# DIFFICULTY LEVELS OF SENIOR SCHOOL PHYSICS CONCEPTS AS PERCEIVED BY STUDENTS AND TEACHERS IN ILORIN, KWARA STATE, NIGERIA

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**Abstract**

The study investigated difficulty levels of senior school physics concept as perceived by students and teachers in Ilorin. The population comprised all physics students and physics teachers in Ilorin. Three hundred, and eighty-five students and 56 physics teachers formed the sample for the study. A researcher-designed questionnaire on Physics Concept Difficulty Checklist for Students (PCDCS) and Physics Concepts Difficulty Checklist for Teachers (PCDCT) were used and validated by three experts. The data collected were analysed using mean and t-test statistics at 0.05 significant level. Findings of the study revealed that 12 physics concepts were perceived Very difficult, 6 Difficult, 10 Moderately difficult and 8 Not difficult to learn by students; while 8 physics concepts were perceived Very difficult, 4 Difficult, 9 Moderately difficult and 15 not difficult to teach by teachers, also, there were no significant difference in students and teachers' perception of difficult concepts based on gender. It was recommended that effort be made to raise the levels of students' perception of difficulty levels of physics concept.

**Keywords:** Physicsconcept, difficulty levels, perception, senior secondary school students

## Introduction

Physics is one of the pre-requisite science subjects for admission into science and engineering courses in higher institutions in Nigeria. This subject has made and is still making significant contribution to many of the inventions that are shaping modern day technology. The subject has also provided explanations for many of the natural events being encountered in everyday life. Young and Freedman (2008) view physics as an experimental science where observation of natural phenomena is done in order to attempt searching for physical theories and laws or principles. Physics is a cross-cutting discipline that is applied in many sectors for economic development.Josiah (2011) opined that the understanding of physics concepts is a pre-requisite for developing modern instrumentation and techniques in the health sector. For instance, with the help of medical physics the appropriate equipment for the diagnosis of diseases are produced. Earlier on, Young and Freedman (2008) had the following view on the cross-cutting nature of physics; the chemists who studies molecule structure, the palaeontologists who attempts to reconstruct how dinosaurs walked the climatologist who pries into how human activities affect the atmosphere and oceans, and the engineers who designs flat screen television and other technologies make use of physics concepts.

Another important role physics plays in the technological development of any nation is in information technology. Josiah (2011) pointed out that the knowledge of physics is required in developing fixed line and optical-fibre network This statement points to the fact that for Nigeria, like any other nation of the world to develop scientifically and technologically, the teaching and learning of physics and other science subjects should be encouraged especially when students first encounter the subject at the secondary school level. The relevance of physics education in sustaining the country's technological development makes it imperative to proffer immediate solution to problems befalling it in terms of teaching qualities and learning the right concepts at the very basic level of education (Jegede & Adedayo, 2013).

The importance of physics to human development as it forms the basis for technological advancement of any nation is numerous. Its study can lead to several scientific fields and professions such as engineering, manufacturing, mining and construction. Furthermore, it generates the fundamental knowledge needed for the future technological advancement of any nation. Physics is both significant and influential, as advances in its understanding have often translated into new technologies which have dramatically transformed modern-day society(Abubakar, 2012). Such technologies include the television, computers, mobile phones, iPods, medical imaging system, fibre-optics and a host of other devices and systems that make use of basic direct current electricity principles and microprocessor. Despite the efforts of the various educational stakeholders, particularly the teachers, findings of the following researchers Adegoke, (2011), Erinosho (2013), Gambari and Yusuf (2014) and Udoh (2012) revealed unsatisfactory performance of students in physics. Also, physics results in the examination conducted by WASSCE for ten years from 2010 to 2019 consecutively, the results revealed average trends of performance as depicted on Table 1.

