Career Interest and Gender as Correlates of Performance in Physics and Mathematics

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Abstract- Science education provide the knowledge required for building and operation of systems and infrastructures upon which modern development is based. The emphasis on science education is more important in a developing country like Nigeria where the need for growth requires an accelerated process of knowledge build- up. One of the constraints on this process is the gender gap in performance in science subjects across the country. The view that females are disadvantaged and face a lot of barriers when it comes to education have cogent realities in Nigeria. In providing information that could serve as objective input for promoting policies that address this gap, this study attempts to study career Interest and gender as correlates of performance in physics and mathematics in colleges of education. Data was obtained using a survey and from the course scores of mathematics/physics students. The analysis revealed that females have a mean performance score of 54.4% while males have 66.1%. The analysis also showed that females are more likely to make less challenging career choices with implications on performance. This study recommends promotion of policies that ensure gender equality in education

Keywords- Career Interest, Gender, Gender Equality

I. INTRODUCTION

Physics and mathematics with biology and chemistry form the core of the science curricula in Nigeria. According to Awoniyi (2004), physics and mathematics also have the distinctness of being linked with a high level of difficulty because of their abstract nature. This abstract nature coupled with poor pedagogies and the inadequate use of ICT in teaching the subjects has being cited as one of the reasons why academic performance in these subjects has being on the drop in recent years. While there is a demonstrated link between various constraints imposed by the Nigerian educational system, there is a widespread speculation that career interest and the gender of students also determine their performance in physics and mathematics. Although the assertion that male students perform better in absolute terms in physics and mathematics can be traced to the fact that there is a general under-representation of females in the Nigerian educational system, the convention lingers that performance in these two subjects is easily determined by the gender of the student (Bamidele, 2004). For example, Awoniyi (2004) stressed that respondents in the South West of Nigeria generally believe that male students perform better than female students in any course with vast mathematical and computational domains.

Gender, defined as a distinguishing element of organisms based on the reproductive roles have being considered in various dimensions as imparting on academic performance (Abubakar and Uboh, 2010). A major dimension of the gender- based discrepancy in performance relates to the access to educational facilities. Ajayi and Muraina (2011) also expressed that in some parts of the world (sub Saharan Africa and Asia), the perception that females should be passive members of the society remain deeply entrenched. One of the more consequential arenas in which these perceptions manifest is the field of education. In some cases, the view that gender is a significant determinant of academic performance, especially in science and mathematics is more prevalent because of the socialization patterns in the society which tend to favour the male child over the female one (Abdullahi et al, 2007). Okafor and Okoye (2004) expressed that differences in expectations from male and female students derive from the socialization patterns in Nigeria which tend to place enormous restrictions on the female gender and demand from her a higher input of daily domestic labour than from the male. Another dimension of the gender- based discrepancies in performance has being traced to gender- based differences in attitude. According to a survey by Raimi and Adeoye (2002), gender differences exist between male and female college of education students' performance in biology, chemistry and integrated science because of differences in attitudes in favour of the male and the belief that such attitude results in better cognitive achievements.

There is also strong evidence that there are differences in the self- efficacy beliefs of male and female students and these have important implications on academic achievement especially in science, mathematics and technology subjects. Fouad and Smith (1996) asserted that gender differences in self- efficacy beliefs are often not apparent at the primary and secondary levels of education but become apparent at the tertiary levels. Gender differences for learning experiences were observed by Williams and Subich (2006) who reported that women in their study reported higher learning experiences and higher self-efficacy beliefs within the traditional social domain; whereas the men in the same study reported that they had better learning experiences and higher self-efficacy within the traditionally male domains of science and mathematics. Olosunde and Olaleye (2009) and Abubakar and Uboh (2010) also conjectured that female students studying science subjects have higher science self- efficacy than those who are studying non- science subjects. The gender differences in the performance of students in science subjects is also linked to

the assertion that the stronger the perceived connection between an activity and gender is, the more likely it is to encounter self-efficacy differences between males and females for that particular activity.

