

# Students' Psychological Predictors of Academic Achievement in Physics

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## Abstract

**Background:** Research indicate that psychosocial factors such as students' attitude, interest, motivation, self-efficacy, locus of control, anxiety and peer group pressure may be potent predictors of academic achievement in any school subject. Thus, the study determined the extent to which motivation, self-efficacy and locus of control predict students' academic achievement in Physics.

**Aims:** The study sought to determine the predictive powers of motivation, self-efficacy and locus of control on students' academic achievement in physics.

**Sample:** A sample of three hundred and seventy five (375) SSII students drawn using multistage sampling procedure was used for the study.

**Methods:** Correlational survey research design was adopted for the study. The study employed two researcher-developed instruments: Students' Psychosocial Factors Questionnaire (SPFQ) and Students' Physics Academic Achievement Proforma (SPAAP) for data collection. Data collected were analyzed using regression analysis.

**Results:** The result showed that 31%, 37% and 52% of the students' academic achievement in physics is predicted by their motivation, self-efficacy and locus of control respectively.

**Conclusion:** Psychological factors such as motivation, self-efficacy and locus of control are prime determinants of students' achievement in the Physics.

**Keywords:** Motivation; Self-efficacy; Locus of Control; Achievement; Physics

## I. INTRODUCTION

Science has become such an indispensable tool that no nation, developed, undeveloped or developing, wishing to progress in the socio-economic sphere will afford to relegate its learning in schools. The role of science in this modern era of technology cannot be over emphasized. According to Olorundare (2011), the role of science in the development of modern societies is evident especially in the face of modern technological innovations. In other words, development of any nation is dependent on the advancement and application of science and technology (Ogunlaye & Fasakin, 2011; Awodun, Oni & Aladejana 2014). This however cannot strive fully without the knowledge and understanding of the theories and

principles of physics and their applications to real life situations.

Physics is a natural science subject. According to Ojediran, Oludipe and Ehindero (2014), physics is the study of matter and natural events, through empirical observations and quantitative measurement. Thus, for speedy national development with respect to science and technology, basic concepts and principles of physics are absolutely necessary. However, despite the above expectations in the study of physics as an essential science subject that promotes better living, Guzel (2004) found that there is an alarming decline in physics academic achievement and physics has been a difficult subject for students from secondary school to the higher institution. Sakiyo and Sofeme (2008) also report that students' academic performance in physics has been low in both internal and external examinations. In the light of this, Owolabi (2009) asserts that the rate of failure in physics at the senior secondary school internal and external examination is alarming and the reduction in the number of students offering the subject over the years call for concern.

Evidence from the West African Examination Council (WAEC) Chief Examiner's reports of students' performance in Physics show that 685,669 candidates enrolled for the examination in the subject in May/June 2014 and recorded a raw mean of 16.00 and a standard deviation of 08.77 while in May/June 2015 a raw mean of 19.00 and a standard deviation of 09.90 was recorded for 658,393 candidates that enrolled for the same examination. This shows a dismal performance in physics which therefore calls for urgent attention on how to improve students' academic achievement in the subject. Many factors have been adduced for poor achievement of students in physics among which are psychosocial variables. But literature is yet to show explicitly how much of students achievement in physics can be predicted by psychosocial factors singly and or jointly. Psychosocial factors are those that possess both psychological and sociological features (John, 2009). Such factors can promote an individual's psychological development and interaction with the social environment. These factors include; students' motivation, self-efficacy, peer group pressure, locus of control, attitude, interest, and anxiety among others.

Motivation refers to the reasons underlying behavior (Guay, 2010). Gredler, Broussard and Garrison (2004), broadly define motivation as the attribute that moves us to do or not to do something. According to Elliot, Andrew, Covington and Martin (2001), motivation can be defined as one's direction to behaviour or what causes a person to want to repeat a behavior and vice versa. Motivation could be intrinsic or extrinsic. Intrinsic motivation is the self-desire to seek out new things and new challenges, to analyze one's capacity, to observe and to gain knowledge (Ryan & Deci, 2000). It is driven by an interest or pleasure in the task itself, and exists within the individual rather than external pressures or a desire for reward. It is manifest in attitudes towards play, exploration, and challenge seeking what people often do for external rewards.