**Table 1: Students' enrolment and performance in May/June WASSCE from 2010 to 2019**

| Year | BIOLOGY | | | CHEMISTRY | | | PHYSICS | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total Sat | Credit Passes | % | Total Sat | Credit Passes | % | Total Sat | Credit Passes | % |
| 2010 | 1,300,418 | 427,644 | 33.90 | 465,643 | 236,059 | 50.70 | 463,755 | 237,756 | 51.27 |
| 2011 | 1,505,199 | 579,432 | 38.50 | 565,692 | 280,250 | 49.54 | 563,161 | 360,096 | 63.94 |
| 2012 | 1,646,150 | 587,044 | 35.66 | 627,301 | 270,570 | 43.13 | 624,658 | 429,415 | 68.74 |
| 2013 | 1,648,363 | 852,717 | 51.73 | 639,296 | 462,517 | 72.34 | 637,023 | 297,988 | 46.77 |
| 2014 | 1,365,384 | 766,971 | 56.17 | 636,268 | 397,649 | 62.49 | 635,729 | 386,270 | 60.76 |
| 2015 | 1,390,234 | 798,246 | 57.42 | 680,357 | 412,323 | 60.60 | 684,124 | 410,543 | 60.01 |
| 2016 | 1,200,367 | 740,345 | 61.68 | 706,873 | 408,122 | 57.74 | 705,125 | 415,655 | 58.95 |
| 2017 | 580,449 | 394,898 | 68.03 | 377,970 | 320,635 | 84.83 | 377,851 | 205,757 | 54.45 |
| 2018 | 1,087,063 | 679,299 | 62.48 | 728,551 | 424,231 | 58.22 | 728,354 | 571,687 | 78.49 |
| 2019 | 1,033,304 | 775,103 | 75.01 | 726,132 | 566,156 | 77.96 | 725,853 | 565,746 | 77.94 |

Source: Statistics Unit, West African Examinations Council, Yaba, Lagos (2019).

Certain factors have been identified as being responsible for this performance in physics as Macmillan (2012) reported that the following factors inhibit the learning of Physics and responsible largely for students' poor academic performances. These factors include: poor teaching methodology, students' negative attitude towards physics, students' lack of interest in physics, school location, gender inequality and poor quality of Physics teacher.Other reasons ranges from: inadequate lower level preparation, weak

mathematics background, lack of job opportunity outside the teaching profession, inadequate teacher qualification, possession of below standard pedagogical content knowledge and student perception of physics as being difficult (Semela, 2010). Based on the problems highlighted, one can deduce that all could be attributed to teachers' and students' perceptions.

The literature is full of studies suggesting that students generally regard physics as conceptually difficult, abstract, uninteresting, and elite discipline only suitable for exceptionally talented and gifted one (Barmby & Defty, 2006; Checkley, 2010; Tomo, 2018; Obafemi & Onwioduokit, 2013). This makes a lot of students from running away from physics related course in higher institutions of learning.
Most studies in Nigeria have focused on students' problems in physics in relation to their attitude, misconceptions and interest. Others have analysed classroom instructional environment, interactions and teacher quality to evaluate student learning. However, for the mere fact that physics has been severally labelled as the most conceptually difficult science subject, it is important to explore the underlying difficulties that might impede quality learning in the subject in the context of Nigeria school environment. This study is therefore aimed at providing insight into the aspects of physics that students consider as posing difficulty in secondary school physics, and the underlying reasons for the difficulty level as it affects their learning.

## Research Questions

The following research questions were raised and answered in the study:

1. What are the difficulty levels of physics' concepts as perceived by students to learn?
2. What are the difficulty levels of physics' concepts as perceived by teachers to teach?

## Research Hypotheses

The following hypotheses were tested in this study:
**$HO_1$**: There is no significant difference in the difficulty levels of physics concepts as perceived by male and female students.
**$HO_2$**: There is no significant difference in the difficulty levels of physics concepts as perceived by male and female teachers.

