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Physics Course Content of University Physics Education Programme as Reference to Content Distribution of JUPEB and WAEC Syllabi

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Abstract. The evolution of curricula at any level of education remains relevant based on evolving developments, challenges, and policy direction of society. A university physics education programme has evolved over the years to accommodate, and in some instances, remediate the societal dynamics using the principles of physics. The training of physics teachers for post-basic or secondary education has changed over the years to accommodate solutions to various infractions. We examine the physics course content of a university physics education programme with a view to providing data on content distribution of both advanced and ordinary level physics syllabi. This study is qualitative research of the case study type which sampled the content of two syllabi and course content of a physics education programme. Content analysis was employed to analyse topics and subtopics among three documents. From the result, topics and subtopics were fractionalised to provide an overview of each of the three examined documents. The implication of this is that amendments can be systematically made to accommodate the newly introduce theme physics in technology. Thus, this study proffers a justifiable template for moderating textbooks to authors, bridging the gap between present and future additions and exposing areas of capacity building for physics teachers, among others.

Keywords: content distribution; JUPEB; physics education programme; physics syllabus; WAEC

1. Introduction

The dynamic nature of science brings to the fore its evolution. This evolution allows for changes to be made in terms of content, process and product. The teaching of science in the classroom is not static. The introduction of emerging areas in science allows for exposure to learners at all levels of education with a view to accommodating and equipping emerging learners with up-to-date knowledge in both existing and new fields or disciplines. Automation and green energy are new areas in physics, especially in the developing countries globally

(Badmus and Jita, 2022). These new areas are expected to be accommodated in both the curricula and syllabi of all subject areas (in this case, physics). For new introduction, the existing framework and content must be assessed to give direction on areas of addition. For a fact, the number of days in a year will not change, and a similar assumption can be said of time spent in school by learners. As such, the curriculum is always reviewed to cater for emerging areas and for jettisoning old knowledge to avoid cognitive overload. This study examined existing syllabi of ordinary and advance level physics with a view to providing a template for introducing the new theme. Subsequent paragraphs will discuss the terminologies and rationale for this study.

A quality education should equip citizens with the ability not only to cater for the immediate need of society but also to meet the evolving demands of such society in field-related challenges. The National Policy on Education (NPE) as relayed in the Nigerian Educational Research and Development Council (NERDC) of 2013 has among its goals the study of science and the production of an adequate number of scientists to inspire and support national development. At the senior secondary level (post-basic education), the core science subjects are Physics, Chemistry and Biology. The production of scientists is necessary to support national development precepts, producing individuals equipped with the content and pedagogical knowledge (know-how) of science concepts at all levels, including senior secondary level of science education (Carlson & Daehler, 2019). Universities are responsible for the training of individuals in various disciplines in science education across the board. As such, the training of educators in the sciences falls under the purview of the faculties of education in these universities (Baumert & Kunter, 2013).

Accreditation of programmes being undertaken in each university is solely done by the National Universities Commission (NUC), a commission under the Federal Ministry of Education. Among other responsibilities, the NUC accredits, supervises and monitors programmes that are being studied at these universities. As a guide, the NUC issues Benchmark Minimum Academic Standard (BMAS) to universities in Nigeria which are occasionally reviewed. These reviews are done to accommodate changes in the curriculum as deemed appropriate in conjunction with various universities in the country. The BMAS, as a document binds public universities (owned by federal and state governments), as well as, private universities (owned by individual and corporate entities). The afore-listed categories of universities have the mandate to abide by the standard set in the BMAS. Courses in this document have the compulsory (C), required (R) and elective components. Although the compulsory courses are a core of the student's discipline, the 'required' courses vary with regard to each department. Elective courses are candidate specific in terms of preferences. The training of the aforementioned prospective scientists (physicists or physics educators) is principally the responsibility of the teachers in each of the fields of science at the senior secondary level of education (NUC-BMAS, 2007).

