

IDENTIFICATION OF DIFFICULT CONCEPT IN PHYSICS SYLLABUS AS PERCEIVED BY PRE-SERVICE TEACHERS IN HIGHER INSTITUTIONS IN KWARA STATE

Aishat A. YUSUF

A. O. AKANBI

R. E. MOHAMMED

Sikirat, I. MUSTAPHA

Department of Science Education,
University of Ilorin,
Ilorin, Nigeria

Corresponding author:

Aishat A. Yusuf,

ORCID ID: 0000-0001-8569-6278

yusuf.mf@unilorin.edu.ng/08039292376

Abstract

This study identified the difficult concept in physics syllabus by the pre-service teachers. Descriptive and inferential statistics were utilised in the analysis of the data gathered. The reliability of the instrument was tested using Cronbach Alpha Formula and a score of $\alpha \leq 0.82$ was derived. Two set of research questions were analysed using t-test of value $p < 0.50$. The population of the study was all Physics education students in higher institutions in Kwara State. Data was collected through questionnaire tagged "Questionnaire on Difficult Concept in Physics Syllabus" "QDCPS" via google form. The main findings of the study indicated that Friction and Viscosity, Fluid at Rest, Waves, Sound waves, Light waves, Refraction of Light, Electric Cells and Electrolysis are the topics perceived as difficult concept in physics syllabus by pre service teachers. The study established that the use of different terminologies in some topics makes it difficult to understand, lack of practical classes affects student's ability to understand some topics in Physics; significant difference was found in perception of pre service teachers on difficult concept in physics syllabus based on mode of entry. Among the recommendations are; Seminars, Training and workshop should be created for teachers in schools to increase the competence of teachers in the teaching of difficult topics in Physics in both private and public schools and Innovation of proper curriculum development in Physics education should be made in Nigeria to enhance effective learning. And the conclusion includes that difficult concept in physics been perceived by the pre-service teachers are borne out of factors such as professional mode of entry and lack of instructional materials.

Keyword: Pre-service Teachers, In-service Teachers, Pedagogical Content Knowledge, Physics syllabus and Difficult Concept

Introduction

Teachers are professional educators who have a role to educate, teach, guide, train and evaluate their students by their competencies. The criteria that a professional teacher must possess is the mastery of the material (understanding material concept). With the ability to understand concepts, teachers become the master of the teaching material, the relationship between related subjects, and apply scientific concepts in everyday life (Purwoko, 2017).

Physics learning and teaching is a means to develop and train student to be able to master the knowledge, concepts and principles of physics and have scientific skills (Yolanda et al, 2016). One of the concepts is electric circuit, this concept influences theories like ohm's law, connection of cells both series and parallel, configuration of lost voltage, electromotive force (EMF) and the potential difference.

Perception is a component of what we do based on our beliefs. Thus, physics pre-service teachers' perception of some concept in physics depends on what they believe and think about those concepts. Due to limitations in what students are able to perceive, they are highly selective in choosing what to perceive based on its relevance to them. In the process of filtering, different people will respond in different ways and manners even when they are subject to the same conditions. Perceptions therefore relate to the way we act or react.

As pre-service teachers who may become prospective physicist, physics teacher or such', the level of doing mathematical proofs in physics, perception about some concepts in physics, views on mathematical proofing in physics gain importance and should be taken into consideration (Morali et al, 2016). To construct their lessons effectively, physics teacher needs to know how concepts (in the objectives of the lesson) appeared and on what this knowledge or principles is based. In order to be able to do these aforementioned things the pre-service teacher need to be well qualified in doing mathematical proofing in physics.

The results of the research by Nugraeni (2013), stated that in the dynamic electrical matter, it found that 55% of the students did not understand the concept of series current and 57% in the theory of parallel circuit and both current and voltage material (Iftinah research, 2017). In this concept pre-service teachers have difficulty in the understanding because the characteristics of the concept are abstract which is difficult to observe directly with the five senses (Falah, 2018).

Statement of Problem

Pre-service teachers who conduct science content specific research increases their knowledge and enthusiasm for teaching the material. However, there is little research available to show how pre-service teachers who learn or conduct content specific education-based research utilize that experience in the classroom.