## Methodology

This research study was a descriptive research of the survey type. The population for this study was all senior school students offering physics and their teachers in Ilorin, Nigeria. The target population was all senior secondary school three physics students and physics teachers from SSI to SSIII in Ilorin. The sample for this study was 385 students and 56 physics teachers purposively selected from twenty senior secondary schools across Ilorin Central Senatorial district.
The research instruments for this study were the researchers designed Physics Concept Difficulty Checklist for Students (PCDCS) and the Physics Concepts Difficulty Checklist for Teachers (PCDCT). The instruments were adapted from WAEC syllabus. It contained all the 36 concepts in senior school physics curriculum. Also, based on 4-points of Likert scale, that is, Not Difficult (1) being the lowest and Very Difficult (4) as highest.The instruments PCDCS and PCDCT for this study were validated by three experienced physics teachers and two Physics Education experts from the Department of Science Education, University of Ilorin. The instruments were then administered to 60 students and 10 teachers

to ascertain the reliability indices using Cronbach's Alpha. The reliability index of the PCDCS was 0.79 and that of PCDCT was 0.81.

The data collected were analysed using descriptive and inferential statistics. Specifically, frequency count, percentages, mean and standard deviation were employed to answer two research questions, while t-test was used to analysis the two hypotheses formulated at 0.05 level of significance.

## Results

**Research Question 1:** What are the difficulty levels of physics' concepts as perceived by students to learn?

**Table 2: Difficulty levels of Physics concepts as perceived by students**

| S/N | Concepts | Mean | Difficulty level |
|---|---|---|---|
| 1. | Magnetic Field | 3.55 | Very Difficult |
| 2. | Wave Particles Paradox | 3.55 | Very Difficult |
| 3. | Quantum Physics | 3.51 | Very Difficult |
| 4. | Electronics | 3.48 | Very Difficult |
| 5. | Electromagnetic Field | 3.41 | Very Difficult |
| 6. | Simple A. C. Circuits | 3.39 | Very Difficult |
| 7. | Electromagnetic Waves | 3.31 | Very Difficult |
| 8. | Gravitational Field | 3.21 | Very Difficult |
| 9. | Description Properties of Field | 3.17 | Very Difficult |
| 10. | Work, Energy and Power | 3.11 | Very Difficult |
| 11. | Sound Waves | 3.09 | Very Difficult |
| 12. | Energy | 3.01 | Very Difficult |
| 13. | Structure of the Nucleus | 2.91 | Difficult |
| 14. | Equilibrium of Forces | 2.89 | Difficult |
| 15. | Machine | 2.78 | Difficult |
| 16. | Motion | 2.68 | Difficult |
| 17. | Electrostatics | 2.66 | Difficult |
| 18. | Simple Harmonic Motion | 2.61 | Difficult |
| 19. | Heat Energy | 2.5 | Moderately Difficult |
| 20. | Rectilinear Acceleration | 2.33 | Moderately Difficult |
| 21. | Current Electricity | 2.32 | Moderately Difficult |
| 22. | Light Waves | 2.31 | Moderately Difficult |
| 23. | Production and Propagation of Waves | 2.29 | Moderately Difficult |
| 24. | Properties of Waves | 2.24 | Moderately Difficult |
| 25. | Structure of the Atom | 2.23 | Moderately Difficult |
| 26. | Human Eye | 2.17 | Moderately Difficult |
| 27. | Scalar and Vector | 2.14 | Moderately Difficult |
| 28. | Fluid at Rest | 2.03 | Moderately Difficult |
| 29. | Newton' Law of Motion | 1.99 | Not Difficult |
| 30. | Speed and Velocity | 1.88 | Not Difficult |
| 31. | Time | 1.86 | Not Difficult |
| 32. | Concept of Matter | 1.83 | Not Difficult |
| 33. | Mass and Weight | 1.79 | Not Difficult |
| 34. | Types of Waves | 1.73 | Not Difficult |
| 35. | Fundamental and Derive Quantity and Unit | 1.25 | Not Difficult |
| 36. | Position, Distance and Displacement | 1.11 | Not Difficult |

The results in Table 2 revealed that 12 physics concepts were perceived Very Difficult, 6 Difficult, 10 moderately Difficult and 8 Not Difficult to learn by senior secondary school students. The most difficult

concepts are Wave particle paradox and Magnetic field, while least difficult or not difficult concepts were Position, distance and displacement. The result implies that most of the concepts in physics were perceived very difficult to learn by students.