The importance of career choice on students' performance in science and education cannot be over- emphasized. Udegbe (2009) also emphasized that career choice when made deliberately often signals the interest of a student in a particular domain and can trigger an increase in aptitude in such domain. The deliberate choice of career provides information to the students on the subjects that should be concentrated on and the degree of efficacy that must be reached if career goals must be achieved. According to Hackett (1995), the link between career interest and performance in the science subjects is aptly demonstrated in the concept of self- efficacy. Fouad and Smith (1996) also demonstrated that the choice of careers coupled with genuine interest leads to the development of self- efficacy beliefs and compatible actions among students. However one of the major constraints in making an empirical attempt at studying the link between career interest and performance in science subjects is that career choices are indeterminate. The studies that have attempted to uncover this relationship have made use of either a determinate list of careers or other approximations.

In some cases, career interests stem from the natural aptitude of the student and this directs him or her to subjects in which the combination of interest and aptitude leads to high performance. Williams and Subich (2006) asserted that career interests can also play a significant role in determining the kind of support that a student have access to and this also determines performance levels. In academically supportive environments, career interests often signals the need for help from parents, teachers, advisors, and peers who work with the student concerned in developing and nurturing the aptitude necessary for high performance.

Taken together, career interests and gender play a significant role in determining performance in science subjects. It is however disheartening that unlike what obtains in the developed countries of North America, Europe, Australia and Asia, the educational systems of most developing and under-developed countries especially those in the sub Saharan Africa do not consider the career interest or aptitude of students and gender in the design and implementation of educational policies (Olosunde and Olaleye, 2009; Udegbe, 2009). This has led to various initiatives by global organizations such as UNESCO and the World Bank aimed at providing assistance to governments in developing policies that in the long run would help in bridging educational achievement gaps.

II. The impact of career interest and gender on performance of students in physics and mathematics in Nigeria

It is important to note that outside the educational setting, gender discrimination in terms of employment opportunities have being linked to gender inequality in the pursuit of science, technology and mathematics education (Okafor and Okoye, 2004). In another study, Abdullahi et al (2007) contended that the disparities in terms of achievement in science and mathematics between male and female students have also fuelled the society wide perception that females are more suitable for occupations that are not based on logic and computational ability which science and mathematics often require.Abubakar (2010) noted that there are gaps in the performance of male and female students in physics because of gender differences that are conjectured to exist in the vocational aspirations and expectations. Abubakar and Uboh (2010) expressed that the gender based differences in self-efficacy provides the basis for explaining gaps in the enrolment levels of female students in mathematics related courses.

The gender discrimination against females in Nigeria have over the years served as a barrier to academic development and achievement. In Nigeria, cultural beliefs revolve around the paradigm that females are not necessarily intelligent as males despite empirical evidence to the contrary. Abubakar (2010) asserted that this perception is evident in the fact that females have the lowest enrolment percentage as compared with males, are more likely to stop schooling due to the household's financial constraints, are more likely to get married and start a family early which effectively disrupts their education and also have more propensity to be subjected to traumas like trafficking, child labour and prostitution which in the long run impairs their ability to compete academically.

Ajayi and Muraina (2011) also noted that the Nigerian academic environment is structurally biased against women. The authors noted that while the developed countries of the world have policies in place that affirmatively support female education, no such effective policies are available in Nigeria and where they are available, their implementation is flawed. This has led to the creation of an environment where females have to tackle social, cultural and systemic barriers while also exposed to negative encounters with teachers, advisors, and peers. Seymour and Hewitt (1997) noted that this lack of support and negative encounters together form a strong reason why female students opt of science subjects sooner than male students even when such male students have comparable or lower levels of performance.