The science stream students have dropped and not so many reasons caused the faulty enrolment to science programmes if not for the way these subjects are taught. As Phang (2012) as contributed that student find studying science to be difficult, boring and not worth the effort. These findings have showed broader concerns that declining interest of students' physics may stunt the efforts to improve technological innovations to make Nigeria a high-income country by 2022.

Those who teach physics bring with them experience as learners in physics classes from elementary school through their college and university careers. Those experiences influence the ways they think about teaching process, their choice of teaching as a career, and subsequent ways in which they are involved with professional development programs. As a result of those experiences, strong beliefs about the subject area or the way it should be taught are formed (Elliot, Atencio, Campbell & Jess (2013). Teacher education programs should incorporate courses that offer ways to construct teachers' knowledge in a coherent way in addition to exposing pre-service teachers to the theoretical aspects of teaching. But when the time comes to teach, pre-service teachers may exhibit instructional practices inconsistent with the theory, but consistent with their experiences and the way they best teach. They may even embrace the knowledge acquired during the programme and state the knowledge as if it is their own belief for teaching and learning among others. However, they may still show discrepancies between their proposed beliefs about the subject area, teaching, learning and their instructional practices.

Attitude are widely studied on different lessons, especially in areas such as in science, health and education sciences. In these lessons, physics which is in almost all academic levels of our education system, which takes part as an important lesson in different faculties and departments, particularly in higher education (education, science, engineering etc.) program.

According to Thacker (2003) there are widespread concerns that pre-service teachers often do not gain a solid conceptual understanding from traditional teaching methods. However, these issues do not apply only to students enrolled, in teaching degrees alone many other scientists will teach at some stage in their careers as teachers, tutors, demonstrators or lecturers. It is therefore also true that experiences in science teaching, accompanied by acquired knowledge develop overtime.

The teaching of some theoretical concept in physics has been given more importance at the high school level. Rather than the mathematical formulation of some topics in physics such as mechanics, electromagnetism, force etc. In general, some of the physics concept is difficult to understand, misunderstandings and misconceptions are common among pre-service teachers as shown by some scholarly research that university student exhibit attribute of misconceptions of some physics concept (Danday (2023)). On this bases, the present study aims to reveal physics pre-service teachers' beliefs and perceptions about how they analyze some difficult concept in the physics syllabus.

Purpose of the Study

The main purpose of this study is to investigate analysis of difficult concept in physics syllabus as perceived by pre service teachers of some selected institutions in Kwara state. Specifically, the study will:

1. Ascertain the topics perceived as difficult concept in physics syllabus.
2. Determine pre service teacher's perception of difficult concept in physics syllabus.
3. Examine the differences in the perception of pre service teachers on concept in physics syllabus based on gender.
4. Examine the differences in the perception of pre service teachers on

concept in physics syllabus based on mode of entry.

Research Questions

The following questions were raised to guide the study:

Q1: What are topics perceived as difficult concept in physics syllabus?

Q2: What are the pre-service teacher's perceptions of the identified difficult concept in physics syllabus?

Research Hypothesis

H01: There are no significant differences in the perception of pre service teachers on concept in physics syllabus based on gender.

H02: There are no significant differences in the perception of pre service teachers on concept in physics syllabus based on mode of entry.

Scope of the Study

The study is interested in the perception of physics pre-service teachers which will help in the identification of some difficult concepts in the physics syllabus. Answers to research questions such as these require that data be collected from a reasonable large sample of final year physics education students that had just concluded their teaching practice exercise in various selected institutions in Kwara state.

S/N	Name of School	Location
1	University of Ilorin	Ilorin south
2	Al-Hikmah University	Ilorin west
3	College of education, Ilorin	Ilorin south
4	College of education, Oro	Oke ero
5	Muhyideen college of education	Ilorin south

Significance of the Study

The findings of this research will play a very beneficial role to the universities, colleges of education and high schools because of the improvement in teaching, considering the leading roles some difficult concept in physics such as force, electromagnetism, mechanics and atomic physics plays in industrialization since the beginning of the concept. The greater demand for efficient and effective teachers with sound physics background justifies the need for learners who have a complete understanding of physics concept.

Furthermore, the pre-service teachers will be guided on what categories of alternative concepts is suitable for each physics concepts in the syllabus and possibly suggest what framework to apply for effective instruction.

