

## PATHWAYS OF PSYCHOLOGICAL VARIABLES ON PHYSICS ACADEMIC PERFORMANCE OF SENIOR SECONDARY SCHOOL STUDENTS IN IMO STATE, NIGERIA

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### ABSTRACT

*The study investigated the pathways of Psychological variables on Physics academic performance of senior secondary school students in Imo State, Nigeria. One research question and one null hypothesis guided the study. The study adopted a correlation research design. The population comprised all the 10,312 SSII Physics students in the 312 public senior secondary schools in Imo State. The sample size is 1019 SSII Physics students. The multistage sampling approach comprising proportionate stratified and purposive sampling technique was used to arrive at the sample. Two researchers designed instruments titled “Psychological Variables Scale (PVS) and a teacher made Physics test “Physics Performance Test” (PPT) were used for data collection. Construct validity of PVS was done with the help of standardized instruments, face and content validities were also established for PVS. Content validity of PAT was done using table of specification. The Cronbach alpha was used to establish general reliability coefficient of PVS at 0.95. While Kuder-Richardson<sub>21</sub> was used to establish reliability coefficient of PPT at 0.71. Linear regression and proportion/percentage were used to answer the research questions, while z-test for a single proportion was used test the null hypothesis. It was found out that, based on the standard, that  $\beta$ -weight value with significant value is less than the probability value of .05, the recursive model resulted in a meaningful recursive parsimonious model of twenty-four (24) paths instead of the initial sixty-four (64) paths. Since the indirect effect of psychological variables contributes to academic performance in physics than the direct effects, it is therefore recommended that more attention should be paid to the indirect significant pathways than the significant pathways of psychological variables.*

**Keywords:** Pathways, Psychological Variables and Physics Academic Performance

### INTRODUCTION

The word Physics is derived from the Greek word *Physikos* to mean by interpretation all aspect of nature. The Free Dictionary (2015) saw physics as the science of matter and energy and of interactions between the two, grouped in traditional fields, such as acoustics, optics, mechanics, thermodynamics and electromagnetism as well as in modern extensions including atomic and nuclear physics, cryogenics, solid-state physics, particle physics and plasma physics. There is no gainsaying when it is mentioned that physics is the foundation for basic science as it has to study nature and the relationship that exist between them.

Adeyegbe in Ajayi and Afolabi (2012) when he reported that there was a decline in students' performance in senior secondary certificate examination. Akubiro and Joshua in Ajayi and Afolabi (2012) reported that there have been complaints from almost all quarters of the Nigerian society that the quality of education is being questioned. Moreso, Enaesater in Ajayi and Afolabi (2012) submitted that some parents are worried about the quality of education received by their children as expressed by the inability of many students to pass in excellent grades.

There is this usual saying that a sound mind is a mind that is ready to assimilate. The state of a person's mind will at times determine his interest and behavior. The word psychology is gotten from two terms, namely ology (study) and psyche (soul). This simply implies the study of the soul when joined together as one word. Wikipedia the Free Encyclopedia (2015) saw psychology as the study of mind and behavior or the scientific study of behavior and mental processes. The psychological variables to be considered are motivation, self-concept, impulsivity, emotional intelligence, attitude, study habit, interest, self-efficacy, stress, locus of control and readiness respectively. This are likely some of the psychological variable that are encountered in our secondary schools. Renninger and Hidi (2002) saw interest as a psychological state of having an affective reaction to and focused attention for particular content and/or the relatively enduring predisposition to re-engage particular classes of objects, events or ideas. Umezuruike (2006) stated that they are the techniques a student employs to go about his/her studies which are consistent and have become stereotyped as a result of long application and practice. It is the most workable approach a student applies to the best of academic achievement. Study habit could be seen as a pattern of activity that went beyond merely reading pleasure (Adeyemo, 2005). Study habit must be a workable technique that the student will be able to apply at will. Uguma and Akpama (2005) reported that self-concept is a perceived opinion of oneself. The concept of yourself must be based on what you yourself are made of and not another person's make up. Cherry (2015) saw self-concept as the image that we have of ourselves.