Researchers often contrast intrinsic motivation with extrinsic motivation, which is motivation governed by reinforcement contingencies. Extrinsic motivation is a drive or influence that comes from outside of the individual (Wigfield, Guthrie, Tonks, & Perencivick, 2004). It includes rewards for showing the desired behaviour, threats of punishment that accompanies undesirable behaviours, and other external forces that are capable of influencing people's actions on tasks. Traditionally, educators consider intrinsic motivation to be more desirable and to result in better learning outcomes than extrinsic motivation (Deci, 2002). Oriahi (2009) revealed that motivation generally has high positive correlation in their academic performance. Also, Middleton, Leavy and Leader (2013) reported that students' academic achievement increased dramatically due to an increase in motivation. This may be attributed to enjoyment of school learning characterized by curiosity, persistence in accomplishing assigned tasks and the learning of challenging, difficult, and novel tasks like in physics. With motivation fully in place, self-efficacy finds a ready ladder upon which to climb. This means that self-efficacy thrives in the atmosphere of motivation.

Self-efficacy entails people's beliefs about their abilities in particular domains thought to be important in motivating them to do what they can do to achieve (Hawthorne, 2004). It is an individual's confidence in his or her abilities to successfully perform a particular task due to positive attitude towards such tasks. In other words, self-efficacy is defined in terms of how individuals perceive their capabilities to attain designated types of performance and achieve specific results. Adedeji, Adeyinka and Adeniyi (2009) revealed that there is a strong relationship between self-efficacy and academic achievement or learning outcomes. Zimmerman (2000) had found that students who are self-efficacious are more likely to undertake difficult and challenging tasks thereby promoting their academic achievement than students who are not self-efficacious. According to Zimmerman, students who are self-efficacious are also more likely to exert more effort and to persist longer in the face of difficulties. It has also been found that self-efficacy influences students' methods of learning.

Students who are self-efficacious appear to use more self-regulating strategies which lead to higher achievement (Hawthorne, 2004). As such self-efficacy may also be thought to predict students' academic achievement in physics. Self-efficacy may also influence a students' locus of control which will in turn affect their academic achievement positively or negatively.

Locus of control is an individual's belief regarding the causes of his or her experiences and the factors to which that person attributes success or failure (Anderson, Hattie & Hamilton, 2005). This can either be internal or external. If a person has an internal locus of control, that person attributes success to his or her own effort and abilities (Adedeji, Adeyinka & Adeniyi, 2009). A person with an external locus of control on the other hand, will be less likely to make the effort to learn since he or she attributes his or her success to luck or fate. In relation to achievement, students' locus of control whether internal or external is thought of as more likely to influence their attitudes towards the learning of any given subject like physics (Thelma cited in Adedeji, Adeyinka & Adeniyi, 2009). Report by Coleman and Deleire (2000) indicate that locus of control indeed strongly influence academic achievement and decision to graduate from high school. Anderson, Hattie and Hamilton (2005) used a novel multidimensional locus of control instrument to investigate the relationship between locus of control and academic achievement in three different types of school and found that locus of control influences academic achievement. Though this evidence shows how locus of control influences achievement, it is still a concern to know the amount of variation in physics achievement that is accountable for by their locus of control. It is also noteworthy that attribution of failure to internal or external locus of controls may cause anxiety in students which can mar their academic achievement.

Based on the forgoing, the researcher observed that many researchers within and outside Nigeria are of a strong believe that psychosocial factors such as students' attitude, interest, motivation, self-efficacy, locus of control, anxiety and peer group pressure are potent predictors of academic achievement in any school subject. But none of the researchers investigated the influence of these psychosocial factors on students' academic achievement in physics to see if possible improvement can be made on the trend of poor achievement in the subject as earlier mentioned. Hence, the following null hypotheses were tested by the researchers at 0.05 level of significance.

**Ho<sub>1</sub>:** Students' academic achievement in physics is not significantly predicted by their motivation to learn.

**Ho<sub>2</sub>:** Students' academic achievement in physics is not significantly predicted by their self-efficacy.

**Ho<sub>3</sub>:** Students' academic achievement in physics is not significantly predicted by their locus of control.

II. MATERIALS AND METHODS

The research design adopted for this study is the correlational research design. The area of study was Zone B education zone of Benue State, Nigeria. The zone comprises of seven (7) local government areas; namely: Makurdi, Gboko, Buruku, Guma, Tarkaa, Gwer and Gwer-west. The population of the study comprised of 6,205 SS II Physics students in the eighty-nine (89) public secondary schools in the seven (7) local government areas of Zone B education zone of Benue State.