Physics is a branch of science that is concerned with the study of matter, energy and their interaction. At the lower level of education, physics is taught as a single subject. The branches of physics at the higher level are numerous and still evolving owing to the nature of science. These branches include but are not limited to biophysics, astrophysics, optics, nuclear physics, thermodynamics, classical physics, atomic physics, mechanics, modern physics, geophysics, and acoustics. At both elementary and intermediate levels, physics is considered as a difficult subject owing to its affiliation with mathematical principles and laws (Singh et al., 2016; Benegas & Villegas, 2021). To some students, mathematics is difficult enough; with its application in physics, a number of students lose interest in studying any aspect of it (Nielsen, 2013). While many view physics as a stand-alone field, it is all-inclusive, its application being found in virtually all the fields of human endeavour. Interestingly, forensic scientists apply the knowledge of physics in unearthing and reconstructing hidden evidence from crime scenes and beyond (Franck & Franck, 2013; Lin et al., 2019).

The importance of the knowledge of physics in the advancement of global technology and the economy has been established. For example, the development in the field of information and communication technology (ICT), especially in the areas of gadgets and devices produced, prevented the world from going into total lockdown owing to legislations put in place by governments to prevent the continuous spread of the deadly Covid19 pandemic. Not only have these benefitted the nation technologically, advancement in information and communication technology has also turned the world into a 'global village', thus facilitating the exchange of information. Societies willing for such advancement must give proper attention to the knowledge of physics, its teaching and learning. The teaching of physics is expected to be enshrined in the curriculum of learners from the most elementary stage to the highest stage possible owing to its importance. It is imperative to pay adequate attention to physics knowledge and the content as spelt out at various levels of education, especially the senior secondary level and the university content of the physics education programme. This becomes germane as a result of the ripple effect physics has in all the science, technology, engineering and mathematics-(STEM)related fields (Badmus & Omosewo, 2020; Bada and Afolabi, 2020).

Despite the importance of studying physics to scientific and technological development, its teaching and learning have associated challenges. These challenges are not limited to student-related factors, teacher-related factors, curriculum-content factors, or lack of or inadequate laboratory resources for effective teaching and learning (Jeronen et al., 2017; Olatundun-Aiyedun & Ogunode, 2020). Of the aforementioned, curriculum-related factors which include the step-down content as reflected in the Advanced Joint Universities Preliminary Examinations Board (JUPEB) and Ordinary West African Examinations Council (WAEC) level syllabi of the Senior Secondary School Physics Curriculum of the NERDC are the focus of this study. Similarly, the physics component of the physics education programme of the National Universities Commission (NUC) is also of interest. In the physics education programme, there are three component courses, namely the physics content, the pedagogical content and the extension component. The extension component courses in this study are referred to as courses in which candidates minor (such as mathematics and chemistry). The focus of this study with regard to the physics education programme is the physics component of the physics education programme (JUPEB, 2020; WAEC, 2020; NUC-BMAS, 2007).

2. Reviewed Literature

Physics education is one of the teacher-education programmes in Nigerian universities' Faculties of Education. Physics teacher-education curricula which were developed in line with the criteria established by the National University Commission (NUC-BMAS, 2007) are meant to produce competent teachers for senior secondary school physics teaching. In effect, graduates of this programme are certified by various universities to have acquired competence in this area of study and to have the pedagogical skill to pass down the knowledge of physics to the learners.

The curriculum is the backbone of any educational system because it specifies what should be taught, how it should be taught and to whom it should be taught (Usman et al., 2019). Ahmadi and Lukman (2015) defined a curriculum as a particular form of specification about the practice of teaching. The curriculum is usually associated with all the learning experiences that the students are expected to learn within a specified period of time. Musingafi et al. (2015) opined that the curriculum is a well-defined and prescribed course of studies which students must complete for them to pass a given level of education. The curriculum is also viewed as the hard core of education that gives the substance and methods for pertinent information, abilities and attitudes for sustainable human development (Milner-Bolotin, 2018).

