



Task Persistence and Past Academic Record of Students in Junior Secondary School Basic Science as Predictors of Students' Academic Achievement in Physics

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Abstract

This study examined task persistence and past academic record of students in junior secondary school Basic Science as predictors of students' academic achievement in physics. Correlational survey research design was employed in the study. A sample of two hundred and ten (210) SS II science students was drawn from a population of 1,904 using multi-stage sampling procedure. "Students' Task Persistence Questionnaire (STPQ)" and "Students' Academic Achievement Proforma (SAAP)" were used for data collection. The instruments were validated, and data obtained from trial testing the STPQ were used to establish the reliability of the instrument using Cronbach Alpha method. An internal consistency reliability index of 0.83 was obtained. Data collected were analyzed using regression analysis. The result revealed that Basic Science predicted students' academic achievement in Physics by 23%. The result also revealed that the variation in students' achievement in Physics as predicted by achievement in Basic Science is significant. The findings also revealed that task persistence did not predict the academic achievement of students in Physics. Based on the findings, it was recommended among others, that Basic Science in junior secondary schools should be properly taught in order to lay a solid foundation so as to ensure a higher academic achievement of students in the senior secondary school Physics; and as well achieve the objectives of Basic Science curriculum.

Keywords: Achievement, Basic Science, Task Persistence, Physics

Introduction

Science is a vehicle that drives any nations' progress and development. Science is the knowledge obtained from the systematic study of the structure and behaviour of the physical world, especially by observing, measuring, experimenting and the development of theories to describe the results of these activities (Ajayi & Ogbeba, 2017). Njoku, (2013) views science as the systematic study of nature through observation and experimentation, leading to the production of an organized body of knowledge needed for problem-solving. It could be deduced that science is a systematic process of making an enquiry about the structure and behaviour of the natural and physical world, based on facts that can be proven through observation and experimentation.

Science as a field of study has enormous contributions to human development. Nations that are considered to be developed have achieved that status through purposeful scientific education of their citizens (Ajayi, 2011). The study of science allows learners to experience the richness and excitement of the natural world as they engage in inquiry, critical thinking and demonstration of skills. Federal Republic of Nigeria (2014) has advocated improvements in the teaching and learning of Science, Technology and Mathematics (STM) in order to lay a solid foundation of technologically oriented manpower in line with the needs of national development efforts. Therefore, learning science becomes more important not only for

the wellbeing of the individual but also for the society as a whole. Due to the importance of science to national development, it was introduced into the Nigerian education system starting from the basic education level as Basic Science.

Basic Science was formally known as Integrated Science but due to some curriculum reforms by the Nigerian Educational Research and Development Council (NERDC) in 2007, which allows learners to appreciate the fundamental unity of science, led to the change of its name. Basic Science as an integrated science course is a subject that deals with the study of living and non-living things. It also combines all other science subjects such as Physics, Chemistry and Biology. Sharad (2009) extended the knowledge of Basic Science to include Mathematics. In the Nigeria education system, science is first presented to the learner at the basic level of education as Basic Science. Basic Science is taught at the Lower (primary 1 - 3), Middle (primary 4 - 6) and Upper (JSS 1 - 3) basic education level.

Basic Science is taught at the primary school level so as to catch the pupils' heart young. As a follow-up, Basic Science is taught at the upper basic education level to enable students to build up and concretize the knowledge of science they had at the primary school level and to lay the foundation for the study of the core science subjects such as Physics, Chemistry and Biology at the senior secondary level of education. Basic Science can be considered as the

foundation of Science Education in Nigeria; basically because it lays emphasis on the fundamental unity of scientific thoughts (Maduabum, 2011). It is expected that by teaching Basic Science to children at the basic education level, every child would be given the basic knowledge and understanding of what science is all about and some of the innovations that are taking place around them. This assertion blends with the objectives of science teaching at the Basic level of Education which is to produce individuals who will be able to live effectively in the modern age of science and technology and contribute to the development of the nation (FRN, 2014).

Basic Science provides students at the upper basic education level with the initial theoretical and practical frameworks which are prerequisites for their future study in core science subjects. This statement was buttressed by Ekundayo (2012) who was of the view that Basic Science enables students to understand science concepts, principles, theories and laws which are further elaborated in the core sciences, including Physics.