A sample of three hundred and seventy five (375) SS II Physics students was used for this study. A multi-stage sampling procedure was used to draw the sample. At the first stage, four (4) local government areas were drawn out of the seven (7) in the zone using simple random sampling technique. Using this technique, the names of the local government areas were written on pieces of paper, folded and put in a container, shuffled and the researcher then drew the local government areas from the container one at a time. At the second stage, disproportionate stratified random sampling technique was used to draw twenty five (25) secondary schools from the 64 public secondary schools in the four local government areas sampled for the study. Also, at the third stage, disproportionate stratified random sampling technique was used to draw 15 physics students from each of the senior secondary schools sampled, making a total of 375 SS II Physics students. Disproportionate stratified random sampling technique was used at the second and third stages because the relative proportions of the strata in the sample do not correspond to their relative proportion in the population.

The researcher employed two instruments; Students' Psychosocial Factors Questionnaire (SPFQ) and Students' Physics Academic Achievement Proforma (SPAAP) for data collection for the study. The Students' Psychosocial Factors Questionnaire (SPFQ) has two (2) sections; section A and section B. Section "A" elicits personal information of the respondents, such as; school name, students' class and class identification number. While section "B" consists of three (3)

clusters (I, II, & III) with a total of fifty six (45) items modeled on a four (4) point Likert scale to elicit responses on the students' psychosocial factors. The students were required to express their level of agreement or otherwise to each of the items based on the four (4) point Likert-type scales of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD) with numerical values or points of 4, 3, 2, and 1 respectively. The Students' Physics Academic Achievement Proforma (SPAAP) was used to collect the annual examination results of the students in Physics for the 2016/2017 academic year. This served as a measure of their academic achievement.

The instruments; Students' Psychosocial Factors Questionnaire (SPFQ) and Students' Physics Academic Achievement Proforma (SPAAP) were faced validated by two experts in measurement and evaluation in the Department of Science Education, and one expert in educational psychology all in Nigeria.

The reliability of the modified instrument; the Students' Psychosocial Factors Questionnaire (SPFQ), was ascertained through trial-testing the instrument using a similar sample of students from other schools in a neighbouring education zone that was not part of the population of this study. Twenty (20) students were used for the trial testing. The internal consistency reliability estimates or coefficients of 0.78, 0.81, and 0.88 were obtained for clusters I, II, and III of the instrument with an overall estimate of 0.84.

Data collected was analyzed using regression analysis. The coefficients of determination ( $r^2$ ) were used to answer all the research questions. All the null hypotheses were tested using the regression ANOVA F-statistic at 0.05 level of significance.

III. RESULTS

**Ho<sub>1</sub>:** Students' academic achievement in physics is not be significantly predicted by their motivation.

Table 1: Summary of the proportion of students' academic achievement in physics that can be predicted by their motivation

Model	R	R Square	Standardized Beta	t	Sig
1	.56	.31	.82	3.36	0.002

Table 2: Regression analysis of the prediction of students' academic achievement in physics by their motivation

Model	Sum of Squares	Df	Mean Square	F	p	
1	Regression	1103.435	3	367.812	66.09*	.000
	Residual	2064.603	371	5.565		
	Total	3168.038	374			

\*P< .05

Table 1 shows that students' motivation to learn predicted their academic achievement in physics  $\beta = .82$   $t(372) = 3.36$ ,  $p = .002$ . Tables 1 & 2 show that motivation to learn also

explained a significant proportion of variance in achievement scores of students,  $R^2 = .31$ ,  $F(1, 373) = 66.09$ ,  $p = .000$ .

**Ho<sub>2</sub>:** Students' academic achievement in physics is not significantly predicted by their self-efficacy.

Table 3: Summary of the proportion of students' academic achievement in physics that can be predicted by their self-efficacy

Model	R	R Square	Standardized Beta	t	p
1	.61	.37	.91	5.71	.001

Table 4: Regression analysis of the prediction of students' academic achievement in physics by their self-efficacy

Model	Sum of Squares	Df	Mean Square	F	p	
1	Regression	908.670	1	908.280	107.26*	.000
	Residual	3159.758	373	8.471		
	Total	4068.428	374			
*P < .05						

Table 3 shows that self-efficacy predicted students' academic achievement in physics  $\beta = .91$ ,  $t(372) = 5.71$ ,  $p = .001$ . Tables 3 & 4 show that self-efficacy explained a significant

proportion of variance in achievement scores students,  $R^2 = .37$ ,  $F(1, 372) = 107.26$ ,  $p = .000$ .

