The "Black Girl Turn' in Research on Gender and Science Education: Toward Exploring and Understanding the Early Experiences of Black Females

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A Literature Review Paper

Abstract

For the past 40 years, educators and researchers have largely discussed sex equity issues, particularly in the K-12 settings. However, within the last few years gender equity issues have become a hotly debated area of research. One may contend that sex is biologically determined maleness and femaleness; whereas, gender is influenced by cultural, social, and historical factors. Although, there has been a lot of emphasis on unfair treatment or exclusion of girls from formal science, the focus was mainly on White, middle class girls with little focus placed on Black girls. This has fueled the debate for the promotion of the 'Black Girl' turn in research on gender and science education, as over the centuries Blacks and girls have been denied their turn in science due to cultural and historical reasons. This literature review addresses the strengths and limitations of the existing bodies of work and concludes with directions toward a student

– based inquiry approach that can explore and help others to understand Black females' perspectives with an aim at filling in some of the missing information in the science education literature.

KEYWORDS: Black girl, gender equality, science education, gender, race, research

{Literature review, 32 references}

Researchers such as Koch & Irby (2002), Towery (2007), Grant & Sleeter (1986), Mirza (1992), among others, have been interested in equity issues related to girls and women in k-12 and at the university levels for a long time. For the past 40 years, educators and researchers have largely discussed sex equity issues, particularly in the k-12 setting (Koch & Irby, 2002). Within this time period, the under representation of women and minorities in science and engineering was at the heart of America's science policy research efforts. No less than 120 empirical and theoretical undertakings and numerous national conferences were conducted in order to address the issue (Leslie, McClure and Oaxaca, 1998).

Gender equity issues, however, have only very recently become a hotly researched topic in education (Koch & Irby, 2002). Although, sex equity has been an interest to educators for the past 40 years, a great deal of current researchers advocated the switch in terminology to the more inclusive term of gender equity (Koch & Irby, 2002). According to Koch & Irby (2002), the term gender equity is now used because it is a more inclusive label and reflects the cultural construction of male and female roles; whereas, sex equity reflects the biological differences of maleness and femaleness. Further, Phillips (1998, as cited by Boston & Baxley, p. 566) argues that although there are more main stream studies that recognize differences between girl and boy gender issues, studies still fail to distinguish among the issues of race, ethnicity, and social class. So, there is a clear failure on the part of the education research literature to examine and conceptualize the integrated issues of race and gender (Boston & Baxley, 2007; Grant & Sleeter, 1986; Mirza, 1992). Instead race and gender are treated more as separate topics than as an integrated, single topic. An even

more disturbing trend in science education research and consequently science education literature is the failure to focus specifically on equity issues as it relates to Black girls and Black women in general. In the early 1990s, there were numerous reports and popular books published about White, middle class girls and their educational disadvantages (particularly, in science); then in the mid-1990s, there began an international growing shift towards examining boys' education and this began the growth in the education and sociological arenas labeled 'the boy turn' in education (Weaver-Hightower, 2003). However, from the early 1990s to presently, little focus has been placed on Black girls or the education movement has failed to adequately address the 'Black girl turn' in education, particularly, science education. I am writing this paper as a response to the Weaver-Hightower's (2003) article entitled, "The Boy Turn in Research on Gender and Education," in order that the lack of focus of the (science) education literature on Black girls and women can be adequately addressed in the 21st century.

What has caused Black girls to be denied their turn in science education research and consequently the science education literature? In this paper, after a brief explanation of my methodology, I present some of the major explanations for why Black girls have been denied their turn in science education research and science education literature. The foremost explanations given for denying Black girls their turn are historical and cultural.

In this paper, I discuss major developments in equity issues over the past 40 years. I review the literature, address the strengths and limitations of the current body of work, and present a framework for future research pertinent to the topic. The paper

begins with an explanation of the methods used for the work included in the review process. Next a brief history of the fight for gender equity (White & Black women's fight) and the birth and essence of feminist and critical social theories are presented, providing background and context for the discussion. This section is followed by a discussion of the two major explanations for Black girls being denied their turn in science education research and science education literature. I then introduce a third explanation, which looks at the effects of Black females own socially constructed meanings on their being excluded and denied full access in certain science arenas—including science research and science literature arenas. I conclude with recommendations for a student-based inquiry approach to science education research, which entails exploring and understanding the early experiences of Black females with an aim at seeking to understand how these early experiences may in turn impact their later low retentions in university science programs and in science careers; this recommendation is offered with the aimed at filling in some of the gaps in the science education research literature.

