ASSESSMENT STRATEGIES OF PHYSICS TEACHERS IN SECONDARY SCHOOLS: A WAY FORWARD FOR PHYSICS ACHIEVEMENT

By

Dr. P. C. Agommuoh & Prof. U. N. Akanwa

Department of Science Education, College of Education, Michael Okpara University of Agriculture Umudike, Umuahia Abia State Nigeria.

Abstract

This study employed descriptive survey design to investigate assessment of strategies of physics teachers in senior secondary schools; way forward in physics achievement.A sample of 150(78males, 72females) out of a population of 544 senior secondary school physics students in Umuahia North Local Government Area (LGA) of Umuahia Education Zone of Abia State was got by simple random technique.Two research questions and one null hypothesis tested at 0.05 level of significance guided the study. The instrument used for data collection was researchers developed four point Likert type 'questionnaire. The instrument was validated and its reliability obtained as 0.89 using Cronbach Alpha. Data were analyzed using mean to answer the research questions and t test statistics for the hypothesis. Result showed that teacher competence like formulating and adopting good teaching lesson plans, relating new lesson with previous lesson skills and teachers preparation of appropriate and valid assessment tools like assessing students learning with proper evaluation tools, informing students of their performance and improvement, recording and proper computation of students skills among others are strategies the physics teacher can use to improve students achievement in physics. Based on the findings recommendations were made to include physics teachers carrying their students along by giving them feedback on their performances among others.

Keywords: Science, Physics, Teaching/Learning, Assessment, Strategies and Achievement.

Introduction

Advancement in Science and Technology and its application in education have generated rich dividends in most disciplines related to the organization and management of education especially in this 21st century. It is not a disputable fact to say that the developments in science and technology are fundamentally altering the way people live, connect, communicate and transact, with profound effects on economic development (Chetty, 2012). According to Chetty (2012), Science and technology are key drivers to development, since technological and scientific revolutions underpin economic advances, improvements in health systems, education and infrastructure. This applied aspect of science and technology in education has provided a lot of breakthrough in the betterment of the lives of citizens in developing countries.

Stressing the importance of science in nation building, Ezenwa & Gambri (2011) opined that for a nation to attain self-reliance, science and technology must be an important component of the knowledge to be given to her citizens not minding their tribe, creed or gender. Science finds its application in all facets of life such as agriculture, medicine, energy and power supply, biotechnology, space research and nuclear technology. The implication of this is that the understanding of science is very important since it helps man to know more about the universe and things around us. Science comprises the basic discipline such as Physics, Chemistry, Mathematics and Biology.

Physics which is one of the core sciences is crucial to understand the world around us, the world inside and the world beyond us. It is the most basic and fundamental science (Agommuoh & Nzewi, 2003). Physics challenges our imagination with concepts like relativity and strong theory which leads to great discoveries and technologies that change our lives. Its importance cannot be overemphasized hence, the need for all citizens to study the subject with utmost understanding.
Physics has helped in the development of modern technology through the application of its principles to modern invention. Its study enhances an understanding of the interplay of forces in nature because it forms veritable armour against superstition which muddles technological advancement anywhere. Physics as a course of study is perceived generally to be very interesting, vast, mathematical and experimental. Almost all aspect of life science, both living and nonliving has something to do with physics, ranging from engineering to mathematics, biology, chemistry. Physics is one of the pre-requisite subjects for the study of engineering, technological, medical and other applied science courses in the university. Its study instructs a person in the art of critical thinking, how to pose questions and how to solve problems. It also equips graduates with mathematical and information technology skills. The study of physics has been and will remain of tremendous importance to mankind because it is capable of explaining natural phenomenon and everyday occurrences. Physics has some features which are generally accepted and believed to widen the knowledge and increase the horizon of understanding of Physics by the learners (Adeyemo, 2010). Adeyemo (2010), believes that these features if duly and critically followed and applied in any given situation will be able to make the subject easy to comprehend and as a result nullify the misconception of people, students, teachers of physics and others about Physics. One of these features is the method/strategies used by Physics teachers in

assessment of the subject. The implication of this is that Physics teachers should use assessment strategies that will enhance students' achievements in Physics.

