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# PERSONALITY TRAITS OF SECONDARY SCHOOL GIRLS ASPIRING TO STUDY SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) IN BENIN METROPOLIS OF EDO STATE, NIGERIA

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**ABSTRACT**: *The study examined some personality traits of secondary school girls aspiring to STEM careers in the Benin metropolis of Edo State in Nigeria. This study is a descriptive survey with a correlational design. The population of the study consisted of senior secondary school girls in sciences selected from federal, state and private schools in Benin metropolis of Edo State, Nigeria. Five hundred (500) female students formed the sample for the study. The data were analyzed using frequency counts, mean, standard deviation and chi-square. The hypotheses were tested using the Analysis of variance (ANOVA) and the multiple regressions. The findings of the study among others were: age and course of interest have a significant influence on girls aspiring to STEM careers; flexibility, self-esteem, enterprising, team spirit, social, and stress tolerance were exhibited by the girls; and that personality trait is a significant predictor of girls aspiring to STEM careers. It was concluded that the personality traits identified affects the single sex and mixed schools in about the same way. This implies that school type does not affect the personality traits of the girls much. Therefore, all secondary school girls have fairly equal chances of excelling in STEM careers. The study therefore recommended among others that: Parents, teachers and all stakeholders in education should be enlightened on participation of girls in STEM. Gender discrimination by employers should be discouraged. Secondary school students especially females should be encouraged to develop STEM competencies and disabuse their minds from the fear of some STEM subjects.*

**KEYWORDS**: Personality, Traits, STEM,



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## INTRODUCTION

The female folks are associated with lots of varieties, creativities, beauties; by this they draw a lot of attention to themselves. The girl child have indeed excelled in different areas of life endeavors; they have distinguished themselves in academics, basically in education and humanities but not so much in Science, Technology, Engineering, and Mathematics (STEM). According to the National Science Foundation (NSF, Science and Engineering Indicators, 2016), women remain underrepresented in the STEM workforce, though with a recent staggering increase in engineering, computer science and physical sciences. But this is not the case with biology, agriculture, social and environmental life science as a reasonable increase of female students are noticeable in this area. STEM covers four specific disciplines – science, technology, engineering and mathematics. Rather than teach the four disciplines as separate and discrete subjects, STEM integrates them into a cohesive learning paradigm based on real-world applications.

According to Midrack (2017), STEM is a global movement in education geared towards increasing students' interest in pursuing higher education and careers in science engineering, computer science and physical science. STEM employs a better model of blended learning and hands- on learning activities, which aims to provide students with the opportunity to experience different ways of learning and problem solving. The generative economic power and social influence of STEM has made the production of a capable science and engineering workforce a priority among business and policy leaders. STEM by principles is meant to be progressive. There has been a relative paradigm shift towards gender equality in STEM. Males have dominated STEM for decades, and for the female to tread in the realm of STEM, they need to brace up, know their abilities and capacities, be in touch with their talents and reach out to break new grounds in STEM fields. Uwaegbulam (2017) perceives STEM as a term utilized to collectively refer to a group of subjects, which has to do with applying logic and theories in innovative and creative ways. The girl child should be given ample opportunities to showcase their abilities and talents, and not restricted to certain roles emulating from traditional, religious and cultural perspectives. Again Uwaegbulam (2017) affirms that before girls attain the point in their life, where they choose to pursue a career in the STEM industry, they must first benefit from the fundamental knowledge acquired during primary and secondary education. Danya (2017) contended that there is no evidence that girls are less capable in STEM rather they often feel incapable partly due to stereotyping form of education in the primary and secondary schools. Danya further asserted that the poor representation of females in STEM may affect female role models for future female students.

According to Atkins (2013), scientific careers are still largely perceived as masculine, and even women who work in the sector believe that engineering is seen as a male career, as it seems more of construction, and heavy machinery. This could be the reason why a large number of females preferred the medical profession to STEM (NGC, 2013), because it is seen as a more caring and nurturing profession (Aspires, 2013). These ideas are working against efforts to achieve gender equality in the sciences. The damaging stereotypes system in the primary and secondary schools have also influenced the subject choice at school, with STEM subjects seen as boys' subjects despite girls' higher attainment in them. Evidence has also shown that female students who are actually doing well in STEM subjects, often feel that the subjects are for the male folks (ASPIRES, 2013). According to Akinsowon and Osisanwo (2014), people have the conception that women in STEM careers are not as good as their male counterparts, except they are extremely and outstandingly good on the jobs. This again puts the female at a cross


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road as her likability tends to diminish because both likability and competence are needed for success in the workplace. They further opined that boys show more interest in sciences than girls, and that the latter are experiencing a sharp decrease in interest in science.

