

ENRICHING SCIENCE CURRICULUM WITH HISTORY TO CURTAIL GENDER ISSUES IN LEARNING SCIENCE AMONG SENIOR SECONDARY SCHOOL STUDENTS IN NIGERIA

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Abstract

The quest to bridge the gap between genders in order to attain balance in science education is the concern for many science education researchers. Indeed, the world is fast growing in the area of science and technology and the performance of students by gender is not any better across the years that can give educationist any hope for development towards that direction in Nigeria. Many researchers have used different approaches towards improving and solving gender related issues in science education. Hence, that prompted the need for this paper. The intention therefore, was to examine enriching science curriculum with history in an effort to curtail gender issues in science among senior secondary students across the nation. The paper discussed 'History and Science: as a way forward' showing how the relationship between history and science can stimulate and lead to self-awareness and positive self-concept in students. The paper explained 'gender and academic performance in science'. It highlighted the concept of gender and pointed gender as a factor that influences students' performance. The paper further discussed about 'historically-enriched curriculum and academic performance in science' bringing out the possible benefits, when relevant historical links or backgrounds are used in teaching science. The paper concludes that, when history of scientist (both gender) is rightly used to enrich the senior secondary school science curriculum and the history of scientist is well represented and integrated in the curriculum, it will enhance the learning of science by all, regardless of gender. It was recommended that; science curriculum should be enriched with historical links and background, and the female scientist should be well represented in the curriculum for gender equality.

Key words: Science Curriculum, History, Gender.

Introduction

Since time in memorial, gender has been a grate issue in learning science. There has been gender discrimination, preference of course of study based on gender, choice of occupation with regard to gender, gender inequality in opportunities available to studying science. For long it has been an issue globally. A lot of researchers have worked on gender related issues with

regard to studying science to provide a solution. But still the desired outcome is yet to be achieved. Evidence can be seen in the student's results every year from JAMB, NECO and WAEC. Pinuwa and Mankili (2023) opined that over the years there was consistent decline in the West African Examination Council (WAEC) and the National Council (NECO) in sciences across the country. Also, the ratio of men to women in different places of work or occupations, which are related to science, is yet another evidence. Many jobs have been labeled to be for men or women, for example electrical engineering is for men, nursing is for women, mechanic is for men, etc. which in turn makes individual students to neglect some science subjects that are not part of their requirement to secure admission to study science related courses. Muhammad and Mu'azu, (2018), reported that emphasis is now centered on developing teaching strategy that have potentials for enhancing students understanding of science concepts, acquisition of requisite skills and performance. Bala (2021), asserts that "any teaching method that will help students to develop scientific skills will help the students to achieve high in science" and also to achieve high in his daily activities or in all ramifications of life. This paper will discuss gender issues related to studying science. As such, this work examined, enriching science curriculum with history to curtail gender issues in studying science among senior secondary students in Nigeria under the headings below.

History and Science Curriculum: A way forward

History is so closely tied to identity Roshan (2017). History can serve as the foundation of a positive sense of self. Therefore, academic history is so committed to the factual record and to the disciplined study of sources. But there is another reason to study history; to hopefully learn from it. This approach to history doesn't try to teach lessons from the past in order to help us make decisions by blunt analogy. Instead, it enlightens us about the legacies of what came before us. It gives us a deeper understanding of the complexities of the present. History then can teach analytical and emotional abilities, and convey real knowledge about the real, contemporary world. This knowledge is gained by disciplined study of primary sources and careful interpretation of historiography (Mark, 2019). Thus, historically-enriched curriculum is of fundamental importance. However, history should not be looked at in isolation. Because the past is closely linked with the present and the curriculum influences the future. When you study the past, you are able to understand the process of education (process of teaching and learning) and how it evolved up to the present, in this way, the present not only becomes clear but also helps to illuminate the future (Usman, 2020). Meanwhile, the rate at which science is developing, it seems impossible to teach students all the information they will need. Instead Abiodun et-al, (2022) suggested that individuals should be given opportunity to discover, invent by themselves and get caught up in the rapid expansion of science. As such, historically-enriched curriculum may provide that opportunity, as it may stimulate self-awareness and lead to positive self-concept through discovering things, which in turn may inspire the students to be more responsible and serious with their academic dealings. It is appropriate to teach students how to learn, to have them acquired the skills that will enable them learn 'how' on their own

