An investigation into strategies to improve female secondary school chemistry students' participation in Science, Technology and Mathematics in Edo State

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Abstract

This study was carried out to determine the strategies that could improve female chemistry students' participation in STM education. Two research questions were raised for the study and one hypothesis was formulated. The design adopted for this study is the descriptive survey research design. The sample for the study was two hundred students randomly selected from four schools. A questionnaire titled strategies for improving senior secondary school female chemistry students participation in STM Education was the instrument used for data collection. The instrument was properly validated and its reliability was determined (r=0.81) before it was used. The data collected were analyzed using frequencies and percentages and Mann-Whtiney U test statistics. The findings of the study are as follows (i) use of strategies such as Parental, Teachers, governmental involvement and elimination of socio-cultural factor will improve female students' participation in STM career (ii). A non-significant difference in the percentage of female chemistry students base on class who agreed that parents, teachers, government and socio-cultural factor have roles to play in promoting female participation in STM education (iii) a significant difference in the percentage of female chemistry students from rural and urban location who agreed on the usage of parents, teachers, government and socio-cultural factor to promote female participation in STM education. Based on the findings, it is recommended that Parents, Teachers, and government should encourage female chemistry students further their career in science, technology and mathematics (STM) related course by providing the needed study materials and guidance respectively among others.

Keywords: STM, female students, chemistry, chemistry education

INTRODUCTION

Hallinen (2015) define Science Technology and Mathematics (STM) as a term used to group together an academic discipline. Eraikhuemen and Oteze (2015) sees STM as a cord of three strings that are interwoven and independent and that, the advancement in the result of one of the fields is influenced by the others. This term is typically used when addressing education policy and curriculum choices in schools to improve competitiveness in science and technology development. (O'Donnell 2018). Science, Technology and Mathematics plays a very important role in the development of a nation's economic.

Kong & Mohd (2020), carried out a systematic literature review on Science Technology Engineering and Mathematics (STEM) approaches in teaching and learning. The results showed that inquiry-based

learning had the highest number of referrals followed by project-based learning, multi-mode learning, problem-solving learning and cooperative learning. Jerki & Han (2020) in their study, concluded that teaching experience of STEM teachers influences the knowledge, motivation and implementation of STEM teaching and learning. STM have been identified as the bed rock or foundation for wealth and it has been argued that in this era of globalization only people with appreciable knowledge, skills and abilities in STM are required in the job market (Eraikhuemen and Oteze, (2015). According to Mandina, Mashingaidze and Mafuta (2013), there can be no technology without science and there can be no modern society without technology. This statement buttressed the statement made by Fafuwa in 1990. Fafuwa (1990), stressed that we cannot hope to be self-reliant with other peoples science and technology and that if we must develop and be self –reliant, we must develop our own science and technology. The science in STM typically refers to two out of the three major branches of science: natural sciences, including biology, physics, and chemistry; and formal sciences, of which mathematics is an example, along with logic and statistics (STM education, 2017).

As important as STM is to national development and the well-being of people, literature has shown that the female students are lagging behind their male counterparts in STM education. For example, Aguele and Uhumuavbi (2003) found out that the ratio of male to female in STM enrollment in some Nigeria University is 3:1, Nwelih, Igene & Igene (2013) discovered that females are less involved in technical and logical aspect of computer in the same vein, Imogie & Eraikhuemen (2008) discovered the female students who enrolled for STM courses in University of Benin are lesser than their male counterparts. For physics education courses, Eraikhuemen & Eraikhuemen (2010) had similar findings. Fatokun and Olasehinde (2016) also discovered in their study that females are still under represented in biology (31.8%), chemistry (30.5%) and physics (31.6%). From the findings of Fatokun and Olasehinde (2016), it can be seen that female students' participation is lower in chemistry. The factors that are identified by research to be responsible for lack of female participation in STM education are attributed to social, cultural, associated psychological barrier, parent and teachers factors.

