



Students' Interest as a Predictor of Senior Secondary School Students' Academic Achievement in Radioactivity in Obollo-Afor Education Zone, Enugu State

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Abstract

This study investigated interest as a predictor of senior secondary school students' academic achievement in radioactivity in Obollo-Afor education zone, Enugu State. The study adopted the correlation survey research design. The population of the study comprised of 2167 physics students in 41 public schools in the 3 L.G.A in Obollo-Afor Education Zone. Sample size of 338 students was used with multi-stage sampling procedure. Two instruments used in this study are (SIPI) and (RAT)". Three experts validated the instrument. SIPI instrument reliability of 0.81 was established using Cronbach alpha while 0.77 for RAT using K-R20. Research questions were answered using correlation coefficient. Hypotheses one was tested using (ANOVA) regression, while hypotheses two was tested using Fisher's Z-test. The findings reviewed that student's interest significantly predict student's achievement in radioactivity. The predictive power of interest on achievement in radioactivity as moderated by gender is not significant.

Keyword: physics, radioactivity, interest, and motivation

Introduction

The state of secondary school students' academic achievement in physics particularly in the area of radioactivity is annoying. This is according to WAEC Chief examiner report from 2017 to 2019. Because the concept radioactivity is one of the main core area of physics. According to Ojediran, Oludipe and Ehindero (2018), Physics is one of the most prevailing science subjects taught at the secondary school level of education. Physics is one of the branches of science that describe how nature works using the language of mathematics. Izaak, (2019), defined physics as the study of matter and natural events, through empirical observations and quantitative measurement. Physics is a natural science that examines matter, energy, and interaction of matter (Darmaj, Astalini, Kurniawan, Perdana & Putra, 2019). In another definition, Kayode, Ogundokun Mohammed and Olorundare (2020) viewed physics as that aspect of science that deals with nature, properties of matter and energy. Physics can therefore be seen as a branch of physical sciences concerned with nature and properties of matter in relation to energy. With the knowledge of physics, an individual can actually make inquiry into the nature, and apply basic rules that help us to understand and predict the world around us.

Physics as an important subject contributes to technology, infrastructure and provides trained personnel the ample opportunity to take advantage of scientific advances and discoveries in the societies. Kaku (2021) stated that physics has contributed to huge success in technological advances and revolutions of knowledge that enabled scientists to find a simple way to carry out all daily life activities. Hence, the production of equipment, instrument and devices for scientific and technological activities centers on the knowledge of physics Izaak, (2019). Stressing on the importance of physics, Gana, Ugwuanyi and Ageda (2019) addressed that for speedy national development to take place, science and technology as well as the basic principles of physics is required. Physics deals with light, heat, mechanics, magnetism, electricity, the shape of atoms and sound. These concepts have application to our daily lives. Physics also helps students to develop critical skills for observation, accuracy, presentation, analysis, and creative thinking, which are essential for the study of other science related subjects (Ukoh, 2020; Elwan, Serage & Alwan, 2022). According to the Nigerian Educational Research and development council (NERDC 2009), the objectives of introducing physics as a subject in secondary school

include; provides basic literacy in Physics, acquire basic concepts and principles of Physics, acquire essential scientific skills and attitudes, Stimulate and enhance creativity.

To achieve these stated objectives, the senior secondary school physics curriculum incorporates various topics that could enable students to attain a higher academic achievement. NERDC(2009), asserted that topics that are can improving students achievement in physics includes; work energy, power, electric fields, magnetic fields, speed velocity and acceleration, projectile, waves, simple harmonic motion, radioactivity among others. However, this study resides more on radioactivity. Radioactivity is of interest because the West African Examination Council (WAEC) chief examiner's reports of 2019 and 2022 showed that radioactivity is one among the major areas of students' weaknesses. Hence, this poor academic achievement of students in physics particularly in the area radioactivity requires a remedy, because literature concerning students' academic achievement in radioactivity has nothing to write home about.