and to provide them with the foundation of skills and attitudes for acquiring and processing knowledge so that they will be adequately prepared to deal with changes in the future. Aibangbe (2021), reiterate that the quality of any educational programme is a function of the quality of those who teach it. Thus, the primary task of the teacher is to ensure that the students learn. According to Bala (2021) the task of the instructor is to translate information to be learned from a curriculum in to a format appropriate to the learner's current state of understanding. According to Rufa'i (2017), Curriculum is broadly speaking the body of knowledge that those undergoing education are required to cover in their area of specialization. Science as a subject occupies a very important position in our school curriculum. There is so much emphasis on science and science related subjects at primary, secondary and tertiary levels of education. Thus, Science is the close observation and examination of the natural world, analyzing information and sources of information, interpreting events, and making decisions based on these observations or conclusions made by others. Quality science education equips students (of any age) with the tools to direct ones' own learning. The individual can make his or her own discoveries, create new knowledge, and apply information and resolve discrepancies on their own. By studying science, an individual is transformed from a passive recipient of information to an active and discerning consumer of information. By implication, history provide this opportunity in learning.

However, Martins-omole (2022) opined that various teaching methods are used for instruction in the teaching of science and the method adopted by a teacher may promote or hinder learning. Relatively, the National Policy on Education (FME, 2018) demanded for teaching methods that would ensure the development of sound basis, for scientific and reflective thinking. Sequel to that, many science organizations for many years to date has advocated for the use of appropriate and good science teaching method. Hence, the use of appropriate methodology in teaching science has been recommended by many science-based organizations that include: The National Science Corporation (NSC) 2017; The Assessment of Performance Unit (APU) 2018; The Secondary School Curriculum Committee (2019); The Engineering Council of the Standing Conference on School Science and Teaching, (2020); The Association for Science Education (ASE), 2020; and The Science Teachers' Association of Nigeria (STAN) 2021; Because, in a classroom setting, students' interest can be enhanced through the use of appropriate instructional strategies (Abiodun, 2022). Nevertheless, using the right methodology can be interesting, challenging and therefore motivating. The main aim of teaching is to transfer knowledge to the learners provided there is interest and history can stimulate and influence interest by implication in this work. Usman (2025), assert that incorporating history in teaching and learning science is important for the growth and development of every society and learning science through history should be fun to learners. Nevertheless, to enrich science curriculum with history means providing historical backgrounds and links designed to throw more light on scientific concepts. For each concept historical account are outlined in relation to the concept making it richer in the content. In

essence, unlike the conventional curriculum where concepts are precisely explained with relevant illustration and the content very much like text written book, the historically-enriched curriculum is enriched with historical links (a template of historically enriched curriculum in the area of genetics is attached in the appendix). Usman (2020), assert that, the historical bonds or element makes the difference between the two curricula. However, each and every curriculum requires a teaching method for its content to be delivered to the students. But the way students absorb information is undergoing a rapid transformation; Images, video, sound bites, tweets and interactive apps are just some of the ways through which they learn nowadays. So keeping that in mind, we need to share our knowledge of history in a way that will be engaging. By implication, History not only provides us with a nostalgic glimpse of how things used to be, but its lessons can teach us things that are important for life today. Mark (2019) stated that, History can be the richest of all stories and the saddest of stories. It's a story of all people, in all places, at all times and because we know of that history, we can decide what may happen in the future. History provides and shows us models of good and responsible behavior, as well as teaching us how to learn from the mistakes of others. It helps us understand how society can change and develop. If we don't teach our students to connect with history, then the consequences may be injurious. The more we know about the past the better prepared we are for the future because by remembering the past, we realize that we are responsible for building a legacy for the generations that follow us. Batagarawa (2021) opined that the diminishing interest in learning science was due to the curriculum content being overloaded and not generally related to working life, the lack of discussion of topic of interest, the lack of creative expression opportunities, the alienation of science from society and the prevalence of isolated science subject. Bichi (2002) in Usman (2025) observed that a systematic approach to learning, like enriching science curriculum with history of pioneer scientist encourages good learning habits, pin-points areas of confusion, contributes to clarity in thinking and promotes intellectual development.