Despite chemistry being one of the cornerstones of science, technology and industry, it is apparent that chemistry plays a greater role in national development through industry in the world, it is the central in the drive of global sustainable economic development. It plays the major roles in food (fertilizers and insecticides), clothing (textile fibers), housing (cement, concrete, steel, bricks), Medicine (drugs) and Transportation (fuel, alloy materials). (Emendu,2014). According to Emendu (2014), chemistry education is a veritable instrument for national development. The importance of chemistry education cannot be undermined in a nation's development. According to Emmanuel (2013), Chemistry Education is the systematic process of acquiring the fundamental knowledge about the universe. With these indispensable knowledge richly acquired, man can shape and reshape his world for his benefit. Hence, the development of the nation is usually measured by the degree and extent of growth brought to it through the enterprise of science education and a gate way to it is chemistry education. Chemistry education is the vehicle through which chemical knowledge and skills reach the people who are in need of capacities and potentials for development. It also addresses the social objective of substance development as education is now of the primary means for empowerment, participation, cultural preservation, social mobility and equity.

In order to solve the problem of gender disparity of students' involvement in STM courses at the higher level, Mandina, Mashingaidze and Mafuta (2013) study on how to increase female participation in advanced level mathematics: A perspective from students and teachers in Zimbabwe. Their research findings revealed that to promote female participation in advanced level mathematics, parents and teachers should: enhance girls' confidence about their mathematics abilities; create a conducive classroom climate that enhances interest and curiosity in mathematics; expose girls to female role models who have succeeded in mathematics and provide information advice and guidance on mathematics careers. They also recommended that gender and cultural biases attached to mathematics should be de-emphasized at home and school and that mathematics teachers' should adopt some of the more recent reform-based instructional strategies that actively engage students

while the Government should give incentives to girls who study mathematics at higher levels in order to encourage young females to pursue mathematical careers.

Problem statement

Observation has shown that at the secondary school levels there is almost equal level of female and male participation in STM based subjects but there exist gender disparity at the higher institution level. It is at this level that the female students need to acquire the needed skills for them to contribute their quota to the national development. Literature has shown that science, Technology and Mathematics education is very crucial to the development of any nation, and given the fact that female is the mother of nation, her education in science, Technology and Mathematics (STM) therefore place her in a better position to facilitate the development of her nation. It is generally believed that if a man is educated; it is an individual that is educated but if a woman is educated, the nation is educated. If any nation desires a genuine development, it cannot continue to ignore the education of its female citizens in STM. According to Annan (2011) no development strategy is better than one that involves women as central players. It has immediate benefits for nutrition, health, savings and reinvestments at the family, community, and ultimately, country level. Educating the girl child is a social development policy that works and a long term investment that yields an exceptionally high return. Based on these, the statement of problem therefore is: what strategies can be used to enhance students' participation in STM education*?*

Objectives

Since literature has revealed the importance of STM in national development and the lack of female participation in STM education in general and chemistry in particular, the objective of this study is determine the strategies to use in improving female participation in STM career courses.

Research questions

The following questions were raised to guide the study.

1. What are the strategies for improving female chemistry students' participation in STM education?

2. To what extent in percentages do students agreed on the strategies required to enhance female students' participation in STM education?

Hypotheses

$H0_1$: There is no significant difference in the extent to which students agreed on the strategies required to enhance female students participation in STM education.

METHODOLOGY

The design adopted for this study is the descriptive survey research design. The design is based on the assumption that whatever is observed at a particular time is normal and under the same conditions would possibly be observed at any other time in the future. The descriptive survey design involves studying a limited number of cases with the aim of drawing up conclusions that cover the generality of the whole population under review. As such this design was used to find strategies in which female chemistry student participation in STM related courses at the tertiary level of learning can be increased. This design is appropriate because Leedy (1980) observes that the descriptive survey design involves looking at phenomena of the moment with intense accuracy.

Sample and Sampling Technique

Simple random sampling was used by the researcher to select four senior secondary schools in Edo State from the existing schools in the local government areas in Edo state. Samples of two hundred students were randomly selected from the four schools (two from urban and two from rural location). Out of the two hundred students, fifty each were sampled from Senior Secondary (SS2) and Senior Secondary (SS) 3 class from each location respectively.