In Nigeria, the different curricula in physics were streamlined to achieve particular purposes because each of the curricula was designed to meet different goals and objectives (Ogodo, 2019). These different goals and objectives all work towards achieving the philosophy of education as recorded in the National Policy on Education. As highlighted in the NPE objectives are a total integration of the individual into the immediate community, the Nigerian society and the world; the provision of equal access to qualitative educational opportunities for all citizens at all levels of education, within and outside the formal school system; the inculcation of national consciousness, values and national unity; and the development of appropriate skills, mental, physical and social abilities and competencies to empower the individual to live in and contribute positively to society (NPE, 2013; Ogodo, 2019).

The senior secondary school physics curriculum is also designed to achieve the goals and objectives of the philosophy of education in Nigeria. The curriculum is designed under six themes as compared to the old curriculum that was designed under five themes (See Table 1). According to Bada et al. (2018), the inclusion of the new theme "Physics in Technology" was to reduce the "abstract nature of some topics in physics, thereby making the knowledge of physics real and concrete" (p. 14). This is because of the importance the study of physics has to the realization of the nation's philosophy of education. The Nigerian Educational Research and Development Council identified four objectives of the senior secondary school physics curriculum (NPE, 2013). These comprise providing fundamental physics literacy of physics for functional living in society, acquiring fundamental concepts and physics principles as preparation for additional studies, acquiring important scientific skills and convictions as preparation for applying physics principles technologically, and stimulating and encouraging creativity.

Table 1: Difference between former and current physics curricula

Theme	Former Curriculum	Current Curriculum
Theme 1	Interaction of matter, space and time	Interaction of matter, space and time
Theme 2	Conservation principles	Conservation principles
Theme 3	Waves	Waves
Theme 4	Fields	Fields at rest and in motion
Theme 5	Quanta	Energy quantization and duality of matter
Theme 6	-	Physics in technology

In order to achieve the earlier objectives, the Nigeria government has tasked a number of examination bodies with the assessment of students or candidates on their attainment of the objectives. Prominent among these examination bodies are the West African Examinations Council (WAEC), the National Examination Council (NECO), the National Board for Technical Education (NABTEB), and the Joint University Preliminary Examinations Board (JUPEB). All these examination bodies have their various syllabi which serve as a guide for students before writing the examination. These syllabi contain the different topics that are more specific to the examination bodies even though the topics that make up the syllabus are drawn from the curriculum.

A syllabus refers to the subject and topics to be covered in the course of study. According to Okai (2010), a syllabus refers to an outline of topics that students are required to study within an estimated time frame. This suggests that the syllabus is more specific regarding the content and topics to be learnt, thereby reducing the ambiguity that comes with the curriculum. The syllabus is a more focussed document outlining the topics to be dealt with during a programme (Dubicki, 2019; Khan & Krell, 2019). This means the various examinations have their specific syllabi that guide the students or learners on specific areas on which to focus. Dubicki (2019) posited that a syllabus ensures a fair understanding between the students and the teachers, thus reducing to the barest minimum the confusion on policy relating to the course. This buttresses the importance of the syllabus of examination bodies to the realization of set objectives. This further justifies knowing the content that makes up the different curricula, especially as they relate to university physics education programmes in Nigerian universities.

Prominent among these syllabi are the senior secondary school physics curriculum (West African Examinations Council and the National Examination Council), the joint university preliminary examination board curriculum, and the university physics education curriculum. The senior secondary school physics curriculum is designed to expose secondary school students to the basic literacy in physics for functional living in society. In addition, it is also meant to prepare learners to acquire basic concepts and principles of physics as preparation for further studies (FRN, 2013). The senior secondary school physics curriculum has its contents arranged in a thematic approach and it is structured on the two concepts of motion and energy. The content of the secondary school physics is further broken down into six themes, namely interaction of matter, space and time, conservation principles, waves, fields at rest and in motion, energy quantization and the duality of matter and physics in technology. Students are expected to have good mastery of all the topics under each theme and are examined across topics. This curriculum represents the standard for the teaching of senior secondary school physics and guide syllabus and instruction among examination bodies and schools (Rocha, 2020).