For curriculum designers and policy makers on education this research will help establish categorized framework for implementing conceptions of some difficult concepts in physics education in universities, colleges of education and high schools which will help facilitate effective propagation of education.

For researchers, this study will help to reveal critical areas in pre-service physics

teachers that have not been explored by previous researchers. This study will help prospective physics teacher have appropriate realization on the fact that they need to master the material concepts that will be delivered to their students in solving problems encountered in their daily lives.

Methodology

The study adopted the descriptive research of the survey type. Survey method was considered appropriate since it enables information to be obtained from a representative sample of the population. The population for this study was final year undergraduate physics education students in selected institutions in Kwara State.

Researchers administer the questionnaire (in google form) via the respondents WhatsApp platform in their respected schools without special considerations aside being Physics Education students. On spot submission of the questionnaire was advised by the researcher to avoid multiple entry of the questionnaire since it will be administered using Google form which will ensure maximum return, and the reports was gotten through Google sheet.

The questionnaire was divided into two sections A and B. Section A requested for students' attributes which includes Name of School, Gender, Department, Mode of Entry, Level and type of School. Section B was designed to obtain students' perception on some difficult physics concepts. Section B was attended to by ticking any of the alternative Likert scale of Difficult, Not Difficult and Undecided.

The research instrument was given to the researcher supervisor and two other lecturers in the Department of Science Education for face-content validation, University of Ilorin to determine the relevance, suitability, measure the face and content validity of the instrument. The reliability of the instrument was done using the split half technique and calculated using the Cronbach Alpha formula. A reliability coefficient of 0.70 with a mean benchmark of 2.0 was obtained which showed that the questionnaire was reliable and fit for administration.

The data was coded and analyzed using Statistical Package of Social Science (SPSS). The statistical test used is the descriptive analysis involving frequency, the percentage for the mean and standard deviation to answer for research questions.

Results and Discussion

Descriptive and inferential statistical tools (frequency, mean and percentage) were used to answer the research questions. The t-test statistical tool was used to test hypotheses. All hypotheses were tested at 0.05 level of significance

Demographic Data

Table 1: Frequency and Percentages of Respondents Gender

		Frequency	Percentage
Gender	Male	442	54.90%
	Female	363	45.10%
Mode of Entry	UTME	706	87.70%
	Direct Entry	99	12.30%
Level	100	194	24.10%
	200	330	41.00%
	300	202	25.10%
	400	79	9.80%
Total		805	100%

Table 1 shows that there were 442 (54.9%) males and 363 (45.1%) females. Hence, male physics education undergraduate students participated more in the study than females on gender basis. 706 (87.7%) of the respondents were admitted via UTME and 99 (12.3%) were admitted via direct entry. This implies that majority of the respondents were admitted via UTME. 194 (24.1%) of the respondents are in 100 level, 330 (41.0%) are in 200 level, 202 (25.1%) are in 300 level and 79 (9.8%) are in 400 level respectively. This shows that most of the students that participated in the study are in 200 level

Q1: What are topics perceived as difficult concept in physics syllabus?

Table 2: *Physics Concepts Perceived as Difficult*

SN	Topics	D	ND	UN	Mean	Decision
1	Units and Measurements	12.30%	82.60%	5.10%	2.07	Not difficult
2	Scalars and Vectors	22.50%	77.10%	0.50%	2.22	Not difficult
3	Motion	36.90%	65.10%	18.60%	1.99	Not difficult
4	Projectiles	3.40%	42.40%	47.20%	1.56	Undecided
5	Linear Momentum	2.50%	55.20%	42.40%	1.60	Undecided
6	Simple Harmonic Motion	4.30%	44.70%	50.90%	1.53	Undecided
7	Equilibrium of Forces	29.60%	41.40%	28.10%	2.07	Not difficult
8	Work, Energy and Power	34.50%	35.40%	29.70%	2.05	Not difficult
9	Simple Machines	27.10%	49.40%	28.20%	2.04	Not difficult
10	Friction and Viscosity	81.20%	21.10%	7.70%	2.74	Difficult
11	Elastics Properties of Solid	8.10%	66.80%	30.10%	1.73	Not difficult
12	Pressure	12.70%	48.90%	38.40%	1.74	Not difficult