Radioactivity is described as the emission of radiation or particles through the spontaneous nuclear disintegration or transformation of the atomic nuclei of radioactive elements. Radioactivity is the phenomenon of the spontaneous disintegration of unstable atomic nuclei to form more energetically stable atomic nuclei (Arnould & Goriely, 2020). According to Abamba, Efe and Esiekpe (2021), radioactivity is the spontaneous decay or disintegration of unstable nuclei of the atom of an element by the emission of alpha (α -) particles, beta (β -) and gamma (γ -) radiation with the production of energy. Radioactivity is therefore seen as the process by which an unstable atomic nucleus loses energy by radiation and also by the disintegration of the atomic nuclei. Radioactivity is a phenomenon that occurs naturally in a number of substances. Atoms of the substance spontaneously emit invisible but energetic radiations, which can penetrate materials that are opaqueto visible light. The effects of these radiations could be harmful to living cells but, when properly used, they have a wide range of beneficial applications in life.

Knowledge obtained from radioactivity has contributed immensely to physics and sciences at large. Radioactivity is the foundation of many discipline and useful for everyday applications in energy, medicine, industry, arts, archaeology and research (Hardy & Towner, 2015; Kornakov, 2018; Butler, 2019). In medicine, radioisotopes have found extensive use in

diagnosis and therapy such that many diseases like cancer are cured by radio therapy. Educationally, López and Marco (2022) opined that the teaching of radioactivity is seen as a key ingredient for developing critical thinking skills in many secondary science education curricula. Considering the importance of physics and particularly the usefulness of radioactivity in various area of science, it is essential for senior secondary school students to achieve high in the subject physics especially in radioactivity.

Generally, achievement is something accomplished successfully, especially by means of effort, constant practice, skill, perseverance or task persistent. However, academic achievement can be defined as the measure of the degree of accomplishment in a specific field of study (Abakpa, 2021). According to Danjuma (2021), academic achievement is the measure of students' acquisition of some degrees of skills at the end of teaching and learning activities. Again, academic achievement is a way of showing whether learning which is refers to as the goal of education has taken place or not including the extent to which learning has taken place (Onukwufor & Ugwu, 2017). Academic achievement is therefore seen as the quantitative measure of learning outcome usually expressed as grade, scores, grade point, ranks andaverage. Danjuma (2021) and López and Marco (2022) pointed out factors that are likely to affect students' academic achievement in physics particularly in radioactivity to be task persistent, students' interest, location, gender and interest. Abakpa (2021), addressed that students academic achievement is majorly affected by interest. Hence, the place of interest in this study.

The term 'interest' usually refers to preference to engage in some type of activities rather than others. According to Danjuma (2015), interest is the attraction that compels anindividual to respond to a particular stimulus. In education, interest is, generally, student attention, greater concentration, pleasant feelings, and increased motivation to acquire knowledge (Mazer, 2021). In this study, interest can be seen as a tendency and high desire for learning. In a classroom situation, the learner will be attentive during a lesson only if the instruction is of interest to the learner. However, some authors like Olanrewaju and Oluyomi (2020) examined the influence of students' interest in physics and class size on students' academic achievement in physics, the result shows that a significantly positive relationship between students' interest in physics and their academic achievement. Again, Okafor (2020) worked on interest as a predictor of academic achievement of secondary

school students in physics in Anambra State, the result of his study shows that student interest predicts about 57% of academic achievement scores of secondary school students in physics. More also, O'Neill and McLoughlin (2019) examining students' interest in physics at second level in Ireland, the result shows that lower secondary level students' exhibit low interest in physics. While the upper level showed significant interest in physics in favor of male students. For this purpose, it is very important to look at gender particularly as it relates to students academic achievement in radioactivity aspect of physics.

Gender is another important factor affecting students' academic achievement in physics. Kashu (2019) defined gender as the political, social, economic and cultural attributes and opportunities, associated with being either male or female. According to Dalu and Manyani (2020) gender is seen as the socially constructed characteristics of men and women, female and male. Gender can be seen in this study as the social and biological characteristics in which people or the society at large defines male or female.

Generally, the society ascribes science and technology and their related disciplines like physics to boys more than their female counterparts. However, Aina and Akintunde (2020) conducted a study on the analysis of gender performance in physics. The study revealed that male students performed better than females. This report contradicts the findings of Nwankwo and Achufusi (2019) who worked on gender difference in physics conceptual change and retention scores: a case study of meta-conceptual teaching approach (MTA). The result indicated no significant gender difference in physics conceptual change and retention scores of students. The importance of physics in providing technological infrastructure and development of trained personnel needed to take advantage of scientific advances cannot be overemphasized. However, literature has continually revealed poor academic achievement of students in the subject. Efforts have been made by researchers to address this ban of poor academic achievement in physics among secondary school student, but could not avail. Considering, the influence of interest on student's academic achievement as shown in the literature, there is need to investigate the predictive power of interest on academic achievement of students in radioactivity using gender as a moderator.