3. Methodology

This study employed qualitative research of a case study. The cases were the WAEC syllabus (ordinary level physics syllabus), the JUPEB (advanced level physics syllabus) and the physics component of the university physics education programme as spelt out in the NUC Benchmark Minimum Academic Standard (BMAS). Content analysis was conducted on these three documents. Content analysis was employed in the examination of the content of West African Examinations Council, Joint University Preliminaries Examination Board (JUPEB) syllabus and the physics content of the university physics education programme. This was done by organising, analysing, representing and presenting data with reference to the research questions. The method adopted was to group the content of the syllabi and physics courses into topics and subtopics for easy correspondence. The topics and subtopics in the syllabus in each case were identified, as well as the number of items in the subtopics and the percentage distribution of each item. The WAEC, JUPEB and BMAS are public documents available to the public and can be found on various websites (https://www.waecdirect.org,https://jupeb.edu.ng, https://www.nuc.edu.ng). There is no ethical violation in accessing, assessing and presenting data in this manuscript.

3.1 The West African Examinations Council (WAEC)

The WAEC is an examining body that was established in 1952 by the British government to conduct a uniform examination among the anglophone countries of Gambia, Ghana, Sierra Leone, Nigeria and Liberia. WAEC conducts two examinations, namely the General Certificate Examinations (GCE) and the West African Senior Schools Certificate Examinations (WASSCE) each year (Upahi et al., 2015). The GCE is usually conducted for external students who are not identified with any secondary school before writing the examination while the West African examination is usually conducted for internal students currently in identified senior secondary schools. The West African Examination Council has its own physics syllabus which students are expected to use as a guide in preparing for writing the examination. To date the examination body appears to be the most widely accepted examination for senior secondary school students in the country and it is also highly rated among the examination bodies on the continent of Africa. The body organizes both ordinary and advance levels of examination in the country. Physics students who register and sit for the WASSCE must have satisfied a minimum of three years secondary school education on the syllabus of the Council. This is because the syllabus spans three years of learning activities which culminate in the writing of the examination (WAEC, 2020).

3.2 The Joint Universities Preliminary Examinations Board (JUPEB)

The JUPEB is an examination body established in April 2014, and pioneered by ten universities in Nigeria. The approval for the examining body was giving by the Federal Government of Nigeria in December 2013. It has the responsibility of conducting standard examinations to student candidates who have been exposed to approved courses with a duration period of one year or more. The JUPEB programme prepares students for diploma programmes or direct entry admission seekers in the 200 level in the university without having to write the Unified Tertiary Matriculation Board (UTME) examinations. The examining body operates a syllabus that is a subset of the physics curriculum as approved by the Federal Republic of Nigeria government (JUPEB, 2020).

3.3 University Physics Education Programme (UPEP)

The National Universities Commission (NUC) dictates the courses for all programmes of study in the universities in Nigeria, including science education programmes. These programmes (science education) are tasked with the responsibility of producing professionally qualified teachers of science in the post-basic (senior secondary) level of education. Accreditation of programmes being untaken in each university is carried out solely by the National Universities Commission (NUC). Among other responsibilities, the NUC accredits, supervises and monitors programmes that are being studied in these universities. As a guide, the NUC issues BMASs to universities in Nigeria which are occasionally reviewed. The BMAS mandates the compliance of the minimum academic courses for prospective students in various disciplines in Nigerian universities. The BMAS contains courses which are compulsory (C), required (R) and elective (E) for the various programmes of study. For a student to graduate from the university, the compulsory and required courses are mandatory for students to pass within the maximum academic years (mostly six). Elective courses are optional and vary from student to student. Although, the compulsory courses are a core of the student's discipline, the 'required' vary with regard to each department. Elective courses are candidate specific in term of preferences (NUC-BMAS, 2007).

3.4 Current Study

This study sought to analyse the content of the WAEC syllabus, the JUPEB) syllabus and the university physics education programmes in Nigeria. Specially, this study has the following objectives: to analyse the content distribution of the physics topics in the WAEC syllabus; to analyse the content distribution of the physics topics in the JUPEB syllabus; and to analyse the content distribution of the physics courses in the physics education programme. In line with the objectives, the following questions were asked: (1) What is the content distribution of the topics in the JUPEB syllabus? (2) What is the content distribution of the topics in the WAEC syllabus? (3) What is the content distribution of the topics in the physics education program syllabus?