Method

In this review process, I discuss a wide selection of (position papers, empirical and theoretically based) studies and common themes and positions used to effectively explain the issue of Black girls being denied their turn in science education research and consequently science education literature. Empirical and non empirical works are utilized in the review. The articles and books that are used represent a wide range of disciplines including anthropology, sociology, urban issues, psychology, education, and

education statistics. They address to a large extent, women equity issues with some focus on the equity issues of Black females specifically.

Educational databases and online sources such as SAGE Journals Online and Questia Google Scholar were searched for the period 1960 – 2007. The search took place from October 20th, 2007 to November 20, 2007. Key words searches, such as: race, Black girl, gender equity, science education, and research articles or research reports were utilized in order to obtain relevant articles of interest. Articles, books, and abstracts that focused on discussions of women equity issues, Black girls being excluded from science literature, feminist theoretical perspectives, social critical theorists perspectives, womanist perspectives, Black feminist perspectives, curriculum bias, gender and motivation, gender and minority ethnic attainment in school science, gender equality, pedagogy and citizenship, gender, math and science, sex and intelligence, co-generative dialogues as feminist pedagogy / research, social constructions, historical, cultural and scientific reasons for exclusion of Blacks and females were selected for the review. These indicators were selected because of their relevance to the topic chosen and because they have been marked by earlier studies as having major implications for Black female equity issues. Other indicators, such as: the test score gap between girls and boys, student gender and teacher gender and its impact on high stakes test scores, and socioeconomic issues of Black females affecting their education achievement were left out because they were deemed irrelevant to the specific focus of the paper. Journals such as *Journal of Educational Research*, *Journal of Personality and Social Psychology*, *Science Education*, *Journal of Research in Science Teaching*, *Science and Education*, *Educational Leadership*, *American*

Psychologist, Review of Educational Research, British Journal of Sociology of Education, Urban Education, Educational Psychologist, Theory and Research in Education and *Education Researcher,* among others, were searched for relevant works. Books such as *The Mind Has No Sex, Women in the Origins of Modern Science*, *Science and Sexism, Has Feminism Changed Science?* And *Fighting Words: Black Women and the Search for Justice* were also utilized in the review process.

Altogether, the searches entailed consulting and examining more than 80 abstracts, journal articles and book chapters for their potential relevance and succinctness to my topic. Because of the specific focus of the reviewed topic, works that did not look generally at women equity issues and specifically at Black female equity issues were excluded from the discussion.

Origins for the Basis of the 'Black Girl Turn' in Science Education Research

This section begins with a discussion on the origins of Black females' fight for gender inclusion in science education and science in general, which gives the background and context for the framing of the rest of the reviewed work. Schiebinger (1991) in her book entitled, *The Mind Has No Sex,* argued that women and girls have been historically excluded from scientific arenas for centuries, dating back to the 1600s in Europe. She postulated that women such as Marie Curie and others were excluded simply on the basis of them being female and therefore being viewed as 'inferior' to men and thus deemed incapable of full and meaningful participation in science.

Liberal feminists in the 1960s and 1970s however, challenged the prevalent stereotypical notions (that were started in the 1600s) that women were inferior and incapable of learning science and were incapable of fully participating in science

arenas—be it, science research or otherwise. To this end, subsequently academic settings barred women (Hamilton & Weiner, 2000). Pinnick (2005) reported that although the feminist movement did shake up university teaching and had positive curriculum effects, only the 'soft sciences' or humanities were affected, but the 'hard sciences' were unfazed by the feminist movements' impacts on university campuses.

Black feminists also took the fight for women equality and inclusion to another level. Proponents of women equality fought for greater empowerment of Black women and girls and hence the Black Feminist Movement was coined in the 1970s and 1980s. Black feminist movements see Black women and girls as being marginalized, firstly as a woman, and secondly, on the basis of being Black (Hill - Collins, 1998).

Critics counter argue that Black girls in general (& women at large) have been denied their turn in science education or in science arenas in general because of their own social construction of feminism in relations to masculinity (Weaver-Hightower, 2003). Meaning that Black females own interpretations of their academic settings and the meanings they formulate from their interactions with fellow teachers and male peers can influence or impact their own self inclusion or exclusion from formal science settings or science arenas – including science education research and consequently science education literature.