Research Questions

1. What is the predictive power of interest on secondary school students' academic achievement in radioactivity?
2. What is the predictive power of interest on secondary school students' academic achievement in radioactivity as moderated by gender?

Hypotheses

H₀₁: The predictive power of interest on secondary school student academic achievement in radioactivity is not significant.

H₀₂: The predictive power of interest on secondary school student academic achievement in radioactivity as moderated by gender is not significant

Methodology

Design of the study; this study adopted correlation research design. According to Nworgu (2015), correlation research design is a design that helps a researcher to establish the relationship between two or more variables. This design is appropriate because the study seeks to establish relationship that exists between students' interest and achievement in radioactivity in physics particularly in Obollo- Afor Education Zone of Enugu State.

Population of the Study; The population of this study comprised secondary school two (SS II) physics students in 41 public schools in three local government areas found in Obollo-Afor Education Zone.

Sample and Sampling Techniques

A sample size of 338 SSII Physics students was used. This was determined using Taro Yamane's formula (Yamane, 1967). The sample comprised 132 male and 206 female SS II physics students selected from 10 coeducational secondary schools drawn from two Local Government Areas in the Zone, using multi-stage sampling procedure. At the first stage, simple random sampling was used to sample 2 L.G.A out of the 3 L.G.A in Obollo-Afor Education Zone. This process involved balloting without replacement where the names of the three local government areas were written on pieces of papers folded and dropped in a container. The container was shuffled after which the researcher randomly drew two Local Government Areas, one after the other from the container. At the second stage, disproportionate stratified random sampling technique was used to sample 10 co-educational secondary schools from the 2 L.G.A in Obollo-Afor education

Zone. This method of sampling was used because the population at this stage was stratified base on the 2 L.G.A this method was used to ensure that the schools in the 2 sampled L.G.A are adequately represented in the sample. Lastly, 338 (132 males and 206 females) were randomly selected.

Instruments for Data Collection

Students' Interest in Physics Inventory (SIPI) and Radioactivity Achievement Test (RAT) were used in this study. The SIPI was adapted from Luo, Dang and Xu (2019) Academic Interest Scale for Adolescents (AISA). The AISA has 29 items modeled on a 5 points rating scale with response options of Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD). In adapting the AISA, all the items of the instrument were skewed towards students' interest in radioactivity. Again, the rating scale was changed to a 4 points rating scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The SIPI comprises two sections (section A and B); showing demographic data and to elicit information on students' interest in radioactivity respectively. Section B of SIPI contains 15 items modeled on a 4-point Likert-type scale with response options of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) with numerical values or points of 4, 3, 2, and 1 respectively. A student was awarded 60 points for ticking SA on all the items of SIPI while a score of 15 was awarded to a student for ticking SD on all the items of SIPI.

The Radioactivity Achievement Test (RAT) was developed by the researcher with the aid of test blueprint using the modified Bloom taxonomy of educational objectives. The RAT covered three aspects of radioactivity which are: Radioactive Decay, Half-life, and Natural and Artificial radioactivity. The instrument consists 30 multiple choice items with response options lettered from A to D.

Reliability of the Instrument

To determine the reliability of the instruments, the instruments were trial tested on fifty(50) senior secondary school two Physics students in a school in Obollo-Afor Education Zone of Enugu State. This is because the students used are assumed to have similar characteristics with the respondents for this study and are not part of the sample for the study. Reliability index of 0.81 was obtained for SIPI using Cronbach alpha while the internal consistency reliability of the RAT was obtained using (K-R20) formula. K-R20 was used because RAT is a dichotomously scored instrument. The reliability coefficient of the RAT was obtained to be 0.77.