In terms of career decisions, various studies suggest that while career interests can determine academic performance, there is also a nexus between gender, career interest and academic performance in science subjects. Owolabi and Etuk- bien (2009) noted that women are more likely than men to consider the needs of others while making their vocational decisions. This relative lack of freedom I making career choices impacts significantly on academic performance because most times there will not be a congruence between natural aptitude and interests and career choice. Women are also more likely to consult with others on matters of career indecision and make choices dependent on their roles in the family. Therefore, the quality and direction of the feedback they receive from the individuals in their environment could prove to be a barrier to their self-efficacy beliefs and consequently, their career choice.

In Nigeria, despite continuous efforts towards gender equality, the trend remains that there are gaps in academic achievement between male and female students. Amuda and Ali (2018) have emphasized the prevalence of this trend in colleges of education in Nigeria. When the factors leading to the gender-based gaps in performance are not arrested, the stage is being set for significant loss of a potential manpower base which the country needs. This is especially cogent in the colleges of education which still provide a larger percentage of the teachers upon whom the transmission of knowledge depends. Based on the above discussion, it is therefore important to determine the correlation between career interest and gender and the performance of students in physics and mathematics.

III. PURPOSE OF THE STUDY

A number of studies have being conducted to examine the underlying determinants of performance in science and mathematics with different findings. Such factors have ranged from attitude (Amuda and Ali, 2018), the modalities of school entry (Udegbe, 2009), variances in teaching methods (Abdullahi et al, 2007), scoio- economic status (Ajayi and Muraina, 2011). This study will however take the view that a possibility of relationship exists between career interest and gender and students' performance in mathematics and physics. This study seeks to assess the extent of this relationship and also the extent of the contribution of gender and career choice to the performance of students' in mathematics and physics in selected colleges of education. The following are the objectives of the study;

1. To examine the relationship between career choice and the performance of students' in mathematics and physics in the selected college of education.
2. To examine the correlation between gender and the performance of students' in mathematics and physics in the selected college of education.

IV. RESEARCH QUESTIONS

Based on the objectives identified in the previous section, this study will be guided by the following research questions;

1. What is the relationship between career choice and the performance of students' in mathematics and physics in the selected college of education?
2. What is the correlation between gender and the performance of students' in mathematics and physicsin the selected college of education?

V. MATERIALS AND METHODS

This study adopted a quantitative research methodology in accomplishing the purpose and objectives identified. A survey and a correlational design were utilized in eliciting data. The study used both primary and secondary data. According to Jen (2002), survey design is the process of documenting the scope, relationship, nature, directions and dimensions of events, behaviour, interest and attitudes about a person or a thing. The survey collected information using a well- designed questionnaire. The population considered for the study were the second year mathematics (with physics option) students at the Federal College of Education, Oyo, Nigeria. The choice of this population as respondents of the questionnaire was their relevance in providing demographic information and data on career choice. Information on the scores of students in four physics courses and four mathematics courses were obtained from the science department after due authorization from the school authority.

A convenience sampling was used in selecting the respondents for the study. The sample consisted of the first 150 (99 males and 51 females) students on the class list. The choice of convenience sampling was rationalised by the need to provide a streamlined method for correlating data elicited from the questionnaires with the scores of respondents in physics and mathematics. The analysis of data and the testing of hypotheses were encapsulated within the larger framework of correlational design. According to Colman (2009), correlational design is a non-experimental type of research design, without manipulations of an independent variable or control of extraneous variables, in which patterns of correlations between two or more variables are analysed. In the case of this study correlation study will help in demonstrating whether a relationship exists between career choice and gender and performance of students in mathematics and physics. Demographic information, gender, career choice and performance scores will be analysed using descriptive statistics. The relationship between career choices will also be examined using frequency counts and percentages for comparison, the same method will be applied for gender.

A component score consisting of the mean of the student's total scores in the eight (8) courses considered (four courses each in physics and mathematics) was used to signify the performance of the student in physics and mathematics and used as a basis for correlation. Data on career choice and gender were obtained from the questionnaire. For the purpose of this study and in order to approximate students' choices to fit into a manageable dataset for career, a schematic was designed which grouped career interests based on how courses are classified in Nigerian tertiary institutions; Teaching/ Education, Basic Science (Mathematics, Physics, Statistics), Applied Sciences (Biochemistry, Industrial Chemistry, Industrial Physics), Medical Science (Science Laboratory Technology, Physiology), Engineering & Technology (Civil, Electronic, Electrical, Mechanical, Industrial Engineering).