The term "assessment" is defined in the Glossary of the 1999 Standards for Educational and Psychological Testing as "any systematic method of obtaining information (from tests or other sources) to draw inferences about characteristics of people, object or program" (Chatterji, 2013). Also Airasian (2001) defines assessment as the process of collecting, synthesizing, and interpreting information to aid in decision-making. For Airasian, assessment involves more than administering, scoring and grading paper-and-pencil tests, and includes the full range of information teachers gather in their classrooms. Assessment is the collecting, recording and analyzing of data about a student's progress and achievement. The main purpose of assessment in Physics is to determine students' achievement in the subject; however, information from assessment can also be used to determine the effectiveness of the teaching methods used to enable all students to achieve to the best of their abilities. It is therefore important that assessment strategies used should be congruent with the expectations of the Physics teacher in the teaching/learning activities in the course of study. Assessment should therefore be planned in advance and be an integral, meaningful part of the instructional process. It is important that all assessment focus on individual performance in meeting the expectations.

In order to collect valid and accurate information about students' attainment of the outcomes, assessment should involve a variety of strategies used frequently throughout the instructional process. Assessment should also be collaborative, involving all participants in the learning process: students, peers, family and teachers. In this, the criteria on which assessment is based should be made clear to all of the participants at the outset. The establishment of the criteria is best achieved with the students themselves; this gives them a role in deciding which aspects or qualities of the project are most important to assess. Once established, a clear list of the assessment criteria should be made easily accessible to remind students of the perimeters of the project. Opportunities should be provided for students to assess their own process and product during and after the project is completed. According to Georgia Department of Education (2016) high quality assessment provides teachers with the information regarding the extent to which students have attained the intended learning outcomes, and it informs teachers' instructional decision making on what to teach and how to teach itas well. Georgia Department of Education (2016) opined that research has found that an effective teacher

i. Gives regular feedback and reinforcement.
ii. Offers timely and specific feedback.
iii. Gives homework and offers feedback on the homework.
iv. Uses open-ended performance assignments.
v. Analyzes student assessments to determine the degree to which the intended learning outcomes align with the test items and student understanding of objectives.
vi. Interprets information from teacher-made tests and standardized assessments to guide instruction and gauge student progress by examining questions missed to determine ifthe student has trouble with the content or thetest structure.

In other words, the Physics teacher's skill in assessment must be more than merely testing students or measuringachievement. The Physics teacher's assessment skill has to center not on how to assess students' achievement but on how to use assessment in pursuit of Physics students' success. Assessment of student learning can emerge in various formats, such as teacherobservation, oral questioning, journal entries, portfolio entries, exit cards, skill inventories, homework assignments, project products, student opinions, interest surveys, criterion referenced tests, or norm-based tests. These are assessment strategies used by teachers. There is therefore the need to investigate the assessment strategies used by Physics teachers in senior secondary schools to enhance achievement in Physics. Hence the need for the study.
The purpose of this study is therefore to investigate the assessment strategies Physics teachers should use in senior secondary schools to enhance achievement in Physics.

Research Question
The following research questions guided the study.

1. What are the mean scores of Physics students' assessment of assessment strategies Physics teachers can use to enhance achievement in Physics?

2. What are the mean scores of male and female Physics students' assessment of assessment strategies Physics teachers can use to enhance achievement in Physics?

Hypotheses

The following null hypotheses guided the study.

Ho_1: There is no significant difference in the mean scores of male and female Physics students' assessment of assessment strategies Physics teachers can use to enhance achievement in Physics.

Method
The study adopted the descriptive survey design to investigate physics students' assessment of assessment strategies of Physics teachers in senior secondary schools; a way forward for Physics achievement. Random sampling technique was used to sample 150(78males, 72females) out of a population of 544 senior secondary school 11 Physics students in Umuahia North Local Government Area (LGA) of Umuahia Education Zone of Abia State. Two research questions and one null hypothesis tested at 0.05 level of significance guided the study. The instrument used for data collection was the researchers developed questionnaire on the assessment strategies Physics teachers can use to enhance achievement in Physics. The questionnaire is a four point Likert scale type of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) which are rated 4, 3, 2 and 1 respectively. The instrument was validated and its reliability obtained as 0.89 using Cronbach Alpha. Data were analyzed using mean to answer the research questions and t- test statistics to test the hypothesis.

