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# Problems Militating Against the Effective Teaching of Gravitational Force: A Study of Secondary School Physics Teachers in Cross River State, Nigeria

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# Problems Militating Against the Effective Teaching of Gravitational Force: A Study of Secondary School Physics Teachers in Cross River State, Nigeria

## Abstract

This research work seeks to x-ray the problems militating against the teaching of gravitational force as a concept in secondary schools Physics in Cross River State, Nigeria. 38 Physics teachers were used in 28 secondary schools in the area of study. Three research questions were answered using the Physics Teachers Questionnaire on concept of Gravitational Force (PTQCGF) as the instrument for data collection. Data was analyzed using percentage. The results of the study revealed that Physics Teachers qualification, inadequate instructional materials and teachers' preparation to the teaching of the concept were among the problems impeding the effective teaching of gravitational force. Various ways of enhancing the teaching of the concept were highlighted - Participation in in-service training, seminars and workshops to help in acquainting teachers of modern methods of teaching the concept, integrating practical activities with classroom teaching and incentives to Physics teachers.

## Introduction

The success of science programmes depends largely on the classroom teachers. They constitute the most important agent in the ongoing exercise to revolutionize the teaching and learning of Science. Science Teachers have the potentials for enhancing the quality of education by bringing life to the curriculum and inspiring students to curiosity and self directed learning (Awotua-Efebo, 1999). Core concepts that permeate the Senior Secondary Physics curriculum as documented by Ivowi (1993) are motion and energy;while sub-concepts are categorized into five sections which include space, time and motion, conservative principle, waves, fields and quanta. Physics is a physical science which its principles used in fields like geology, medicine, geophysics, engineering, astronomy etc.

In Physics, gravity is the attractive force of earth or other celestial body on an object. We talk about gravitational field as a region around a massive body in which a force of attraction is felt by other bodies. For example, a gravitational field exists on and near the surface of the earth and all the bodies on or near the surface of the earth experience a force of attraction towards the surface of the earth.

## History of the Concept of Gravitational Force

In the 16$^{th}$ century, the Polish Astronomer Copernicus discovered that motion of planets could be explained much more simply if they are considered to circle the sun rather than the earth. The Copernican view was revolutionary because it removed the earth from the center of the universe. This idea was highly controversial. The Danish Astronomer, Tycho Brahe was quite different from his contemporaries. He believed that accurately measuring the positions of the planets in the sky and understanding their motion would be better, this was a magnificent idea.

Armed with the obtained data, Johannes Kepler (a young colleague to Brahe) discovered some remarkable laws regarding planetary motions. Kepler had no idea why the planets traced elliptical paths about the sun and no general explanation for the mathematical relationships which he had discovered. Hence further understanding of

gravitational force required someone to explain Kepler's findings. In 1668, the English physicist, Sir Isaac Newton observed that a force of some kind must be acting on the planets otherwise their paths would be in straight lines. Max (1924) stated that the most modern non-relativistic gravitational calculations are based on Newton's work.

About 1687, a law of universal gravitation which was consistent with Kepler's third law was proposed by Sir Isaac Newton. He statedthat a body attracts another body with a force and that for any two bodies, the force of attraction is directly proportional to the product of their masses involved and inversely proportional to the square of the distance separating them. The concept of gravitation was originated by Isaac Newton to account for the apparent motion of the moon about the Earth, the essence being a force of attraction called gravity, between the Moon and the Earth. Newton used this theory of gravitation to give the first satisfactory explanations of many diverse physical facts, such as Kepler's laws of planetary motion, the ocean tides and the precession of equinoxes.

**The Physics Teacher and Concept of Gravitational Force**

Gbamanja (1999) saw teaching as the organization of curricular and relevant resources and direction of experience and activities to facilitate meaningful resources. The concept of gravitational force is understood using practical and demonstrative approach, therefore individuals who teach it should be practical. Georgewill (1998) opined that students learn more by seeing and acting, these constitute the basics of learners' oriented teaching. The inability of teachers to effectively teach the concept of gravitational force will not only discourage the students from understanding it, but the long term effect on the technological benefits it avails the students.

