

# Integrated Process Skills (IPS) and Students' Achievement in Physics Practical's in Ikwerre Local Government Area, Rivers State

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## Abstracts

Physics is an experimental subject that requires high dexterity, intellectual ability and skills for its understanding. The acquisition of appropriate scientific skills enhances both mental and physical abilities required for academic performance, problem solving and contributions towards societal development. Therefore, this study was to investigate acquisition level of components of Integrated Process Skills (IPS) among secondary school students in physics practicals in Ikwerre Local Government Area of Rivers State. The non-experimental participant observation research designs were adopted for the study. A sample size of 180 Senior Secondary two (SS2) physics students was selected for the study using a purposive sampling technique. Data was collected using the "Integrated Process Skills Test in Practical Physics" (IPSTPP) with a reliability index of 0.76. The data gathered were analyzed using multiple correlation analysis, Analysis of Variance (ANOVA) and Scheffe post-hoc analysis at 0.05 level of significance. The findings of the study revealed that students' achievement in physics practicals is significant and positively related to the components of integrated process skills and that there is significant difference in students' achievement on physics practicals as a result of component of Integrated Process Skills with a post-hoc analysis that indicates that students' performance was highest in Identification and Controlling Variables (ICV) and least in Graphing and Interpreting Data (GID). Based on the findings, recommendations were made to enhance students' acquisition of integrated process skills during physics practical's.

**Keywords:** Acquisition, Components, Integrated Process Skills, Physics, Practical's.

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## INTRODUCTION

Man finds himself in a complex world that compel him to study nature's laws and behaviour using a systematic and logical means such that he would find convenience for himself. The study is dynamic and continuum, unveiling further knowledge for man's existence and survival. By

conscious and unconscious efforts, man has been indulging in science. The Science Council (2015) stated that science is the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence. It is a body of empirical, theoretical and practical knowledge about the natural world produced by consistent and cumulative process, which emphasize on observation, explanation and prediction of real world phenomena using experiment, (Mishra & Yadav, 2013). Science is therefore a product as well as a process. The processes of science are procedures or activities used by scientists in the formulation, verification of generalizations of events in nature.

Physics as a science subject is the study of physical properties of matter and its interaction with energy. It is typically an experimental subject; principles and concepts generated from physics are very useful in interpretation of natural phenomena in sciences. The general objectives of the physics curriculum as stated in the curriculum document (FME, 2009) are to:

- (i) Provide basic literacy in physics for functional living in the society
- (ii) Acquire basic concepts and principles of physics as a preparation for further studies
- (iii) Acquire essential scientific skills and attitude as a preparation for the technological application of physics.
- (iv) Stimulate and enhance creativity.

The above objectives serve as guide in attaining a holistic scientific literate society if adequately pursued. Therefore, principles or concepts in physics should be taught by placing adequate emphases on practical activity (Awotua-Efebo, Williams & Aderonmu, 2015). Approach to the teaching and learning of physics involves theoretical presentations and practical demonstrations, where both students and teachers carry out practical activities. Practical work or activities significantly is any learning experience that learners observe, interact and manipulate with real objects in explaining events of the natural world. In achieving any platform for generalizations in nature, certain scientific skills that an individual is expected to acquire.

Onwioduokit (2013) defined skill has cleverness at doing something, resulting from either practice or natural ability. The Business dictionary (2015) also define skills as the ability and capacity acquired through deliberate, systematic, and sustained effort to smoothly and adaptively carryout complex activities involving ideas and things. Skills denote the mastery of logically linked series of activities that can be learnt easily. It is therefore a quality of performance, which does not depend solely upon a person's fundamental innate capacities, but must be developed through training, practice and experience. Lee (2002) stated that science process skills are necessary characteristics required of a learner to perform scientific activities and solve science problems. Karsli, Sahin and Ayas (2010) argue that science process skills are skills used by scientists for composing knowledge, thinking of problems and making conclusions. Nwosu (1987) revealed that the prerequisite knowledge of concepts and principles in science can be obtained only if the learner underlying capabilities (the science process skills) which are needed to practice and understand science. These skills are the foundation for scientific enquiry as well as the holistic intellectual skills needed to learn the concepts and broad principles used in making valid inductive inference.