Method of Data Collection

The researcher obtained permission from the authority of the schools before administering the instruments to respondents. A face-to-face method of data collection was employed in the administration of the instruments. The Physics teachers in the sampled schools served as research assistants for the study. The researcher briefed the research assistants on the purpose of the study, and the professional conducts required of them during instrument administration. Students' were directed to respond to SIPI before answering the RAT. This enabled the researcher obtain information on students' level of interest in radioactivity to see if they could predict their academic achievement in radioactivity achievement test.

Method of Data Analysis

Simple linear regression was used to answer research questions 1 while multiple regression analysis was used to answer research questions 2. Linear regression is used when there is one predictor and one criterion variables while multiple linear regression is used when there are two or more predictor variables but one criterion variable. The correlation coefficients were interpreted based on Nwana (1979) guide. Coefficients that ranged from 0.00-0.20 were regarded as very low, 0.20-0.40 (low), 0.40-0.60 (medium), 0.60-0.80 (high) and 0.80-1.00 (very high).

Results

Research Question One

Table 1: Linear regression analysis of the predictive power of interest on secondary school students' academic achievement in radioactivity

Model	N	R	R ²	Adjusted R ²
1	338	0.67	0.44	0.44

Note=Number of Respondents, R=Correlation coefficient, R²=Coefficient of determination

The result in Table 1 shows the predictive power of interest on secondary school students' academic achievement in radioactivity. The result shows that, the correlation coefficient (R) obtained between interest and secondary school students' academic achievement in radioactivity was 0.67. This shows that relationship exist between interest and academic achievement in radioactivity. Furthermore,

the coefficient of determination associated with the correlation coefficient of 0.67 was 0.44. The coefficient of determination shows that, 44% variation in students' achievement in radioactivity is attributed to their interest. This implies that, 56% variation in students' achievement in radioactivity can be attributed to other variables other than interest.

Hypothesis One

Table 2: ANOVA F-test of no significant predictive power of interest on secondary school student's academic achievement in radioactivity

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	9834.841	1	9834.841	266.365	0.00
Residual	12405.916	336	36.922		
Total	22240.757	337			

$\alpha = 0.05$, Df= Degree of freedom

The result in Table 2 shows that an F-ratio of 266.365 with an associated exact probability value of 0.00 was obtained. This probability value of 0.00 was compared with 0.05 level of significance, the result was significant because 0.00 is less than 0.05. The null hypothesis, which stated that the predictive power of interest on secondary school student's academic

achievement in radioactivity is not significant, was therefore rejected. The inference drawn is that the predictive power of interest on academic achievement in radioactivity is statistically significant. This implies that students' interest can be used to forecast their academic achievement in radioactivity.

Research Question two

Table 3: Linear regression analysis of the predictive power of interest on secondary school students' academic achievement in radioactivity as moderated by gender

Model	Variable (Gender)	N	R	R ²	Adjusted R ²
1.	Male	132	0.66	0.43	0.43
2.	Female	206	0.67	0.45	0.45

Note: N=Number of Respondents, R=Correlation coefficient, R²=Coefficient of determination

The result in Table 3 shows that correlation coefficients (R) of 0.66 and 0.67 with associated coefficients of determination (R^2) of 0.43 and 0.45 were obtained for male and female students' respectively, between their interest and academic achievement in radioactivity. These coefficients of determination (R^2) indicated that 43% of the variation in secondary school students' academic achievement in radioactivity was

due to interest for males, while 45% was due to interest for females. The difference in the variation of male and female students' academic achievement in radioactivity as predicted by interest was 2%, with females having a slight higher percentage. Hence, gender moderated 2% of the predictive power of interest on students' academic achievement in radioactivity.

Hypothesis Two

Table 4: Fisher's Z test analysis of significance between the correlation coefficients (R) of male and female secondary school students on the predictive power of interest on academic achievement in radioactivity

Variable (Gender)	N	R	Z	P	Dec
Male	132	0.66	-0.16	0.87	NS
Female	206	0.67			

Note: N = Number of respondents, R = Correlation coefficient, Z= Fisher's calculated value, P = Fisher's exact probability value or tabulated value. Dec = Decision, NS = Not Significant.