Instrument for Data Collection

A questionnaire titled strategies for improving senior secondary school female chemistry students participation in STM Education was the instrument used for data collection. The instrument was constructed by the researcher. The instrument has two sections; section A elicits information on students' bio-data and section B contains sixteen items which dealt with the identified factors responsible for lack of female participation in STM education. The items in the questionnaires were structured on four-point Likert rating scale of Strongly Agree (SA) – 4, Agree (A)- 3, Disagree (D) -2 and Strongly Disagree (SD) -1. The respondents are to tick (√) against their opinions.

Validation of the Instrument

To ensure the face and content validity of the instrument, the instrument was given to three experts. Two lecturers in science education department, and one lecturer from Measurement and Evaluations. They were given the topic, research questions and questionnaire to validate. Their corrections were effected and this made the instruments valid

Reliability of the Instrument

The reliability of the instrument was determined using test-retest procedure. In doing this the instrument was administered to a different group of chemistry students not used in the study. The instrument was given to the same group of chemistry students after an interval of two weeks. The data collected were correlated using Pearson Product Moment Correlation coefficient. The reliability coefficient (r) for the test was 0.81. With this value, the instrument is reliable because the first and the second tests measured the same attribute and r-value is higher than 0.5.

RESULTS

Research question 1: what are the strategies for improving female chemistry students' participation in STM education?

Table 1: Descriptive statistics showing strategies for enhancing female chemistry students participation in STM education (n=200)

Strategies	Class	location	frequencies	percentage
Parental and teachers involvement	SS2	Rural	20	10.00
	SS3	Rural	20	10.00
Teachers, socio-cultural and governmental involvement	SS2	Rural	25	12.5
	SS3	Rural	25	12.5
Parental, Teachers, socio-cultural and governmental involvement	SS2	Rural	10	5.0
	SS2	Urban	50	25.00
	SS3	Urban	50	25.00

Table 1 showed that 20(10%) each from SS2 and 3 from rural location agreed that only parental and teachers involvement will enhance female chemistry students participation in STM education whereas, 25(12.5%) each from SS2 and 3 from rural location agreed that only teachers, socio-cultural

factor and government involvement will enhance female chemistry students participation in STM education. The table also showed that majority of the students in urban location irrespective of their classes agreed that parental, teachers, socio-cultural and governmental involvement are strategies that will enhance female chemistry students participation in STM education and 10(5.0) of SS2 students from rural location also agreed to that.

Question 2: To what extent in percentage do students agreed on the strategies required to enhance female students' participation in STM education?

Table 2a: Descriptive statistics showing students level of agreement and disagreement with parental involvement as strategy for enhancing female participation in STM education (n=200)

s/n	**Using parental involvement as a strategy**	Class	location	SA F(%)	A F(%)	D F(%)	SD F(%)
1	Encouragement from my parent will make me as a female chemistry students further my career in science, technology and mathematics (STM) related course	SS2 SS3	Urban Rural Urban Rural	15(7.5) 40(20.0)	35(17.5)	 25(12.5) 10(5.0) 25(12.5)	 25(12.5) 25(12.5)
2	Provision of needed books and materials by my parent will make me as a female chemistry students further my career in science, technology and mathematics (STM) related course	SS2 SS3	Urban Rural Urban Rural	20(10.0) 50(25.0)	20(10.0) 20(10.0)	5(2.5) 25(12.5) 20(10.0)	5(2.5) 25(12.5) 10(5.0)
3	Engaging a private teacher to help guide me in chemistry by my parent will make me as a female chemistry students further my career in science, technology and mathematics (STM) related course	SS2 SS3	Urban Rural Urban Rural	10(5.0) 20(10.0)	20(10.0) 20(10.0) 5(2.5)	20(10.0) 15(7.5) 10(5.0) 30(15.0)	 35(17.5) 15(7.5)
4	The personal involvement of my parents in studying my chemistry text book with me will make me as a female chemistry students further my career in science, technology and mathematics (STM) related course	SS2 SS3	Urban Rural Urban Rural	10(5.5) 5(2.5) 30(15.0)	20(10.0) 20(10.0)	15(7.5) 25(12.5) 30(15.0)	5(2.5) 20(10.0) 20(10.0)