To develop scientific process skills, practical activities should form the basis of science instruction. This avenue provides students opportunity to be successful and having a sense of achievement. Wakefield (2002) expressed that when students are successful, they feel confident about what they can do, thereby increasing their self-esteem. Science students need ample avenues to practice science learning within a variety of scientific investigations using required instructions that enhance the needed scientific process skills. Scientific process skills are skills

needed to undertake meaningful scientific enquiry. These skills are steps, which build up scientific characters or methods of scientific thinking in the learner because they are guided through scientific processes. Science process skills include observing qualities, measuring quantities, sorting or classifying, inferring, predicting, computation, experimenting, and communicating. Ango (1992) and Özgelen (2012) classified science process skills into two types such as basic and integrated process skills.

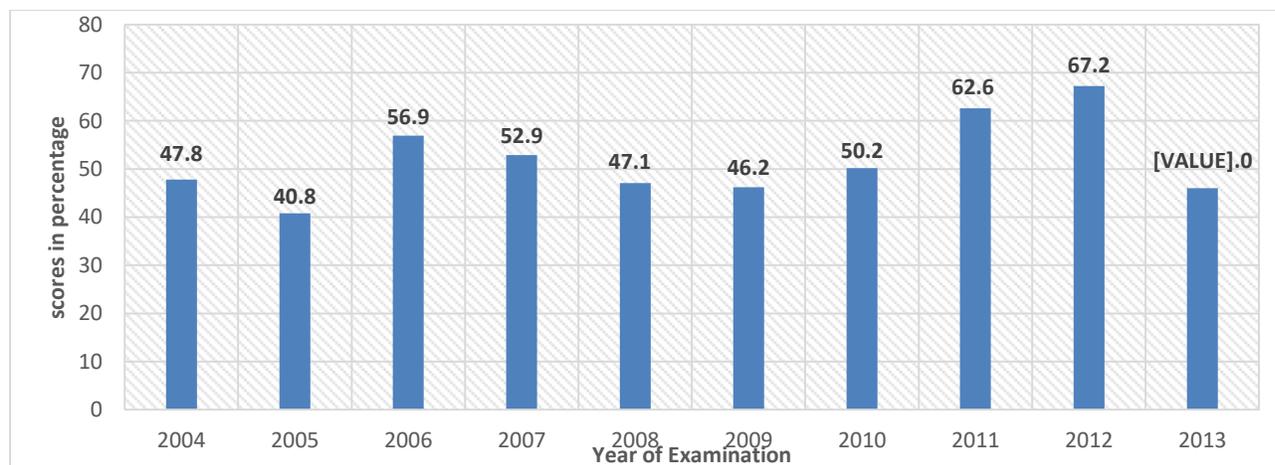
The basic science process skills are fundamental skills required in the development of the integrated skills. Akinbobola and Afolabi (2010) stated that basic science process skills are vital for the learning and formation of scientific concept at primary and junior secondary school. The integrated process skills are more complex skills required for scientific inquiries in senior secondary schools and tertiary levels of education. A learner is expected to possess the basic process skills as they lay the foundation for the application of integrated process skills. The components of Integrated Process Skills (IPS) include; Identification and Controlling Variables (ICV), Stating Hypothesis (SHY), Defining Operationally (DOP), Create Data Table (CDT), Graphing and Interpreting Data (GID).

In carrying out practicals in physics, the components of integrated process skills are fundamental as they form the procedure in achieving required results. The obtained results significantly are the basis on which assessment and reflections to which the learner has acquired the integrated process skills. In light of the above, this paper is therefore designed to establish if there is any relationship between acquisition level of Integrated Process Skills (IPS) and students' performance in physics practicals in secondary schools.

### Statement of Problem

Physics been a science subject is studied at the senior secondary school and its aim at developing in learners understanding of basic scientific phenomena and application of scientific ideas to everyday life. It is expected that students' performance in physics practical examinations should be a function of the level of integrated science process skills acquire over the years due to consistent involvement in physics practical sessions and as such enhance their performance in the external examinations. However, Chief examiner reports of West African Examinations Council (WAEC) (2013, 2014 & 2015) have identified numerous flaws in students' approach towards physics practicals and as such significantly affected the overall students' performance.

Figure 1: Analysis of science students' performance of WAEC from 2004-2013



Source: West Africa Examination Council, Lagos.