**Research Question 2** What are the difficulty levels of physics' concepts perceived difficult to teach by teachers?

**Table 3: Difficulty Levels of Physics Concepts as Perceived by Teachers**

| S/N | Concepts | Mean Value | Difficulty level |
|---|---|---|---|
| 1. | Quantum Physics | 3.58 | Very Difficult |
| 2. | Electronics | 3.57 | Very Difficult |
| 3. | Simple A. C. Circuits | 3.40 | Very Difficult |
| 4. | Wave Particles Paradox | 3.38 | Very Difficult |
| 5. | Magnetic Field | 3.32 | Very Difficult |
| 6. | Production and Propagation of Waves | 3.16 | Very Difficult |
| 7. | Electromagnetic Field | 3.10 | Very Difficult |
| 8. | Heat Energy | 3.08 | Very Difficult |
| 9. | Types of Waves | 2.97 | Difficult |
| 10. | Electromagnetic Waves | 2.93 | Difficult |
| 11. | Scalar and Vector | 2.59 | Difficult |
| 12. | Light Waves | 2.51 | Difficult |
| 13. | Current Electricity | 2.40 | Moderately Difficult |
| 14. | Electrostatics | 2.38 | Moderately Difficult |
| 15. | Human Eye | 2.35 | Moderately Difficult |
| 16. | Sound Waves | 2.29 | Moderately Difficult |
| 17. | Newton' Law of Motion | 2.22 | Moderately Difficult |
| 18. | Simple Harmonic Motion | 2.11 | Moderately Difficult |
| 19. | Description Properties of Field | 2.11 | Moderately Difficult |
| 20. | Equilibrium of Forces | 2.03 | Moderately Difficult |
| 21. | Properties of Waves | 2.00 | Moderately Difficult |
| 22. | Structure of the Nucleus | 1.94 | Not Difficult |
| 23. | Machine | 1.85 | Not Difficult |
| 24. | Gravitational Field | 1.81 | Not Difficult |
| 25. | Mass and Weight | 1.78 | Not Difficult |
| 26. | Rectilinear Acceleration | 1.7 | Not Difficult |
| 27. | Work, Energy and Power | 1.7 | Not Difficult |
| 28. | Motion | 1.69 | Not Difficult |
| 29. | Structure of the Atom | 1.64 | Not Difficult |
| 30. | Energy | 1.58 | Not Difficult |
| 31. | Speed and Velocity | 1.56 | Not Difficult |
| 32. | Fluid at Rest | 1.5 | Not Difficult |
| 33. | Concept of Matter | 1.23 | Not Difficult |
| 34. | Time | 1.15 | Not Difficult |
| 35. | Fundamental and Derive Quantity and Unit | 1.08 | Not Difficult |
| 36. | Position, Distance and Displacement | 1.07 | Not Difficult |

Table 3 shows difficulty levels of physics concepts as perceived by teachers to teach. The results of the analysis revealed that 8 physics concepts were perceived Very Difficult, 4 Difficult, 9 moderately Difficult and 15 Not Difficult to teach by senior secondary school teachers. The most difficult concepts were Quantum physics while least difficult concepts were Position, distance and displacement. The results imply that most of the concepts in physics are either perceived not difficult or moderately difficult to teach by senior secondary school teachers.

**Hypotheses Testing**

**Hypothesis 1:** There is no significant difference in the difficulty levels of physics concepts as perceived by male and female students.

**Table 4: t-test analysis for perceived difficulty level concepts based on gender**

| Gender | N | Mean | SD | Df | t-value | Sig. | Remark |
|---|---|---|---|---|---|---|---|
| Male | 209 | 86.02 | 15.33 | | | | |
| | | | | 383 | 12.59 | .11 | NS |
| Female | 176 | 65.15 | 11.22 | | | | |

p>0.05

Table 4 presents the t-test results of students' perception of difficulty levels of concepts in physics based on gender. The result showed that there was no significant difference between male and female students' perception of difficult concepts in physics as the p-value (.11) is greater than (0.05) significance level. Hence, the hypothesis 1 was not rejected. Thus, this implies that students' perception of difficulty levels of physics concepts based on gender were similar.