Masculinity and femininity resides in and is produced by institutions (Weaver-Hightower, 2003). The curriculum, division of labor, tracking, and other school structures – all can be viewed as a part of the school's gender regime and can affect gender relations in subtle ways, either negatively or positively, according to one's interpretations (Weaver-Hightower, 2003).

However, despite critics views (such as Weaver-Hightower, 2003) on the issue and the argument made for ignoring the 'Black girl turn' in education research, the pressing issue is that Black girls can not be continuously denied their turn in science education research. They have been ignored for too long. As Mirza (1992) stated:

> "…..in nearly 40 years of sociological studies of race, Black girls have been neglected" (p. 213).

As mentioned beforehand, analysis of the literature reviewed showed that history of exclusion, and cultural factors are to be blamed for Black girls being denied their turn in science, that is, in science education research and science education literature.

History, Extra – Scientific Agendas and Black Girls Turn in Science Education Research

For centuries and decades, women have been excluded from full participation in science in academic settings (including in the science research arena) in Europe and in America. From 1600 to present, there have been very little changes in the way girls and women, particularly those of color, are regarded with respect to their exclusion from formal science. In the 1700s, Rosseau believed that women were not qualified for research in abstract areas such as science and mathematics because their brains were regarded as being 'unfit' (Campbell, 1991). And throughout the nineteen century there were the promotion and publication of unscientific theories put forward in an tempt to keep women and girls, particularly, those of color at home and away from formal schooling, especially higher education schooling in science and mathematics (Norman, 1998; Schiebinger, 1991). Two centuries later, American schools under the influence of their European ancestors continued the trend of disallowing Blacks and women equal

access in science. This trend of scientific disbarment of Blacks and women may have been heightened in the 1950s due to America's science and technology research arenas becoming heavily influenced by the Soviet's research innovative scientific initiatives (i.e. their space & technology innovations). Because America was being challenged in the 1950s to produce more stable and competive science programs and qualified individuals in the field, this may have led to greater emphasis being placed on boys to acquire scientific knowledge at the expense of the exclusion of girls (also Black girls).

The historical inaccessibility of science to Blacks and females enabled science and scientists to continuously legitimize the unfair treatment of those marginalized groups (Norman, 1998). Anatomical, craniometrical data and the slave trade were justifying reasons for the persistent exclusion of women and Blacks from science arenas – in research and in literature. Paul Broca in 1861 examined 432 human brains and found that the brains of males were heavier than that of females, as brains of males on average were reported to weigh 1325 grams and brains of females had an average reported weight of 1144 grams (Rushton, 1997). Similarly, David Ankney in 1992 examined 1261 autopsy data of American adults and he found that at any given body surface area or height, men's brains are heavier than women's brains, with the brain mass of men averaging about 100 grams heavier than that of women at the same height (Rushton, 1997, p. 176). Further studies that demonstrated sex differences in craniometrical reports were studies done by Rushton (1997) and Haier, Jung, and Yeo (2005). Rushton (1997) confirmed Ankney's (1992) brain mass study. Rushton (1997) conducted a cranial capacity study and after performing a stratified random sampling of

6325 U.S. Army personnel, and after adjusting via analysis of covariance for effects of age, stature, weight, military rank, and race, Rushton found that men's brains averaged 1442 cm^3 and women's brains averaged 1332cm^3 (p. 176). Haier, Jung & Yeo (2005) research also reported that women were less intelligent than men because their brain contained fewer gray matter (linked to intelligence) than men. In fact, it was reported that men had six times more gray matter than females (Haier, Jung & Yeo, 2005).

With regards to race and the brain size debate, results were racist and favored the White male over others. Rushton (1997) cited the research work of Robert Bennett Bean in his report. Bean (1906, as cited by Rushton, p.175), a Virginia physician, published a study which found that the weight of 103 American Negroes' brains at autopsy varied with the amount of Caucasian admixture, from 0 admixture = 1157 grams, 1/16 admixture = 1191 grams, 1/8 = 1335 grams, ¼ = 1340 grams to ½ = 1347 grams. Further, it was reported that the Blacks in the study had less convoluted brains than Whites and that Whites had a proportionately larger genus to splenium ratio (front to back part of corpus callosum), which implied that Whites had more activity in the frontal lobes which was thought to be the seat of intelligence (Bean, 1906 as cited by Rushton, 1997).