Also Meador (2020) reported that personality traits of an individual have a great impact on the kind of career choice made by that individual. Personality traits are a combination of characteristics that are innate to people as well as characteristics that develop from specific life experiences. The personality traits that make up a person go a long way in determining how successful he/she is. Meador contended that there are certain personality traits that help teachers and students succeed and that success may mean different things to different people. Meador, therefore outlined the following as some of the personalities that help students to succeed in their academic pursuit.

**Flexibility:** when an individual is able to cope with changes and reflect on situations in a creative way. He or she sees the issue either way**.**

**Self esteem:** this simply indicates a disposition which a person possesses and which represents his/her judgment of his/her own values.

**Enterprising**: this personality trait likes to lead and persuade people, but carefully avoid activities that require careful observation and scientific, and analytic thinking.

**Team spirit:** this type enables that individual to work in one accord with another person. Putting together teams that function well and persistently achieve set goals.

Stress tolerance: a person's ability to provide quick serial answers to continuously challenging issues.

**Intuitiveness:** This is the ability to understand something without reason simply through instinct. Intuitive students can sense when a friend or a teacher is having a bad day and can try and improve the situation.

**Resourcefulness**: This is the ability to make the most of what you have available to solve a problem or make it through a situation. Students who have this trait can take the tools they have been given and make the most out of their ability.

Some of these listed personality traits were examined in this study. Also schools around the world are classified based on school ownership (private/ public schools). In Nigeria, public schools are further classified into state government schools and federal government schools. There is also the gender based classification (single sex or gender-segregated schools/co-educational or mixed schools). Independent School Parents (2015) stated that women who were educated at single – sexed schools were compromised at the workplace as their ability to co-operate with men was inhibited and that such girls show less kindness than girls from co-educational schools. Malik (2013), in his study discovered that girls from single – sex school scored higher in personality characteristic "emotional stability". They were less tense/frustrated and were more "socially bold" than those from co-educational schools.


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Meanwhile, STEM education has increased the proficiency of students who pursue a STEM career in advanced studies. This is because STEM occupations remain influential in economic growth and innovation. According to Ndinenchi and Okafor (2016), STEM education in Nigeria will serve as a veritable tool for sustainable national capacity building starting from the elementary to tertiary levels. On his part, Waldren (2017) highlighted the benefit of STEM as follows: helps one stay current; it allows one to be innovative and creative. In spite of these benefits it has been observed that there has been a gap in the male /female workforce in the STEM in many parts of the world including Nigeria due to some identified factors which include lack of genuine interest in engineering by female students, intellectual and physical abilities, parental influence, peer pressure, employers attitude and employment conditions, and government laws, regulations and specific personality type (Matope and Makotose, 2007). This study examined some identified personality traits as it affects secondary school girl aspiration to STEM careers

**Rationale for the Study**

A lot of studies have shown that women and girls have been sidelined and discouraged both intentionally and unintentionally from the STEM field by teachers, parents, employers and the society at large. This has led to a huge gender gap in some STEM disciplines, such as engineering, mathematics, physics and technological fields. Though lots of studies have been done on the factors influencing female participation in STEM. However, not so much has been done on the personality trait of the female as determinant of female participation in STEM in Benin Metropolis of Edo State Nigeria.

This study highlights some personal characteristics such as age, course of interest as well as some personality traits such as flexibility, self-esteem, enterprising, team spirit, social, stress tolerance, neuroticism and curiosity of secondary school girls aspiring to STEM careers in the Benin metropolis of Edo State. Specifically, the paper seeks to:

1. Find out if age and course of interest influences girls aspiring to STEM careers
2. Examine the personality traits exhibited by girls aspiring to STEM careers
3. Determine if there is a significant difference in personality traits exhibited by girls aspiring to STEM careers based on school ownership
4. Determine if personality traits are good predictors of girls aspiring to STEM careers.

The study will be beneficial to the government, parents and even students as it will reveal the personality types and interest of secondary school girls aspiring to STEM careers. It will also reveal the influence of social background, school type and ownership on secondary school girls aspiring to STEM careers.

**Research Questions**

1. Does age and course of interest influence girls aspiring to STEM careers?
2. What are the personality traits exhibited by girls aspiring to STEM careers?


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3. Is there a significant difference in personality traits exhibited by girls aspiring to STEM careers based on school ownership?

4. Are personality traits good predictors of girls aspiring to STEM careers?

Research questions 1 and 2 were answered, while 3 and 4 were hypothesized.

