

Predicting Students' Achievement in Physics using Academic Self Concept and Locus of Control Scale Scores

By

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Abstract

Based on researchers' submission that student factors are germane in explaining underachievement in Physics at all levels, this study focused on predicting students' achievement in secondary school Physics using their Academic Self Concept and Locus of Control Scale Scores as the main thrust of this study. Three hypotheses were tested. The sample was made of two hundred senior secondary school II Physics students (100 Boys and 100 girls, with mean age of 16.5years) randomly drawn from six public co-educational secondary schools in Irepodun Local government area of Kwara state. Data were collected by means of three instruments: a Physics Achievement test ($r = 0.71$); Academic self concept scale ($\alpha=0.85$) and Locus of Control scale ($\alpha=0.77$). Data were analysed using both descriptive and inferential statistics. Findings revealed that Academic self concept and Locus of control, when taken together, significantly predicted students' achievement in Physics ($R^2 = 0.154$, $p < 0.05$); academic self concept alone also significantly predicted students' achievement in Physics ($R^2 = 0.144$, $p < 0.05$) however Locus of control alone did not significantly predict students' achievement in Physics ($R^2 = 0.017$, $p > 0.05$). These findings suggest that as against students' Locus of control, academic self concept is a potent student factor to be taken into consideration when explaining achievement in physics. It was recommended among others that Physics teachers should help boost students' personality factors especially academic self concept by being warm towards students and creating a conducive classroom environment that makes physics learning more practical and interesting. Curriculum affective components of learning should also be incorporated into school curriculum by curriculum developers.

Keywords: *Predicting, achievement, physics, Academic self concept, Locus of Control*

1. Introduction

The importance of Physics as one of the basic Sciences in human and societal development cannot be over-emphasized. Physics is the basis of modern technology. Physics based technology is a ground of manufacturing industries. It helps us to study the universe, connect to things and to understand how our environment works. Its laws, facts, theories and principles make us interact better with our surrounding. Inventions of cars, air conditioners, mobile phones, lights, laptops, fans, air buses, micro waves are all made possible through the application of its principles. Based on these benefits, governments of nations, Nigeria inclusive, have laid more emphasis on the study of Physics and other Science subjects in our schools. However, students' dwindling performance in Physics in public examinations is so worrisome and this has led many researchers into investigating the factors that could be responsible for this. Among the variables identified are: Students' poor study habit, low self-esteem, teacher factors like poor teaching methods, shortage of qualified teachers, Inadequate teaching facilities in Schools, home and school environmental factors, and so on (Oludipe, 2002; 2008; Aluko,2010; Ifesanwo, 2012; Lawal, 2012; Omotayo, 2012).

Educational psychologists have at various times analyzed the different types of relationships, both associative and predictive that exist between academic self concept and achievement, and locus of control and achievement but there's a dearth of literature on the composite and relative contributions of these variables to secondary school Physics achievement. This therefore is the main thrust of this research study.

Self concept itself is the set of perceptions or reference points that someone has about himself: the set of characteristics, attributes, qualities and deficiencies, capacities and limits, values and relationships that a person knows to be descriptive of himself and which he perceives as information concerning his identity. It is understood to be fundamentally a descriptive assessment and has a cognitive meaning. It is formed from experiences and relationships with the environment, where significant people play an important role. Educational psychologists (Byrne, 1996; Rotter, 1996) have analyzed different types of relationships, both associative and predictive that exist between self concept and academic performance. Academic experiences of success or failure have been reported to affect pupils' self concept and self-image and vice versa. In a school setting, the most significant others that could influence a person's self concept are probably the teacher and classmates whose support or non-support for an individual student's academic pursuit is likely to have a significant impact on the person's self concept and interest in school. The facets or dimensions of self concept could be social, physical and academic.