13	Fluid at Rest	83.60%	10.40%	6.30%	2.77	Difficult
14	Temperature and Measurement it's	6.10%	49.80%	44.60%	1.61	Undecided
15	Thermal Expansion	3.90%	43.10%	53.60%	1.51	Undecided
16	The Gas Law	2.00%	81.60%	17.60%	1.85	Not difficult
17	Heat Energy	8.30%	51.80%	39.90%	1.68	Not difficult
18	Heat Transfer	37.40%	36.00%	32.50%	1.99	Not difficult
19	Change of state	19.50%	51.60%	28.90%	1.91	Not difficult
20	Molecular Nature of Matter	44.80%	20.70%	34.80%	2.10	Not difficult
21	Waves	80.20%	9.90%	9.80%	2.70	Difficult
22	Sound Waves	51.70%	45.80%	2.50%	2.47	Difficult
23	Light Waves	74.00%	10.20%	18.80%	2.58	Difficult
24	Refraction of Light	82.10%	2.80%	15.30%	2.67	Difficult
25	Optical Instrument	28.90%	42.70%	28.30%	2.01	Not difficult
26	Electromagnetic Waves	54.40%	23.70%	21.00%	2.33	Difficult
27	Gravitational Field	29.20%	32.80%	38.00%	1.91	Not difficult
28	Electric Field	56.90%	25.10%	20.80%	2.37	Difficult
29	Electric Cells	80.70%	6.50%	12.80%	2.68	Difficult
30	Electrolysis	77.10%	5.20%	17.60%	2.60	Difficult

Source: Field work (2022)

Table 2 reveals the frequency, percentage distributions and mean of topics perceived as difficult concept in physics syllabus. It was indicated that Friction and Viscosity, Fluid at Rest and in Motion, Waves, Sound waves, Light waves, Refraction of Light, Electromagnetic wave, Electric Cells and Electrolysis are perceived to be the difficult concept in physics. Units and Measurement, Scalars and Vectors, Motion, Equilibrium of Forces, Work, Energy and Power, Simple Machine, Elastic properties of solid, Pressure, Gas laws, Heat Transfer, Change of State, Molecular nature of Matter, Optical Instrument and Gravitational Field are perceived not to be the difficult concept in physics. Projectile, Linear Momentum, Simple Harmonic Motion, Temperature and Measurement, Thermal Expansion and Heat Energy are perceived to be an undecided concept in physics. The not difficult concepts (14) are more in proportion than difficult concepts (10) and the undecided concepts (6) are the least in proportion.

Q2: What are the pre-service teacher's perceptions of the identified difficult concept in physics syllabus?

Table 3: Pre-service Teacher's Perception of Difficult Concept in Physics Syllabus

S/N	Items	Mean	SD
1	My ability to relate some topics to daily life makes it less difficult	2.19	0.971
2	The use of different terminologies in some topics makes it difficult to understand	3.51	0.5
3	Physics topics do not depend on memorizing, they are interpretable	2.51	1.28
4	My teachers' poor attitude to teaching make some topics difficult	2.64	1.07
5	Inability of my teacher to explain some concepts well make some topics difficult for me	3.6	0.49
6	Lack of instructional materials prevents me from understanding some topics	3.51	0.5
7	Some topics are difficult because they are long, complicated and includes too many details	3.2	0.92
8	Lack of practical classes affects my ability to understand some topics in Physics	2.98	0.82
9	The teachers' style of teaching makes some topics difficult for me to understand	2.64	1.25
10	I find some topics difficult because they are not interesting	2.41	1.12

Table 3 indicates the frequency, percentage distributions and mean of the pre-service teacher's perception of difficult concept in physics syllabus. It was revealed that inability of teacher to explain some concepts well make some topics difficult for me (M=2.14), the use of different terminologies in some topics makes it difficult to understand (M=3.51), lack of instructional materials prevents students from understanding some topics (M=3.51), some topics are difficult because they are long, complicated and includes too many details (M=3.20), lack of practical classes affects my ability to understand some topics in Physics (M=2.98), teachers' poor attitude to teaching make some topics difficult (M=2.64) and teachers' style of teaching makes some topics difficult to understand (M=2.64). Physics topics do not depend on memorizing, they are interpretable (M=2.51). Inability of my teacher to explain some concepts well make some topics difficult for me (M=.3.60). I find some topics difficult because they are not interesting (M=2.41).