However, the type of teaching method or instructional approach employed to teach, greatly have effects on students' performance. Thus, in a typical classroom you come across different students, the serious, average and lazy students. Those that are up and doing and others that needed to be pushed before they do what is expected of them. In respect to this, the minds of the students need to be awoken. There is need to knock on their closed minds. Hence, they need to be motivated. Sometimes what we see others doing or has done or when we listen to the stories of successful people we tend to be motivated. However, scientific history is a medium of transferring past event or information of the past about our great successful scientist. It is assumed that when this type of stories are shared with science students, it may motivate and stair their interest. Also, it will increase their willingness to do more academically and they may aspire to become like the scientist they hear about, which in return may likely make them work harder and may be reflected in their performance. For example, when a student understands through history, that most of these scientist came from poor families and lower

status, but it did not hinder them from becoming what they are today. The students may comprehend that knowledge has nothing to do with gender, riches or status but rather the effort, determination, willingness and hard work that one invests in it. It is said; anything worth doing is worth devoting time and doing it well. According to Silva (2020) the ultimate aims of science education in every society are to provide people with the knowledge of science needed for the fulfillment of the socio-economic and cultural needs of the society as well as ensure the means for physical survival.

Gender and Academic Performance in Science

The relationship between the two terms ‘science and gender’ or concepts is that, gender is one of the factors interacting with students learning of science as well as their academic performance. The influence of gender on students’ performance in Nigeria has for long been an area of concern to educational researchers, but no consistent result has been obtained. Researchers like; Nicholas et-al, (2015); Wada (2016); Mustapha, (2018); Zubairu and Musa (2021); Martins-omole, (2022) and Usman, (2025), reported that gender had no effect on performance in science. Sha’ibu and Mari (2017); Abiodun,(2021) and Abiodun et-al (2022) explained that females were significantly better than the males. While researchers like McDermott, Zisook and Balon (2021); UNESCO (2019) and HRSC (2019) reported that male subject were superior over their female counterparts in science achievement and that the academic achievement of boys and girls in science, technology and mathematics has been perceived differently, where boys are rated higher than girls. In essence gender difference is characterized by female underrepresentation and underachievement in science, as such the effect of gender on school science cannot be overemphasized. Some researchers in science education such as Mustapha, (2018); Batagarawa, (2021); Kum, (2022), Martins-omole, (2022) and Abiodun et-al (2022) have expressed concern on gender related issues with the view to improving science teaching and learning. UNESCO (2019) and FASEB (2021), stated that efforts are being made to address gender disparities in Science education, including policies and programs aimed at increasing the participation of girls and women in the fields, by improving teaching methods; strategies and curricula. Hence, this paper is an effort towards that direction.

However, it has been observed that the position of females in science, mathematics and vocational education is below average when compared to male. According to McDermott, Zisook and Balon (2021) in a global study of female representation in academic psychiatry institutions, found that there were a decreasing number of females along the career path in all except three institutions, indicating gender disparity in performance. The findings of Wada (2016) and Zubairu and Musa (2021) showed no significant difference between male and female achievement in science. However, recent studies in the developed world have shown a reversal in academic performance between males and females in science (Asante & Oduro, 2023). The finding of Usman (2025) showed no significant difference between male and female performance in science. Nevertheless, (Ogunyele & Adeyemo, in Usman, 2025) found that

gender is one of the predictors in secondary students' academic achievement in science. It can be deduced from the aforementioned that some researchers found that male students achieve significantly higher than female students, while in some report, reverse is the case. Hence, gender issues in learning science among senior secondary students in Nigeria cannot be ignored.

The term gender can be confusing at times, may be understood as or simply mean the same thing as sex of an organism or human being (sex is the physical condition of being male or female). Gender is such pervasive aspect of an individual's identity. Thus, by context, Gender refers to the social and psychological dimensions of being male or female. It is also culture oriented and as such over the years female students mostly show inferiority when it comes to science, evidence is seen in their result. This could be due to the motive they associated with their identity and the believe they have about science; that science is meant for boys, and that female education ends in the kitchen. Hence, gender discrimination becomes part of their experience and in turn affects them in learning science; it is then reflected in their performance which in the same vain make the male counterparts feel superior over them.

It was reported by BBC NEWS (2020) that, some parents discourage their girls from science and technology careers saying that they are abnormal and may not be capable of managing marital home. The girls themselves feel discouraged by the attitudes of teachers and parents and often suffer from self-esteem. Thus, gender difference is characterized by female underrepresentation and underachievement in science and this is due to gender bias, stereotype or gender roles which are referred to as a set of expectations regarding how female or male should feel, think and act. The problem with gender bias, stereotype or gender roles is that girls are not always encouraged to use their talents which deprive society from the contributions they could make (Muhammad and Mu'azu, 2018). Because, when girls lack encouragement it can affect their self-realization and self-esteem. Hence, it can affect their academic performance in school science and by implication it can affect their further development in all ramifications of life. Muhammad et-al, (2018) and Batagarawa (2021), assert that teachers are of the view that girls are intellectually incapable of competing in science and difficult task with the boys.