Academic self concept is an individual's perception of self-efficacy in academic subjects. It is the student's attitude and feelings with regards to their abilities and academic potential. The most important component of general self – concept for a teacher is academic self – concept, the part that deals with people's beliefs of their ability as students. The way learners feel about their abilities may impact their academic performance. Consequently, academic achievement may not primarily be an expression of learners' abilities but also of their self concept of ability which when positive, helps them feel confident and able but, when negative, cause them to feel hesitant and uncertain. According to Hamachek (1995), learners at various levels do experience successes and failures. Those experiencing success tend to project more positive academic self concept than those with more failure experiences.

Academic self-concept is an effective variable for predicting students' learning behaviours. According to Dambudzo (2005), academic self concept deals with perceptions of causes of academic performance which figure prominently in theories of achievement motivation and have important implications for the behavior of individuals in academic situation. In other words, academic self concept has to do with beliefs about one's ability, effort, performance, intelligence and behavior in general, and in specific situations such as subject matter or specific tasks. Craven, Marsh and Print, (2000) emphasize that a positive academic self concept is linked to academic effort and consistency, course work selection, educational ambition, completion of high school and following University attendance. Byer, (2000) was of the opinion that academic self concept not only promotes students' interest in learning but also their motivation for further learning. Ifesanwo, (2012) in her study found that academic self concept alone accounted for 15% of the total variation in students' achievement in financial accounting. Similarly, Omotayo, (2012) reported that academic self concept predicted 14.9% of the total variation in students' achievement in Economics.

The foregoing literature have revealed same trend but this researcher wishes to find out whether the status-quo is the same for Physics students.

Apart from students' academic self concept, another variable of concern is their locus of control. LOC is a multi-dimensional construct that is aimed at capturing the causality of behavior. The construct relates to the expected outcomes of actions and the not the actions themselves. The construct of Internal versus External control of reinforcement is a part of Rotter's (1966) social learning theory. Rotter's (1966) argues that people could be placed along a continuum in respect of the extent to which they typically see what happens to them as dependent on their own control or the control of the external forces. At the one end of the continuum are the internals, who generally maintain that the outcomes in their lives depend largely on their own actions and choices. They believed that outcomes are a consequence of own striving, ability, personal effort, and initiative. They feel responsible for the consequences of their actions.

At the other end are externals, who believe that there is little one can do to influence outcomes; they believe that their outcomes are independent of their own behavior and attribute them to chance, fate, luck,

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social structures or powerful other people. According to Leone and Burns, (2000), internals are more inclined than externals to perceive their behavior as instrumental in obtaining desired outcomes and avoiding undesirable outcomes. Dollinger, (2000) found that internals surpass externals on incidentally acquired and seemingly trivial knowledge which nevertheless has relevance for learners' academic success. In same vein, Lawal, (2012) found that locus of control significantly predicted students' academic achievement in Accounting ($R^2 = 0.131$, $p < 0.05$). However, Omotayo, (2012) revealed that locus of control did not significantly predict ($R^2 = 0.017$, $p > 0.05$) students' Achievement in Economics. Since research findings on how locus of control predicts students' achievement does not lend itself to simple summary, there is therefore need for further research especially in physics which is the area of concern of this researcher.

Statement of the Problem

This study investigates the extent to which students' Academic Self Concept and Locus of Control predicts students' their achievement in secondary school Physics.

Research Hypotheses

1. Academic self concept and locus of control when taken together, will not significantly predict students' achievement in Physics.
2. Academic self concept alone will not significantly predict students' achievement in Physics.
3. Locus of control alone will not significantly predict students' achievement in Physics.

Limitations of the study

This study is limited to senior secondary school II physics students in Irepodun Local government area of Kwara state, Nigeria. The questionnaires are self reports of the students about their Locus of Control and academic self concept and were so treated. The sample consisted of 200 senior secondary II physics students. Findings from this study are limited to Nigeria setting.

2. Methods

Research design

This study is a descriptive survey type of research. The variables under consideration have already occurred and are therefore not manipulated in any way.

Target Population

All public senior secondary school students of Irepodun Local government area of Kwara state, Nigeria constitute the target population for this study.

Sample and Sampling Procedure

The sample was made of two hundred senior secondary school II Physics students (100 Boys and 100 girls, with mean age of 16.7years) randomly drawn from six public co-educational secondary schools in Irepodun Local government area of Kwara state.

