owusu-Ansah, 2013; Manuh, Gariba, & Budu, 2007). This is counterintuitive to the fact that there are socioeconomic returns to education based on current costs and future benefits (Schultz, 1993).

Women are marginalized and underrepresented in all disciplinary fields, especially the STEM fields (Campion & Shrum, 2004; Erinosho, 1994). This is contrary to the recognition of governments globally that science and technology are sine qua non to development (UNESCO, 2007). Within the STEM fields, institutional injustices are manifested in stereotype threats, differential effect of work and family demands; implicit and explicit bias; and lack of women in academic leadership and decision-making positions (Spencer, Steele, & Quinn, 1999).

Concerning STEM and other disciplinary fields in Ghana, gender disparities persist (Campion & Shrum, 2004) due to sociocultural considerations, gendered social practices within households, financial difficulties associated with women education, and lack of role models for girls in schools (Atuahene & Owusu-Ansah, 2013; Morley, Leach, & Lugg, 2009). Tettey (2010) provides statistics relative to gender disparities among the faculty members at the University of Ghana in 2008. The composition of female academic staff as compared to male academic staff is 24 percent and 76 percent, respectively. The proportions of female academic staff at various ranks: Lecturer, Senior Lecturer, and Professor were 25 percent, 24 percent, and 17 percent, respectively. The trends in female academic staff qualifications in the same year were for Masters and Doctorates, 29 percent and 20 percent, respectively. When Science, Technology, Engineering, and Mathematics (STEM) are compared to the Humanities, STEM lags.

Regardless of the gender disparities in the various disciplines and specifically STEM, there are women who rise through the ranks in their fields to professorial ranks, heads of departments or institutes, and deans. The objective of this paper was to explore the gendered experiences of senior female academics[1] in STEM in Ghana because of their vast experiences in their fields. They are successes in disciplinary areas and professions traditionally perceived to be male domains.

The paper[2] poses as its questions:

How do senior female STEM academics and research scientists in Ghana experience gender biases relating to their STEM experiences? and

How have they succeeded in responding to the gender biases they have faced in their STEM experiences?

What have been their efforts in curbing gender biases?

2. Social capital

Social capital is "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition" (Bourdieu, 1983, p. 249). It engrosses the resources and information to which individuals or groups have access through their social relationships (Bourdieu, 1983).

Social capital (exchange of information, ideas, and resources) in the science sector is likened to a bi-annual ceremonial practice in the Western Pacific islands where elite males from various islands exchange their prized possessions to compete for prestige, power, and status in their society. They seek white and red shells arranged in the form of a ring called *kula*. The man that wins the ring keeps it until the next encounter. This ceremonial practice bonds islands and their economies together. The political stability of the trading islands are enhanced through the trading interactions among the elite trading men. The *kula* illustrates that the politics and economy are embedded in social relations in that milieu (Malinowski, 1922). Social capital in the science academy emerges as a matter of necessity around scientists who must accumulate resources and talents in order to provide the members of their networks with exclusive information to which non-members do not have special access (Etzkowitz, Kemelgor, & Uzzi, 2000). Women in science lack the social capital imperative for the ousting of the male-dominated structure of science (Etzkowitz, Kemelgor, Neuschatz, Uzzi, & Alonzo, 1994). Senior scientists who have developed an optimal degree of social capital are conceived of as bankers of social capital, who are repositories of the largest access of information and widest networks transcending teams, departments, and universities. They deposit social capital to their "apprentices" and/or trainees through invitations to top-notch conferences and access to privileged information (Etzkowitz et al., 2000).

Networks in academic science settings are skewed in favor of male scientists. The lack of invitation to grant proposals by senior faculty to young women faculty seeking tenure and promotion, unlike their male colleagues, is indicative of the message they get in their scientific community (Etzkowitz et al., 2000). Inclusion in strong networks constitutes a head start to career in science (Etzkowitz et al., 2000). Nonetheless, a major factor that accounts for the decline in proportion of women scientists who succeed in each rung of the professional ladder including those who persist en route to their doctorates is exclusion from social ties. This is where the quality of graduate school experience and the necessary support needed to assist in the transition to a productive and gratifying career in science becomes an issue (Etzkowitz et al., 2000).