The stories of female scientists and those of minority ethnic groups are not well represented or portrayed in the school science curriculum (Frost, Reiss and Frost, 2005). Pupils, therefore often conclude that science is mainly a White male activity (Frost, Reiss & Frost, 2005). Historically the faces of scientific discoveries have been White males. For science textbooks portray to students that the faces linked to scientific discoveries were White males, such as Sir. Isaac Newton, founder of Newton's Law and

the gravity concept, James Watson and Francis Crick founders of the DNA double helix structure, and Gregor Mendel who was heralded to be the father of modern genetics. Additionally, there is the suggestion that Blacks and females' contribution to science has been ignored in favor of the White male elite.

Norman (1998) suggests that historically erroneous scientific data steeped in taxonomies of discrimination are to be blamed for the ignoring of women's and minorities' contributions to science. The extra scientific agenda entails: (a) Scientists or researchers ignoring some of their data findings and utilizing only a few of their data results that may support the assertions or conclusions that the scientists or researchers want it to support, while ignoring the data results that may not support the conclusion or assertion that they are making; and (b) fudging or faking the data in such a way that it may support an erroneous conclusion. During the 17th and 18th centuries, scientists utilized extra scientific agendas or employed taxonomies of discrimination in their research; in that, they manipulated data results in ways to prove the assertion they wanted to be proved. For the scientific establishment was expressive in pursuing the agenda of providing scientific basis and justification for the gender stereotyping and discrimination of minorities as a whole (Schiebinger, 1991 as cited by Norman, p. 367). For example, they used certain anatomical and craniometrical data findings to erroneously conclude that women and minorities were incapable of learning. Alexander Munro, a professor of Anatomy at the University of Edinburgh found data to erroneously support his conclusions that women skeletal structures showed that they were 'incomplete and deviant' and he also reported data findings that concluded that women were good for 'reproduction and childbearing' (Norman, 1998). Schiebinger (1991)

wrote on the physical descriptions scientists and anatomists of the 17th and 18th centuries gave of a woman's anatomy:

> The bones of women are frequently incomplete, and always of a make in some parts of the body different from those of the robust male, which agree to the description already delivered, unless where the proper specialties of the female were particularly remarked, which could not be done in all places where they occur, without perplexing the order of this treatise: therefore I chose rather to sum them up here by way of appendix (p.193).

Further, it was also stated:

> A weak constitution makes the bones of women smaller in proportion to that of men. A sedentary life makes their clavicles less crooked and a frame proper for their procreative functions make women's pelvic area larger and stringer to lodge and nourish their tender fetus (Schiebinger, 1991, p.193).

Additionally, craniometry (the study of head sizes to determine intellectual capacity) also provided data to prove the intellectual inferiority of women and blacks compared to the White male. Further, craniometrical findings in the 17th and 18th centuries and the extra scientific agenda at the time led to the placement of European women, Black women and Black men in lower hierarchies than the White male so-called elite of the time. According to skull and pelvis data, African females were place lower on the pelvis and skull size continuum, European males were placed at the top of the skull size continuum and European females were placed at the top of the pelvis size continuum (Schiebinger, 1991). Skull and pelvis size data was put forward by scientists in the 17th and 18th centuries as a measure to support their racist and sexist agendas which supported false

assertions that were used to exclude Blacks and females from science. Although the history of exclusion of Blacks and women and the extra scientific agendas of White males have impacted or influenced the modern day denial of Black girls being afforded their turn in science education research and consequently science education literature, cultural factors are also to be blamed for Black girls not being afforded their turn.

Cultural

Cultural factors such as school's culturally bias curriculums and textbooks that are steeped in negative cultural norms and stereotypes about Black women, culture of White male power dominance, and lack of access to the dominant, White male cultural capital (that may have afforded White males their continuous inclusion in all scientific arenas, that is, in science education research & science education literature) are all proposed as cultural factors that can explain why Black girls have been continuously denied their turn in research on gender and science education.

Texts and literary books (in general) have always been designed to represent and reflect the popular culture of the time (Boston & Baxley, 2007; Sherwood, 1999; Koch & Irby, 2002), but the problem with it is, instead of being used as a 'catalyst for change,' it instead has been used as a continuous agent that fuels the denial of Black girls and women full inclusiveness in science (education). During the early 1800s, children's literature 'became highly divided based upon gender' (Tarbox, 2002 as cited by Boston & Baxley, p. 562). Girls were exposed to literature that emphasized domestic and subservient roles (Boston & Baxley, 2007; Frost, Reiss & Frost, 2005). Louisa May Alcott's (1869 / 2004) "little Women" and Charlotte Bronte's "Jane Eyre" (1847 / 1997) all captured the fairy tale love life of dreamy females. Whereas, other texts such as

‘Great Expectation’ told of the male character who despite poverty rose to become successful in life.