Instruments

Three instruments were used for data collection in this study. These are:

- Physics Achievement test (PAT)
 - Academic self concept scale (ASCS) and
 - Locus of Control scale (LOCS)
- Physics Achievement test (PAT)

The Physics Achievement Test, (PAT) was developed by the researcher and it was made of 40 multiple choice items with options A-D. It was trial –tested on a pilot sample size of 30 senior secondary school II

students in Egbeda Local government area using test-retest procedure of three weeks interval. The reliability index was found to be 0.71 ($r = 0.71$) using Kuder-Richardson formula 20.

Academic self concept scale (ASCS)

The Academic self concept scale (ASCS) was developed by Omotayo, (2012) but adapted for use by this researcher. It was made of 15-items on a 4 – point likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) to which respondents were to indicate their degree of Agreement or otherwise to the 15-items on the scale. The face validity of the instrument was ensured by Educational psychologists who scrutinized the instrument and made useful criticisms where necessary. Necessary corrections were effected on the instrument and then it was trial-tested on a pilot sample size of 40 senior secondary school II students in Egbeda Local government and the internal consistency reliability(α) was found to be 0.85.

Locus of Control scale (LOCS)

The Locus of Control Scale (LOCS) was also made of 15 items on a 4 – point scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) to which respondents were to indicate their degree of Agreement or otherwise to the 15-items on the scale. It was originally developed by Rotter, (1966) but adapted to fit Nigeria setting by Onabanjo, (2000) and further adapted for use by this researcher. The instrument was trial-tested on a pilot sample size of 40 senior secondary school II students also in Egbeda Local government and the internal consistency reliability (α) was found to be 0.77.

Data Collection

The PAT, ASCS, and LOCS were administered on the students by the respective Physics teachers in the sampled schools after the permission of the school principals in the six selected schools were sought. The instruments were administered within three days with two schools visited per day. Students’ responses were coded and scored thereafter. For the Pat, correction was made for guessing.

Data Analysis Procedure

The data collected in this study were analyzed using both descriptive and inferential statistics. The students’ scores on PAT, ASCS and LOCS were analyzed using descriptive statistics tools of mean and Standard deviation while inferential tool of Multiple Regression Analysis and Analysis of Variance (ANOVA) were employed to test the hypotheses at the 0.05 level of significance.

3. Results

Ho 1. Academic self concept and locus of control when taken together, will not significantly predict students’ achievement in Physics.

Table 1: Regression of Academic self concept and Locus of control on students’ achievement in Physics

Predictor variables	Multiple R	R ²	Adjusted R ²	Error of Estimate
Academic self concept and locus of control	0.392	0.154	0.145	5.959

Analysis of Variance (ANOVA)

Source	Sum of Squares	DF	Mean Square	F	Sig of F	Remark
Regression	1271.603	2	636.302	17.919	0.000	Significant
Residual	6995.392	197	35.510			
Total	8267.995	199				

From Table 1, the two predictor variables, Academic self concept and Locus of control, when taken together, accounted for 15.4% of the total variation in students’ achievement in Physics ($R^2 = 0.154$, $p < 0.05$). This result is significant at $p < 0.05$. Therefore, the null hypothesis Ho 1 was rejected.

Ho 2. Academic self concept alone will not significantly predict students' achievement in Physics.

Table 2: Regression of Academic self concept on students' achievement in Physics

Predictor variables	Multiple R	R ²	Adjusted R ²	Error of Estimate
Academic self concept	0.380	0.144	0.140	5.978

Analysis of Variance (ANOVA)

Source	Sum of Squares	DF	Mean Square	F	Sig of F	Remark
Regression	1191.368	1	1191.368	33.334	0.000	Significant
Residual	7076.627	198	35.741			
Total	8267.995	199				

From Table 2, Academic self concept alone accounted for 14.4% of the total variation in students' achievement in Physics ($R^2 = 0.144$, $p < 0.05$). This result is significant at $p < 0.05$. Therefore, the null hypothesis Ho 2 was rejected.