**Hypotheses**

1. There is no significant difference in personality traits exhibited by girls aspiring to STEM careers based on school ownership

2. Personality traits are significant predictors of girls aspiring to STEM careers.

## METHODOLOGY

This study is a descriptive survey with a correlational design. The population of the study consisted of senior secondary school girls in sciences selected from federal, state and private schools in Benin metropolis. Benin comprises five local government areas, which are Oredo, Egor, Ikpoba-Okha, Ovia North-East and Uhunmwonde local government areas. Five hundred (500) female students formed the sample for the study. The population was stratified into Federal, State and private owned schools. This was further stratified into private mixed schools, state mixed schools, private girls and state girls' schools. The simple random sampling (using random numbers) was used to select the females from the sample schools. 55 respondents were selected from the private mixed schools, 126 from the state owned schools, 74 from private girls schools, 113 from state girls schools and 132 from Federal girls schools.

The instrument for the study was a structured questionnaire consisting of two parts: section A consisted of the social demographic data of the respondents such as age, class, STEM courses of interest, academic qualification of parents, etc. Section B consists of 56 items using a four point Likert scale of strongly agree, agree, disagree and strongly disagree. The face and content validity were employed by three experts in the field of science and engineering to validate the instrument. The Cronbach reliability statistics was used to ascertain the reliability of the instrument. It gave a reliability index of 0.87.

The data were analyzed using frequency counts, mean, standard deviation and chi-square for the research questions. A mean criterion value of 2.50 which is the arithmetic mean of the weights assigned to the four point Likert scale was used as acceptance. The hypotheses were tested using the Analysis of variance (ANOVA) and the multiple regression. All the hypotheses were tested at 0.05 level of significance.


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## RESULTS

### Research question 1: Does age and course of interest influence girls aspiring to STEM careers?

**Table 1: Influence of age and course of study on girls aspiring to STEM careers**

| Personal Characteristics | Responses | | | | $\chi^2$ | p-value |
|---|---|---|---|---|---|---|
| **Age** | **Strongly Agree** | **Agree** | **Disagree** | **Strongly disagree** | | |
| < 15 years | 70 (35.5) | 70(35.5) | 30(15.2) | 27(13.7) | 14.217 | 0.027* |
| 15 – 18 years | 90(31.7) | 113(39.8) | 42(14.8) | 39(13.7) | | |
| >18 years | 02(10.5) | 07(36.8) | 02(10.5) | 08(42.1) | | |
| Total | 162(32.4) | 190(38.0) | 74(14.8) | 74(14.8) | | |
| Course of interest | | | | | | |
| Biological /environmental sciences | 220(41.6) | 267(50.5) | 18(3.4) | 2(5.9) | 44.208 | 0.000* |
| Physical sciences | 07(20.6) | 17(50.0) | 08(23.5) | 02(5.9) | | |
| Engineering | 03(18.8) | 10(62.5) | 02(12.5) | 01(6.2) | | |
| Mathematics | 00(0.0) | 08(72.7) | 01(9.1) | 02(18.2) | | |
| Total | 230(39.0) | 302(51.2) | 29(4.9) | 29(4.9) | | |

**Significant*

Table 1 shows that the majority of the respondents sampled were between 15 and 18 years of age. It further revealed that 32.4%, 38.0%, 14.4% of those sampled strongly agree, agree, disagree and strongly disagree that age had influence on girls aspiring to STEM careers. The chi-square value of 14.217 and p value of 0.027 indicated that age of girls has a significant influence on their aspiring to STEM careers. Another revelation from table 1 is that, the major course of interest of girls aspiring to STEM careers is biological/environmental sciences. The chi-square value of 44.208 and p value of 0.000 indicated that the course of interest of girls has a significant influence on girls aspiring to STEM careers.

### Research question 2: What are the personality traits exhibited by girls aspiring to STEM careers?

**Table 2: Descriptive statistics of the personality traits exhibited by girls aspiring to STEM careers**

| Personality traits | Mean | Standard deviation | Ranking |
|---|---|---|---|
| Flexibility | 2.79 | 0.48 | 5 |
| Self-esteem | 3.32 | 0.10 | 1 |
| Enterprising | 2.80 | 0.36 | 4 |
| Team spirit | 3.00 | 0.32 | 2 |
| Social | 2.54 | 0.50 | 7 |
| Stress tolerance | 2.68 | 0.45 | 6 |
| Neuroticism | 2.38 | 0.58 | 8 |
| Curiosity | 2.86 | 0.10 | 3 |


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Table 2 revealed that personality traits exhibited by girls aspiring to STEM careers are flexibility, self-esteem, enterprising, team spirit, social, stress and tolerance. However, neuroticism was not exhibited by them. Self-esteem was the most highly exhibited trait while sociality was the least.