In the 1970s, there were very few works portraying Black females as main characters and today in the twenty-first century, a few of the popular books in print focuses on the negative aspects of being Black and female in America. To counter societal images of poor and working – class urban adolescent girls as the ‘school drop outs,’ the ‘teenage welfare mothers,’ the drug addicts, and the victims of domestic violence or AIDS, Boston & Baxley (2007) is suggesting the need for positive images of the urban adolescent female to be prevalent in some common arena (i.e. school books or multicultural texts).

Feminists have been critical of the forms of knowledge and content materials allowed into the classrooms, which have focused on the invisibility and / or stereotyping of girls and minorities (Hamilton & Weiner, 2000). Sadker, Sadker and Steindam (1989) reported that females were less likely to be studied in history or read about in literature, and additionally, math and science problems were more likely to have underlying hints of White male stereotypical terms and illustrations. Further, Schiebinger (1995) provided several examples of how science was gendered in text books. For example, in textbook accounts in the 1980s about conception, the male sperm was described as the active sperm and the female egg as the passive egg. Visual images therefore were denoted in the k-12 textbooks of the 1980s images of the sperm hero, actively pursuing the passive egg. This type of thinking only supported the White masculine agenda which was to continuously deny women full inclusiveness in science arenas.

Teacher and science education researchers who have continuously denied Black females their full inclusiveness in science (education) have contended that there is too much pressure placed on publishers of modern day textbooks to be politically correct. They argue that there is an over emphasis and too much irrational concerns placed on the textbooks usage or portrayal of the White European male as being symbolic of racism, sexism and oppression (Ornstein, Lasley & Mindes, 2005).

With increase diversity in the education system, there is an important need for more gender inclusive curriculums (Boston & Baxley, 2007; Krieg, 2005). Towery (2007) in her research involving examining strategies for training teachers to foster gender equity, she acknowledges that while there is the need to prepare teachers for the diverse needs of their students, recommendations for how teachers can go about accomplishing this goal varies. Some strategies to foster equity may simply involve raising teachers' awareness of their teaching practices; whereas, another focus may be on getting teachers to examine and select gender-fair or gender-neutral content materials (Towery, 2007).

However, there may be challenges to be faced by teachers who have to fight against administrators and school boards for the formal curriculum and curriculum content materials to be changed to be more gender fair or gender-neutral, especially in science (Kreinberg, 1989). So, an examination and rethinking of curriculum and materials may also be in order (Weaver-Hightower, 2003).

Are masculinities and femininity defined by and within the curriculum? Are materials still as highly gendered as they once were, and in what ways? Education scholars are divided on both sides, some feeling that the curriculum materials are

weighted toward masculinity and others feeling that the materials favor girls (Weaver-Hightower, 2003). The essentially overarching point of all the debates is that careful thought and planning should be given to k-12 school curriculums and materials in order for them to meet the needs of girls and boys of different races and ethnicities (Weaver-Hightower, 2003).

As Weaver-Hightower (2003, p. 489) points out, the most imperative need is for independent research to be conducted 'on the ground' in schools and other educational environments. Also the expressed concern for girls and boys to both be given their turn in research on gender and education is stated accordingly by Weaver – Hightower (2003):

> I want to emphasize, finally, the need for simultaneity mentioned above. Finding ways to create curriculum and pedagogy that suit many different students is partly a pragmatic concern, because boys and girls are most commonly schooled together. The very fact that I can speak of a 'turn' in the literature, however, indicates that educationalists have thus far been unable to envision gender in its relational interdependencies; instead, first it was girls, and now it is boys. What is needed, rather, is curriculum, pedagogy, structures, and research programs that understand and explore gender (male, female, and 'other') in complexly interrelated ways and that avoid 'girls then, boys now. How might we research and write about boys and girls within the same article or book? (p. 489 - 490).

In adding to Weaver-Hightower's written statement above, I would like to add, how can we continuously ignore the Black girl turn in our (science) education literature, but keep our focus on boys and White, middle class girls and their disadvantages?

Besides culturally biased curriculums lending to the denial of Black girls' turn in science education, the culture of White male power dominance and Black girls being denied access to the dominant, White male cultural capital (that may afford them opportunities for full inclusion in science education research) may all explain why Black girls are denied their turn in research on gender and science education.