3. Methodology

3.1. Research design

The exploratory study to inquire into the experiences of senior females STEM academics and research scientists methodologically hinged on Crotty's (1998) elements of research design. Epistemologically (and ontologically), the study was subjectivist in nature. Subjectivism holds that knowledge is influenced by personal feelings, attitudes, experiences and opinions and that truth is not objective (Crotty, 1998). Interpretivism was the theoretical perspective of the study's methodology. It heralds human actions, meanings and interpretation. People and their knowledge are inseparable. Knowledge is relative to the study context, culture, and time (Scotland, 2012). The depth and nuances of the information concerning participants' experiences required the adoption of a flexible interview type. Thus, semi-structured interviews were utilized for the study. The findings of the study were analyzed thematically through coding methods.

3.2. Participants, research rites, and sampling methods

Fifteen participants in diverse STEM disciplines were interviewed in September 2014 at the University of Cape Coast (UCC), the Kwame Nkrumah University of Science and Technology (KNUST), and the Centre for Scientific and Industrial Research (CSIR), KNUST is predominantly a STEM institution, the CSIR is the state's only research institute, and UCC is a predominantly non-STEM institution.

Some of the participants were initially sampled through the purposive/criterion sampling technique. The type of sampling focuses on the selection of cases that meet some predetermined criterion of importance (Patton, 2001), which in the context of the study were discipline, gender, and position, or status of participants. I got a list of the STEM females in the professorial ranks. By virtue of the fact that the numbers were very low, I had to change the gamut of the participants to be interviewed, from Associate Professors to Professors, to include Senior Lecturers.[3] This meant that Lecturers and Assistant Lecturers were excluded. Accessing the participants were challenging. I was able to use my gatekeepers to interview one-third of the participants but I utilized snowball sampling to get more participants. By asking the research participants to assist the researcher in recruiting potential participants (Patton, 2001), the remaining two-thirds were recruited. There were 8 participants sampled out of a population of 12, 4 out of 6, and 3 out of 5 recruited from KNUST, UCC, and CSIR, respectively. Concerning the KNUST sampled participants, 2 were Professors, 2 were Associate Professors, and 4 were Senior Lecturers. Concerning UCC, there were 1, 1, and 2 participants who were Professors, Associate Professors, and Senior Lecturers, respectively. Concerning CSIR, there were 1 and 2 participants who were Principal Researchers and Senior Researchers.[4] No professor was recruited.

3.3. Data collection: Semi-structured interviews

Semi-structured interviews are flexible interviews that the interviewers follow a list of questions, interview guide, to cover during conversations with participants. They ask follow-up questions and probes that proceed from conversations with the respondents (Rubin & Rubin, 2012). An interview protocol was developed which was used to ask leading questions during the interviews. The interviews were held in serene office locations during the morning and afternoons with an audio-recorder except for one participant. For security reasons, one professor insisted on being interviewed without being recorded. The researcher made shorthand notes of the interviews and constantly asked for repetitions to allow for capturing of essential data information. There was rapport between the researcher and the participants as important information were elicited without much difficulty. Interviews spanned averagely for 53 min. The shorthand written notes of the participant who was interviewed without an audio recorder were reorganized cogently. The researcher transcribed three interviews while the remaining 12 interviews were transcribed by a private transcription services company within a month (see Table 1).

Table 1. Participants and their disciplines

Participants	Discipline
ML	Mechanical engineering
LA	Agronomy
CR	Soil Science
PT	Forestry/Natural resources
MB	Entomology/Wildlife
LS	Entomology/Wildlife
RM	Biology
RK	Biology
YD	Microbiology
BF	Physiology
YO	Optometry
DI	Nursing
NT	Analytical Chemistry
YM	Physics
DY	Mathematics

3.4. Data analysis

The whole data analysis process was characterized by reading, rereading, assembling and dissembling of interview data. The transcribed interviews were analyzed thematically by utilizing coding phases. In the open coding phase, the data were initially analyzed word-by-word and later line-by-line to create several themes. Similar themes generated in the open coding phase were synthesized in the axial coding phase. The axial codes were interconnected to generate a coherent grand theme or a narrative aligned with the research questions of the study.

