Appropriateness and relevance of the Nigerian Basic Science Curriculum Contents: Teachers and students' perceptions

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ABSTRACT

This article examined the Nigerian Basic Science Curriculum by focusing on the appropriateness and relevance of the curriculum contents as perceived by the science teachers and students. To achieve this objective, two research questions were formulated in this descriptive study. The study sample consisted of 435 students who were randomly selected and 57 Basic Science teachers who voluntarily participated in the study. Two researcher-developed instruments: Relevance of Basic Science Curriculum Scale (RBSCS) and Appropriateness of Basic Science Scale (ABSCS) were used to elicit information from students and teachers respectively. Each of the questionnaires consisted of 56 sub-topics (attached to a five-point Likert Scale) as spelt out in the curriculum guide prepared by the State Ministry of Education. Data collected were analyzed using descriptive statistics in form of mean. The findings of the study included the fact that: (1) genetics, the nervous system and sense organs were considered moderately appropriate and highly relevant as rated by science teachers and students respectively, (2) all physical science contents were considered highly irrelevant by the students while these contents were rated by the teachers as moderately appropriate for the third year junior secondary school, (3) topics such as environmental hazards, drug abuse, reproductive health and resources from living and non-living things were rated as highly relevant and highly appropriate. Based on the findings, it was recommended that science education researchers, curriculum development agencies, science educators and professional associations should collaborate in designing (1) socially relevant curriculum through infusion of more indigenous scientific knowledge into Basic Science Curriculum, (2) developmentally appropriate curriculum through application of relevant theories of developmental psychology.

KEYWORDS

Curriculum contents, curriculum analyses, curriculum content appropriateness and relevance, indigenous scientific knowledge, basic science curriculum

RÉSUMÉ

Cet article a examiné le programme nigérian de sciences fondamentales en mettant l'accent sur la pertinence et la pertinence du contenu du programme tel qu'il est perçu par les professeurs de sciences et les élèves. Pour atteindre cet objectif, deux questions de recherche ont été formulées dans cette étude descriptive. L'échantillon de l'étude était composé de 435 élèves qui ont été choisis au hasard et de 57 enseignants en sciences fondamentales qui ont volontairement participé à l'étude. Deux instruments développés par des chercheurs : Relevance of Basic Science Curriculum Scale (RBSCS) et Appropriateness of Basic Science Scale (ABSCS) ont été utilisés pour obtenir des informations auprès des élèves et des enseignants respectivement. Chacun des questionnaires se composait de 56 sous-sujets (attachés à une échelle likert en cinq points) comme indiqué dans le guide pédagogique préparé par le ministère de l'Éducation de l'État. Les données recueillies ont été analysées à l'aide de statistiques descriptives sous forme de moyenne. Les résultats de l'étude incluaient le fait que : (1) la génétique, le système nerveux et les organes sensoriels étaient considérés comme modérément appropriés et très pertinents, tels qu'évalués respectivement par les professeurs de sciences et les élèves, (2) tous les contenus en sciences physiques ont été considérés très peu pertinents par les élèves alors que ces contenus ont été jugés modérément appropriés par les enseignants pour la troisième année du secondaire, (3) des sujets tels que les risques environnementaux, l'abus de drogues, la santé génésique et les ressources de la vie et les choses non vivantes ont été jugées très pertinentes et très appropriées. Sur la base des résultats, il a été recommandé que les chercheurs en éducation scientifique, les organismes de développement des programmes d'études, les éducateurs scientifiques et les associations professionnelles collaborent à la conception d'un programme d'études (1) socialement pertinent par l'infusion de plus de connaissances scientifiques autochtones dans le programme d'études en sciences de base, (2) programme d'études adapté au développement grâce à l'application de théories pertinentes de la psychologie du développement.

