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**Impact of Prior Knowledge of Behavioural Objectives on  
Students' Academic Achievement in Physics**

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**Abstract**

This study investigated impact of prior knowledge of behavioural objectives on students' academic achievements in physics. The quasi-experimental research design was used for the study. The sample for the study consisted of a total of one hundred and eighty eight (188) students drawn from secondary schools in Yakurr and Abi Local Government Areas of Cross River State. Ten secondary schools were used for the

study. Five schools were purposively assigned to the experimental group while the other five schools were assigned to the control group. The instrument for data collection was the Atomic Physics Achievement Test (APAT) which consisted of fifty (50) items of multiple choice in nature. The instrument had a reliability index of 0.89 using the Kuder-Richardson formula -20. After pretest both groups were taught the concept of atomic physics but with the experimental group given the behavioural objectives before commencement of treatment. The data collected were analyzed using analysis of covariance with pretest scores as covariate. The results of the study showed significant difference in academic achievement between the experimental and control groups, significant difference in achievement between male and female students with the females taking the lead and a significant interaction effect between treatment and gender of the students. It was concluded that prior knowledge of behavioural objectives promote students' academic achievement. Hence, it was recommended, among others, that physics teachers should be encouraged to give students behavioural objectives prior to the teaching of the concept.

**Key Words:** Prior Knowledge; Behavioural Objectives; Academic Achievement; Physics.

### **Background to the Study**

Physics is one of the major Science subjects offered by students at the senior secondary school level of education. Science on its own had been defined by many and such definitions include that by Ogunkunle (2009) who stated that "science is a dynamic human activity concerned with understanding the workings of the world." Omole and Chiroma (2005) defined science as "the systematic study of nature to find out knowledge, principles and pattern that are applied to improve living standards of man". It is this systematic study of nature that has brought advances and discoveries in science. These discoveries and the level of technological advancement had led to the categorization of the world into developed, developing and under-developed countries.

Physics as a branch of science concerns itself with the study of matter and the energy changes associated with the matter. The subject attracts fewer numbers of enrolments as compared to other science subjects. This is why Abiam (1997) Orji (2000) and Udo (2011) stated that physics has the lowest popularity index among secondary school sciences. This is based on the assumption by the students that the subject is difficult and abstract in nature.

The paucity of students to study physics is a serious concern to Nigeria and indeed all stakeholders in education. This is because the products of physics has its usefulness at home, industry, hospital and even in the farm. It is also a major pre-requisite for the study of engineering, technology, medicine, and other science based courses.

Physics education is besetted with myriad of problems, but notably among them is the method this subject is delivered to the recipients. Among other components of the teaching process, the delivery of instruction is very essential. A good instructional delivery will translate to a good evaluation. But today, the delivery of instruction in our schools leaves much to be desired (Effiong, Nkwo and Udo, 2014). Thus the need for reform in physics instruction has become necessary in order to improve students' achievement. In this way the tendency of underachievement will be removed. Underachievement is seen as low achievement due to inability of the classroom instruction to evoke the totality of the innate potentials of the learners. This is why this study on the effect of prior knowledge of behavioural objectives on physics students' academic achievement is being undertaken.

Prior knowledge is the knowledge available to the learner before learning tasks begin (Edinyang, 2006). And exposing the students to behavioural objectives of the concept prior to the commencement of the lesson is what is known as prior knowledge of behavioural objectives. According to Hartlay and Davis in Igbojinwaekwu (2012) when students are exposed to the behavioural objectives of a concept before the commencement of a lesson, it gives the students direction on the learning activities, permits students to study more effectively and reduce the time wasted on irrelevant materials. It should be noted that the way learning material is introduced to the learner has a great deal to do with students' motivation and learning. Carefully designed and adequately prepared introductory activities can do a great deal to bridge the gap between what had been learnt and what to be learnt. As asserted by Ogenewede (2012), for effective teaching to take place, the teacher must stimulate, encourage and maintain active participation of students through the selection of appropriate teaching methods. The mastery of subject matter content alone by the teacher is not enough but the method employed in delivering the content matters a lot.

### **Purpose of the Study**

The purpose of this study were:

- (1) To find out the effect of prior knowledge of behavioural objectives on the mean achievement scores of senior secondary school students in physics
- (2) Determine if there exist any significant difference in the mean achievement scores of female and male senior secondary school physics students, when exposed to prior knowledge of behavioural objectives
- (3) To find out if there is any interaction effect of prior knowledge of behavioural objectives and gender on students' achievement in physics

### **Research Hypotheses**

The following null hypotheses were formulated and tested at 0.05 level of

significance as a guide:

H<sub>01</sub>: There is no statistically significant difference in the mean achievement scores of students taught physics with prior knowledge of behavioural objectives and those taught without prior knowledge of behavioural objectives.