However, all these speculations would have been minimized, had it been the history of female scientist were reflected or featured in the science curriculum. Because there are many female scientists that has contributed in science, since time in memorial, but their names were kept low. So low to the extent that even a noble prize which they deserved were handed to their male research partners which they did the work together and side lining the female scientist, for example; Rosalind Franklin was overlooked while Francis Crick and James Watson were awarded a Nobel prize in 1962 for discovering DNA structure. Similarly, Bernell was overlooked for a Nobel Prize in physics in 1994, even though the award went to the two male academics who worked alongside her (BBC News, 2020) and probably the female contribution was even greater in the cause of the work. In essence, gender bias in science has been in

existence for long and because the western education was handed to us by the colonial masters, we tend to use it the way it was, putting little or no consideration about gender issues when it comes to curriculum review, reforms and innovations and hence always try to conform to the dictated guidelines. If at all, the historical links about more female scientist will be provided in the Nigerian science curriculum, beside the already existing ones (which is more of male scientist). It will harmonize gender in the field of science and may serve as a source of motivation to female students. The female scientist will serve as the role model to the female students that has lost self-esteem and feel that science is for male and their own knowledge ends in the kitchen and little beyond that. Hence, gender equity will surface and a balance in learning science will be attained.

Moreover, it was reported in BBC News on 6th february (2020), by Hazel shearing that an education charity says- not a single woman's name features in the national curriculum for science, prompting calls for the government to act over a lack of visible role models for girls at secondary school level. In line with what the education charity says, the 'teach first campaign (The STEMism camping) that was launched, called to close gender gaps in science and math careers. It stressed that no female scientist were mentioned in the GCSE science curriculum. Because comparatively just two (2) DNA pioneers were referred to while forty males (40) scientist or their discoveries were mentioned. Moreover, when a separate poll was conducted by the charity, it revealed that half of people are unable to name a single female scientist, alive or dead (it means even parents as part of the society, cannot support their children at home since they lack the knowledge). This simply implies that gender related issues in the area of gender bias and quest for learning science/ scientific knowledge is all over the world. But it is important to know that it is not just Britain's men that had made pioneering scientific discoveries, there are also some overlooked Britain women whose research has changed the world. Some examples of the female scientist are:

1. Rosalind Franklin, a DNA structure pioneer.
2. Barbara Mc Clinton, the mother of Genetics. She discovered jumping genes while working with maize and was awarded a noble price in 1983 for the discovery. Her discovery was made thirty years before the genetic code and DNA structure were discovered. As of 2022 she remains the only woman who has received an unshared noble price in that category. A justification for nicknaming her the mother of genetics.
3. Mary Somerville (1780-1782), an Astronomer (she was named in 19th Century queen of science after her death) she was the first female member of Royal Astronomical society in London in 1835. She wrote a lot of books, and her detailed work on the solar system was influential in the discovery of NEPTUNE.
4. Mary Anning (1799-1847), a paleontologist. A self-taught pioneer, she discovered Jurassic remains and came across her first find: an ancient reptile, later named an Ichthyosaurs at the age of 12. The natural history museum calls her the "Unsung hero of fossil discovery" as the scientific community was reluctant to recognize her

contributions to science during her life-time. It was a century after her death that geological society of London begin to admit women.

5. Elizabeth Garrett Anderson (1836-1917), a Doctor, she was the first woman to qualify in the UK as a doctor but it wasn't easy to get there. In her mid-20s, she enrolled as a nurse at London in Middlesex hospital. She attended lecture and observed the male medical students, but no university would let her take the exams to become a doctor. Not until she discovered that the society of Apothecaries couldn't legally refuse her, she qualified in 1869. She co-founded the London school of medicine for women and campaigned for women's right to vote.
6. Elsie Widdowsen (1906-2000) Dietician. She was one of the dieticians who oversaw the addition of vitamins to food during wartime rationing in 1940, when food was being rationed during world war two.
7. Dorothy Hodgkin (1910-1994) a chemist. She schooled in Beccles Suffolk, where she fought to be allowed to study chemistry along with the boys. She used X-ray technology to discover the structures of penicillin, insulin and vitamin B12. In 1964, she won a noble prize in chemistry (the only British woman to have done so), she also lectured in Somerville College in Oxford in the 1940s. Also, from 1976-1988 she was president of the Pugwash conference; an international org. set up in 1950s to assess the danger of nuclear weapon.