It should be noted that level or growth of science and technology of any nation is a function of how well learners are equipped with scientific skills that are fundamental for finding solution to problems. Practical activity in physics is one means of developing the required skills that is a platform for sustainable development. Then, if consideration is placed on the state of, the question that comes to one's mind is that does the achievement of physics students in practical activities have any relationship with the level of acquisition of components of Integrated Process Skills (IPS)? Based on this, the study seeks to investigate the relationship between acquisition level of Integrated Process Skills (IPS) and students' performance in physics practical's in secondary school.

### **Purpose of the Study**

The purpose of the study is to investigate acquisition level of Integrated Process Skills (IPS) and students' performance in physics practicals in secondary school in Ikwerre Local Government Area of Rivers State. Specifically, the objectives of the study are to:

- Determine the extent of relationship between acquisition level of Integrated Process Skills (IPS) and students' performance in physics practicals in secondary school.
- Investigate the component of Integrated Process Skills (IPS) that is mostly acquired by physics students during physics practical session.

### **Research Questions**

- What is the relationship that exists between acquisition level of Integrated Process Skills (IPS) and students' performance in physics practicals in secondary school?
- Which of the following component of Integrated Process Skills (IPS) is mostly acquired by physics students' during physics practical session?

### **METHODOLOGY**

The research design that was employ for the study was the non-experimental, participant observation research designs. These research designs were used because the researchers do not have direct control of the independent variables. The population of the study comprised of all SS 2 physics students in Ikwerre Local Government Areas of Rivers State. Using a purposive sampling technique, a sample size of 180 Senior Secondary two (SS2) physics students selected from two schools were used for the study. The criteria for the selection of this sample was based on the premise that students from the schools must have must have indulged in several practical's in physics especially those in electricity and the theoretical aspect of current electricity has been learnt.

Data for the study were collected using an instrument called the "Integrated Process Skills Test in Practical Physics" (IPSTPP) which was developed by the researchers. IPSTPP consist of circuit diagram involving the verification of Ohm's law, graph sheets and further questions that will enable the participants to (1) identification and controlling variables involved in the experimentation, (2) state hypothesis, (3) define operationally, (4) create data table and (5)

graphing and interpreting data. There were five sections focused for assessments and each of the sections was graded 20 marks. Therefore, a total score of 100 marks was the highest score expected to be achieved by a student. The instrument was validated by two experts in physics education to determine the face and content validity of the instrument. IPSTPP was subjected to a pilot test applying the test-retest method for an interval of a week to 20 students having same equivalent characteristics with the sample size. The data obtained was analyzed using the Cronbach Alpha Correlation statistics and a reliability index of 0.76 was obtained making the instrument reliable for the study. The data collected for the study were analyzed using the multiple correlation analysis, Analysis of Variance (ANOVA) and Scheffe post-hoc analysis at 0.05 level of significance.

## RESULTS

### Research Question 1:

What is the relationship that exists between acquisition level of Integrated Process Skills (IPS) and students' achievement in physics practicals in secondary school?

Table 1: Analysis of Inter-correlation matrix showing the relationship between the independent variables and students' achievement in physics practicals

Source	1	2	3	4	5	6
Achievement	1.000					
Identification and Controlling Variables	0.659	1.000				
Stating Hypothesis	0.301	0.317	1.000			
Defining Operationally	0.623	0.278	0.020	1.000		
Create Data Table	0.539	0.018	0.402	0.059	1.000	
Graphing and Interpreting Data	0.085	0.110	0.576	0.540	0.307	1.000

Table 1 above indicated that there is positive relationship between each of the components of integrated process skills and students' achievement in physics practical's. It was also shown that students' achievement in physics practicals is significant and positively related with Identification and Controlling Variables (ICV) ( $r = 0.659$ ;  $p < 0.05$ ); with Stating Hypothesis (SHY) ( $r = 0.301$ ;  $p < 0.05$ ); with Defining Operationally (DOP) ( $r = 0.623$ ;  $p < 0.05$ ); with Create Data Table (CDT) ( $r = 0.539$ ;  $p < 0.05$ ) and with Graphing and Interpreting Data (GID) ( $r = 0.085$ ;  $p < 0.05$ ). The findings therefore revealed that change in any of the components of integrated process skills brings about change in students' achievement in physics practical's.