HO₁: There is no significant difference in the perception of pre service teachers on difficult concept in physics syllabus based on gender.

Table 4: t-test Analysis on difference in the perception of pre service teachers on difficult concept in physics syllabus based on gender

Variable	Gender	N	Mean	SD	Df	t-value	p-value
Perception	Male	442	2.54	0.49	805	0.878	0.38
	Female	363	2.51	0.5			

Table 4 indicates the t-value of 0.878 with significant value of 0.38 computed at critical alpha level of 0.05 and degree of freedom of 805. Since the significant value $p > 0.05$, the null hypothesis is not rejected. It therefore implies that there is no significant difference in the perception of pre service teachers on difficult concept in physics syllabus based on gender.

HO₂: There is no significant difference in the perception of pre service teachers on difficult concept in physics syllabus based on mode of entry.

Table 5: t-test Analysis on difference in the perception of pre service teachers on difficult concept in physics syllabus based on Mode of Entry.

Variable	Mode of Entry	N	Mean	SD	Df	t-value	p-value
Perception	UTME	706	2.52	0.5	805	-1.689	0.092
	D.E	99	2.69	0.49			

Table 5 indicates the t-value of -1.689 with significant value of 0.092 computed at critical alpha level of 0.05 and degree of freedom of 805. Since the significant value $p > 0.05$, the null hypothesis is accepted. It therefore implies that there is no significant difference in the perception of pre service teachers on difficult concept in physics syllabus based on mode of entry.

Discussion of Findings

This study ascertained the analysis of difficult concept in physics syllabus as perceived by pre service teachers in selected institutions in Kwara State. It ascertained the topics perceived as difficult concept in physics syllabus, pre service teacher's perception of difficult concept in physics syllabus. The study also found out differences in the perception of pre service teachers on concept in physics syllabus based on gender and mode of entry.

It was revealed in this study that friction and viscosity, fluid at rest, waves, sound waves, light waves, refraction of light, electric cells and electrolysis are the topics perceived as difficult concept in physics syllabus by pre service teachers. This finding is in agreement with the findings of Bello and Opaleye (2018) which revealed that Simple Harmonic Motion; Projectile; Waves; and Gas laws among others concepts of Physics were mostly considered difficult

The study also revealed that inability of teacher to explain some concepts well make some topics difficult, the use of different terminologies in some topics makes it difficult to understand, lack of instructional materials prevents students from understanding some topics, some topics are difficult because they are long, complicated and includes too many details, lack of practical classes affects students ability to

understand some topics in Physics, teachers' poor attitude to teaching make some topics difficult and teachers' style of teaching makes some topics difficult to understand. The finding of Erinoshio (2013) corroborate the findings of by revealing that teaching strategies, students' attitude, inadequate learning resources and students' learning habits were the reasons adduced by students of the perceived difficult topics.

The study further revealed that there is no significant difference in the perception of pre-service teachers on difficult concept in physics syllabus based on gender. This implies that gender of the pre-service physics education students has no impact on their perception on the difficult concept in physics syllabus. The findings in the study of Uwem and Macmillan (2016) differs from this finding by concluding that while the level of perceived difficulty of concrete concepts in physics differ by gender, that for perceived difficulty of abstract concepts is insignificantly different.

It was further revealed that there is no significant difference in the perception of pre-service teachers on concept in physics syllabus based on mode of entry. This implies that the mode of the pre-service physics education students has no influence on their perception on the difficult concept in physics syllabus. However, this finding differs from the findings of Obafemi and Onwioduokit (2013) which found no relationship between the response of the students and teachers as seven of the concepts which were considered difficult or very difficult by the students were also considered difficult or very difficult by the teachers.

Conclusion

The study concluded that friction and viscosity, fluid at rest, waves, sound waves, light waves, refraction of light, electric cells and electrolysis are the topics perceived as difficult concept in physics syllabus by pre service teachers. Also, the use of different terminologies in some topics makes it difficult to understand, lack of instructional materials prevents students from understanding some topics, some topics are difficult because they are long, complicated and includes too many details, and lack of practical classes affects student's ability to understand some topics in Physics. It was also concluded that there is no significant difference in the perception of pre service teachers on difficult concept in physics syllabus based on gender and mode of entry. However, significant difference was found in perception of pre service teachers on difficult concept in physics syllabus based on mode of entry.