Findings and Discussions of Findings

The findings reported in this section are derived from a descriptive analysis of data collected from the field survey and using the scores obtained from the science department for physics and mathematics. From the analysis of the data collected, there are a total of 150 participants in the study. Of these, there were 99 males (66%) and 51 females (34%). This statistic confirms earlier assertions by Udegbe (2009) Abdullahi et al (2007), and Amuda and Ali (2018) that there are marked gender disparities in the enrolment of students into the science departments of colleges of education in Nigeria. Analysis of the data also revealed that out of the 51 females, 31 (or about 61%) of them are aged between 30 and 39 years.

This signified that most of these women entered school at a very late age and are naturally at a disadvantage compared to males who have a mean entry age of 22.9 years.

This also confirms contemporary claims that females face significant barriers in terms of schooling in sub Saharan Africa. The analysis of data obtained from the survey also showed that an over- whelming 51% of females express preference for a career in teaching/ education as against just 9% for males. The survey also revealed that 34%, 31% and 22% of males want a career in engineering and technology, applied sciences and medical sciences respectively. This confirmed that even though both groups are in the same class and being taught the same subject modules, male students are characteristically more ambitious than female students who prefer a career that would allow them to take care of their family. This aligns with the findings of Raimi and Adeoye (2002) who expressed that a significant proportion of females go to colleges of education attend such schools in order to have a certification that would allow them to teach in schools and thus pursue a career that allows them to have time for their family. From the survey, only 12%, 9% and 11% of female students expressed interest in medical sciences, engineering and technology and applied sciences respectively.

The first research objective is to examine the relationship between career choice and the performance of students' in mathematics and physics in selected college of education. From the results of the survey, students whose career choices are applied sciences, engineering and technology and medical sciences have higher performance scores in physics and mathematics compared to students who chose a career in teaching/education or basic sciences. The overall mean performance score for the class was 52.9%. Students whose choice was engineering and technology had a mean performance score of 79.7% which is significantly greater than the average class score. Students whose career choice were for medical sciences and applied sciences had mean performance scores of 72.1% and 68.7% respectively. The implication of this is that the choice of career have an important relationship with performance in science subjects. As noted by Seymour and Hewitt (1997), this could be as a result of the fact that students who make these choices have an aptitude for science and as such have greater interest with the consequence of higher performance.

The second research objective is to examine the correlation between gender and the performance of students' in mathematics and physics in the selected college of education. This was also done using descriptive statistics. As stated earlier, of the 150 respondents, 51 are females. An analysis of the scores of these group showed that they had a mean performance score of 54.4%. On the other hand, the 99 males in the class (signifying 66% of total population) had a mean performance score of 66.1%, giving an absolute percentage difference of 11.7%. A frequency ranking of the scores obtained also showed that no female is in the first percentile based on performance. It is evident from these analyses that there are gaps between male and female students in terms of performance. While tangential to the objectives of this study, analyses have also revealed that females tend to make less challenging career choices and this, as demonstrated also have implications on performance. As shown above, less challenging career choices (teaching/ education and basic science fields) predisposed students to lower performance. A number of explanations have being offered for this trend, nevertheless what is evident is that females display lower performances in science subjects (in this case physics and mathematics) and the gender differences in performance is in fact significant.

In summary, the findings of the study point to the fact that the gaps in performance between male and female students are getting wider and would have implications for national growth and development in terms of the availability of manpower. Social stereotypes that consign females to less challenging career choices are detrimental to the country's quest towards gender equality and the benefits associated with it. The study have also shown that there are discrepancies in performance based on the career choice of students, with female students shown to have a tendency towards a choice of less-challenging career choices. In order to close this gap, it is important to promulgate educational policies that will have as their basis gender equality. It is only by achieving this that the gaps in performance can be closed.