MOTS-CLÉS

Contenu des programmes, analyses des programmes d'études, pertinence du contenu du curriculum, connaissances scientifiques autochtones, programme d'études scientifiques de base

INTRODUCTION

Many countries in the world today strive to improve the quality of science and technology education as it is important to members of the society. The significant impact of science on the growth and development of a nation is as a result of relevant science topics being taught in schools. Relevance is particularly important for retention of students in science fields. Students develop interest in relevant science disciplines that are of immense benefits to the society (Joint Admissions and Matriculation Board). For instance, many Nigerian students are seeking admission through Unified Tertiary Matriculation Examinations to pursue courses in nursing, medicine, engineering, and veterinary schools and colleges

Inclusion of relevant and appropriate topics that are in the Basic Science curriculum designed for junior secondary school calls for making wise curriculum decision in respect of which learning is relevant and when it is best learned. Relevance, in the context of this study is conceptualized as to the extent to which curriculum contents meet the needs and interest of the learners and the aspirations of the society. Science learning becomes relevant when the learning has (positive) consequences on students' life. According to Stuckey, Mamlok-Naaman, Hofstein and Eilks (2013), positive consequences can be conceived in two ways; (1) satisfying the essential needs regarding the students' interest or educational requirements (that students will actually perceive) and (2) anticipating future needs (that students may not necessarily think of).

The relevancy issue in the development of quality science curriculum is of a great concern to science educators. The inclusion of relevant contents on socioscientific issues (e.g., climate change, ozone layer deflections, pollution, HIV/AIDS) into the science curriculum has not only enabled students to discover the link between science and the society but also enhanced their ability to think critically about issues dealing with the immediate environment. It has been shown that any curriculum that utilized socioscientific issues as its framework makes science contents relevant to students at lower grade levels (Dolan, Nichols, & Zeidler, 2009).

In addition, science can be made more relevant to learners through development of a social structure for science education programme by taking into consideration the contextual feature of the science learning settings. Students learn most effectively in a broader community context because transfer of knowledge in pure academic form to a real-world setting is made easy in such instructional context (Sadler, Romine, & Topcu, 2016).

Compounding the issue of irrelevance of science curriculum is the compartmentalization of knowledge. Fragmentation of scientific knowledge into disciplines makes students consider their science subjects as irrelevant to their lives out of school (Venezia, Kirst, & Antonio, 2003). As reported by (Harada, Kirio, & Yamamoto, 2008), curriculum becomes more relevant when there are connections between subjects rather than strict isolation.

Appropriateness is closely related to the readiness to cope with the demands of the Basic Science Curriculum. Science educators (e.g., Tekkumru-Kissa & Stein, 2015; Tekkumru-Kissa, Stein, & Schunn, 2015) contend that "matching science curriculum to students' cognitive levels will go a long way in enhancing effective learning of science. However, improper match between the two results in learner's tiredness, lack of interest in the topic or subject and poor performance in classroom tests. This in turn gives room to doubt the science teachers' competence.

The basic problem of the newly introduced Basic Science Curriculum in Junior Secondary Schools is that science education in Africa failed to fully recognize the intellectual and cultural milieu of the children (Edho, 2009). Failure of the curriculum planners to take into account the learners' needs and aspirations of the African society leads to students being drilled on science contents that are devoid of relevance.

Towards the end of completing junior secondary school basic science and technology, students gradually lost interest in science (Ejide, 2010). Various reasons have been identified for such occurrence at the terminal stage of schooling; some attributed it to science teachers' quality and preparation. This may be a plausible reason. However, students' lack of interest in science could be traceable to disconnection of science and technology curriculum contents from the content of the students' daily lives and interest (Keane, 2008; Ogunniyi, 1988).

In the first year of junior secondary school, students embraced science because they learn about habitats, mixtures, energy sources, boiling and evaporation, forests, living and non-living things in their environments. These topics are exciting at this level of schooling, but rapidly lose their appeal as the students' progress to third year junior secondary school. At this level, science becomes more complex and abstract due to the inclusion of topics such as molecular structure, force, work, energy, power, magnetic, and electron flow. Apart from lack of relevance syndrome, the current Basic Science Curriculum was heavily criticized for demanding too much from students at early years of schooling. As a result, science and technology experiences of large proportion of junior secondary students are marred by unnecessary struggle and failure. For instance, the junior secondary schools in Oyo State in 2016 recorded a statewide failure in the Junior School Certificate Examination conducted by the State Ministry of Education (State Ministry of Education, 2016).