Recommendation

Based on the findings of this study, the following recommendations were made.

1. Having identified the difficult concepts in physics syllabus, the teachers should focus on the difficult topics in Physics and device means of making the concepts easier through appropriate use of instructional material and teaching methodology.
2. Government and other stakeholders should provide instructional resources for teaching Physics to facilitate the efficient learning of difficult topics in Physics.
3. Seminars, Training and workshop should be created for teachers in schools

to increase the competence of teachers in the teaching of difficult topics in Physics in both private and public schools

4. Innovation of proper curriculum development in Physics education should be made in Nigeria to enhance effective learning.

References

- Bello, T., & Opaleye, O. (2018). Perceived difficult concepts in physics among senior secondary school students in Ife Central Local Government Area of Osun State. *International Journal of Contemporary Issues in Education*, 3, 30–41.
- Danday, B. A. (2023). Fostering Critical Thinking Among Pre-service Teachers Through a Multiple Representation-Based Collaborative Pedagogical Approach. In *Brain, Decision Making and Mental Health* (pp. 191-217). Cham: Springer International Publishing.
- Elliot, D. L., Atencio, M., Campbell, T., & Jess, M. (2013). From PE experiences to PE teaching practices? Insights from Scottish primary teachers' experiences of PE, teacher education, school entry and professional development. *Sport, Education and Society*, 18(6), 749-766.
- Falah, H. (2018). *Remediasi Kesalahan Siswa SMA Mengerjakan Soal-Soal Rangkaian Listrik Arus Searah Melalui Model Pembelajaran Twa*. <https://media.neliti.com/media/publications/214712-remediasi-kesalahan-siswa-sma-mengerjaka.pdf>.
- Iftinah, A., Prastowo, S., & Harijanto, A. (2017). Analisis Penguasaan Konsep Rangkaian Arus Bolak-Balik Pada Siswa Kelas XII SMA. *Seminar Nasional Pendidikan Fisika 2017*, 2(2527–5917).
- Nugraeni, D. (2013). Penyusunan Tes Diagnostik Fisika Materi Listrik Dinamis. *Jurnal Pendidikan Fisika*, 2, 12–16.
- Obafemi, D. T. A., & Onwioduokit, F. A. (2013). Identification of Difficult Concepts in Senior Secondary School Two (SS2) Physics Curriculum in Rivers State, Nigeria. *Asian Journal of Education and E-Learning*, 1(5).
- Phang, F., Abu, M., & Bilal Ali, M. (2012). *Faktor Penyumbang Kepada Kemerosotan Penyertaan Pelajar Dalam Aliran Sains: Satu Analisis Sorotan Tesis [Contributing factors to the decline in student participation in Science Stream [MA Thesis]*. Universiti Teknologi Malaysia.
- Purwoko, R. Y. (2017). Analisis Kemampuan Content Knowledge Mahasiswa Calon Guru Matematika Pada Praktek Pembelajaran Mikro. *Jurnal Pendidikan Surya Edukasi*, 3(1), 55–65.
- Thacker, B. A. (2003). A study of the nature of students' models of microscopic processes in the context of modern physics experiments. *American Journal of Physics*, 71(6), 599–606. <https://doi.org/10.1119/1.1566431>
- Uwem, S., & Macmillan, M. (2016). Students' Gender and Perceived Difficulty of Concepts in Secondary School Physics in Jos Metropolis, Nigeria. *IOSR Journal of Research & Method in Education*, 6(5), 1–5.
- Y. Erinosh, S. (2013). How Do Students Perceive the Difficulty of Physics in Secondary School? An Exploratory Study in Nigeria. *International Journal for Cross-*

Disciplinary Subjects in Education, 3(Special 3), 1510–1515.
<https://doi.org/10.20533/ijcdse.2042.6364.2013.0212>

Yolanda, R., & Syuhendri, A. (2016). Analisis Pemahaman Konsep Siswa SMA Negeri Sekecamatan Ilir Barat I Palembang pada Materi Suhu dan Kalor dengan Instrumen TTCI dan CRI'. *Jurnal Inovasi Dan Pembelajaran Fisika*, 3(1), 1–13.