Result

Table1: Mean Scores of Senior Secondary School Students' Assessment of the Assessment Strategies Physics Teachers can use in Enhancing Achievement in Physics.

S/N	ITEM	SA	A	D	SD	X	REMARKS
Physics teachers can							
1.	Use conventional multiple-choice, matching, alternate choice, true/false, and fill-in-the-blank questions appropriately.	105	20	20	5	3.5	Agree
2.	Use short answer, constructed response, and essay to encourage students to explain their understanding of important ideas and principles.	90	30	20	10	3.3	Agree
3.	Design performance tasks to ask students to show what they can do with the knowledge and skills learned.	100	30	20	-	3.5	Agree
4.	Observe students informally in the classroom to assess their ongoing learning.	95	40	10	5	3.5	Agree
5.	Encourage students' self-assessment of their own thinking, reasoning, processes, and products.	90	50	5	5	3.5	Agree
6.	Clearly explain homework.	50	25	70	5	2.8	Agree
7.	Design diagnostic assessment to identify students' strengths, weaknesses, and mental readiness for learning new content or skill.	110	20	20	-	3.6	Agree
8.	Use formative assessment to monitor student learning progress and modify instruction.	95	55	-	-	3.6	Agree
9.	Use summative assessment to determine the student attainment of thestandards of subject areas.	100	35	15	-	3.6	Agree
10.	Be a critical consumer of available assessment resources.	40	38	65	7	2.7	Agree
11.	Relate assessment to the content under study and to student capacity.	10	32	105	3	2.3	Disagree
12.	Match assessment to intended learning objectives.	85	45	15	5	3.4	Agree
13.	Align assessment with written and taught curriculum.	90	48	12	-	3.5	Agree

14. Use assessment that can truly reveal whether students understand the learning.	90	30	10	20	3.3	Agree
15. Use ongoing assessment to monitor student progress.	105	22	18	5	3.5	Agree
16. Use multiple assessments to determine whether a student has mastered a skill.	95	45	5	5	3.5	Agree
17. Design assessments to assess both higher- and lower-level content and skills.	105	20	20	5	3.5	Agree
18. Exercise accommodations in assessment for students with special needs.	17	30	100	3	2.4	Disagree
19. Use robust rubrics or scoring guides for student assignments, products, and projects.	90	40	15	5	3.4	Agree

Table 1 clearly showed that all the items have mean values greater than 2.5 which is the mean value of the four-point scale used in the study except items 11 and 18 which have 2.3 and 2.4 respectively. This means that all the Physics students agreed that all these items except items 11 and 18 are assessment strategies Physics teachers can use in the Physics classrooms to enhance achievement in Physics.

Table 2: Mean Scores of Male and Female Senior Secondary School Physics Students' Assessment of the Assessment Strategies used by Physics Teachers in Enhancing Achievement in Physics.

S/N	ITEM	MALE Mean (X)	REMARKS	FEMALE Mean(X)	REMARKS
Physics teachers can					
1.	Use conventional multiple-choice matching, alternate choice, true/false, and fill-in-the-blank questions appropriately.	3.62	Agree	3.38	Agree
2.	Use short answer, constructed response, and essay to encourage students to explain their understanding of important ideas and principles.	3.49	Agree	3.03	Agree
3.	Design performance tasks to ask students to show what they can do with the knowledge and skills learned.	3.79	Agree	3.39	Agree
4.	Observe students informally in the classroom to assess their ongoing learning.	3.41	Agree	3,60	Agree
5.	Encourage students' self-assessment	3.37	Agree	3.58	Agree