Despite students' lack of interest in learning science coupled with their poor performance in Basic Science which perhaps can be traceable to the quality of curriculum used in schools, curriculum matters relating to science curriculum remain understudied. Regretfully, numerous studies (e.g., Abakpa & Agbo-Egwu, 2013; Igbokwe, 2015) on junior secondary school curriculum focused on mere describing the nature and structure of Basic Science Curriculum, development and interpretation of the curriculum guides and proposing strategies for overcoming challenges associated with its implementation. Therefore, in order to expand knowledge about the Basic Science curriculum, this study focuses on the relevance and appropriateness of the curriculum to junior secondary school students. To achieve the purpose of this study, two research questions posed to guide the study.

1) What topics do the teachers perceive as appropriate to be taught at the third year of junior secondary school?
2) What topics do the students perceive as relevant to their needs and interest?

THE OBJECTIVES AND STRUCTURE OF BASIC SCIENCE CURRICULUM

The Basic Science curriculum is one of the components of the 9-year Basic Education Curriculum (BEC) designed for the attainment of the goals of Education for All (EFA) as well as targeted towards achieving the noble objectives set by the National Economic Empowerment and Development Strategies (NEEDS) and the Millennium Development Goals (MDGs). The 9-year Basic Education Curriculum was developed by the Nigeria Educational Research and Development Council (NERDC) and structurally organized to reflect three components namely: (1) Lower Basic Education Curriculum for primary 1-3 (age 6-8 years) Basic 1-3. (2) Middle Basic Education curriculum for primary 4-6 (age 9-11) i.e., Basic 4-6 (3) Upper Basic Education Curriculum of Junior Secondary (JS) 1-3 (age 12-14) Basic 7-9

The Nigerian Basic Science Curriculum is designed for learners at the age range of 12 to 14years. This is a stage of development at which learner experience a period of rapid and significant change, intellectual and moral development. The curriculum aims to ensure that learners' experience of science in school will assist them to: (1) develop interest in science and technology, (2) apply their basic knowledge and skills in science and technology to meet societal needs, (3) take advantage of the numerous career opportunities offered by the study of science and technology and (4) become prepared for further studies in science and technology.

The curriculum is well grounded in advanced and relevant educational theory and practice derived from philosophy and psychology of teaching and learning. It accords equal importance to what the child learns and to the process by which he or she learns it. The newly developed Basic Education Curriculum (NERDC, 2012) provides for extensive learning experiences and richer science contents through infusion of topics on socioscientific issues into the existing curriculum in order to make it more relevant. This was done with a view to identifying with the developed and developing countries of the world. An overview of topics and sub-topics to be treated at the third year of Junior Secondary School is presented in Table 1. Concepts and skills are outlined at each class level, and their development is approached through the exploration of the content of the curriculum; strong emphasis is placed on developing the ability to question, to analyze, to investigate, to think critically and to solve problem. A significant feature of the curriculum is that the activities prescribed for each topic in the teaching and learning process imply full participation of learners. Thus, encouraging a child centered teaching and activity oriented learning.

The Nigerian Basic Science Curriculum seeks to cater for the developmental and educational needs of the learners in their contemporary society. A significant feature of the curriculum is that it suggests several assessment techniques for teaching and learning process from which teachers may choose depending on the curriculum objectives, the class and state policies.

TABLE 1

Topics and subtopics to be covered at the third year of Nigerian Junior Secondary School as decoded from the Junior Secondary School Curriculum (Revised): Basic Science and Technology, JSS 1-3 developed by the Nigerian Educational Research and Development Council (NERDC) (2012)