4. Gendered experiences of participants

The first 3 stages of the STEM experiential journeys: Interest Creation and Development (pre-higher education), Higher Education Participation, and Career Dynamics were characterized with gender discrimination and support. The Higher Education Participation and Career Dynamics stages were cyclical. The participants began with an interest in STEM before accessing higher education. The career dynamics stage/process was the period where they were part of the world of work. Their outputs at work based on their experiences were positive. They have been empowering prospective and current women in STEM to take the bull by the horns and succeed in their endeavors.

The participants on their trajectories from their basic school to junior high school (JHS) to senior high school (SHS) to tertiary education and career experienced minimal barriers of gender biases. The socialization in their nascent educational years, from which they were beneficiaries, immensely catapulted them to surmount gender biases that came their way in the quest for success in their STEM academic and professional endeavors. The overwhelming support[5] that they had overshadowed the gender discrimination they encountered throughout their experiences. Almost all the people who lent them support had STEM backgrounds right from their homes to their schools/universities and career settings. The home is the first or traditional agency of socialization. Families, especially parents have strong clouts in influencing the behavior of their children and wards in particular directions. The participants tremendously benefited from parental support and encouragement when they started school and realized the sciences and mathematics were prospective subject areas. They had parents with solid educational and STEM backgrounds. Thus, they appreciated the need for their daughters to exploit their interest in the STEM fields they had chosen. Such parents emphasized the ubiquity of science in the lives of females, making it an important area of study and career development for females:

> It was encouragement. My dad is a scientist and he wanted [laughs] as usual … Everything about a woman is science, everything about your work in the house is science, that's the common statement. In the kitchen you're putting things together, its chemicals, the food you eat are all chemicals, if you're doing your make-up, its chemical. So every woman should be in science actually.

Networking in the academic settings was an important factor in their progression in their STEM educational journeys. The academic networks to which they belonged although strong, hinged on their efforts. Their individual efforts in joining certain professional or disciplinary societies and subsequently holding certain positions together with the males who formed the majority of the office holders gave them an advantage in their studies. These networks gave them opportunities to gain much knowledge from their disciplines and unearth their leadership potentials. Hence, leadership opportunities and academic advancement were benefits of the academic networks to which they belonged. With regard to their study groups, the participants were peculiarly the linchpins of those networks made up of both males and females. That is to say, their absence in group study meetings denoted the dearth of quality in those meetings. Although they were relied upon in those groups, they still benefited because their roles propelled them to study harder and the knowledge they had in their courses were validated. As a result they were very good in their academic work, and their study groups cemented the knowledge they had in their studies. They did not necessarily prefer studying in groups but when it was the only option they had to utilize to do well in their studies, they seized that opportunity very well:

> In my department, we had the students' Chemical Society, so I was a very active member. I was a secretary at the time most of the guys held executive positions. I gained certain insights … that I would have lacked if I had not joined the Chemical Society and had not become an executive. My networks were strong, they were still supportive … it was exciting for me, trust me, the opportunities were also there to travel … I was also part of study groups and whenever group discussions came on and I didn't come, they felt the discussion didn't go on well. Before I joined the discussions, I had to make sure I finished studying whatever I am going there to discuss, so I only went there just to get confirmation of what I think or to explain to other people who did not understand.