Culture can be broadly defined as 'the acquired knowledge people use to interpret their experiences and thus to generate behaviors based on these experiences, whether positive or negative' (Spradley, 1980, p.6; Bogdan & Bilklen, 2006). Firstly, all social relations are influenced by power that must be accounted for in analyzing informants' interpretations of their own situations. Critical (feminist) theorists insists that the 'culture of power' or 'power conflicts' must always be taken into account to some degree, whether it is the informant's power or lack of it (Mac An Ghaill, 1994; Finders, 1997).

A woman who walks into a man's meeting or a person of color who has walked into a White organization knows what it is like to walk into a culture of power that is not your own (Harley, Jolivette, Mccormick & Tice, 2002). The woman or person of color may feel insecure, unsafe, disrespected, unseen, or marginalized. Whenever, one group of people accumulates more power than another group, the more powerful group creates an environment that places its members at the cultural center and other groups at the margins. People in the more powerful group are accepted as the norm, so they may not see the benefits they receive (i.e. the access to the dominant White male cultural capital system), or may not see the exclusion, uneasiness, or unwelcoming environments the out group or powerless groups receive (Harley, Jolivette, McCormick

& Tice, 2002). Black girls and women are the marginalized group that experiences all of the aforementioned negativities of the out group mentioned, and continuously are ignored and excluded from full participation in science arenas - that is, science education research and in science education literature. Once again, the probing thesis question formulated on the basis of Black females being denied full access to the 'White male cultural capital' and being excluded from science education research is, when will the Black girl be given her turn in research on gender and science education?

Arnot (2006) contended that girls and boys may be denied their turn in education research because of the ways the problems of equality and differences are conceptualized. To explain this point, she differentiates between two political remedies for injustices to girls (& boys); she labels these remedies as 'redistribution' and 'recognition.' Redistribution addresses the ways in which disadvantage is sustained in the socio-economic sphere through exploitation, economic marginalization and deprivation by advocating a restructuring of the political economy in order to redistribute income, re-organize the division of labor to allow for more democratic decision – making (Arnot, 2006). Recognition, on the other hand, according to Arnot (2006), addresses issues such as cultural domination, non-recognition and disrespect by encouraging cultural or symbolic changes. This in her own words and opinion may entail:

> 'Revaluing disrespected identities and the cultural products of maligned groups, recognizing and positively valorizing cultural diversity, transforming societal patterns of representation, interpretation and communication, and thus changing people's sense of self' (Arnot, 2006, p. 135).

Frazer, however, argued that redistribution and recognition strategies in relations to social class and sexuality are unproblematic since redistribution and recognition have the same goal, which is to remove discrimination; however, by contrast, Frazer (1997, as cited by Arnot) views the resolutions in relation to gender and race as more complex. Frazer's viewpoints of the redistribution-recognition problem has implications for schools' contemporary pedagogy, in that, schools in the twenty-first century are expected to 'redistribute educational opportunities in the name of equality' while at the same time they must recognize differences between the sexes and within each gender group (and also be able to recognize the complex bivalent collectivities of gender and race integration as a single issue / topic) (Frazer, 1997 as cited by Arnot).

The theories of cultural male power dominance and the access or lack of access to the dominant male cultural capital offered thought provocative standpoints as to why Black girls may not be highlighted in research on gender and science education. Although, theories of cultural male power and bias curriculums offer stimulating perspectives that adds new viewpoints to the 'Black girl turn' on gender and science education research, the conclusions do not inform the 'Black girl turn' debate issues and overall exclusion of Black females from science arenas – in research and in literature.

Summary of the Literature

The Black girl turn literature has been supported by a great deal of implicit research which attempted to make the case for the issue to have a greater emphasis in science education research. The importance of research of this kind can be traced back to the influence of two critical themes in the literature: cultural and historical (inclusive of the White male elists' past and present racist and sexist agendas). The culture of male

power dominance inherent in institutions and in the media, the lack of access to the White male cultural capital, and history of exclusion have been cited in the literature as prevailing explanations for Black girls being denied their turn in research on gender and science education, but these reasons can not be viewed as the only possible reasons.

For although, some researchers, fail to associate girls' own socially constructed meanings with their exclusion, other researchers view socially constructed meanings and the meanings one associate with masculinity and femininity as a drawback for girls and women, although, it is believed that agencies, such as the school, and popular print and television medias help to perpetuate the socially constructed meanings formulated by one gender in regards to the other (Weaver-Hightower, 2003).