Chapters	Topics	Subtopics
1	**Genetics (Family trait)**	(a) Defining genetics (b) Type of family (c) Transmission of characters in organisms (d) Expression of characters in organisms (e) Sex determination in humans (f) Application of principles of heredity.
2	**Environmental Hazards**	(a) Bush burning and its consequences (b) Soil erosion and how it can be controlled (c) Flooding and how it can be prevented (d) deforestation and its effects on the environment (e) Benefits and possible hazards of modern methods of farming (f) The ozone layer and how it may be affected by humans
3	**Drug Abuse**	(a) How alcohol and tobacco might affect the body (b) How different narcotics might affect the body (c) National Agency for Food and Drug Administration and Control (NAFDAC) and its activities in waging war against fake, counterfeit and substandard drugs and foods. (d) National Drug Law Enforcement Agency (NDLEA) and its activities in waging war against hard drugs and drug traffickers.
4	**Metabolism in the human body**	(a) Parts and basic functions of alimentary canal (b) The mechanical breakdown of food (c) The chemical breakdown of food and the roles of amylase, a protease and a lipase enzyme (d) The absorption of nutrients from the villi.
5	**The nervous system and sense organs**	(a) Nervous system and the body response to stimuli (b) Eye defects and how they can be corrected (c) Eye and how it sees objects (d) Tongue and how it works (e) Skin and how it regulates the body temperature (f) Skin and how it prevents the body against bacterial invasion and the ultra violet radiation (g) Skin and how it serves as excretory organ
6	**Reproductive health**	(a) Sexually transmitted diseases and how to be protected against them (b) Mode of transmission of HIV and how to control it. (c) How to take care of pregnant women (d) Care and attention to be given to the mother and her body from the day of delivery to six weeks. (e) How to take care of our reproductive system.
7	**Element, Compound and Mixture**	(a) Elements and their properties and uses (b) Mixtures (petroleum and coal) and uses of its constituents (c) Compounds and their properties and uses (d) How constituents of mixture can be separated (e) How to write formulae of ionic compounds.
8	**Resources from living things**	(a) Resources (e.g. fruit, grain, oil) from food crops (e.g. orange, maize, soya beans) (b) Resources (e.g. cocoa, kolanut, oil palm) from cash crops (e.g. cocoa plant, kolanut tree and oil palm). (c) Resources (e.g. hard wood) from wood crops (e.g. Iroko, Teak, Ebony Mahogany) (d) Medicinal uses of plants (e) Plants that are used for dyes and pigments (f) Resources (e.g. meat, milk, bones,

		hide and skin, manure) from animals (e.g. cow, goat, chicken) (g) location of this resources in Nigeria and their economic importance
9	**Resources from non-living things**	(a) Types of soil and their properties (b) What soil is made up of (c) Location of solid minerals in Nigeria (d) How crude oil is converted into other Minerals (e) Uses of iron, marble, coal, limestone, tin and columbite.
10	**Skill acquisition**	(a) Meaning of skill acquisition (b) reasons for skill acquisition (c) Various types of skills (d) Importance of skill acquisition.
11	**Science and Development**	(a) The nature of science (b) Products of science and how they came into existence (c) Methods of enquiry in science (d) Things a scientist is obliged to obey in carrying out scientific inquiry (e) right and wrong applications of science (f) implications of bad scientific practices on individual's life (g) adverse effect of bad scientific practices on a country.
12	**Light energy**	(a) The concept of reflection and refractions (b) The apparent depth and its danger to swimmers (c) How we see things (d) The concept of suspension and how to use it to interpret the rainbow.
13	**Sound Energy**	(a) How to use objects to produce sound by making them vibrate (b) The production of sound from a vibration medium (c) How sound is reflected and identification objects that reflect sound (d) How sound is heard by the ear.
14	**Magnetism**	(a) Types of magnet and their uses (b) Properties of a magnet (c) Poles of a magnet (d) Law of magnetism.
15	**Electrical Energy**	(a) Indicate the direction of electron flow in a circuit (b) How to connect ammeter and voltmeter to a series or parallel circuit and read their values (c) Functions of some materials in the house circuit (d) Reading electric meter for building.
16	**Radioactivity**	(a) Radioactive element and types of radiation (b) How radioactivity can be applied in the medical field and industry (c) Radioactive radiation and what they do to the human body.