International Society for Research on Impulsivity (n.d) defined impulsivity as a behavior without adequate thought, the tendency to act with less forethought than do most individuals of equal ability and knowledge, or a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions. Nwankwo (2005, p.213) opined that:

*There are two schools of thought that provide some explanation to the phenomenon of motivation. The mechanistic school holds that motivation is innate and it has to be expressed towards events or situations automatically. It is its belief also that human behaviour is guided and controlled by motivation and thus must be expressed. The cognitive or rationalistic school holds that individuals are motivated, not because motivation is innate, but because individuals can use their cognitive processes or rationality to assess situations and to direct themselves to whatever activities they wish.*

Nwankwo in his explanation explained that motivation is always expressed in two schools of thoughts namely the mechanistic and the cognitive or rationalistic views

Goleman (1995) saw emotional intelligence as a wide array of competencies and skills that facilitate performance. Individuals need to work in harmony and together with other people, there is great expectation that there will be optimal performance as they collaborate, therefore, competencies and skills that facilitate performance are as a result of understanding

their emotions. Goleman and Boyatzis (2001) explained that emotional quotient (EQ) is more critical than intelligence quotient (IQ) in determining the success of students. Bar-on (1997) categorized emotional intelligence as non-cognitive behaviours which address the emotional, personal, social and survival dimensions of intelligence, which are often more important for daily functioning than intelligence quotient (IQ).

Ukwuije and Orluwene (2012: 325) reported that path Analysis was developed around 1918 by geneticist Sewall Wright as a technique to assess the direct causal contribution of one variable to another in a non-experimental dataset and has since been applied in various disciplines in sociology, economics and education etc. experimental study and control are not required in any manner in order to establish any form of relationship. The researchers do not on its own create the relationship between the independent variables and the dependent variables. Oslem in Ukwuije and Orluwene (2012) saw path analysis as a graphical representation of the effects of the coefficients that measure or estimate the relative size and direction (+ or -) of various net effects between variables. They went further to state that path analysis is straight forward extension of multiple regression. In a Path Analysis, a single headed arrow ( $\rightarrow$ ) depicts a causal relation and it stems from the cause to the effect. A double headed curved arrow ( $\leftrightarrow$ ) shows variables that are merely correlated with each other. There are two types of variables in Path Analysis namely exogenous and endogenous variables. Exogenous variables are those variables that do not have any arrow pointing at them while endogenous variables depend on the effect on other variables. Ukwuije and Orluwene (2012: 326) opined that path coefficient shows the direct effect of a variable assumed to be a cause on another variable assumed to be an effect. The Path direction is represented with standardized regression coefficient (beta weight), the scores in standard score (z-score) and it is written in two subscripts that allow the number representing the effect to come first before the cause. The Path from 1 to 2 is represented as shown  $P_{21}$  which is written thus  $P_{21}$ .



Ukwuije and Orluwene (2012: 327) listed some of the assumptions required to do Path analysis as shown below:

1. All relations are linear and additive. The causal assumptions are shown in the path diagram.
2. The residual (error terms) are uncorrelated with the variables in the model and with each other.
3. The causal flow is one way.
4. The variables are measured on interval scales or better.
5. The variables are measured without error (perfect reliability)

The authors stressed that some of these assumptions may be violated without many consequences. It is based on this assumption that the researchers want to establish the path model of psychological variables and academic performance in physics for senior secondary school students in Imo State.

## STATEMENT OF PROBLEM

Researches and experiences have shown that students' academic performances are tied to the state of the mind of the students. It therefore appears that the performance of students in an examination is to a greater extent the function of psychological state of the students. Studies

have revealed that students who are not psychologically stable are moody, disturbed, distracted, distressed, confused, and restless and most of the times lack concentration. These problems have gone a long way to misrepresent the efforts of the teachers, schools, stakeholders and administrators. The poor performance of the students has over the years been attributed to the students, teachers and the state of educational facilities. It has gone beyond this, because, even when the students are very intelligent, and the teachers and the facilities are in optimal standard there are still poor performance recorded to a high extent. The researchers are bordered on the alarming failure rates of physics students in Imo State. Hence the researchers want to establish the significant pathways of psychological variables (direct and indirect) to which students' academic performance is achieved.