### Research question 2:

Which of the following component of Integrated Process Skills (IPS) is mostly acquired by physics students' during physics practical session?

Table 2: Showing Analysis of Variance of component of Integrated Process Skills on students' achievement in physics practicals

Source	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	871.389	4	217.847	46.132	.002
Within Groups	826.389	175	4.722		
Total	1697.778	179			

The Table 2 above shows the Analysis of Variance (ANOVA) of components of Integrated Process Skills on students' achievement in physics practicals. The findings of the study revealed that there is significant difference in students' achievement on physics practicals as a result of component of Integrated Process Skills with  $F_{(4,175)} = 46.132$ ;  $p < 0.05$ . Since there is significant difference between the means of component of Integrated Process Skills, further analysis of multiple comparisons using the Scheffe post-hoc test was employed to determine the margin of difference between the mean.

Table 3: Showing Scheffe post-hoc analysis of difference between the means of component of Integrated Process Skills

Component of Integrated Process Skills	N	Subset for alpha = 0.05			
		1	2	3	4
ICV	180	74.833			
DOP	180		61.444		
SHY	180		50.167		
CDT	180			49.583	
GID	180				21.417
Sig.		1.000	.188	.861	.273

Analysis of Table 3 is the post-hoc analysis of marginal mean difference between the components of Integrated Process Skills (IPS) on students' achievement in physics practicals. The study reveals that Identification and Controlling Variables (ICV) has the highest mean value of 74.833, which was followed by Defining Operationally (DOP) with mean value of 61.444, Stating Hypothesis (SHY) with mean value of 50.167, Create Data Table (CDT) with mean value of 49.583 and Graphing and Interpreting Data (GID) with mean value of 41.417.

The findings of the study revealed that during practical activities in physics, students' achievement was highest in Identification and Controlling Variables (ICV), followed by Defining Operationally (DOP), Stating Hypothesis (SHY), and Create Data Table (CDT). However, students' achievement in physics practicals is least in Graphing and Interpreting Data (GID).

## DISCUSSIONS OF FINDINGS

This research work was focused on investigating acquisition level of components of Integrated Process Skills (IPS) and students' achievement in physics practicals. Data showed that students' achievement in physics practicals is significant and positively related to the components of integrated process skills, and that there is significant difference in students' achievement on physics practicals as a result of component of Integrated Process Skills with a post-hoc analysis that indicates that students' performance was highest in Identification and Controlling Variables (ICV) and least in Graphing and Interpreting Data (GID). Lending support to the findings of the

study, Sevilay (2011) had commented that integrated process skills are the terminal skills required for practical activities and they enable the development of enthusiastic abilities, scientific disposition and provides intellectual groundwork for scientific inquiries. Koray, Köksal, Ozdemir and Presley (2007) in their research studies showed that there were positive relationships between the students' acquisition of integrated process skills and their achievements in science.

There is need to consciously develop in the students the components of integrated process skills as they recommended that more integrated process skills should be added in external physics practical examination to enable students develop problem solving abilities and creativity which serve as fundamental tools for addressing scientific issues. Ogunniyi (2000) opined that the relevance of acquisition of process skills in science teaching is that it involves students' in doing science. It is on this note that Igboegwu and Okonkwo (2011) expressed that the significance of science process skills could be meaningful when the students exhibit competence in them particularly at their formative stage of learning science in secondary schools. They further explained that these skills when acquired will be carried over to higher education and will as well be utilized in solving everyday problems.

## **CONCLUSION**

Integrated Process Skills (IPS) acquisition in the teaching and learning of science is the hallmark of solving problems and performing scientific experiments. Science learning can never be excluded from the inquiry process and as such development of these skills not only improves students' performance in science subject areas, but avail them the opportunities to have procedural knowledge and become problem solvers in the society.

## **Recommendations**

Based on the findings of the study above, the following recommendations were posited by the researchers:

- Acquisition of all the components of Integrated Process Skills (IPS) should be emphasis by physics teachers during practical session by posing tasks that will encourage students' participation and application of the integrated process skills.
- Objectives that can aid the development all the components of Integrated Process Skills (IPS) should be integrated into the physics curriculum.

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