4. Findings

This section presents data analysis which provides answers to the research questions raised in this study. Content analyses of the WAEC syllabus, JUPEB syllabus and the physics content of the physics education programme are presented respectively.

Research Question One: What is the content distribution of the topics in the WAEC Syllabus?

Table 2: Content distribution of the WAEC syllabus

S/N	Topic	Frequency of items in subtopics	Percentage distribution (%)
1	Concepts of matter	6	3.6
2	Fundamental and derived quantities and units	2	1.2
3	Position, distance and displacement	4	2.4
4	Mass and weight	2	1.2
5	Time	2	1.2
6	Fluid at rest	3	1.8
7	Motion	7	4.2
8	Speed and velocity	4	2.4
9	Rectilinear acceleration	4	2.4
10	Scalars and vectors	6	3.6
11	Equilibrium of forces	3	1.8
12	Simple harmonic motion	5	3.0
13	Newton's laws of motion	3	1.8
14	Energy	3	1.8
15	Work, energy and power	7	4.2
16	Heat energy	11	6.7
17	Production and propagation of waves	4	2.4
18	Types of waves	2	1.2
19	Properties of waves	6	3.6
20	Light waves	8	4.8
21	Electromagnetic waves	1	0.6
22	Sound waves	9	5.5
23	Description property of fields	2	1.2
24	Gravitational field	3	1.8
25	Electric field	11	6.7
26	Current electricity	8	4.8
27	Magnetic field	8	4.8
28	Electromagnetic field	6	3.6
29	Simple A.C. circuit	7	4.2
30	Structure of the atom	5	3.0
31	Structure of the nucleus	3	1.8
32	Wave-particle paradox	10	6.1
	Total	**165**	**100.0**

Table 2 reveals the content distribution of the topics and subtopics in the WAEC syllabus. There are 32 main topics in the syllabus with a total of 165 subtopics. The percentage distribution of the topics is as follows: Concepts of matter 3.6%; Fundamental and derived quantities and units 1.2%; Position, distance and displacement 2.4%; Mass and weight 1.2%; Time 1.2%; Fluid at rest 1.8%; Motion 4.2%; Speed and velocity 2.4%; Rectilinear acceleration 2.4%; Scalars and vectors 3.6%; Equilibrium of forces 1.8%; Simple harmonic motion 3.0%; Newton's laws of motion 1.8%; Energy 1.8%; Work, energy and power 4.2%; Heat energy 6.7%; Production and propagation of waves 2.4%; Types of waves 1.2%; Properties of waves 3.6%; Light waves 4.8%; Electromagnetic waves 0.6%, Sound Waves 5.5%; Description property of fields 1.2%; Gravitational field 1.8%; Electric field 6.7%; Current electricity 4.8%; Magnetic field 4.8%; Electromagnetic field 3,6%; Simple AC circuit 4.2%; Structure of the atom 3.0%; Structure of the nucleus 1.8%; and Wave-particle paradox 6.1%. Based on the data in Table 1, it can be concluded that Heat energy and Electric field with 11 sub-topics which each account for 6.7% of the entire subtopic distribution have a wider distribution in the WAEC syllabus.

Research Question Two: What is the content distribution of the topics in the JUPEB syllabus?

Table 3: Content distribution of the JUPEB syllabus

S/N	Topic	Number of items in subtopics	Percentage distribution (%)
1	Units	7	2.6
2	Vectors	6	2.2
3	Particle kinematics	8	3.0
4	Dynamics	12	4.4
5	The gravitational field	5	1.8
6	Work, energy, power	7	2.6
7	Circular and oscillatory motion	14	5.2
8	Elasticity	5	5.5
9	Hydrostatic	10	3.7
10	Hydrodynamics	11	4.1
11	Idea gases	7	2.6
12	Temperature and thermometry	5	1.8
13	Heat and energy	7	2.6
14	Thermodynamics	4	1.5
15	Electromagnetic waves	2	0.7
16	Geometrical optics	8	3.0
17	Lenses and optical instruments	8	3.0
18	Oscillations and waves	9	3.3
19	Wave theory of light	8	3.0
20	Sound waves	8	3.0
21	Electronics	10	3.7
22	Capacitors	6	2.2
23	Current electricity	14	5.2
24	Magnetic field	3	11
25	Force on conductor and moving charge	7	2.6