**Hypothesis 1: There is no significant difference in personality traits exhibited by girls aspiring to STEM careers based on school ownership**

**Table 3: Mean and standard deviation of personality traits exhibited by girls aspiring to STEM careers based on school ownership**

| Schools | N | Mean | Std. Deviation |
|---|---|---|---|
| Federal girls school | 132 | 141.76 | 17.215 |
| State girls school | 113 | 143.51 | 15.110 |
| Private girls school | 74 | 146.94 | 16.883 |
| State girls mixed school | 126 | 147.82 | 16.781 |
| Private girls mixed school | 55 | 139.27 | 16.552 |
| Total | 245 | 143.64 | 16.516 |

Table 3 shows the mean and standard deviation of personality traits exhibited by girls aspiring to STEM careers as 141.76 and 17.22; 143 and 15.11; 146.94 and 16.88; 147.82 and 16.78 and 139.27 and 16.52 for Federal girls school, State girls school, Private girls school, State girls mixed school and Private girls mixed school.

**Table 4: Analysis of Variance (ANOVA) of the personality traits exhibited by girls aspiring to STEM careers based on school ownership**

| | Sum of Squares | df | Mean Square | F | Sig. | Remark |
|---|---|---|---|---|---|---|
| Between Groups | 1920.140 | 4 | 480.035 | 1.782 | .133 | Not significant |
| Within Groups | 64636.252 | 240 | 269.318 | | | |
| Total | 66556.392 | 244 | | | | |

Table 4 shows an F value of 1.782 and a p value of 0.113, this indicates that there is no significant difference in personality traits exhibited by girls aspiring to STEM careers based on school ownership ($p > 0.05$).


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**Hypothesis 2: Personality traits is not significant predictor of girls aspiring to STEM careers**

**Table 5: ANOVA**

| Model | | Sum of Squares | df | Mean Square | F | Sig. | Remark |
|---|---|---|---|---|---|---|---|
| 1 | Regression | 2898.180 | 8 | 362.273 | 48.697 | .000 | Significant |
| | Residual | 1718.470 | 231 | 7.439 | | | |
| | Total | 4616.650 | 239 | | | | |

**$R = 0.792$; $R^2 = 0.628$; Adjusted $R^2 = 0.615$**

Table 5 shows an F value of 48.70 and a p value of 0.000. This implies that personality traits are a significant predictor of girls aspiring to STEM careers. The $R^2 = 0.628$ implies that personality traits accounted for about 62.8% of girls aspiring to STEM careers.

Table 6 shows the Beta and p values as: 0.207 and 0.000; 0.302 and 0.000; -0.221and 0.000; 2.621 and 0.009; and 0.698 and 0.000 for flexibility, self-esteem, enterprising, team spirit, and curiosity. This implies that flexibility, self-esteem, enterprising, team spirit, and curiosity significantly impact on girls aspiring to STEM careers. However, social, stress tolerance and neuroticism did not impact significantly on girls aspiring to STEM careers ($p>0.05$).

The R-partial and part gives us a glimpse of the relative importance of the predictors. Flexibility provided significant part and partial correction (R – part = 0.149; R – partial = 0.237; $p< 0.000$). Self-esteem provided a significant part and partial correction (R – part = 0.195; R – partial = 0.304; $p< 0.000$). Enterprising provided significant part and partial correction (R – part = -0.206; R – partial = -0.320; $p< 0.000$). Team spirit provided significant part and partial correction (R – part = 0.105; R – partial = 0.170; $p< 0.009$). Curiosity provided significant part and partial correction (R – part = 0.618; R – partial = -0.712; $p< 0.000$). However, social media did not provide any significant part and partial correlation as the probability for R – part and R – partial is $p> 0.545$. Also, stress tolerance did not provide any significant part and partial correlation as the probability for R – part and R – partial is $p> 0.769$. And neuroticism did not provide any significant part and partial correlation as the probability for R – part and R – partial is $p> 0.504$.