VI. STUDY LIMITATIONS

The limitation of this study is based on the fact that the sample comprises students from just two colleges of education in Nigeria and as such generalizing the results of the study will be constrained by other local factors. There is therefore a need to carry out similar studies in other institutions in order to establish a refuting or an affirmative conformation. The study also recognizes the fact that there is a low level of bias as the data used in analysis was collected independently of the subjects of the study. It is however important to note that performance is subject to a number of different factors and that the effect of gender and career choice is not absolute or carrying more weight than these other factors.

VII. CONCLUSIONS AND RECOMMENDATIONS

The findings of the study point to the fact that there is a significant relationship between gender and academic performance of students' in mathematics and physics in selected colleges of education. Male students have being shown to perform better in physics and mathematics. This is in line with conventional view, nevertheless it is important to note that gender inequality is detrimental to any educational system and this is all the more important in a country like Nigeria where the female child has being historically discriminated against. Career choice category also showed a weak correlation with the students' performance in mathematics and physics. This might due to the fact that students are not entirely sure in their choice of careers which considering the economic situation of the country often changes over time and as such does not form an important

consideration on the choice of effective study among students. The relationships uncovered in this study have a number of policy implications and the following recommendations are based on them;

1. The realization that gaps in performance between male and female students are often triggered by social expectations and constraints which culminates in the under- enrolment and late enrolment of female students necessitates the development of effective policies that would stress gender equality in terms of access and duration of education.
2. There is a need to institute policies on the provision of extra- support to female students, especially those in the science, technology and mathematics fields. Such policies are important in remedying the wide gap in performance that already exists between male and female students. While, the institution of gender equality informed policies will eventually lead to a decline in the gap in the long run, the promotion of extra support for the female will serve to accelerate this process.
3. It is also important to train lecturers and other stakeholders in the educational sector to give equal opportunities to both male and female in participation and interaction in the classroom. Such reorientation is necessary in order to correct entrenched perceptions on the role of the female and her supposed level of participation in the classroom. Such reorientation is also crucial to the process of ensuring that any top- down policy or initiative on gender equality is effective to closing performance gaps.
4. Finally, there should be widespread awareness campaigns informed by coherent messages on female achievement and the importance of making early career decisions. Such campaign should be targeted at the parent, guardians and other key community stakeholders and should emphasize the need for education for females with examples of outstanding females in their field of endeavour.

VIII. REFERENCES

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Appendix

Career Interest and Gender as Correlates of Performance in Physics and Mathematics

Questionnaire

Dear valued respondent,

My name is..... . I am currently carrying out a study aimed at examining career interest and gender as correlates of performance in physics and mathematics. The following questionnaire will require a short while to complete. There is no compensation for responding nor is there any known risk. In order to ensure that all information will remain confidential, please do not include your name. If you choose to participate in this survey, please answer all questions as honestly as possible and return the completed questionnaires promptly via replying by returning the printed hard copy to the

researcher. Participation is strictly voluntary, and you may refuse to participate at any time.

Thank you.

Section A: Demographic Information (Kindly tick the appropriate block as it applies to you)

A1	**Gender**	Male ☐			Female ☐	
A2	**Age**	Under 20 years ☐	20-29 years☐	30-39 years ☐	40-49 years ☐	50 years and over ☐

Section B: Which of the following grouping best describes your career interest for the future Kindly tick the appropriate block as it applies to you.

Career Grouping		
1	Teaching/ Education	
2	Basic Science (Mathematics, Physics, Statistics)	
3	Applied Sciences (Biochemistry, Industrial Chemistry, Industrial Physics)	
4	Medical Science (Science Laboratory Technology, Physiology)	
5	Engineering& Technology (Civil, Electronic, Electrical, Mechanical, Industrial Engineering)	