26	Electromagnetic induction	10	3.7
27	Alternating current (AC) circuit	10	3.7
28	Atomic structure	9	3.3
29	Elements of modern physics	9	3.3
30	X-rays	7	2.6
31	Wave-particle duality	6	2.2
32	Radioactivity and nuclear energy	9	3.3
33	Introduction to semiconductors	7	2.6
34	Applied physics	3	1.1
	Total	**271**	**100.0**

Table 3 reveals the content distribution of topics in the JUPEB syllabus. Table 2 shows that there are 34 main topics and 271 subtopics in the JUPEB syllabus. The percentage distribution of the topics is as follows: Units 2.6%; Vectors 2.2%; Particle kinematics 3.0%; Dynamics 4.4%; The gravitational field 1.8%; Work, energy, and power 2.6%; Circular and oscillatory motions 5.2%; Elasticity 5.5%; Hydrostatics 3.7%; Hydrodynamics 4.1%; Ideal gases 2.6%; Temperature and thermometry 1.8%; Heat and energy 2.6%; Thermodynamics 1.5%; Electromagnetic waves 0.7%; Geometrical optics 3.0%; Lenses and optical instruments 3.0%; Oscillations and waves 3.3%; Wave theory of light 3.0%; Sound waves 3.0%; Electronics 3.7%; Capacitors 2.2%; Current electricity 5.2%; Magnetic field 1.1%; Force on conductor and moving charge 2.6%; Electromagnetic induction 3.7%; Alternating current (AC) circuit 3.7%; Atomic structure 3.3%; Elements of modern physics 3.3%; X-rays 2.6%; Wave-particle duality 2.2%; Radioactivity and nuclear energy 3.3%; Introduction to semiconductors 2.6%; and Applied physics 1.1%. Based on Table 2, it can be concluded that the topic Elasticity with 15 subtopics has wider scope in the JUPEB syllabus.

Research Question Three: What is the content distribution of the topics in the university physics education courses?

Table 4: Content distribution of the topics in the physics education syllabus

S/N	Topic	Frequency of items	Percentage distribution (%)
1	Mechanics and properties of matter	15	5.0
2	Heat, sound and optics	18	6.0
3	Atomic and nuclear physics	14	4.7
4	Electricity and magnetism	15	5.0
5	Practical physics I	12	4.0
6	Practical physics II	5	1.7
7	Mechanics and properties of matter II	8	2.7
8	Vibration and waves	9	3.0
9	Heat, atomic and nuclear physics	14	4.7
10	Electricity and magnetism II	11	3.7
11	Practical physics III	9	3.0
12	Practical physics V	1	0.3
13	Practical physics VI	10	3.3
14	Waves and optics	15	5.0

15	Thermodynamics and statistical physics	11	3.7
16	Quantum physics	11	3.7
17	Electromagnetic theory I	17	5.7
18	Electronics I	8	2.7
19	Practical physics and treatment of data I	7	2.3
20	Measurement method	8	2.7
21	Solid state physics I	10	3.3
22	Solid state physics II	6	2.0
23	Nuclear and particle physics	14	4.7
24	Communications	17	5.7
25	Electromagnetic theory II	14	4.7
26	Digital electronics	8	2.7
27	Physics of the lower atmosphere	12	4.0
	Total	**299**	**100.0**