The characteristic feature of the Nigerian Basic Science Curriculum in terms of content is quite not different from the science curriculum at lower secondary grade in other countries (e.g., Botswana, Morocco and Germany). Discrepancies slightly occur in terms of the nature and extent of topics coverage. For instance, the treatment of natural hazards in both Morocco and Germany lower secondary grade curricula is extended to the study of earthquakes and volcanoes whereas such topics do not feature at this level in Nigerian Basic Science Curriculum. In addition, Nigeria, Botswana and Morocco lower secondary curricula featured reproductive health with different degrees of coverage. Botswana extended the treatment to cover teenage pregnancy and family planning while Morocco included breast feeding and birth control. Disparity in the curriculum content is hinged on each country's attempt to create strong links between science and society, industry and the environment with a view to making science curriculum relevant.

In terms of cognitive complexity of the curriculum contents, the cognitive demand of all the science curricula in those countries mentioned above in relation to the students' level of understanding varied from predominantly lower cognitive levels to higher cognitive level.

METHODOLOGY

This was mainly a descriptive study that was conducted. First, to determine the students' views on the extent of relevance of each science topic to their local/immediate needs. Second, to determine the teachers' views on the degree of appropriateness of each science sub-topic to age and background knowledge of learners. The population for the study comprised all basic science and technology teachers and their third year junior secondary school students in one of the educational zones of Oyo State. The study sample consisted of 435 students who were randomly selected from 35 schools that were initially selected using stratified random sampling techniques in the study zone. In the second case, 57 teachers who attended the workshop on implementation of Basic Science Curriculum organized by the Science Teacher Association of Nigeria (STAN) voluntarily participated in the study. In order to achieve the objective of this study, two researcher-designed instruments were used: Relevance of Basic Science Curriculum Scale (RBSCS) and Appropriateness of Basic Science Curriculum Scale (ABSCS). Each of the questionnaires consisted of 63 sub-topics as spelt out in the curriculum guide prepared by the State Ministry of Education.

Regarding the RBSCS, each subtopic was attached to a five-point Likert scale ranging from "highly relevant" to "highly irrelevant" with moderately relevant as the pivotal point of the scale. Students rather than teachers were involved in rating the extent of relevance of each of the sub-topics to their local-immediate needs. This is because students are considered as being capable to participate in making decision about their education. In support of students' involvement, Chan (2011) observed that children are capable of assessing their situation, considering possible options, expressing their views and therefore influencing decision making processes in myriad ways.

Concerning the second instrument, ABSCS, the science teachers rated each of the sub-topics in terms of their appropriateness to the age and background of the third year students of junior secondary schools using a five-point Likert scale: highly appropriate (5), appropriate (4), moderate (3), inappropriate (2), and highly inappropriate (1). With these clearly defined scales, higher mean values (greater than 3) in both RBSCS and ABSCS can be interpreted to mean more relevant and/ or more appropriate contents. Thus, in interpreting the findings if the study, the mean values were utilized.

The need for an in-depth exploration of science teachers' perception on the appropriateness of the topics necessitated the adoption of group discussions which serve as an additional data source. This was done for 12 hours; distributed over 2 weeks during the STAN workshop. The researcher and specialist in curriculum studies served as the moderators during the discussion sessions.

RESULTS AND INTERPRETATION

Determination of the cluster mean values for each topic in respect of the study sample perception of appropriateness and relevance of Basic Science Curriculum yielded the result presented in Table 2.

For ease of reference, the results presented Table 2 and the outcome of the discussion session with the science teachers are presented on topical basis.

Based on the above results (Table 2), it is evident that all science teachers rated the first topic (Genetics) as moderately appropriate with a cluster mean value of 3.51. Regarding the relevance of the topic, students rated the topic as highly relevant (cluster mean value = 4.68). All the basic science teachers who participated in the discussion session recognized the chapter as simplified contents of genetics which will later serve as foundation for further study of genetics in senior secondary school.