Teachers with sensitivity and a thorough understanding of the subject matter are highly effective in teaching students since they are the prime objects of the educational system. Several studies have shown that physics teachers are unable to meet up their demands of teaching due to serious deficiencies such as overloaded physics curriculum, shortage of laboratory equipment, lack of instructional teaching materials and few periods of physics teaching. (Akanbi, 1989; Maduabum, 1989; Ogunleye, 2000; Owolabi, 1999; Adolphus, Torunarigha & Aderonmu, 2007). Certain language and scientific term usage constitute reason why students avoid science lesson. Graham (1978) argued that verbal instructions merged with classroom demonstration will produce sound results. For result oriented teaching, the teacher must prepare himself or herself adequately for the class. He must be conversant with the relevant scientific terms associated with gravitational force which will be used in the classroom. An attempt is therefore made to investigate problems militating the teaching of gravitational force in physics.

**Purpose of the Study**

The purpose of the study was to investigate the problems militating against the effective teaching of the concept of gravitational force and ways to enhance the teaching in secondary schools.

**Research Questions**

1. Are there qualified Physics teachers in our secondary schools?
2. What are the problems involved in teaching of the concept of gravitational force?
3. What ways can be employed to enhance the teaching of the concept of gravitational force in secondary schools?

**Population and Sample of the Study**

The population of the study involved all physics teachers in secondary schools in Cross River State Central which comprises of Biase, Yakurr, Abi and Obubra Local Government Areas. In other to obtain the sample size of the study, the stage sampling was used to obtain the number of schools and teachers which made the sample size of the study.

As a result of the above sample technique used, seven (7) schools from each Local Government Area were chosen, making a total of 28 schools. However, 38 teachers were used among the Local Government Areas.

**Research Design and Instrument**
The research was conducted using the survey research design method so as to elicit information from the respondents. The data collecting instrument was a 9-item questionnaire captioned "**Physics Teacher Questionnaire on Concept of Gravitational Force" (PTQCGF)**. The first five item statement of the questionnaire deals with the problems militating the teaching of the concept of gravitational force while item statement 6 – 9 specifically highlight ways to enhance the teaching of the concept.

The research instrument was subjected to test of reliability using the test re-test method in a location which is entirely different from the population of study i.e. Akampkpa LGA. Using the Product Moment Correlation Coefficient (mean deviation method) the coefficient of reliability of 0.92 was generated which was suitable for the study.

**Data Collection and Analysis**
The PTQCGF instrument was personally administered by the researcher to the sampled respondents so as to obtain 100% retrieval of the research instrument after duly completed by the respondents. To analyze the collected data generated for the study, the simple percentage formula was employed for research question 1, while the descriptive statistics using the 4 point Likert scale mean rating method was used for research question 2 and 3.

In decision taking, any calculated mean ($\bar{x}$) that is above the mean rating (xr) of 2.50 is "Accepted" while calculated mean ($\bar{x}$) below the mean rating (xr) of 2.50 is "Rejected".

**Results and Discussions**

**Research Question 1:** Are there qualified Physics teachers in our secondary schools?
Table 1 revealed the data of physics teachers' qualification in the area of study. It was observed that 36.8% had qualified teachers' certificate while 63.2% do not acquire qualified teachers certificate. Adolphus and Torunarigha (2007) stated that in any system of education, teachers as professionals are significant to the survival and purpose of education. Effective teaching of concept like gravitational force requires well trained, skillful and qualified teachers in other to obtain productive goal oriented result. Umoren (2001) added that a teacher who lacks professional experience or qualification endangers the entire school system and his handling of the curriculum and teaching methods largely depends on outdated methods which do not include innovation and skillfulness.

**Research question 2:** What are the problems involved in the teaching of the concept of gravitational force?

The analysis of table 2 above revealed that item statement 1, 2, 3 and 5 having mean (x) of 2.84, 2.67; 2.53 and 2.57 respectively, while item statement 4 had mean of 2.12. Discussing the issues raised in the study, it was observed that inadequate instructional materials are a constraint to the teaching of gravitational force in secondary schools. Akanbi (1989) posited that creative teaching that is learner centered and problem solving oriented cannot be successfully implemented without variety of instructional materials, facilities and space. Usen (2008) stressed that modern instructional materials are necessities for effective teaching and learning which in turn help to improve students' performance in the SSCE examination. In his view, Akanbi (1989) described these materials as tools for enriching visualizing, amplifying, transmitting and accelerating the teaching and learning process.

The results as shown in table 2 reveal that inappropriate teaching methodology affect the teaching of gravitational force. Methods of teaching adopted by teachers influenced the students learning style and the acquisition of science process skills. As stated in the curriculum document (FME, 1985) the guided discovery method was recommended for physics teaching. These methods ensure effective understanding of the concept. Ivowi (1993) stated that this method is aimed at ensuring that learning is activity based while the students mind is actively engaged through series of well structured experiences.