### **AIM AND OBJECTIVE**

The aim of this study is to establish the pathways of psychological variables on students' academic performance in Physics in secondary schools in Imo State.

1. Determine the significant pathways in the path model through which the psychological variables (motivation, attitude, self-concept, and emotional intelligence, stress, readiness, locus of control, self-efficacy, study habit, impulsivity and interest) establish students' performance in Physics in secondary schools in Imo State.

### **RESEARCH QUESTION**

The following research questions guided the study:

1. What are the significant pathways in the path model through which the psychological variables (motivation, attitude, self-concept, and emotional intelligence, stress, readiness, locus of control, self-efficacy, study habit, impulsivity and interest) establish students' performance in Physics in secondary schools in Imo State?

### **HYPOTHESIS**

The following null hypotheses were tested at an alpha level of 0.05:

1. There are no significant pathways in the path model through which the psychological variables (motivation, attitude, self-concept, and emotional intelligence, stress, readiness, locus of control, self-efficacy, study habit, impulsivity and interest) significantly predict students' performance in Physics in secondary schools in Imo State.

### **METHODOLOGY**

The population of the study comprised all the 10,312 SSII Physics students in 312 Public senior secondary schools in Imo State. There are 6 senatorial zones of education and 27 Local Government Areas in Imo state. Owerri zone I has 79 schools, Owerri zone II has 54 schools, Okigwe I has 34 schools, Okigwe II has 40 schools, Orlu I has 68 schools and Orlu II has 37 schools respectively. Schools in each local government area are provided in appendix III. (Source: Secondary Education Management Board Zonal Office, Owerri Zone 1: Planning, Research and Statistics, 2014/2015).

The sample size of the study consisted of 1019 physics students in Imo State, Nigeria. A multistage sampling approach involving proportionate stratified random sampling technique using 10% of the population and purposive sampling technique were used to arrive at the sample size. The Taro Yamen was used to get the minimum sample size of 400 SSII Physics

students. The sampling was done from 6 educational zones, Local Government Areas, schools and students respectively. The stratified random sampling technique using 10% of the 312 schools in the six (6) educational zones of Imo State shows that eight (8) schools were drawn out of 79 schools in Owerri I zone, five (5) schools from 54 schools in Owerri II zone, three (3) schools in 34 schools in Okigwe I, four (4) schools from 40 schools in Okigwe II, nine (9) schools from 68 schools in Orlu I, and four (4) schools from 37 schools in Orlu II respectively. Purposive sampling technique was employed to draw all the 338 students in the 8 schools from Owerri I, all the 155 students in the 5 schools from Owerri II, all the 107 students in the 3 schools from Okigwe I, all the 68 students from the 9 schools in Orlu I, and all the 121 students from the 4 schools drawn from Orlu II respectively. This gave a sample size of 1019 students from the 31 schools in the six educational zones in Imo State, Nigeria. See figure 1 for details. Two instruments were used for data collection. A self structured questionnaire titled “Psychological Variables Questionnaire” (PVQ) and a physics teacher made test titled “Physics Performance Test” (PPT) were data collection. The PVQ is structured after the modified Likert four points rating scales of Strongly Agree (4), Agree (3), Disagree (D) and Strongly Disagree (SD) respectively. The PVQ has two sections of A and B. section A consists of the demographic information of the respondents while section B consists of 58 items. The PVS was correlated using Pearson Product Moment Correlation with the standardized instruments. The various correlation coefficients of the self designed instruments with the standardized instruments gave Self concept 0.66, Motivation 0.84, Impulsivity 0.69, Emotional Intelligence 0.73, Attitude 0.88, Study Habit 0.75, Interest 0.84, Self-Efficacy 0.73, Stress 0.79, Locus of Control 0.67 and Readiness 0.61 respectively. The face and content validities of the Psychology Variables Questionnaire (PVQ) and Physics Performance Test were ensured. The reliability coefficient of the instruments was estimated using the cronbach alpha reliability estimate. The general reliability coefficient of the instrument Psychological Variable Questionnaire (PVQ) was given at 0.95 and the various subscale of Self concept 0.74, Motivation 0.93, Impulsivity 0.89, Emotional Intelligence 0.89, Attitude 0.63, Study Habit 0.85, Interest 0.56, Self-Efficacy 0.79, Stress 0.71, Locus of Control 0.57 and Readiness 0.58 respectively. The Kuder-Richardson21 was used to establish reliability coefficient of PAT at 0.72. Linear regression and percentage/proportion were used to answer the research question. The null hypothesis was tested with the help of z-test ratio for a single proportion at 0.05 alpha level of significance.