The explanations addressing or making the case for the Black girl turn have led to many new and innovating directions that can be employed in the field of science education. Although, the Black girl turn issue has been discussed implicitly or implied in research literature, there are clear limitations and areas that need to be explored further with this issue.

A Third Explanation: Black Females Socially Constructed Meanings

From the research literature, it can be interpreted that cultural factors and historical factors (inclusive of erroneous historical data informing extra scientific agendas) negatively affect the Black girl turn in research on gender and science education. However, a third explanation for the lack of inclusiveness of Black girls or women within the science (education) research arenas may be a personal one: their own socially constructed meanings formulated from daily interactions and experiences with their teachers and fellow male peers, and the overall interpretations they make of

these interactions can affect the actions they take in response to their experiences (whether an immediate action or delayed action), and ultimately this can affect their inclusion or exclusion from science. For common to all feminist traditions is the assertion that both science and gender (and to some extent racism) are social constructions that are constructed by individuals based on their daily interactions with others (Keller, 1985).

Although, individuals construct negative or positive meanings of masculinity and femininity (and to some extent racism) for themselves, they do so with the subconscious or conscious assistance of agencies; 'thus agency accompanies the construction of masculinity (or femininity & racism) (Weaver-Hightower, 2003). Weaver-Hightower (2003) suggests that institutions provide the ideas of masculinity and femininity (& racism) though in a subconscious or covert way. Curriculum bias / stereotyping, tracking, and division of labor are some of the ways in which institutions carry out the so call 'gender regime' which can greatly affect gender relationships between (Black) females and their male peers. However, curriculum or content materials can become more positive agents in helping to assist Black females in formulating more positive socially constructed meanings and interpretations for themselves in an aid to improve gender and race relationships and to dismantle the 'gender regime' (& maybe race regime) that can be seen as existing in some k-12 schools and university programs in science and math. To achieve this end, Walkerdine (1990, as cited by Arnot) explored the utilization of more 'school girl fictions' and Boston & Baxley (2007) through their meta analytical study entitled, 'Living the literature,' explored how positive images or

messages in literary texts may positively motivate Black female adolescents, while at the same time improve their overall self image.

Toward Exploring and Understanding the Early Experiences of Black Females

Despite the volume of research on equity issues for girls and women in science, there have been relatively few studies, that is, qualitative studies employing phenomenological approaches that entailed interviewing the clientele - the Black student - to explore and seek to understand the early experiences of these Black females in science, and how the science education literature can be informed by correlating the early experiences of young Black females in science to Black females' later university and career decisions (& low retention rates) (Leslie, McClure and Oaxaca, 1998). Leslie, McClure, and Oaxaca (1998) states:

> "…we quickly learned that most post adolescent behaviors in regard to science and engineering can be understood clearly only by reference to earlier life experiences" (p. 2).

In research involving students, students' voices are forced to the margins of the specific issue, whereas, researchers and teachers' voices are put forward as the foremost experts on the topic or issue. Students' actual words are very rarely presented, but rather, they are presented as subjects and their words interpreted by researchers (Wiggan, 2007). However, it is felt that the Black girl turn issue can be richly informed through dialogues with Black young, elementary and pre-elementary age girls. Thus, there can be a shift in power dynamics, so that students and teachers can share in the development and research process; students should therefore not be seen as mere

subjects, but as active participants with their own voices, opinions, and suggestions (Wiggan, 2007; Scantlebury & LaVan, 2006).

Core research questions that should be a part of this kind of research project are: according to Black young female students, what is gender and racial equality in science, how can it be achieved or enacted, and what does it mean to them as Black females? And, in what ways do they perceive their every day classroom experiences can influence or impact their later decisions to persist or desist in science careers or science studies? Getting students' perspectives on these questions can only inform the science education pedagogical literature, curriculums and school policy. A student-based inquiry project would present students' ideas, perspectives and possible solutions to the Black girl being denied her turn in science education, which can strengthen the literature and broaden our understanding of the issues involved (Wiggan, 2007).

There are major research studies that should be explored further, such as: (a) examining the meaning of gender and racial equality among Black young females; (b) correlating the early science experiences of (Black) females with later science career or university decisions; (c) investigating the benefits of having better curriculum developers who can design more gender – neutral and racially fair k-12 curriculums; and (d) investigating the idea of more teacher training programs to aid teachers in promoting more gender and racially inclusive environments in their classrooms. The information gained from the proposed studies can provide useful data for effecting change in schools and in science education specifically. Students might possess important perspectives that would benefit science education research and programs, but science

education researchers, educators and policy makers will never know until they begin to explore and understand their perspectives (i.e. the Black female perspective).