From table 2a, 50 (25%) of SS 2 students in urban location totally agreed that parental engagement will help female participate in STM education, while 50 (25%) of them from rural location totally disagreed. For the SS3 students who are in Urban location, 40 (20%) agreed and 10(5.0%) 0f them disagreed, while 50(25%) of them from rural location totally disagreed. On the issues of provision of textbooks and materials for students' parents, 40(20%) of SS 2 urban students agreed that provision of textbooks and materials for students' parents will enhance female students participation while 10(5.0%) totally disagreed. On the hand, 50(25%) of SS3 students in urban location and 20(10%) from rural location agreed respectively whereas 30(15.0%) of the rural SS 3 students disagreed. In addition, 30 (15%) of SS2 students from the urban location agreed that engaging a private teacher to help guide them in chemistry by their parent will make them as a female chemistry students further my career in science, technology and mathematics (STM) related course while 20(10%) of them disagreed whereas their counterpart from rural location (50(25%)) totally disagreed. While for the SS3, 40 (20%) of them in the urban location agreed and 10(5.0%) of them disagreed. Those from the

rural area (45 (22.5%)) totally disagreed and 5(2.5%) agreed. On the strategy of personal involvement of their parents in studying their chemistry text book with them will make them as female chemistry students further their career in science, technology and mathematics (STM) related course, 30(15%) of SS2 students from urban location agreed and 20 (10%) disagreed. Whereas only 5 (2.5%) of their counterpart from rural location agreed and 45(22.5%) of them disagreed. For the SS3 students 50(25%) from Urban location agreed and 50(25%) from rural location disagreed. This shows that there is a difference in the percentage of students who agreed and disagreed that using parental involvement as a strategy to enhance female students' participation in STM.

Table 2b: Descriptive statistics showing students level of agreement and disagreement with teachers involvement as strategy for enhancing female participation in STM education (n=200)

	Teachers involvement as a strategy	Class	location	SA F(%)	A F(%)	D F(%)	SD F(%)
5	Encouragement from my chemistry teacher will make me as a female chemistry students further my career in science, technology and mathematics(STM) related course	SS2 SS3	Urban Rural Urban Rural	25(12.5) 15(7.5)	20(10.0) 30(15.0) 5(2.5)	 15(7.5) 5(2.5) 25(12.5)	5(2.5) 35(17.5) 20(10.0)
6	The use of teaching methods that will enable me participate in chemistry classes will make me as a female chemistry students further my career in science, technology and mathematics (STM) related course	SS2 SS3	Urban Rural Urban Rural	15(7.5) 5(2.5)	35(17.5) 15(7.5) 20(10.0) 5(2.5)	 25(12.5) 15(7.5) 20(10.0)	 10(5.0) 10(5.0) 25(12.5)
7	When am taught by a female teacher, I will have the determination as a female chemistry students further my career in science, technology and mathematics (STM) related course	SS2 SS3	Urban Rural Urban Rural	15(7.5) 5(2.50 5(2.5) 5(2.5)	25(12.5) 5(2.5) 25(12.5) 10(5.0)	10(5.0) 10(5.0) 20(12.5) 15(7.5)	 30(15.0) 20(10.0)
8	When chemistry teachers acts as mentor to me, I will have the zeal as a female chemistry students to further my career in science, technology and mathematics (STM) related course	SS2 SS3	Urban Rural Urban Rural	15(7.5) 5(2.5)	25(12.5) 45(22.5) 5(2.5)	10(5.0) 30(15.0) 20(10.0)	 20(10.0) 25(12.5)

From table 2b, 45 (22.5%) of SS 2 students in urban location totally agreed that encouragement from chemistry teacher will make them as female chemistry students further their career in science, technology and mathematics(STM) related courses while 5 (2.5%) of them from urban and 50% from rural location totally disagreed respectively. For the SS3 students who are in rural location, 45 (22.5%) agreed and 5(2.5%) of them disagreed. On the usage of teaching methods, 50(25%) of SS 2 students from Urban location totally agreed that the usage of child center methods will make them further their courses in STM career. While 15(7.5%) of them from the rural also agreed and 35(22.5%) of them disagreed. For the SS3 students, 25% (12.5%) of them from urban location agreed and 25% (12.5%) disagreed. While 5 (2.5%) from rural location agreed and 45 (22.5%) disagreed. On the issues of been taught by female chemistry teachers, 40(20%) of SS 2 urban students agreed that being taught with female chemistry teacher will enhance female students participation in STM career while 10(5.0%) totally disagree. Whereas 10(5.0%) of them from rural location agreed and 40(20%) of them totally disagreed. On the hand, 30(15%) of SS3 students in urban location agreed and