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**Table 6: Coefficients**

| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Correlation | | | Collinearity statistics | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | Std. Error | Beta | | | Zero-order | Partial | Part | Tolerance | VIF |
| (Constant) | 2.494 | 1.875 | | 1.330 | 0.185 | | | | | |
| Flexibility | 0.235 | 0.064 | 0.207 | 3.704 | 0.000 | 0.331 | 0.237 | 0.149 | 0.516 | 1.937 |
| Self-esteem | 0.260 | 0.054 | 0.302 | 4.849 | 0.000 | 0.304 | 0.304 | 0.195 | 0.417 | 2.400 |
| Enterprise | -0.214 | 0.042 | -0.221 | -5.126 | 0.000 | -0.103 | -0.320 | -0.206 | 0.868 | 1.152 |
| Team spirit | 0.117 | 0.044 | 0.135 | 2.621 | 0.009 | 0.302 | 0.170 | 0.105 | 0.611 | 1.638 |
| Social | -0.025 | 0.041 | -0.025 | -0.607 | 0.545 | 0.123 | -0.040 | -0.024 | 0.914 | 1.094 |
| Stress tolerance | 0.022 | 0.074 | 0.018 | 0.294 | 0.769 | 0.073 | 0.019 | 0.012 | 0.429 | 2.333 |
| Neuroticism | -0.047 | 0.070 | -0.039 | -0.669 | 0.504 | 0.101 | -0.044 | -0.027 | 0.472 | 2.117 |
| Curiosity | 0.264 | 0.063 | 0.698 | 5.394 | 0.000 | 0.587 | 0.712 | 0.618 | 0.784 | 1.276 |

## DISCUSSION

The study reveals that age and course of interest have a significant influence on girls aspiring to STEM careers. Also, those between 15 and 18 years of age aspire more to STEM than other age levels. This is in collaboration with Archer (2013), who opined that ASPIRES survey of 10- 13 years old found that 80% agreed with the statement "scientists are brains". Also Atkins (2013) asserted that potential students were being put off by the idea that engineering is "too difficult". In the same vein, Atkins (2013), stated that scientific careers are still largely perceived as masculine, and women who work in the sector believe that engineering is seen as a male career, associated with cars, construction, and heavy machinery. The study also revealed that girls who aspire to STEM careers, preferred courses in biological/ environmental sciences to other courses. This is in tandem with NGC (2013) who observed that a far greater number of women have entered the medical profession in the past four decades, to the point where women now outnumber men at medical school. And ASPIRES (2013) contended that though medicine requires science A- levels, medicine is perceived as a normal or desirable choice for women, because it is seen as a caring or nurturing profession consistent with prevailing attitudes about women. This has made more girls tend towards biological/environmental sciences.

With regards to the personality traits exhibited by girls aspiring to STEM, the study revealed that flexibility, self-esteem, enterprising, team spirit, social, and stress tolerance were exhibited by them. However, neuroticism was not exhibited. Self-esteem was the most highly exhibited trait while sociality was the least. This is in tandem with Meador (2020) who stated that personality traits are a combination of characteristics that are innate to people as well as characteristics that develop from specific life experiences. Also, Fairley (2015) Stress tolerance - the ability to feel (or appear) comfortable in a high pressure environment is one key personality trait of high performing women.


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The study also revealed that there is no significant difference in the exhibition of personality traits by girls aspiring to STEM careers based on ownership of school. The study however, disagreed with Malik (2013), who asserted that girls from single – sexed schools scored higher in personality characteristic "emotional stability". They were less tense/frustrated and were more "socially bold" than those from co-educational schools. Also, Independent School Parents (2015) stated that women who were educated at single – sexed schools were compromised at the workplace as their ability to co-operate with men was inhibited and that such girls show less kindness than girls from co-educational schools.

The study further revealed that personality traits (flexibility, self-esteem, enterprising, team spirit, social, stress tolerance, neuroticism and curiosity) is a significant predictor of girls aspiring to STEM careers. flexibility, self-esteem, enterprising, team spirit, and curiosity significantly had an impact on girls aspiring to STEM careers. However, social, stress tolerance and neuroticism did not impact significantly on girls aspiring to STEM.

## CONCLUSION

The study revealed that the personality identified affects the single sex and mixed schools in about the same way. This implies that school type does not affect the personality traits of the girls much. Therefore, all secondary school girls have fairly equal chances of excelling in STEM careers. Hence if these characteristics are understood by girls they can pick up interest, pursue and remain in the STEM path.

## RECOMMENDATION

Based on the findings of the study, it was recommended that:

1. Parents, teachers and all stakeholders in education should be enlightened on participation of girls in STEM.
2. Students should be properly enlightened on STEM careers and the careers pathway.
3. Gender discrimination by employers should be discouraged
4. Secondary school students especially females should be encouraged to develop STEM competencies and disabuse their minds from the fear of some STEM subjects.

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