**Ho<sub>3</sub>:** Students' academic achievement in physics is not significantly predicted by their locus of control.

Table 5: Summary of the proportion of students' academic achievement in physics that can be predicted by their locus of control

Model	R	R Square	Standardized Beta	t	p
1	.72	.52	.93	10.54	.000

Table 6: Regression analysis of the prediction of students' academic achievement in physics by their locus of control

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	1151.476	1	1151.476	164.15*	.00
	Residual	2616.562	373	7.015		
	Total	3768.038	374			
*P < .05						

Table 5 shows that locus of control predicted academic achievement of students in physics  $\beta = .93$ ,  $t(372) = 10.54$ ,  $p = .000$ . Tables 5 & 6 show that locus of control explained a significant proportion of variance in students' achievement scores,  $R^2 = .52$ ,  $F(1, 373) = 164.15$ ,  $p = .000$ .

the roles of such psychosocial factors in teaching and learning. Thus, when students are adequately motivated, they tend to achieve better. Also, the better the self-efficacy and locus of control of students, the more their achievement. These results agree with earlier findings by Middleton, Leavy and Leader (2013) who found that students' achievement increased dramatically, in part as a function increase in their level of motivation, and Oriahi (2009) who found that students' motivation had high positive correlation with their academic performance. In the same way the result agreed with findings from the study by Akomolafe, Ogunmakin and Fasooto (2013) who revealed that significant positive correlations were shown between academic performance and academic self-efficacy, academic motivation and academic

#### IV. DISCUSSION OF THE FINDINGS

The findings of the study showed that 31%, 32% and 51% of the students' academic achievement in physics is predicted by their motivation, self-efficacy and locus of control respectively. Besides, the corresponding hypotheses revealed that students' academic achievement in physics is significantly predicted by their motivation, self-efficacy and locus of control. These findings may have been so because of

self-concept of students. In the same vein, Adedeji, Adeyinka and Olufemi (2009) also found that locus of control and self-efficacy jointly and relatively contributed significantly to the prediction of academic achievement of the students. Moreover, the result is also in line with the findings by Awofala, Awofala, Fatade and Nneji (2012) which showed that there was a significant effect of locus of control on students' achievement in (a) Mathematics (b) Biology, (c) Chemistry, and (d) Physics.

In essence, academic achievement of students is most likely to be positively correlated or seriously affected their motivation, self-efficacy and their locus of control. In other words, students are more likely to achieve higher or learn better when they are adequately motivated, when they have positive self-efficacy, and also when they effective in their locus of control. That is to say, with these variables favourably activated in students, they will be more likely to achieve at a higher level in school or vice versa.

#### V. CONCLUSION AND IMPLICATIONS

The study revealed that psychosocial factors such as motivation, self-efficacy and locus of control are potent predictors of students' academic achievement in physics. Precisely, the finding of this study implies that students ought to develop kind of motivation, self-efficacy and locus of control that would promote their achievement in the subject otherwise their achievement in physics will be negatively affected. The findings of this study also have implications for parents in that they ought to create a favourable home environment that will enable their children/wards develop the right attitude towards physics, be well motivated and also possess the right self-efficacy and locus of control in the study of the subject

The findings of this study also have implications for teachers. Teachers ought to take the influence of psychosocial factors into consideration during instruction to promote their achievement in the subject. Also, teachers need to adopt strategies or methods that may encourage students to participate actively in class. Moreover, the findings of this study also have implications for educational planners and administrators. Educational planners and administrators can formulate and implement different kinds of educational programmes that will duly consider the development of students' motivation, self-efficacy and locus of control.

#### VI. RECOMMENDATIONS

The following recommendations were made according to the findings of the study.

1. Students should exhibit the kind of motivation, self-efficacy and locus of control that would promote their achievement in the subject.
2. Parents' should create a favourable academic environment at home and also provide all needed materials for their wards in order to promote their enthusiasm for academic activities in all subjects.

3. Teachers should adopt strategies and use materials that will bring out students' curiosity and enhance their academic motivation, self-efficacy and locus of control.

#### VII. LIMITATION OF THE STUDY

Non-included characteristics of the sample such as students' gender and school location may also be responsible for some observed relationship in the study which demands care in drawing sharp conclusions. Based on that, the researchers suggested that a replication of the study could be done where students' gender and school location will be incorporated as moderator variables.

#### COMPLIANCE WITH ETHICAL STANDARD

The researchers complied with research ethical standards

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#### DECLARATION OF INTEREST STATEMENT

The researchers do not have any conflict of interest

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