As shown in the table, communication skills in the teaching of gravitational force are very important. When teachers communicate effectively using the appropriate scientific terms, the learning is very interesting and lucid. Agabi (2002) urges that teachers should endeavor to use proper body movement, proper voice or tone quality and be time conscious while communicating in the classroom.

Finally, the study revealed that inadequate teacher's preparation affects the teaching of gravitational force. Learning is interesting when the teacher develops his or her lesson in a sequential interactive and possesses adequate mastery of the subject. Abraham and Leigha (2008) suggested that lesson planning or preparation consumes more time than actual classroom delivery. However, it makes classroom delivery less tortuous and interesting.

**Research Question 3:** What ways can be employed to enhance the teaching of the concept of gravitational force in secondary schools?

Table 3 revealed that item statements 6 to 9 were accepted with the following mean: 3.16, 2.85, 2.68and 2.73 respectively. Several ways have been highlighted to enhance the teaching of the concept of gravitational force; it was shown that regular participation in workshops, seminars and in-service training would avail the teachers the modern trends of the concept of gravitational force. Physics teachers should be exposed to this training with a view to raising their knowledge skills and approaches to the teaching of the subject.

Also mentioned is availability of Laboratory equipment, as teaching of this concept requires practical activities. Physics laboratories are specifically designed for scientific investigations and testing of ideas to validate or falsify scientific generalizations. An equipped laboratory would enable the teachers to help their students discover new information which will not only require scientific thinking but add depth to their understanding of what is being experimented on (Falk and Balling,1980).

Improving the teaching of gravitational force would also include the consideration of the physics curriculum. The study revealed that a review of the physics curriculum is necessary. This is in line with the view of Adolphus, Torunarigha and Aderonmu (2007). Teaching of gravitational force will be less complicated if the physics curriculum is functional and stimulating so as to achieve the goals of science teaching as a process of inquiry.

Finally, special incentive packages should be given to teachers. These packages will not only aid them financially, but will change that attitude to work, i.e. preparation to work and enable a conducive teaching and learning atmosphere.

## Conclusion

The teacher is a major factor in any educational system. The National Policy on Education (FRN,1998) recognized their importance by stating that no economy can be greater than the standard of their teachers. Therefore, this study specifically focused on problems militating the teaching of gravitational force and ways of enhancing the teaching. Several issues were raised and extensively discussed in other to alleviate the teaching of the concept which has several practicable consequences in science and technology.

**TABLES**

**Table 1:** Showing qualification of Physics teachers in schools sampled for the study.

| Teaching Qualifications | No | Non-Teaching Qualifications | No |
|---|---|---|---|
| M. Ed | - | M. Sc | - |
| B. Ed/B. Sc (Ed.) | 6 | B.Sc./HND | 20 |
| NCE | 8 | OND | 4 |
| Total | 14 | Total | 24 |
| Percentage | 36.8% | Percentage | 63.2% |

**Table 2:** Responses on the problems militating against the effective teaching of the concept of gravitational force

| S/no | Item statement | Mean (X) | Decision |
|---|---|---|---|
| 1 | Inadequate instructional materials affects the teaching of gravitational force | 2.84 | Accepted |
| 2 | Inappropriate teaching methodology affects the teaching of the concept of gravitational force | 2.67 | Accepted |
| 3 | Teachers' communication skills and scientific terms used in the concept of gravitational force affects the teaching. | 2.53 | Accepted |
| 4 | The problem-solving aspect of gravitational force makes the topic difficult to teach. | 2.12 | Rejected |
| 5 | Inadequate preparation affects the teaching of gravitational force. | 2.57 | Accepted |

**Table 3:** Teacher's responses on ways of enhancing the teaching of the concept of gravitational force in secondary schools?

| s/no | Item statement | Mean (X) | Decision |
|---|---|---|---|
| 6 | Participation in regular in-service training, workshop and seminars help in acquitting teachers of modern methods in teaching concepts like gravitational force. | 3.16 | Accepted |
| 7 | Laboratory equipment should be provided to aid effective teaching of the concept | 2.85 | Accepted |
| 8 | There should be a review of the physics curriculum so as to improve the teaching of concepts like gravitational force | 2.68 | Accepted |
| 9 | Implementation of special incentive packages to teachers by the government would motivate them | 2.73 | Accepted |

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