**Hypothesis 2:** There is no significant difference in the difficulty levels of physics concepts as perceived by male and female teachers.

**Table 5: t-test analysis for perceived difficulty level concepts based on gender**

| Gender | N | Mean | SD | Df | t-value | Sig. | Remark |
|---|---|---|---|---|---|---|---|
| Male | 39 | 44.67 | 10.62 | | | | |
| | | | | 54 | 3.39 | .74 | NS |
| Female | 17 | 33.83 | 8.62 | | | | |

p>0.05

The results on Table 5 indicates that there was no significant difference in the perception of difficulty levels of physics concepts among physics teachers based on gender. This is because, since the p-value (.74) is greater than (0.05) significance level. Hence, hypothesis 2 is not rejected. This, therefore means that the male and female physics teachers had similar perception about difficulty levels of physics concepts.

**Discussion**

The findings of this study revealed that physics concepts perceived very difficult and difficult to learn by students were 12 and 6 concepts respectively, while 10 and 8 physics concepts were perceived

moderately difficult and not difficult to learn. The most difficult among the concepts are Magnetic field, Wave paradox particles with highest mean scores, while the least difficult concept is Position, Distance and Displacement which had lowest mean score. This study agrees with the finding of Fisher (2009) who found that some concepts such as Projectile motion, Simple harmonic motion and Diffraction of light waves were difficult for the students. Also, the finding is in support of Obafemi and Onwioduokit (2013) revealed that both students and teachers attest to the difficulty nature of physics concepts.

The findings further revealed that physics concepts perceived very difficult and difficult to teach by teachers were 8 and 4 concepts respectively. The remaining 24 concepts were either moderately difficult (9) or not difficult (15) to teach. This is in agreement with the finding of Rohandi. (2017) whose finding showed that teachers find physics difficult to teach of their inability to help students to erase the psychological effect of their believe that physics is difficult.

The results also showed that there was no significant difference between male and female students' perception of difficulty levels of physics concepts. This means that gender had influence in the levels of their perception of difficulty levels of physics concepts. This may be possible as previous studies opined that female students perform better in verbal topics/concepts than their male counterpart but most of the topics/concepts require adequate grasps of mathematical skills which is to the advantages of the male students. The result agrees with the findings of Ogunkola and Fayombo (2009) which revealed that there was no significant statistical difference in Barbadian secondary school students' science achievement based on their gender. But in contrast with Claire, Haworth, and Dale, (2010) who found that female students performed better than their male counterparts in science subjects.

Furthermore, the findings showed that there was no significant difference between male and female physics teachers' difficulty levels of physics concepts. This implies that teachers' gender did not have influence on their perception of difficulty levels, this further shows that physics teachers have similar perception as they were fully abreast of pedagogical contents knowledge of physics. This agrees with the result of Omosewo (2009) who found out that teacher's gender did not influence their perception of difficulty nature of physics but rather timing in preparing the lesson is hindrance in covering the syllabus for physics.

**Recommendations**

The following recommendations have been made on the basis of the findings:

1. Effort should be made by teachers to raise the levels of students' perception of difficulty levels of physics concepts by employing a combination of learning and teaching strategies in bringing home understanding the right perception;
2. Prospective physics teachers should be allowed to take all the courses relevant to senior school physics in the department of physical science in addition to educational courses in order to get good grasps of physics pedagogical contents and pedagogical contents knowledge;
3. Students should be allowed to attend physics lesson irrespective of their gender, this will enhance equal opportunity and learning experience as there was no difference in their perception of difficulty nature of physics; and

4. No form of discrimination should be entertained in employing qualified teachers, irrespective of their gender difference as the study revealed similar perception of physics concepts.

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