## **RESULTS**

### **Research Question One**

What are the significant pathways in the path model through which the psychological variables (Motivation, Attitude, Self-concept, and Emotional Intelligence, Stress, Readiness, Locus of control, Self-efficacy, Study Habit, Impulsivity and interest) predict students’ performance in Physics in secondary schools in Imo State?

### **Hypothesis One**

There are no significant pathways in the path model through which the psychological variables (Motivation, Attitude, Self-concept, and Emotional Intelligence, Stress, Readiness, Locus of control, Self-efficacy, Study Habit, Impulsivity and interest) significantly predict students’ performance in Physics in secondary schools in Imo State.

**Table 1. Significant pathways through which the eleven psychological variables predict students' academic performance in Physics**

S/n	Paths	Variables Paths	Zero-Order Correlation	Beta-Weights( $\beta$ )	Sig.	Remarks	Z ratio	Z crit.
1	P <sub>31</sub>	Motivation - self concept	.572	.515	.000	Indirect	31.3	1.96
2	P <sub>61</sub>	Motivation - interest	.131	.098	.000	Indirect		
3	P <sub>91</sub>	Motivation – attitude	.160	.228	.000	Indirect		
4	P <sub>12,1</sub>	Motivation-physics score	-.090	-.071	.005	Direct		
5	P <sub>11,2</sub>	Self efficacy –study habit	-.240	-.227	.000	Indirect		
6	P <sub>43</sub>	Self concept-readiness	-.069	.157	.000	Indirect		
7	P <sub>53</sub>	Self concept-stress	-.008	-.170	.000	Indirect		
8	P <sub>93</sub>	Self concept- attitude	-.084	-.148	.002	Indirect		
9	P <sub>54</sub>	Readiness-stress	.080	-.097	.001	Indirect		
10	P <sub>84</sub>	Readiness-impulsivity	.236	.435	.000	Indirect		
11	P <sub>94</sub>	Readiness-attitude	.309	.485	.000	Indirect		
12	P <sub>11,4</sub>	Readiness-study habit	.083	-.115	.002	Indirect		
13	P <sub>95</sub>	Stress-attitude	.085	.093	.004	Indirect		
14	P <sub>10,5</sub>	Stress-emotional intelligence	.107	.099	.001	Indirect		
15	P <sub>96</sub>	Interest-attitude	.123	.135	.000	Indirect		
16	P <sub>12,6</sub>	Interest-physics score	-.159	-.171	.000	Direct		
17	P <sub>10,7</sub>	Locus of control- emotional intelligence	.043	.043	.042	Indirect		
18	P <sub>98</sub>	Impulsivity-attitude	.147	.157	.016	Indirect		
19	P <sub>11,8</sub>	Impulsivity-study habit	.596	.586	.000	Indirect		
20	P <sub>11,9</sub>	Attitude-study habit	.149	.149	.000	Indirect		
21	P <sub>12,9</sub>	Attitude-physics score	.093	.092	.003	Direct		
22	P <sub>11,10</sub>	Emotional intelligence-study habit	-.015	-.640	.015	Indirect		
23	P <sub>12,10</sub>	Emotional intelligence-physics score	-.011	.614	.011	Direct		
24	P <sub>12,11</sub>	Study habit –physics score	.007	.007	.007	Direct		