Table 4 reveals that there are 27 physics courses in the syllabus with a total of 299 subtopics. The percentage distribution of the topics is as follows: Mechanics and properties of matter 5.0%; Heat, sound and optics 6.0%; Atomic and nuclear physics 4.7%; Electricity and magnetism 5.0%; Practical physics I 4.0%; Practical physics II 1.7%; Mechanics and properties of matter II 2.7%; Vibration and waves 3.0%; Heat, atomic and nuclear physics 4.7%; Electricity and magnetism II 3.7%; Practical physics III 3.0%; Practical physics V 0.3%; Practical physics VI 3.3%; Waves and optics 5.0%; Thermodynamics and statistical physics 3.7%; Quantum physics 3.7%; Electromagnetic theory I 5.7%; Electronics I 2.7%; Practical physics and treatment of data I 2.3%; Measurement method 2.7%; Solid state physics I 3.3%; Solid state physics II 2.0%; Nuclear and particle physics 4.7%; Communications 5.7%; Electromagnetic theory II 4.7%; Digital electronics 2.7%; and Physics of the lower atmosphere. Furthermore, the data in Table 3 indicated Heat, sound and optics to have 18 subtopics which accounts for 6.0% of the entire subtopic distribution in the physics education syllabus.

5. Discussion

The findings from this study revealed the content distributions of the topics/sub-topics in the WAEC, the JUPEB and the university physics education programme syllabi. The results in Table 2 showed that the heat energy and electric field had the highest number of occurrences in the WAEC syllabus. Table 3 revealed that circular and oscillatory motion and current electricity had the highest number of occurrences in the JUPEB syllabus while Table 4 showed that topics such as heat, sound and optics, electromagnetic theory, communication, mechanics and properties of matter, waves and optics, electricity and magnetism topped occurred most frequently in the university physics education programme. A critical review of the three syllabi revealed that the topics that make up the theme 'Physics in technology' have not been integrated into any of the syllabi despite its inclusion in the last review of the senior secondary school physics curriculum in 2009. This poses a significant question regarding its teaching, even at the senior secondary school level of education. It appears that there is a misalignment between the physics curriculum and the topics in the three physics syllabi of the WAEC, JUBEB and UPEP. The disparity in the number of topics and subtopics among the three syllabi also confirms misalignment in the three official documents. This finding is significant as it reveals a disconnect between the official physics curriculum and the three physics-related syllabi as its topics and subtopics do not completely reflect what the physics curriculum prescribes. This finding contributes to scholarship as it reveals the gap in theory and practice, as the official curriculum did not totally capture all the topics or subtopics as it ought to. The study also proffers a justifiable template that can be used in the moderation of textbooks and other resources in order to bridge the gap between the present and future additions to the curriculum.

6. Conclusion

As mentioned in the analysis, the profiling of the topics and subtopics has been brought to the fore in this study. Similarly, this profiling of content establishes a template for easy moderation and representation owing to the sixth theme in the senior secondary school physics curriculum (physics in technology) which so far, has no representation in either the syllabi of Advanced JUPEB or Ordinary WAEC levels. As indicated in previous paragraphs, there are two topics in the sixth theme, namely Renewable energy and Automation. These two topics have consequent subtopics which must also be represented in the various syllabi. While the purview of this study is not to moderate or determine the worthiness in terms of representation, this study is a reference material that establishes a framework or template for policy makers and curriculum experts. By extension, the WAEC and the JUPEB syllabi, as well as the physics content of the physics education programme have all been laid bare. Worthy of note is the fact that these topics are well established as courses in the BMAS. Therefore, a shift is needed to change the status of these courses from elective (E) to required (R) to prepare and give capacity to teachers in training for the task of teaching these aspects, among others. Based on the aforementioned, this study should guide the introduction of the sixth theme into the syllabi of ordinary and advanced level topics as well as guiding its introduction into the physics education content of the university physics education programme.

Based on the findings of this study, the present curriculum was reviewed in 2009 and is due for re-evaluation with regard to emerging areas in physics education. A misalignment exists in the syllabus when compared to the curriculum content. The sixth theme (Physics in technology) is yet to gain prominence in various textbooks after 13 years. Therefore, efforts need to be directed on its integration into textbooks, as well as the classroom teaching. It is worth noting that the sixth theme is practically oriented and must engage the curiosity of learners. To this end, it is necessary to build the capacity of teachers, instructors and laboratory personnel to engage students. Researchers are encouraged to devise practical manuals in this area to foster hands-on and activity-based approaches to its teaching as recommended in the curriculum. Further studies should be conducted on discrepancies in terms of content of the documents reviewed in this study

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