20(10%) of them disagreed, whereas 15(7.5%) of the rural SS 3 students agreed and 35(15%) of them disagreed. In addition, 40(20%) of SS2 students from the urban location agreed that when chemistry teachers acts as mentor to them, they will have the zeal as a female chemistry students to further their career in science, technology and mathematics while 10(5%) of them disagreed whereas 50(25%)) of their counterpart from rural location totally disagreed. While for the SS3 students in the urban location, 50(25%) of them agreed, and 5(2.5%) of them from the rural location also agreed whereas 45 (22.5%) of them disagreed. This shows that there is a difference in the percentage of students who agreed and disagreed that using Teachers involvement as a strategy to enhance female students' participation in STM.

Table 2c: Descriptive statistics showing students level of agreement and disagreement for the usage of socio-cultural factor as a strategy for enhancing female participation in STM education (n=200)

	Using socio-cultural factor as a strategy	Class	location	SA F(%)	A F(%)	D F(%)	SD F(%)
9	Giving sanitization to female students on the contribution of STM career to national development will make female chemistry students further their educational career in science, technology and mathematics related course	SS2 SS3	Urban Rural Urban Rural	5(2.5) 35(15.0)	30(15.5) 15(7.5)	15(7.5) 25(12.5) 45(22.5)	 25(12.5) 5(2.5)
10	Giving sanitization to female students on the need to socialize with STM experts will make them further their career in STM related courses	SS2 SS3	Urban Rural Urban Rural	15(7.5) 25(12.5)	25(12.5) 10(5.0) 25(12.5) 10(5.0)	10(5.0) 20(10.0) 30(15.0)	 20(10.0) 10(5.0)
11	The stoppage of male STM students and experts from antagonizing their female counterparts will enable female students participate in STM career related courses	SS2 SS3	Urban Rural Urban Rural	20(10.0) 35(17.5)	10(5.0) 15(7.5)	15(7.5) 20(10.0) 50(25.0)	5(2.5) 30(15.0)
12	Encouragement from society to female chemistry students on the need for their contribution to societal development will encourage them further their education on courses related to STM career	SS2 SS3	Urban Rural Urban Rural	45(22.5) 5(2.5) 40(20.0)	5(2.5) 5(2.5) 10(5.0)	 40(20.0) 50(25.0)	

From table 2c, 35 (18.0%) of S SS 2 students in urban location totally agreed that giving sanitization to female students on the contribution of STM career to national development will make female chemistry students further their educational career in science, technology and mathematics related course while 15 (7.5%) of them disagreed and 50 (25.0%) of them from rural location totally disagreed. For the SS3 students who are in urban location, 50(25%) of them agreed whereas 50(25.0%) of them from rural area disagreed. On the issue of giving sanitization to female students on the need to socialize with STM experts to enable them further their career in STM related courses,40(20.0%) of SS 2 students from urban location totally agreed While 10(10.0%) of them disagreed whereas 10(5.0%) of them from rural location agreed and 40(20.0%) of them disagreed. While 50(25%) of SS3 students in urban location agreed, 10(5.0%) of them from the rural location also agreed whereas 40(20%) of them disagreed. On the issues of stoppage of male STM students and experts from antagonizing their female counterparts to enable female students participate in STM career related courses, 30(15.0%) of SS2 students in urban location agreed while 20(10.0%) disagreed

and 50(25.0%) of them from the rural location totally disagreed. On the other hand, 50(25.0%) of SS3 students in urban location agreed and 50(25.0%) of them from rural location disagreed. On the issue of encouragement from society to female chemistry students on the need for their contribution to societal development in encouraging them further their education on courses related to STM career, 50(25.0%) of the rural SS 2 students agreed and 10(5.0%) of them also from rural location agreed and 40 (20.0%) disagreed. In addition, 50(25%) of SS3 students from the urban location agreed and 50(25%) of them from rural location disagreed. This shows that there is a difference in the percentage of students who agreed and disagree that using socio-cultural factor as a strategy to enhance female students' participation in STM