Conclusion and Implications for Schools

Why have Black girls been overlooked by researchers who study issues relating to gender and science? The research literature gives several possible explanations for the 'Black girl turn' dilemma. The perspectives of White male power dominance, denial of access to the White male cultural capital, and historical explanations were put forward as possible explanations in the literature reviewed for this paper. However, although cultural and historical factors were cited as reasons that can explain the Black girl turn dilemma, they can also be viewed as inadequate reasons to fully explain away the whole problem /issue at hand. More studies are needed in the science education research arena that would give young students of color powerful voices as agents of change, rather than allowing them to serve as only passive subjects to be interpreted by theory driven researchers who often do not present a totally accurate picture of what the students true interpretations of their experiences and perspectives are.

The student- based inquiry approach is recommended for further insights to be acquired on the Black girl turn dilemma. The student- based inquiry projects can add to the science education literature and policies by providing more accurate students' perspectives (from first hand accounts) and more valid information.

After thoroughly reviewing the literature, there were a few implications for practice and teaching that came up that should be noted for enhancing the k-12 classroom settings. Ornstein, Lasley and Mindes (2005) outlined in their book "*Secondary and Middle School Methods*" six phases teachers and administrators can

employ in recognizing gender bias and in creating more gender equitable science content and teaching:

(a) The absence of women in science is not noted in materials

(b) There is some recognition that most scientists are men and thus science may reflect a masculine perspective

(c) There is identification of the barriers that prevent women from pursuing and entering science –related fields

(d) There is a search for women scientists and inclusion of their contributions

(e) Science is done by women (particularly feminists)

(f) Science is redefined and reconstructed to include everyone

To add to Ornstein, Lasley, and Mindes' (2005) suggestions, it is suggested by the literature that not only should there be a gender fair curriculum, but also there should be a racially fair curriculum that fully includes the significant contributions of Black girls and Black women (Mirza, 1992; Leslie, McClure & Oaxaca, 1998; Boston & Baxley, 2007). According to Sadker, Sadker & Steindam (1989), it is suggested that promotion of more gender fair curriculums (& I add, more racially fair curriculums) acknowledge diversity among students, it also denotes inclusiveness and it allows for multiple perspectives and points of views to be put forward in classrooms.

So, one has to realize that when teachers and researchers pay more emphasis to the Black female in their research and policies then this may help to improve their self image, science performances, and possible later retentions in university science programs and within science oriented careers. But, to keep ignoring Black females can only mean continuous low academic performances in science and also continuous low

retention rates in academia and in industry. In order to ‘fix’ the problem of Black girls being denied their turn in science as a whole –that is, in science education research, and consequently science education literatures, limitations within the science education field has to be addressed. Therefore:

(a) The exclusion of minority women and girls from curriculum content and learning settings in mathematics and science like that inherent in the science literature of today needs to be addressed. As Weaver-Hightower (2003) pointed out, the ‘girl then, boy now’’ or flip flop approach in addressing gender issues in education research needs to be smoothed out, so that there may be a more gender balanced approach in education research. But Mirza (1992), and Black feminist shakers, such as Hill – Collins (1998), advocates for not only gender balance, but also racial balance as well, so that science education research and science education literature can include an integrated racial and gender fair balance, which can therefore lead to more research that can look at the Black girl turn in science education and their disadvantages, instead of the literature continuing the flip flop trend of “White, middle class girls turn then,’ and ‘Boys turn now’ (Weaver-Hightower, 2003).

(b) Girls and boys are faced with sexual stereotypes from birth and so future research and educational programs should focus on gender equity issues as early as the K-5 levels as opposed to later (Leslie, McClure and Oaxaca, 1998; Boston & Baxley, 2007).

(c) The advocation for teachers to be better curriculum developers who can spot gender bias in text books and other curriculum materials is needed (Towery, 2007).

(d) More research focusing on teacher training for novice teachers who may need to be guided on how to create more racially and gender inclusive environments in science

may also be desirous (Towery, 2007). So the advocation of: (a) gender and racially fair curriculums and inclusive learning settings; (b) increased teacher training, especially for novice teachers (Towery, 2007); and (c) The call for better curriculum developers who can monitor and censor inadequate curriculum content materials before it is given to classroom teachers; are all highlighted as possible areas of research that should be targeted by science education researchers (Datnow, Hubbard, and Conchas, 2001).

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