Physics is an important science subject that makes immense academic demands on the students in its learning. Physics as one of the science subjects remains one of the most difficult subjects in the school curriculum (NERDC, 2007). Physics refers to the basic physical science; it can, at base, be defined as the science of matter, motion and energy, and how they relate to each other. The learning of the physics is difficult at best and almost impossible at worst but because of its enormous importance to science and technology, there is huge interest in student's achievement in physics (Samuel, 2016). Despite its importance, studies have revealed that the academic achievement of Nigerian students in Ordinary Level Physics has been generally and consistently poor over the years (Ogunbanwo, 2014). Science students, after taking their BECE are expected to be able to reflect mastery of basic concepts of science which could also enhance their academic achievement in the science subjects and usher them into studying science related courses at tertiary institutions. But this may not be the case owing to the fact that over the years, the academic achievement of students in Physics at both internal and external examinations is still placed below the expected level (Saage, 2009).

The term "academic achievement" has been described as the scholastic standing of a student at a given moment. It refers to how an individual is able to demonstrate his or her intellectual abilities. This

scholastic standing could be explained as the grades obtained in a course or group of courses taken. Ezugwu, Ibenegbu, Mbonu-Adigwe & Okoye (2022) views academic achievement as the outcome of the assessment of a student's intellectual ability which can be measured by grades obtained from examinations or continuous assessment. It is, in other words, the outcome of a teaching and learning process.

For the periods reviewed, there has been a general poor academic achievement of students in Physics. Tracing the trends in students' achievement in Physics, Samuel (2016) noted that students performed very poorly in external examination. In supporting the finding, Enemarie (2016) found that students' achievement in Physics is poor. Sakiyo and Badau (2017) also found that students' academic achievement in Physics in public examinations has not been satisfactory.

Subsequently, available data from the two public examination bodies in their appraisal report on Senior Secondary Certificate Examination (SSCE) indicates that there was a downward trend in students' achievement in core Physics in Nigeria (WAEC Chief Examiners Report, 2018). Records from WAEC Chief Examiner's report (2016) showed that from 2014 to 2016, there was a negative trend in the achievement of students in Physics with an average achievement of 56.01%. The report showed that only a few students obtained a minimum of five credits in Physics. The NECO Chief Examiners Report also shows that in the period between 2015 to 2019, students' results in Physics have been poor (NECO, 2019).

These poor academic achievement of students in Physics has been attributed to many factors ranging from method of instruction, unavailability of instructional materials, poor classroom management, lack of qualified science teachers, and inadequate exposure of students to activities (Abdullahi & Bichi, 2017; Adewale, 2019). Notwithstanding, researchers have tried to find solution to these problems by advocating the use of innovative teaching methods and materials, integration of ICT in teaching, proper classroom management, task-based learning, yet the problem persists. This calls for concern as Physics is one of the core subjects for admission into tertiary institutions for candidates going into pure science courses (Bello & Oke, 2012). Due to the fact that the learning of Physics involves active learner participation and engagement, it is possible that a high academic achievement in Physics

could be attributed to high persistence in academic task.

Task persistence is the ability to stick to something in spite of distractions, physical or emotional discomfort or lack of immediate success. In the words of Andersson and Bergman (2011), task persistence is the ability to persevere and to sustain attention at a task, even in the presence of internal and external distractions. Task persistence is an important skill throughout life, for educational and occupational attainment. Valiente (2008) stated that task persistence is expected to have a positive influence on academic achievement and vice versa. A number of studies have shown the importance of task persistence in academic achievement. Valiente (2008) found a positive influence of persistence on academic achievement. Porpat, (2010) showed that task persistence affects an individual's educational attainment positively. Rabiner, Godwin and Dodge (2016) found that persistence in a task contributed to a high academic achievement and attainment of success. In the same vein, Gert, Gijbels, Coertjens and Petegem (2012) found a positive influence of task persistence on students' academic success. Affendey, Paris, Mustapha, Sulaiman and Muda (2010) showed that task persistence was one of the factors identified as predicting academic performance of students. This shows that there could be a relationship between task persistence and academic achievement of students in the core science subjects. However, gaining an insight on students' academic achievement in Basic Science as well as how they persist in doing academic tasks may provide useful insight into acknowledging their areas of improvement and strength in future achievement in Physics.

Considering the divergent views and findings of previous researchers on the predictive validity of the Basic Education Certificate Examination in Basic Science, it is therefore on this premise that the researcher deems it pertinent to carry out a study to find out if students' past academic record (Basic Science achievement scores of students at junior secondary school examination result) coupled with their perseverance skill in a psychomotor task (task persistence of students) can be effectively used in predicting their academic achievement in Physics.