The in Table 4 indicated that a calculated Fisher's Z-value of -0.16 and an exact probability value of 0.87 were obtained. This probability value of 0.87 was compared with 0.05 set as the level of significance for testing the hypothesis, and it was found not to be significant because 0.87 is greater than 0.05. The null hypothesis was not rejected. Meaning, there was no significant difference between the correlation coefficients (R) of male and female students on the predictive power of interest on student's academic achievement in radioactivity. Meaning gender does not significantly moderates the predictive power of interest on student's achievement in radioactivity.

Discussions

The result shows that the correlation coefficient between interest and secondary school students' academic achievement in radioactivity is high. This means that there is a high positive relationship between interest and students' academic achievement in radioactivity. By implication an increase in students' interest correspond with an increase in their academic achievement in radioactivity. Also, the coefficient of determination associated with the correlation coefficient was 44%. Meaning that interest accounts for 44% variation in students' academic achievement in radioactivity. Further analysis of the predictive power of interest on secondary school students' academic

achievement in radioactivity revealed that the associated probability of the calculated value of F is less than the level of significance. Hence, the null hypothesis was rejected. This implies that the predictive power of interest on student's academic achievement in radioactivity is significant. Students' interest in radioactivity can therefore be used to forecast their achievement in the topic. This is true because interest in radioactivity will stimulate a drive in students to concentrate which will likely improve students' academic achievement.

This finding is in agreement with earlier finding of Olanrewaju and Oluyomi(2020), who revealed among other things that there is a significantly positive relationship between students' interest in physics and their academic achievement. This means that, an increase in students' interest corresponds with increase in academic achievement in physics. The finding also aligns with that of Okafor (2020), who showed that student interest predicts about 57% of academic achievement scores of students in physics. This represents a significant percentage variance as revealed by this present study. This shows that the drive associated with interest is a determining factor in students' academic achievement in radioactivity. The finding also aligns with O'Neill and McLoughlin (2019), who revealed that senior secondary level students showed significant interest in physics. This interest may

enhance their academic achievement as revealed by this present study. Hence, the finding of the study adds to empirical reports that interest is a significant predictor of students' academic achievement in radioactivity.

The result shows that the correlation coefficient between interest and students' achievement in radioactivity as moderated by gender is high. By implication, an increase in male and female students' interest correspond with an increase in their academic achievement in radioactivity with female having a slight higher correlation coefficient. Also, the coefficient of determination associated with the correlation coefficients was 43% and 45% for male and female respectively, which amounted in a 2% difference between male and female. Further analysis of the predictive power of interest on secondary school students' academic achievement in radioactivity as moderated by gender revealed that the associated probability of the calculated value of Fishers Z-test is greater than the level of significance. Hence, the null hypothesis was not rejected. This implies that the predictive power of interest on secondary school student's academic achievement in radioactivity as moderated by gender is not statistically significant. Gender did not moderate the predictive power of interest on achievement in radioactivity. This may be true because both male and female students may have interest in radioactivity. Hence, it will be difficult to attribute interest to a particular gender, thus giving both male and female equal chances of achieving high grades in radioactivity.

The findings disagree with earlier findings by O'Neill and McLoughlin (2019), who revealed that gender is significantly predict interest in physics in favor of the male. This conflict's the present finding which revealed no significant moderating effect of gender on the predictive power of interest on academic achievement in radioactivity. However, the finding aligns with that of Nwankwo and Achufusi (2019), who showed no significant gender difference in physics conceptual change and retention scores of students. Hence, the finding of the study adds to empirical reports that gender does not moderates the predictive power of interest on senior secondary school students' academic achievement in radioactivity.

Conclusions

From the findings of this study it was inferred that students' interest can forecast their academic achievement in radioactivity. However, looking at the moderating influence of gender, the study concludes that gender as a moderator cannot be used to determine

the predictive power of interest on students' academic achievement in radioactivity

Recommendations

Based on the findings of this study, the following recommendations were made.

1. Class teachers should give both male and female students equal opportunity to participate in teaching and learning in order to eliminate gender biasness in students' interest.
2. School administrators should provide favorable school/learning environment that will drive students' interest in learning especially radioactivity.
3. Students should be goal driven, through this, their interest in radioactivity will increase thereby improving their academic achievement in physics.
4. Teachers should organize programme to boost students' interest such that the students will develop desire to participate actively while learning the topic radioactivity as this will in improve students' academic achievement in physics.

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