H<sub>02</sub>: There is no statistically significant difference in the mean achievement scores of male and female students taught physics with prior knowledge of behavioural objectives and those taught without prior knowledge of behavioural objectives

H<sub>03</sub>: There is no statistically significant interaction effect between the treatment and the gender of students in the mean achievement scores in physics.

### Method

The study adopted the quasi-experimental design. The population for the study consisted of all senior secondary school (SS II) physics students in Yakurr and Abi Local Government Areas of Cross River State. Yakurr and Abi are located in the central Senatorial District of Cross River State, Nigeria. Yakurr Local Government Area has fourteen (14) government owned secondary schools while Abi Local Government Area has ten (10) government owned secondary schools. The simple random sampling technique was used to select six secondary schools from Yakurr Local Government Area and four secondary schools from Abi Local Government Area. Three schools from Yakurr were purposively assigned to the experimental group while the other three schools were purposively assigned to the control group. Also in Abi Local Government Area two schools were assigned to the experimental group while the other two schools were assigned to the control group. Thus both experimental and control groups had five schools each and in each of the schools selected, an intact class of the students were used. This brought the sample size to one hundred and eighty eight (188) SS II students. The experimental group was made up of ninety eight (98) students, sixty six (66) males and thirty two (32) females while the control group comprised of ninety (90) students, sixty (60) males and thirty (30) females.

The instrument for data collection was the Atomic Physics Achievement Test (APAT). The APAT was a multiple choice test items that consisted of fifty (50) questions drawn from atomic physics. Each correct answer of the APAT attracts two marks while each wrong score attracts a zero score.

The instrument was face validated by three experts. Two in physics education and one in measurement and evaluation from the Cross River University of Technology, Calabar. The instrument was also subjected to item analyses and the results showed difficulty index of 54.3% and discrimination index of 55%.

The instrument was trial tested using 30 students in a school similar to those used in the study. The results of this trial test was used to calculate the reliability of the

instrument using Kuder-Richardson formula - 20. The analysis showed a reliability index of 0.89 which was high enough to consider the instrument reliable.

Pretest of the APAT was administered to both the experimental and control groups before the commencement of treatment. The results of the pretest showed that the two groups were not significantly different, hence any difference after treatment could thus be attributed to the difference in treatment.

The two groups were taught the concept of atomic physics for three weeks using a structured lesson note prepared by the researcher. The researcher employed the services of the regular physics teachers in each of those schools. The physics teachers had been trained on the concept and how to use the lesson package. The experimental group were given the behavioural objectives based on the concept of interest before the commencement of treatment while the control group were taught the concept without prior knowledge of the behavioural objectives. After the period of teaching, both groups were administered with the post test. In this case the items were rearranged and a different size of paper used. The results of the study is as presented below.

**Results**

Results of the study are presented below hypothesis by hypothesis. All hypotheses were tested at 0.05 level of significance.

Ho<sub>1</sub>: There is no statistically significant difference in the mean achievement scores of students taught physics with prior knowledge of behavioural objectives and those taught without prior knowledge of behavioural objectives.

**Table 1: Analysis of variance of the achievement scores of students taught with and without prior knowledge of behavioural objectives:**

Source of variation	Sum of squats	df	Mean square	F	Sig.
Correct model	6612.79	4	1653.20	68.32	0.000
Intercept	2591.76	1	2591.76	107.10	0.000
Pretest	264.88	1	264.88	3.65	0.056
Treatment	5710.60	1	5710.56	235.99	0.000*
Gender	412.56	1	412.56	17.05	0.000
Treatment x Gender	588.07	1	588.07	24.30	0.000
Error	4428.32	183	24.20		
Total	75704.00	188			
Corrected total	11041.11	187			

\* Significant at 0.05 alpha level

R square = 0.599, Adjusted R squared = 0.590

From table 1, the analysis showed that there is a significant difference between students taught physics with prior knowledge of behavioural objectives and those taught without prior knowledge of behavioural objectives ( $f - cal = 235,99$ ,  $p = 0.000$ ). Hence the null hypothesis is rejected at the 0.05 level of significance. This implies that prior knowledge of behavioural objectives significantly influenced students' academic achievement in physics. The table also shows a regression index squared of 0.590, indicating that about 60% of the total variance in the achievement of students in physics is attributable to the influence of prior knowledge of behavioural objectives.