The purpose of this study was to find out students' academic achievement in senior secondary school Physics as predicted by their academic achievement in Basic Science and task persistence. To

address the problem of the study, the following research questions were posed to guide the study:

1. What amount of variation in students' achievement in Physics is predicted by their achievement in Basic Science?
2. What amount of variation in students' achievement in Physics is predicted by task persistence?

The following null hypotheses were formulated and tested at 0.05 (α) level of significance:

Ho₁: Students' achievement in Basic Science is not a significant predictor of students' achievement in Physics.

Ho₂: Task persistence is not a significant predictor of students' achievement in Physics.

Method

The study adopted a correlational survey research design. This kind of research design seeks to establish what relationship; association or co-variation exists between two or more variables. The population for this study consists of 1,904 senior secondary two (SS2) science students in public secondary schools in Nsukka education zone for 2018/2019 academic session. There are 1200, 461 and 243 SS2 science students in Nsukka, Igbo-Etiiti and Uzo-Uwani LGAs, respectively. The sample of this study consists of 210 SS2 science students drawn from the population. The sample was drawn using multi-stage sampling procedure.

The researcher developed two instruments titled "Students' Task Persistence Questionnaire (STPQ)" and "Students' Academic Achievement Proforma (SAAP)". The STPQ has two sections: section A contains the demographic data of the respondents and section B contains 25 items rated on a four (4) point Likert type scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) with numerical values of 4, 3, 2, and 1 respectively, to seek information on students' task persistence in science-related activities. The student's Academic Achievement Proforma (SAAP) was used to collect the already existing achievement scores of the sampled SS2 science students in their Basic Science BECE of 2017 and their scores in Physics end-of-term results. The Proforma contains four columns: serial number, students' identification number, scores obtained in Basic Science BECE, and scores obtained in Physics in their class end of term results.

The instruments were subjected to face and construct validation. The construct validity of the items of the STPQ was ascertained through Factor Analysis using Principal Component Analysis (PCA) with Varimax Rotation on three (3) factor loadings. A total number of thirty (30) students were used for this. In selecting valid items, the researcher employed Meredith (1969) criterion of 0.35 and above for substantive factor loadings for valid items. However, 23 items were considered pure, and thus selected. The STPQ instrument was trial tested on an equivalent group of 30 students. The internal consistency was established using Cronbach alpha reliability method and a reliability coefficient of 0.83 was obtained, and this shows that the instrument is reliable and adequate for the study.

The researcher visited each of the schools that were used for the study. Such visits helped the researcher to make contacts with the school authority especially the principals and the form teachers of the students, who provided information about the students. After that, the researcher with the help of three (3) research assistants, administered the STPQ instrument to the respondents, and collected them on the spot too. Meanwhile, with the permission of the school principals and form teachers, students' achievement scores in Basic Science for the 2017 BECE and their class end of term achievement scores in Physics were

obtained from the principals and form teachers respectively, using the Proforma. Data collected were analyzed using multiple regression analysis. Meanwhile, coefficient of determination (R^2) was used to answer all the research questions. For the hypotheses, ANOVA output from regression analysis was used to test all the hypotheses. All the hypotheses were tested at 0.05 level of significance.

Results

Table 1: Amount of variation in students' achievement in Physics that is predicted by achievement in Basic Science

Model	N	R	R^2	Adjusted R^2
1	210	0.48	0.23	0.23

N = Number of respondents (students), R = Correlation coefficient, R^2 = Coefficient of determination

Result in Table 1 shows the amount of variation in students' achievement in Physics as predicted by achievement in Basic Science. The Table showed a moderate positive correlation coefficient (R) of 0.48 with associated coefficient of determination (R^2) of 0.23. This coefficient of determination (R^2) indicated that 23% variation in students' achievement in Physics (criterion variable) is predicted by their achievement in Basic Science (predictor variable).

Table 2: Regression analysis of students' achievement in Basic Science in predicting students' achievement in Physics

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	8653.15	1	8653.15	62.42	0.00
Residual	28833.63	208	138.62		
Total	37486.78	209			

$\alpha = 0.05$

Result in Table 2 showed that an F-ratio of 62.42 with associated probability value of 0.00 was obtained. This probability value of 0.00 was compared with 0.05 level of significance and it was found to be significant because 0.00 is less than 0.05. The null hypothesis was therefore rejected and inference drawn that, students' achievement in Basic Science is a significant predictor of students' achievement in Physics.