Table 2d: Descriptive statistics showing students level of agreement and disagreement for the usage of Using government involvement as a strategy for enhancing female participation in STM education (n=200)

	Using government involvement as a strategy	Class	location	SA F(%)	A F(%)	D F(%)	SD F(%)
13	Employment of career guidance councilors by the government for career counseling making sure the councilors do their jobs will encourage female students further their education on courses related to STM career	SS2 SS3	Urban Rural Urban Rural	45(22.5) 5(2.5) 25(12.5)	 25(12.5)	5(2.5) 15(7.5) 50(25.0)	 30(15.0)
14	Encouragement from government through giving of incentive to female chemistry students will make them further their education on courses related to STM career	SS2 SS3	Urban Rural Urban Rural	40(20.0) 50(25.0)	5(2.5) 5(2.5) 25(12.5%)	5(2.5) 25(12.5)	 20(10.0) 25(12.5)
15	Immediate employment for STM female degree holders by government will encourage female students further their education on courses related to STM career	SS2 SS3	Urban Rural Urban Rural	 15(7.5)	50(25.0) 5(2.5) 25(12.5)	 20(10.0) 5(2.5)	 25(12.5) 5(2.5) 50(25.0)
16	Organization of field trip sponsored by government will encourage female students further their education on courses related to STM career	SS2 SS3	Urban Rural Urban Rural	 5(2.5) 30(15.0)	50(25.0) 15(7.5)	 30(15.0) 50(25.0)	 15(7.5) 5(2.5)

From table 2d, 45 (22.5%) of S SS 2 students in urban location totally agreed that employment of career guidance counselors by the government for career counseling making sure the councilors do their jobs will encourage female students further their education on courses related to STM career while 5 (2.5%) of them disagreed and 5 (2.5%) of them from rural location totally agreed and 45(22.5%) disagreed. For the SS3 students who are in urban location, 50(25%) of them agreed whereas 50(25.0%) of them from rural area disagreed. On the issue Encouragement from government through giving of incentive to female chemistry students to make them further their education on courses related to STM career,45(22.5%) of SS 2 students from urban location totally agreed While 5(2.5%) of them disagreed whereas 5(2.5%) of them from rural location agreed and 45(22.5%) of them disagreed. While 50(25%) of SS3 students in urban location agreed whereas 25(12.5.0%) of them from the rural location agreed and 25(12.5.0%) of them disagree. On the issues of immediate employment for STM female degree holders by government to encourage female students further their education on courses related to STM career, 50(25.0%) of SS2 students in urban location agreed and 5 (2.5%) of them from rural location also agreed, while 45(22.5%) of them disagreed. On the other

hand, 40(22.5%) of SS3 students in urban location agreed and 10(5.0%) disagreed, whereas 50 (25.0%) of them from rural location disagreed. On the issue of Organization of field trip sponsored by government will encourage female students further their education on courses related to STM career, 50(25.0%) of the rural SS 2 students agreed and 5 (2.5%) of them from rural location agreed whereas 45 (22.5%) of them from the rural area disagreed. In addition, 45(22.5%) of SS3 students from the urban location agreed and 5(2.5%) of them disagreed. Also 45(22.5%) of them from rural location agreed and 5(2.5%) disagreed, and 50(25.0%) of the SS 3 students in the rural location disagreed. This shows that there is a difference in the percentage of students who agreed and disagreed that using government involvement factor as a strategy to enhance female students' participation in STM.

$H0_1$: There is no significant difference in the extent to which students agreed on the strategies required to improve female students participation in STM education.

Table 3a: Mann- Whtiney U test statistics showing the significant difference in percentage of the extent to which students agreed on the strategies required to improve female chemistry students participation in STM education base on class.

Class	N	Mean Rank	sum of Ranks	Mann- Whtiney U	z	Sig (2-tail)
SS2	100	99.00	9900.00			
				4850.000	0.368	0.713
SS3	100	102.00	10200.00			

Table 2a shows the Mann- Whtiney U statistics showing the significant difference in percentage difference to the extent to which students agreed on the strategies required to enhance female students participation in STM education base on class. The table shows that the difference in percentage of students as observed in tables 2 was not significant since the calculated sig value of 0.713 is higher than the critical sig value of 0.05. With this $H0_1$which states that there is no significant difference in the extent to which students agreed on the strategies required to enhance female students' participation in STM education base on class is therefore retained.