H0<sub>2</sub>: There is no statistically significant difference in the mean achievement scores of male and female students taught physics with prior knowledge of behavioural objectives and those taught without prior knowledge of behavioural objectives.

**Table 2: Analysis of variance of the mean achievement scores of male and female students taught physics with prior knowledge of behavioural objectives.**

Source of variation	Sum of squats	df	Mean square	F	Sig.
Correct model	6612.79	4	1653.20	68.32	0.000
Intercept	2591.76	1	2591.76	107.10	0.000
Pretest	264.88	1	264.88	3.65	0.056
Treatment	5710.60	1	5710.56	235.99	0.000
Gender	412.56	1	412.56	17.05	0.000*
Treatment x	588.07		588.07	24.30	0.000
Error	4428.32	183	24.20		
Total	75704.00	188			
Corrected total	11041.11	187			

\* Significant at 0.05 alpha level of significance

The results in table 2 showed that there is a significant difference in the mean achievement scores of male and female students exposed to prior knowledge of behavioural objectives. Thus, the null hypothesis is rejected. This implies that prior knowledge of behavioural objectives has gender disparity. The post-hoc analysis showed that the male students in the experimental group had an adjusted mean of 66.91 and a standard deviation of 4.79 while the female in the experimental group had an adjusted mean of 74.06 and standard deviation of 7.56. This indicates that prior knowledge of behavioural objectives favours the females than the male students.

H<sub>03</sub>: There is no statistically significant interaction effect between the treatment and the gender of students in the mean achievement scores in physics.

**Table 3: Analysis of variance of the interaction between treatment and gender of student in physics.**

Source of variation	Sum of squats	df	Mean square	F	Sig.
Correct model	6612.79	4	1653.20	68.32	0.000
Intercept	2591.76	1	2591.76	107.10	0.000
Pretest	264.88	1	264.88	3.65	0.056
Treatment	5710.60	1	5710.56	235.99	0.000
Gender	412.56	1	412.56	17.05	0.000
Treatment x	588.07		588.07	24.30	0.000*
Error	4428.32	183	24.20		
Total	75704.00	188			
Corrected total	11041.11	187			

\* Significant at 0.05 alpha level of significance

From table 3, there is a significant interaction effect between treatment and gender of students ( $P < 0.05$ ). Hence the null hypothesis is rejected. This means that the effect of prior knowledge of behavioural objectives on students' achievement is not the same at all levels of gender.

### **Discussion of Results**

The result of the study as shown in table (1) indicate that there is a significant difference between the experimental and control groups. This is because the prior knowledge of behavioural objectives provides the students with a clear goal, give room to effective study and reduce time that could be wasted on irrelevances. Also prior knowledge of behavioural objectives provides the students with the specific objectives and has an anchoring effect that enhances learning. Thus the listing of what students should know at the end of the lesson help students to be more focused on main issues and lead to better assimilation of the relevant facts. The prior knowledge of behavioural objectives is very advantageous because it enables both the teacher and the students to get clear purposes, the broad content is broken down into manageable and meaningful pieces, it facilitates the organization of the contents into sequences and in hierarchies, it simplifies evaluation and clarifies the selection of materials to be used in the lesson. The result of this study is in conformity with that of Igbojinwaekwu (2012) and Nwagbo and Okoro (2012) that found significant difference between the experimental and control groups after treatment. On the achievement of male and female students, the results as shown in table 2 showed a significant difference in the mean achievement scores of male and female students. However, the female students were found to perform better than the males. This is because the female's adjusted mean (74.06) was higher than those of the male students (66.91). Hence prior knowledge of behavioural objective favours the female students than the male students. This result confirms that of Akinsola and Igwe (2002) and Udo (2011) in which the female students performed better than their male counterparts after treatment.

On the effect of interaction, the study showed a significant interaction effect between treatment and gender, with the females taking the lead. This result is however in contrast with that of Agommuoh and Nzewi (2003) that showed no significant interaction effect between gender and treatment. The result of this study however confirms the statement of Jensen in Abonyi (2002) that no single instructional process provides optimal learning for all the students. That is a particular instructional process tends to favour some students than others.

### **Conclusion/Recommendations**

As evident from the results of this study, students exposed to prior knowledge of behavioural objectives strategy performed significantly higher than their counterparts taught atomic physics with the conventional lecture method. This implies that teachers should be encouraged to use the prior knowledge of behavioural objectives strategy in delivering their lessons. Also adequate workshop should be organized for all science teachers to enable them acquire the skills of effectively and efficiently applying prior knowledge of behavioural objectives teaching strategy in the teaching/learning process. Experience from the field has it that most science teachers do not know how to state



educational objectives in behavioural terms.

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