TABLE 2

Cluster Mean Values in respect of the study sample perception of appropriateness and relevance of the Nigeria Basic Science Curriculum contents

Chapter	Topic/No. of Subtopics*	Mean value Range		Cluster Mean Value	
		Appropriateness	Relevance	Appropriateness	Relevance
1.	Genetics (Family Treats) (6 subtopics)	2.81 - 3.86	4.67 - 4.81	3.51	4.68
2.	Environmental Hazards (5 subtopics)	4.18 - 4.82	4.02 - 4.46	4.62	4.35
3.	Drug Abuse (4 subtopics)	4.40 - 4.88	4.36 - 4.55	4.66	4.46
4.	Metabolism in the human body (4 subtopics)	3.38 - 3.68	3.15 - 3.77	3.49	3.38
5.	The nervous system and sense organ (7 subtopics)	3.47 - 3.75	4.33 - 4.81	3.61	4.60
6.	Reproductive health (5 subtopics)	4.25 - 4.46	4.06 - 4.79	4.34	4.48
7.	Element, Compound and mixture (5 subtopics)	4.10 - 4.60	4.13 - 4.53	4.46	4.16
8.	Resources from living things (7 subtopics)	4.54 - 4.83	4.35 - 4.87	4.71	4.61
9.	Resources from non-living things (5 subtopics)	4.09 - 4.82	4.18 - 4.55	4.49	4.36
10.	Skill acquisition (4 subtopics)	3.44 - 3.52	4.44 - 4.60	3.49	4.60
11.	Science and Development (7 subtopics)	3.02 - 3.47	4.05 - 4.61	3.34	4.50
12.	Light energy (4 subtopics)	3.09 - 3.20	1.32 - 1.73	3.17	1.70
13.	Sound energy (4 subtopics)	3.23 - 3.45	1.21 - 1.69	3.34	1.47
14.	Magnetism (4 subtopics)	3.20 - 3.69	1.43 - 1.99	3.43	1.74
15.	Electrical energy (4 subtopics)	3.02 - 3.84	1.13 - 1.73	3.44	1.43
16.	Radioactivity (3 subtopics)	4.74 - 4.91	4.75 - 4.91	4.82	4.36

*Details of the subtopics can be found in Table 1

As observed during the discussion, science teachers were against the inclusion of sex determination which they considered to be inappropriate at this level. According to them, treatment of sex determination involved teaching of abstract genetics concepts and the use of symbolic representation of meiosis in gamete formation. Alternatively, they suggested extending the chapter by introducing hereditary variations such as gender, height of person, colour of seed, tongue rolling sensitivity of tongue to taste of certain chemical substances and clasping of hand. As expressed by some science teachers, the inclusion of hereditary variation at level of schooling would make the topic more relevant and interesting to the students because they are visible to students.

As could be seen from Table 2, the science teachers rated the topic as highly appropriate (cluster mean value = 4.62) while the students rated it as highly relevant (cluster mean value =

4.35) as well. All the discussants remarked that this is one of the most appropriate contents of the Basic Science Curriculum in the sense that developmentally students have matured enough to grasp the contents and more so useful illustrations and relevant examples of cases of flooding and erosion are available in teaching the topics within learners' environment. Also, the discussants considered the teaching of benefits and possible hazards of modern farming methods very easy in terms of teaching. This is because according to them, the contents of modern farming methods can easily be transformed into a form that can be easily assimilated by the learners. More importantly, effective teaching of the topic required the use of field trips and practical work as suggested by the discussants.

From the foregoing results (Table 2), the science teachers rated all the subtopics under the main topics (Drug Abuse) as highly appropriate with a cluster mean value of 4.66 while the third year junior secondary school students rated all the subtopics as highly relevant (cluster mean value = 4.46) as well.

Table 2 reveal that the cluster mean value regarding relevance of the topic (metabolism in the human body) as rated by the students is 3.38 meaning moderately relevant while science teachers in their rating of the appropriateness of the topic considered it as moderately appropriate (cluster mean value = 3.49). The discussants were of the view that explaining the chemical breakdown of food and the role of different enzymes at this level of schooling requires teacher demonstration of a sound pedagogical content knowledge. According to them, achieving meaningful learning of the topic will require teacher simplification of the contents to aid students' comprehension.