It can be deduced that, their collective history is a story of hard work, resilience, perseverance, curiosity, commitment, determination, high self-esteem, braveness, confidence and selfless effort. However, even if Nigerian science curriculum would be enriched with history, both the teachers and the students need to bring in their best to move science forward. Because science teacher(s) play a vital role in addressing the problem of gender in science education. Levi in 2000 highlighted three roles a science teacher must play on gender issues Viz:

- a. Ensure provision of equal opportunities and respect for differences in the classroom.
- b. Ensure that boys and girls have the same experiences (treat boys & girls equally.)
- c. Compensate for gender differences in the society.

Almamari and Almamari, (2022) opined that despite the fact that certain measures have been taken to bridge the gap between boys and girls, gender inequality is still a limiting factor to the achievement of desired learning outcome and developments in science. However, for teaching and learning of science in schools to progress, and especially bridge the gap in gender inequality, certain factors have to be considered; household factors, socio-cultural factors and policy related factors, so also school related factors, school curriculum and environmental factors. As such implementing the use of history to enrich science curriculum in teaching science is a step towards addressing these factors. Because, it encapsulates and addresses all the factors stated, in a unique, dynamic and special way.

Historically-Enriched Curriculum and Academic Performance in Science

There are different ways to enriching a curriculum but historically-enriched curriculum is one that exposes students to different background of scientist in relation to their ability to constructing knowledge through experiences, resilience and perseverance to mention but a few. It has the capacity to balance the wide range of students' need. All students are unique in their background and learning styles. However, historically-enriched curriculum is likely or can successfully be an encouraging and empowering experience for all science students. Stories are stimulating and influential in nature and it can have great impact on student in a way that can make them maximize their effort in studies by motivation, especially when a teacher is prepared and is creative in telling the story of the past event. In that way the students may become motivated. Zacccone and Pedrini (2019) and Silva (2020) stipulated that for teaching and learning to be interesting and stimulating there has to be motivation on the part of the teacher and learner so as to ensure the development of positive mindset and subsequently maximize academic performance. Mustapha (2018) opined that academic performance are computed or grades recorded for a group of learners. Thus, the performance of an individual for a given learning period influences his future choice career. The International Assessment Event of Education Progress (IAEP, 2018) advocated that, the students making meaningful progresses in their choices of career are those mostly with relevant background and a good record of academic performance at lower level.

Due to the fact that not every student learns in the same way and not every student can accurately demonstrate mastery of educational topics and concept in a similar Passion. Historically-enriched curriculum will give or expose them to the basic ideas of scientific knowledge and the academic life history of scientists, while they construct their own knowledge independently by what they were exposed and attracted to. As supported by the constructivist, knowledge is seen as a constructed element that results from the learning process. It is hoped that when students are exposed to the history of great scientist and their achievements in life regardless of gender and despite their background and the underdevelopment of their time. It may inspire, motivate and redirect their mindset and conscious ability to do well in their studies and improve in their performance. If they consider, realize and come to terms with the fact that they have great opportunities to do better now in the era of advance and sophisticated technology like artificial intelligence (AI).

Conclusion

In conclusions, when history of scientist (both gender) is rightly used to enrich the senior secondary school science curriculum and the history of female scientist is well represented in the curriculum, it will enhance the learning of science by all, regardless of gender. Because history is open to all and is not gender bias. It only tells and reveals real life events that happened in the past. As such, students may find it useful. There by inspiring, stimulating and motivating them to do more in their journey towards learning science. Therefore, it is important

to enrich science curriculum with historical links and background in order to facilitate students learning of science in Nigeria.

Recommendations

1. Science curriculum should be enriched with historical links and background and the female scientist should be well represented in the curriculum for gender equality.
2. Science students should be oriented about the value of having adequate knowledge on the history of scientist.
3. Science teachers, curriculum developers, designers and innovators, policy makers, science organizations should support the idea of enriching science curriculum with relevant history of scientist and it should be free from gender bias.

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