The educational progression of some of the participants was not without any gender barriers. One peculiar characteristic of the participants was their formidable resistance to gender discrimination when it reared up. There were people, mostly males, in their communities who tried to dissuade them from pursuing their interest in STEM. They doubted their ability as women to pursue STEM. This implied that they were perceived to fare better in the non-STEM programs believed to be manageable. In such situations they were adamant and focused on pursuing their dreams and aspirations. The high socialization they in their preceding years were conduits for surmounting the gender bias. They had the resilience in overcoming any opposition or impediment from their friends and neighbors. This was because the influence of their parents in encouraging them to pursue their academic interests was very strong. Parental socialization in the STEM interests was very indispensable in their advancement on their STEM career paths. The patriarchal influence of the community was not strong enough to outweigh the resolve of the participants, heavily socialized from home, to quit their STEM interests and ambitions:

> I even got people scaring me, like, science is difficult so why do you want to … friends and neighborhood people … saying science is difficult and I'm a woman and what am I going to do in science and basically, it's difficult and even guys don't want to do science and I am a lady, that kind of stuff. But then I didn't care. Things like that don't affect me. If I want to do something I want to do it. I didn't mind them. As for them [her parents], "follow your passion" kind of thing.

The participants had other strong countervailing responses to the gender discrimination whenever it (the gender discrimination) reared its heads. The discrimination for them was a blessing in disguise and an opportunity for them to prove the chauvinistic society wrong that they could not only undertake STEM but excel in them as well. One participant described how the societal perception that prospective female academics and scientists are not sociable served as a hedge for her to succeed in her academic endeavors.

> I think I have been fortunate. I also think I was too serious that they [the boys] were scared. I was very serious. They're not interested or they will snub you or something. So I think that protected me, that perception. I hid behind that kind of wall, if you like and that was very pivotal in my success in my field … When anybody comes up with that issue, especially the guys, like you're a woman … I ask them what the difference between a man and a woman is. I don't see any difference. Maybe the physical features make us different. But then when it comes to what I can do and what you can do, I see no barrier to it.

During their career stages, they had to deal with the challenges of grappling with the conflict between work and family demands and the issue of the institutional settings or environment in which they work. The conflict in work and family demands arose from the fact that as career women, they were expected to take care of their home (Ward & Wolf-Wendel, 2004). Simultaneously they were expected to meet the institutional expectations to ensure job security. The participants in addressing the conflict had a philosophy of balancing work and family responsibilities. Despite the thought of balancing as the way to deal with the conflict, the participants acknowledged that some sacrifices were made in order to catch up with men in the work environments who had head starts, because they spent most of their time at work. Most of them talked about deferring childbirth and when they decided to have children, they had only a few children, with their husbands consent, in order to cope

with their duties. They took that decision having in mind the stress other women who have more children go through while undertaking their professional responsibilities. One participant responded to the reality of work-family conflict:

> Well I married in medical school anyway. By the time I finished I was married but I still put off having children along the line too and then when I decided to have, I would have only one. So I have only one seven year old girl now and that was the decision I had to make because knowing the kind of career path … maybe because one I took a decision to have only one child so it's been manageable for me … so maybe that was my personal decision but of course I needed my husband to accept that personal decision that I can only have one.

4.1. Soaring productivity as the outcome of experiences

Owing to the experiences of the participants, their outcomes were enriching. Their network transcended national scope and borders. They had and still have international research partners through whose efforts they have been winning grants awards and leading in research projects. In broader perspective, faculty members are not only transmitters and producers of knowledge but generators of revenue to the academy. Winning grants awards for research is cardinal to the professional development of faculty and progression of the academy. One faculty member did not hide her joy in talking about the two grants, both international grants, she had won thus far:

> Since 2012 and since then I have won two research grants, one from DANIDA. Yeah, I applied for a grant from DANIDA and I had the award. And I applied for another grant from the University of Michigan—STEM something—and had that grant too, so I am just about beginning the second. It's being undertaken in Ghana. Yeah I have partners in Michigan and have partners and University of Utah and I have a partner in the Netherlands. And he is the one that I said I am trying to work out my PhD with and I am the local PI.

The high academic productivity they talked about also included the publications they have which have made them due for promotion. They had to satisfy this expectation in view of the reality of the "sink or swim" or "publish or perish" phenomenon. Once you are not publishing in peer reviewed journals, you are not going to be promoted and may be axed from your job. In academia, contribution to knowledge production is central. Productivity by publishing was significant to the participants:

> I have published not less than twelve articles in peer reviewed journals in Chemistry in seven years. I'm a lecturer now. I'll be soon be promoted to senior lecturer but still waiting for my letter … I have been notified that the promotion letter will be mailed to me very soon.