	of their own thinking, reasoning, processes, and products.				
6.	Clearly explain homework	3.09	Agree	2.50	Agree
7.	Design diagnostic assessment to identify students' strengths, weaknesses, and mental readiness for learning new content or skill.	3.73	Agree	3.88	Agree
8.	Use formative assessment to monitor student learning progress and modify instruction.	3.71	Agree	3.56	Agree
9.	Use summative assessment to determine the student attainment of the standards of subject areas.	3.85	Agree	3.26	Agree
10.	Be a critical consumer of available assessment resources.	3.22	Agree	2.36	Disagree
11.	Relate assessment to the content under study and to student capacity.	2.50	Agree	2.20	Disagree
12.	Match assessment to intended learning objectives.	3.30	Agree	3.50	Agree
13.	Align assessment with written and taught curriculum.	3.50	Agree	3.50	Agree
14.	Use assessment that can truly reveal whether students understand the learning.	3.40	Agree	3.08	Agree
15.	Use ongoing assessment to monitor student progress.	3.70	Agree	3.40	Agree
16.	Use multiple assessments to determine whether a student has mastered a skill.	3.50	Agree	3.60	Agree
17.	Design assessments to assess both higher- and lower-level content and skills.	3.60	Agree	3.40	Agree
18.	Exercise accommodations in assessment for students with special needs.	2.50	Agree	2.30	Disagree
19.	Use robust rubrics or scoring guides for student assignments, products, and projects.	3.50	Agree	3.30	Agree

Table 2 clearly showed that for all the items, all the male students have mean values greater than 2.5 which is the mean value of the four-point scale used in the study while the female students have mean value greater than 2.5 for all the items except items 10, 11 and 18 which have 2.36, 2.20 and 2.30 respectively. This means that all the male and female Physics students agreed that all these items are assessment strategies Physics teachers can use in the Physics classrooms to enhance achievement in Physics except items 10, 11 and 18 which the female students do not agree with.

Table 3: t- test of Mean Scores of Male and Female Senior Secondary School Physics Students' Assessment of the Assessment Strategies Physics Teachers can use in Enhancing Achievement in Physics.

Gender	N	Mean	Standard Deviation	t-calculated	t-tabulated
Male	78	3.25	1.812	0.181	1.98
Female	72	3.20	0.70		

Table 3 clearly showed that t-calculated value of 0.181 is less than the t-table value of 1.98. The null hypothesis of no significant difference is therefore upheld. This therefore means that there is no significant difference in the mean scores of male and female Physics students' assessment of the assessment strategies Physics teachers can use in the Physics classrooms to enhance achievement in Physics.

Discussion

From tables 1 and 2, it is observed that all the physics students agreed that the listed items are assessment strategies Physics teachers can use in the Physics classrooms to enhance achievement in Physics. This study is in agreement with the works of Georgia Department of Education (2016) who believes that assessment of student learning can emerge in various formats, such as teacher observation, oral questioning, journal entries, portfolio entries, exit cards, skill inventories, homework assignments, project products, student opinions, interest surveys, criterion referenced tests, or norm-based tests. Airasian (2001) in support of this stressed that assessment should therefore be planned in advance and be an integral, meaningful part of the instructional process. This means that all assessments must focus on individual performance in meeting the stated expectation.

Result in table 3 indicated that there is no significant difference in the opinions of male and female students on the assessment strategies Physics teachers can use in the Physics classrooms to enhance achievement in Physics. This means that gender does not play any role.

Conclusion

It is therefore concluded that short answer, constructed response, essay to encourage students to explain their understanding of important ideas and principles, multiple assessments to determine whether a student has mastered a skill, formative assessment to monitor student learning progress and modify instruction, observation of students informally in the classroom to assess their ongoing learning are some of the assessment strategies Physics teachers can use in the Physics classrooms to enhance achievement in Physics.

Recommendations

Based on the findings the following recommendations are made;

1. Physics teachers should carry their students along by giving them feedback on their performances.
2. Physics students should be properly drilled in the use of various assessment skills that will enhance achievement in the Physics classrooms.
3. Physics teachers should motivate their physics students by making physics interesting.
4. Seminars and conferences should be organized for in-service physics teachers regularly to update their knowledge of Physics and assessment skills.

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