Table 3: Amount of variation in students' achievement in Physics that is predicted by task persistence

Model	N	R	R^2	Adjusted R^2
1	210	0.04	0.00	- 0.00

N = Number of respondents (students), R = Correlation coefficient, R^2 = Coefficient of determination

Result in Table 3 shows the amount of variation in students' achievement in Physics as predicted by task persistence. The Table showed a low positive correlation coefficient (R) of 0.04 with an associated coefficient of determination (R^2) of 0.00. This coefficient of determination (R^2) indicated that 0% variation in students' achievement in Physics is predicted by task persistence.

Table 4: Regression analysis of students' task persistence in predicting their achievement in Physics

Model	Sum of Squares	Df	Mean Square	F	Sig.
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Regression	45.23	1	45.23	0.25	0.62
Residual	37441.55	208	180.01		
Total	37486.78	209			

$\alpha = 0.05$

Result in Table 4 showed that an F-ratio of 0.25 with associated probability value of 0.62 was obtained. This probability value of 0.62 was compared with 0.05 level of significance and it was found not to be significant because 0.62 is more than 0.05. The null hypothesis was therefore not rejected and inference drawn that, task persistence is not a significant predictor of students' achievement in Physics.

Discussion

The findings of this study showed a positive relationship with 23% variation in students' academic achievement in Physics as predicted by their achievement in Basic Science. This implies that, other variables not investigated by this study predicted more of students' academic achievement in Physics by 77%. Findings also revealed that the variation in students' academic achievement in Physics as predicted by achievement in Basic Science is significant. The findings of this study corroborate with the findings of Ugwu (2011), who found that Basic Science significantly predicted the achievement of students in the individual science subjects including Physics in senior secondary schools, even though the current study did not predict as much amount as the previous study. However, the finding disagrees with the findings of Onwukwe and Okereke (2009) whose findings revealed that there is no significant difference in achievement in Basic Science and single science subjects including Physics, among secondary school students.

The probable explanation for this finding could be as a result of the fact that the aspect of Physics in Basic Science were not well expressed in the course of its teaching at the junior secondary school level, and as such did not lay a good foundation for the study of Physics at the senior secondary school level. It could also be that the Basic Science teachers were not very democratic in their teaching of basic Physics concepts which must have made the learning of Physics boring and uninteresting to the students hence discouraging them from developing love and interest in learning Physics as a single science subject at the senior secondary school level. Another reason could be that the objectives of Basic Science as stipulated in the Basic Science curriculum were not actualized, and however, did not prepare the students

well for the learning of Physics at the senior secondary school level.

The findings of this study showed a positive relationship with 0% variation in students' academic achievement in Physics as predicted by task persistence. This implies that, students' academic achievement in Physics is not predicted by task persistence. Findings also revealed that the variation in students' academic achievement in the Physics as predicted by task persistence is not significant. The result of this study is not in line with the findings of Rabiner, Godwin and Dodge (2016) which revealed that task persistence highly predicted students' academic achievement. In addition, the findings of this study is also in disagreement with earlier findings of Affendey et al (2010) and Gert et al (2012) who found that task persistence was a good predictor of academic achievement among school children. However, the findings of this study indicate that task persistence alone does not determine to a great extent, a students' success or failure in performing academic tasks.

This shows that students' academic achievement may not be as a result of their constant persistence in only classroom activities but other factors around the school environment, since task persistence has proven not to significantly contribute to the academic achievement of the students in Physics. This point can be justified by the fact that in carrying out activities in the course of learning Physics in the classroom, a lot of factors has to come into play in order to diligently carryout these activities so as to get to the final result. In carrying out these tasks, there are processes involved which are called science process skills; they include, measuring, classifying, and communicating, among others. However, science related activities cannot be carried out effectively without involving these processes. This is because science is not done haphazardly but as a process, and this could have influenced the findings of this study.

Conclusion and Recommendations

On the strength of the findings of this study, the following conclusions were drawn. Basic Science predicted students' academic achievement in Physics by 23%. However, the variation in students' achievement in Physics as predicted by achievement in Basic Science is significant. Task persistence predicted

variation in students' academic achievement in Physics by 0%. However, the variation in students' achievement in Physics as predicted by task persistence is not significant.

It is recommended therefore that; apart from content coverage of the curriculum, the teacher should also be sensitive about other factors that contribute positively to students' academic achievement such as teacher's disposition, school climate, peer tutoring, classroom environment, etc, and incorporate them in the teaching and learning process since they are proven to have contributed to a large extent to students' academic achievement.

Physics teachers should try to explore better ways that would help steer up the students' interest in learning Physics other than task persistence as this may help in promoting their academic achievement in this subject. For instance, the teacher should introduce humour in the classroom during the teaching of Basic Science in the junior secondary school rather than just giving them tasks as a way of engaging them in meaningful learning.

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