4.2. Efforts in curbing gender biases: Psychological empowerment

By embarking on psychological empowerment, the participants were helping females in STEM to create a feeling of self-worth and develop a belief that they can overcome gender barriers they face. Gender barriers are realities which can be overcome. They believe females have the inherent agency and self-determination to surmount gender barriers. This is important in weaning them off the "Cinderella Complex" where they have to wait upon and depend on their "prince".[6] As a consequence they do not favor altering the system to favor the females because of their gender but equipping them with their mentorship and coaching to succeed and surmount the challenges they face. In buttressing the aforementioned philosophy, one faculty member said she has been telling girls in science to have the self-confidence and mental capacity to succeed:

> Creating avenues for females who have issues with their education to achieve equality by advising and encouraging and referring to one's experience like "I have been able to do that through this" is fine. That you are not going to seek for special dispensation for them … I would not go out there saying this is a female so you have to do this. I just advise them that

> they shouldn't look down upon themselves but strive towards their goal, whatever they want to do, they should just fight for it and work towards it, they shouldn't limit themselves or be intimidated by the boys … And then whatever is available for you to use to achieve your aim or goal you should work with it to make things better because nobody will help you but it's your own mentality on how you perceive things. So the structures there are not favoring us… just see yourself as somebody I can make it.

To translate their psyching of female students into having the belief that they can surmount challenges in their STEM experiences, they have been empowering their students in the lecture rooms to make them assertive. Through pedagogical management engrossing the structure of the le4cture rooms, potential and existing occurrences of gender discrimination have been nipped in the bud. A faculty member narrated how the arrangement of the seating arrangements of Parliament with its checks and balances has been able to stifle gender discrimination:

> My students are all honorable members, they understand that concept very well … So they call me Speaker of Parliament … So my session is parliament session. I introduce all my topics as parliamentary debates. Because they're a large class and you have to find a way to engage everybody. The point is when they raise any issue that is not honorable, members will bring them to order. So one would say, "honorable member, I put it to you, you're out of order" to halt any sexist comment or tangential statement … and then you would have a majority speaker somewhere—someone who constantly contributes.

5. Discussion

5.1. Gender discrimination in the experiential stages

The societal perception anchored by the belief in the intellectual inferiority of women undertaking STEM programs in schools and universities is consistent with the theories that reinforce their supposed inferiority (Erinosho, 1994): gene factors (Gray, 1981), hormonal factors (Rosenkrantz, Vogel, Bee, Broverman, & Broverman, 1968), and brain lateralization (Sherman, 1979). Associated with the societal perception is the tagging of characteristics that show the distinctions between males and females (Erinosho, 1994). When females decide to pursue STEM courses, the psychological association of personality variables to females influence their choice of STEM courses. Raised to develop emotions, concern, and feelings for nature rather than the mechanistic relationship with physical objects (Johnson, 1987; Matyas, 1985; Smail & Kelly, 1981), most females who pursue STEM disciplines choose the humanistic STEM disciplines (Harding, 1982; Walberg, 1967) like biology (Howes & Hamilton, 1992) or biologically-oriented disciplines (Etzkowitz et al., 1994). This puts the women who undertake "hard" or masculine-oriented disciplines in a situation where they are regarded as violators of patriarchal norms in society concerning education and specifically STEM disciplines. This explains why in their educational experiences from primary school to the SHS they face obstacles as they find themselves in chilly classroom environments lacking support from the male counterparts, whether students or faculty (Boateng & Nyarko, 2016; Murray, Meinholdt, & Bergmann, 1999).

Believing that the STEM should be the preserve of males, they (males) are associated with STEM characteristics as "remoteness", "abstractness", "impersonality", "detachment", and "objectivity" (Birke, 1986; Hills & Shallis, 1975). Females are however associated with anti-STEM characteristics: "passivity", "coyness", and "subjectivity" (Birke, 1986). In this regard, social processes produce gender identities which constitute sources of challenges in educational institutions which in turn become exemplifiers of STEM as masculine endeavors (Stake & Granger, 1978). Differential sex roles emanating from externally oriented gender-role socialization at home, school, and society (Kelly, Wildman, & Urey, 1981) extends to the cultural division of labor stereotyping certain careers (Erinosho, 1994). Women, at least wives and mothers, under these circumstances are compelled to take careers with flexible work schedules and loads because of their child caring and home management roles (Erinosho, 1994). Women, thus, grapple with daunting challenges as they navigate through their professional and family realities.