**\*Note: P<.05- significant effect (this could be direct or Indirect effect) [P>.05- not significant]**

Table 1 shows the different path coefficients ( $\beta$ - weights) in the path model with their corresponding zero-order correlations and their associated significant level at .05. The paths whose  $\beta$ - weight or coefficients are significant at .05 probability level (with  $\beta$ - weights greater than .05) were retained, while the others were trimmed to produce the more parsimonious model. The result showed that the least path coefficient is  $P_{11,10}$  ( $\beta$ - weight - .640) while the strongest path is  $P_{12,10}$  ( $\beta$ - weight .614). It was also shown that in table 4.2, 24 paths out of the 64 paths in the hypothesized recursive model are significant at .05 probability level. Moreso, the z-ratio value of 31.3 is greater than the z critical value of 1.96. Therefore, the null hypothesis is rejected. By implication, there are significant path ways between psychological variables and physics score in secondary schools in Imo State.

### **The Significant Pathways in the Path model through which the Psychological Variables Establish Students' Performance in Physics**

Table 1 shows the different path coefficient ( $\beta$ - weights) in the path model with their corresponding zero-order correlations and their associated significant level at .05. The paths whose  $\beta$ - weight or coefficients are significant at .05 probability level (with  $\beta$ - weights greater than .05) were retained, while the others were trimmed to produce the more parsimonious model. The result showed that the least path coefficient is  $P_{11,2}$  ( $\beta$ - weight - .227) that is self efficacy through study habit to physics achievement while the strongest path is  $P_{12,11}$  ( $\beta$ - weight .837) study habit to physics achievement. It was also shown in table 4.2 that 24 paths out of the 64 paths in the hypothesized recursive model are significant at .05 probability level. The pathways are motivation through self-concept to physics achievement, motivation through interest to Physics achievement, motivation through attitude to Physics achievement, motivation to physics achievement, self efficacy through study habit to Physics achievement, self concept through readiness to physics achievement, self concept through stress to physics achievement, self concept through attitude to physics achievement, readiness through stress to physics achievement, readiness through impulsivity to physics achievement, readiness through attitude to physics achievement, readiness through study habit to physics achievement, stress through attitude to physics achievement, stress through emotional intelligence to physics achievement, interest through attitude to physics achievement, interest to physics achievement, locus of control through emotional intelligence to physics achievement, impulsivity through attitude to physics achievement, impulsivity through study habit to physics achievement, attitude through study habit to physics achievement, attitude to physics achievement, emotional intelligence through study habit to physics achievement, emotional intelligence to physics achievement and study habit to physics achievement. Therefore, there is a significant path ways between psychological variables and physics score in secondary schools in Imo State. Study habit showed a significant direct high relationship with academic performance. This agrees with Siah and Maiyo (2015) in their study in relationship between study habits and academic achievement of students in Spicer Higher schools, India. They found out that there is a positive relationship of 0.66 between study habit and academic achievement. In their remarks, they asserted that study habit needs a significant attention in order to enhance academic performance of students. Isangedighi in Siah and Maiyo (2015) observed that indiscipline, poor motivation to students, no information, teachers poor behaviour to work and students negative self concept about themselves have resulted into students' inconsistent and poor academic performance. This is because the study showed self efficacy has the least beta weight to students' academic performance in secondary schools in Imo State. Moreso, it implies that, if the students are not properly motivated to learn, there is always poor record of academic performance. Therefore proper motivation and high positive self-concept of students will lead to enhanced academic

performance. The finding of this study is against the report of Nagaraju in Siahi and Maiyo (2015) that students usually do not devote sufficient time to the studies and seldom has proper study habit. This is because the study has shown that the study habit possessed by the students lead to their academic performance In Physics.

### **RECOMMENDATION**

1. Since the indirect effect of psychological variables contributes to academic performance in physics than the direct effects, it is therefore recommended that more attention should be paid to the indirect significant pathways than the significant pathways of psychological variables.
2. Guidance counsellors in the schools should use expressive therapies such as arts, design and music to boost student's psychological variables identified in this research work.
3. Qualified physics teachers should be employed are retrained on the job, so that their students will benefit from them adequately.



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