Table 3b: Mann- Whtiney U test statistics showing the significant difference in percentage difference to the extent to which students agreed on the strategies required to enhance female students participation in STM education base on location.

Location	N	Mean Rank	sum of Ranks	Mann- Whtiney U	z	Sig (2-tail)
Urban	100	150.25	15025.00			
				25.000	12.201	0.000
Rural	100	50.25	5075.000			

Table 3b shows the Mann- Whtiney U statistics showing the significant difference in percentage difference to the extent to which students agreed on the strategies required to enhance female students participation in STM education base on location. The table shows that the difference in percentage of students as observed in tables 1 is significant since the calculated sig value of 0.000 is less than the critical sig value of 0.05. With this H_{01} which states that there is no significant difference in the extent to which students agreed on the strategies required to enhance female students participation in STM education base on location is therefore rejected.

DISCUSSION OF FINDINGS

One major finding of the study showed that use of strategies such as Parental, Teachers, governmental involvement and elimination of socio-cultural factor will enhance female students' participation in STM career. These factors have been identified in literature has some of the factors responsible for lack of female students participation in STM education. These identified factors are as a result of exposing young females to stereotype-confirming beliefs on who excels in some STM careers. According to the finding of Beilock, Gunderson, Ramirez & Levine (2010) females who are confirmed to stereotype beliefs performed worse in mathematics. The findings is in agreement with the findings of Mandina, Mashingaidze and Mafuta whose study revealed that revealed that to promote female participation in advanced level mathematics, parents and teachers should: enhance girls' confidence about their math abilities; create a conducive classroom climate that enhances interest and curiosity in mathematics; expose girls to female role models who have succeeded in mathematics and provide information advice and guidance on mathematics careers. And also with that of Markus (2014) and Eraikhuemen and Oteze (2015) who discovered in their study that parent, teachers and government have roles to play in promoting female students participation in STM education.

Another finding of the study showed that there is no significant difference in the percentage of female chemistry students base on class who agreed that parents, teachers, government and socio-cultural factor have roles to play in promoting female participation in STM education. These findings could be as a result of their awareness that irrespective of sex, that female have roles to play in the development of national economy and that Reduction in participation of female in STM discipline will limits the pool of qualified talented and innovative labour in STM industries.

The last finding of the study showed that there is a significant difference in the percentage of female chemistry students from rural and urban location who agreed on the usage of parents, teachers, government and socio-cultural factor to promote female participation in STM education. This could be as a result of the differences in the level of awareness and exposure of the female chemistry students as a result of their location. In most cases, urban students are exposed and more informed on issues compared to their counterparts from the rural locations.

CONCLUSION AND RECOMMENDATION

A review of related literature has showed that there is low participation of female students in STM career in higher institution of learning. From the findings of the study, it is concluded that using parental involvement, teacher involvement, socio-cultural factors and governmental involvement as strategies will help promote female chemistry students participation in STM education. Based on the findings of the study, it is recommended that

- Parents should encourage their female chemistry students further their career in science, technology and mathematics (STM) related course by providing the needed study materials for them guiding them in their study and also employing the services of private chemistry teachers
- Teachers should encourage their female chemistry students further their career in science, technology and mathematics (STM) related course by use of activity base methods that will enable students participate in the teaching and learning process and acting as mentor to them
- Socio-cultural factor should be eliminated by **g**iving sanitization to female students on their contribution of STM career to national development as this will make female chemistry students further their educational career in science, technology and mathematics related course and also on the need for them to socialize with STM experts as this will make them further their career in STM related courses. In addition, there should be a stoppage by male STM students and experts should stop antagonizing their female counterparts and the society

should encourage female chemistry students on the need for their contribution to societal development will encourage them further their education on courses related to STM career.

- Government should employ career guidance counselors for career counseling and making sure the councilors do their jobs, the government should also give incentive to female chemistry students and provide immediate employment for them at graduation in order to encourage female students further their education on courses related to STM career.

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