5.2. Factors limiting STEM at lower educational levels

Females are disadvantaged in STEM fields in terms of access, persistence, attainment, and employment. The situation is more profound at the lower educational levels which are supposed to be the rostrums for successful STEM career endeavors. Various factors account for low participation and inhibition of females in STEM. The first is the lack of parental socialization of girls who are or may be interested in the STEM disciplines.

Parental influence is important in the entrenchment of gender-based norms in the choice of field of study (Knight & Cunningham, 2004). Parental background in or understanding of STEM (as gleaned from this paper) enhances the development and evolution of interest of girls in STEM in their rudimentary educational years. Second, the gendered association of disciplines parents, teachers, and society in general gives rise to the low participation of females in STEM. The general societal stereotyping that births gender roles deeply compartmentalizes men to STEM and women to non-STEM. Erinosho (1994) asserts that this situation originates in the home where boys and girls are brought up. Boys are made to play with and fix objects like toy automobiles evocative of science and technological beings. Girls on the other hand are made to play with dolls and undertake household chores evocative of domestic and procreative beings. Based on these norms, girls are told to undertake courses of domestic and clerical natures while boys are told to undertake STEM courses. Third, the perceptions and attitudes of teachers in the STEM classroom accentuate the unattractiveness of STEM to girls. Teachers extend what happens in the home in their classrooms through comments and gestures geared toward inhibiting girls from undertaking studies in STEM (Erinosho, 1994).

5.3. The role of social capital in STEM experiences

The observation that STEM females lag behind their male colleagues is not necessarily in convergence with the findings of this study. That inclusion in strong networks provides a head start to STEM careers (Etzkowitz et al., 2000) is not always exclusive to males in STEM. Some females in STEM excelled or at least modestly succeeded in their experiential journeys due to the peer and supervisory/advisory networks they had. Incidentally, their female agency and self-determination (Oyewumi, 2003) was paramount in securing them the networks they benefited from. Their sterling performance in their studies made them (especially participants who consistently experienced minimal gender disparities) linchpins of the study groups they were part of and, enabled them to hold vital offices in disciplinary associations. As a result they succeeded in their academic endeavors and their supervisors/professors referred them to subsequent academic and/or professional positions. These supervisors/professors acted as social capital bankers who deposited their capital in terms of access to privileged information and wide networks (Etzkowitz et al., 2000). The empowerment activities of the successful STEM women hinged on women developing and using their agency and self-determination in attracting and joining networks necessary for their successes in the STEM experiential journeys.

In a social milieu where interdependence and its management are vital to productivity, women in STEM are generally at the nadir of the scientific enterprise (Etzkowitz et al., 2000). They lack or possess smacks of social capital denoting power, status, and authority (Malinowski, 1922) which is the crown jewel for success in all settings including those of STEM. This is ironical because females are the relational beings as compared to males but they are deprived of relationships vital for their success in their STEM academic and professional endeavors (Etzkowitz et al., 1994, 2000).

Although the participants succeeded with the social capital they had, they advocated psychological empowerment in the face of gender discrimination: a seemingly paradoxical situation. The "leaning-in" and the social capital perspectives of how gender discrimination can be curtailed when applied separately can obliterate gender disparities in STEM. In view of the fact that societies are characterized with patriarchy breeding gender disparities and unequal STEM socialization, either perspective cannot be successful for all females. These two constructs when made collaborative can bridge gender gaps and inequalities in STEM. The participants would not have made it if they did not make use of the social capital (socializing agents). They were encouraged and psyched by their

parents, teachers, peers, etc. to progress in their STEM educational and professional endeavors. The collaborative perspectives should be perceived as means to an end. It is imperative that after leaning in the structure of the STEM academy and making use of social capital, female STEM academics exploit the latter perspective to reform the patriarchal structures of the STEM educational sector. This will be beneficial to prospective and existing female STEM academics especially those with low or no social capital to succeed in the navigation of the STEM milieu.