Ho 3. Locus of control alone will not significantly predict students' achievement in Physics

Table 3: Regression of Locus of control on students' achievement in Physics

Predictor variables	Multiple R	R ²	Adjusted R ²	Error of Estimate
Locus of control	0.129	0.017	0.012	6.408

Analysis of Variance (ANOVA)

Source	Sum of Squares	DF	Mean Square	F	Sig of F	Remark
Regression	138.418	1	138.418	3.371	0.068	Not significant
Residual	8129.577	198	41.058			
Total	8267.995	199				

From Table 3, Locus of control accounted for 1.7% of the total variation in students' achievement in Physics ($R^2 = 0.017$, $p > 0.05$). This result is not significant at $p > 0.05$. Therefore, the null hypothesis Ho 3 was not rejected.

4. Discussion

The first finding which revealed that academic self concept and locus of control when taken together significantly predicts students' achievement in Physics suggests that in order to raise students' achievement in Physics, the two predictor variables- academic self concept and Locus of control when taken together are important students' characteristics to be considered. This agrees with the findings of Omotayo, (2012) who reported a similar finding. These two psycho-social factors in the students which have to do with their self beliefs about their academic ability and the source of control over reinforcement are germane and studies (Lawal, 2012; Omotayo, 2012) have established that when students have a positive academic self concept and are internals with respect to their locus of control, they are likely to put more efforts into their academic work and it's more probable they will perform well academically. This further suggests that significant others and forces beyond students cannot dictate the extent they can go academically rather their self beliefs will spur them to working hard. Buttressing this finding, earlier study of Eberhart & Keith, (1989) revealed a causal relation between students' academic self concept and locus of control. Similarly, in the study of Arogundade, (2010), the result of the multiple regressions reveal that based on the R squared value of 0.991 obtained, locus of control and self-esteem accounted for about 99.1% of the variance in teachers' frustration irrespective of the mode of self-esteem and locus of control an individual teacher is operating on.

The second finding that academic self concept alone accounted for 14.4% of the total variation in students' achievement in Physics ($R^2 = 0.144$, $p < 0.05$) and this result is significant at $p < 0.05$ shows that in order to raise students' achievement in Physics, academic self concept is an important students' characteristic to be considered. Supporting this view are Lyon & MacDonald, (1990) who reported that academic self-concept correlated significantly higher with teachers' grades and standardized measures of

achievement than either general self-concept or locus of control. A multiple regression analysis also confirmed the potential usefulness of academic self-concept for predicting students' achievement. Infact, they concluded that academic self-concept may be a more useful construct in helping understand students' achievement than frequently administered measures of general self-concept. To this end, teachers and parents alike need to boost students' morale and help instill confidence in them.

The third finding that Locus of control accounted for just 1.7% of the total variation in students' achievement in Physics ($R^2 = 0.017$, $p > 0.05$) and did not significantly predict achievement in physics suggests that in order to raise students' achievement in Physics, Locus of control is not an important students' characteristic to be considered. This also agrees with the findings of Omotayo, (2012) but contradicts the findings of Ifesanwo, (2012) and Lawal, (2012).

5. Conclusion

The focus of this study was predicting students' Achievement in Secondary School Physics using their academic Self Concept and Locus of Control Scale Scores. Findings revealed that academic self concept and Locus of control, when taken together, significantly predicted students' achievement in Physics; academic self concept alone also significantly predicted students' achievement in Physics however Locus of control did not significantly predict students' achievement in Physics. These findings suggest that as against students' Locus of control, academic self concept is a potent factor to be taken into consideration when explaining physics students' achievement in Physics.

6. Recommendations

Since this study reveals that academic self concept alone and when taken together with locus of control predicts students' achievement in Physics, it is pertinent that teachers aid students to maintain a positive self belief about their academic ability and their belief about the source of control over reinforcement.

Also, Physics teachers should help boost students' personality factors especially academic self concept by being warm towards students and creating a conducive classroom environment that makes physics learning more practical and interesting.

Curriculum affective components of learning should also be incorporated into school curriculum by curriculum developers.

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