6. Conclusion

The prevalence of gender inequalities and inequities in Ghana engrosses the STEM disciplinary domains and associated academic profession. Females are grossly underrepresented and marginalized in STEM because of patriarchal norms and ethos of the Ghanaian society. Nonetheless there are a few of them who defy the odds and are successful in their STEM academic trajectory leading to professorial ranks. The gendered experiences of 15 senior female academics in STEM in Ghana were elicited through semi-structured interviews. They attended exclusively female senior high schools, and enjoyed support from parents, teachers/lecturers, and mentors. As a result when they entered their world of STEM academic work, they applied their backgrounds and rudimentary experiences in STEM to become productive in academia. Despite their tremendous successes, their experiences as STEM students and professionals, right from their nascent educational years to their career periods, were replete with profound gender biases embedded in school and work structures, societal practices and comments from various people mostly males. They have chosen to embark on psychological empowerment drives on their protégés to nip the low participation of females in STEM in the bud.

The stakeholders in gender and STEM education have pivotal role to play in ensuring females actively participate in the STEM sector. **S**chools can play important roles in spurring interest of girls in STEM. Teachers and school leaders can use Parents Teachers Association (PTA) platforms to educate parents about the utility of STEM to the society and economy. They should be illuminated on the detriment of attaching gendered roles to disciplines especially STEM. Since they are the primary socialization agents, they should play indispensable roles in supporting the pursuits of their children in STEM. The behavioral roles of parents toward their children relative to gender roles can change as a result. With such socialization, the girls will be able to develop and progress in such a manner that as they proceed into the higher educational levels and in the professional world, they will be resolute against gender discrimination from peers, subordinates or superiors. Per the perspectives of the participants of the study, the stakeholders can nip gender discrimination in STEM in the bud by psyching females to be resolute in and committed to their STEM interests despite substantial impediments.

Beyond psychological empowerment, the manifold stakeholders in gender and STEM education have a pivotal role to play in ensuring females actively participate in the STEM sector. Schools can play important roles in spurring interest of girls in STEM. Teachers and school leaders can use Parents Teachers Association (PTA) platforms to educate parents about the utility of STEM to the society and economy. They should be illuminated on the detriment of attaching gendered roles to disciplines especially STEM. Since they are the primary socialization agents, they should play indispensable roles in supporting the pursuits of their children in STEM. The behavioral roles of parents toward their children relative to gender roles can change as a result. With such socialization, the girls will be able to develop and progress in such a manner that as they proceed into the higher educational levels and in the professional world, they will be resolute against gender discrimination from peers, subordinates or superiors. Per the perspectives of the participants of the study, the stakeholders can nip gender discrimination in STEM in the bud by psyching females to be resolute in and committed to their STEM interests despite substantial impediments.

There are extant initiatives in Ghana implemented by the government to accelerate the participation of females (and all students in some cases) in STEM especially in pre-tertiary education. Such policies and initiatives are the STME Clinics which have been decentralized to district levels under the Ghana Education Unit. An initiative meant to bolster the STEM interest in SHS students studying the sciences is the annual Brilliant Mathematics and Science Quiz. This initiative has unearthed the potentials and talents of science students. Such policies and initiatives are laudable and have certainly assisted many STEM students and professionals to be what they are now.

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Notes

1. There are related studies on other levels of faculty members and research scientists in STEM.
2. It is part of a larger study with ramified findings.
3. They are nonetheless at the base of the seniority of faculty rank pertaining to Ghanaian universities.
4. Equivalent to Associate Professors and Senior Lecturers in the universities.
5. The support and successes are evident in the quotes in consonance with the exploration of experiences and manner of experiences of participants in qualitative research.
6. Men and also other sources like the state and other institutions including higher education institutions in terms of interventions initiatives addressing gender inequities.

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