Based on the results presented in Table 2, it is obvious that the cluster mean values of all the subtopics with respect to the appropriateness and relevance of the topic (The nervous system and sense organ) are 3.61 and 4.60 respectively. This means that the respondents regarded the nervous system and sense organs as a topic to be moderately appropriate to the student's level of understanding as well as highly relevant to the needs of students.

The chapter on Reproductive health is considered by the student as one of the most highly relevant topics in the Basic Science Curriculum. The cluster mean value for all the subtopics is 4.48 (Table 2). The teachers who responded to the questionnaire regarded this chapter to be highly appropriate (cluster mean value = 4.34) as reflected in their rating (Table 2).

Regarding the appropriateness of teaching Element, Compound and Mixture as a topic at the third year of Junior Secondary School, the science teachers rated the topic as highly appropriate with a cluster mean value of 4.46 (Table 2). Regarding the relevance of the topic, student rated the topic as highly relevant (cluster mean value = 4.16) as shown in Table 2.

The next two chapters (Resources from living and non-living things) were considered as developmentally appropriate and socially relevant by the science teachers and students respectively. The science teachers who responded to the questionnaire expressed their views regarding the appropriateness of the two chapters by rating chapter 8 as having a cluster mean of 4.71 and chapter nine as having a cluster mean of 4.49. Chapter 8 (cluster mean value = 4.61) and chapter 9 (cluster mean value = 4.36) were both rated as highly relevant in terms of students' needs and interests. The discussants remarked that both topics are intellectually fit at this level of schooling in the sense that students possess the necessary background knowledge to understand the topics (resources from living-and non-living things). These resources are readily available within the immediate environments of the learners.

Concerning the appropriateness of the topics for this level of schooling, the teachers rated this chapter (Skill acquisition) as moderately appropriate (cluster mean = 3.49) as shown in Table 2. On the other hand, the students who participated in responding to the questionnaire considered the topics to be highly relevant (cluster mean value = 4.60). The science teachers remarked that this chapter is expected to be treated theoretically as designed by the curriculum developers and it introduces students to various types of skills within the learners' societies. The science teachers argued that practical activities associated with the topic should have been included in Basic Science Curriculum rather than introducing the practical aspect in the Basic Technology Curriculum.

As revealed in Table 2, the science teachers in their rating regarding the appropriateness of chapter eleven (Science and Development) rated it as moderately appropriate with cluster mean value of 3.34. On the other hand, the students considered this topic to be highly relevant as evident in their rating (cluster mean value = 4.50).

The remaining four chapters deal with physical science topics. The first chapter focused on light energy and its topic is expected to be treated under four subtopics. The teachers and students who responded to the questionnaire rated the topic regarding its appropriateness and relevance as moderately appropriate (cluster mean value = 3.17) highly irrelevant (cluster mean value = 1.70) respectively. The second chapter on sound energy and whose topic is expected to be treated under four subtopics is rated as moderately appropriate (cluster mean value = 3.34) and highly irrelevant (cluster mean value = 1.47) by the teachers and students respectively. The third chapter focused on magnetism. The curriculum developers expected the topic to be treated under four subtopics and it is rated as moderately appropriate (cluster mean value = 3.43) and highly irrelevant (cluster mean value = 1.74) by the teachers and students respectively.

The chapter preceding the last chapter is also a physical science aspect. It focuses on electrical energy. Meaningful teaching of this chapter is expected to cover the following subtopics; indicate the direction of electron flow in a circuit, how to connect ammeter and voltmeter to a series or parallel circuit and read their value, functions of some materials in the house circuit and reading electric meter for building. Regarding the appropriateness of the topic for the level of students under consideration in this study, the teachers rated the topic as moderately appropriate (3.44). Concerning the relevance of the topic, it was rated as highly irrelevant (cluster mean = 1.43).

The last chapter deals with the treatment of radioactivity which is also an aspect of physical science at junior secondary school. This topic was later introduced to students in physics and chemistry curriculum in senior secondary school. The depth of treatment of radioactivity at junior secondary school level is restricted to the following three subtopics: (i) radioactive elements and types of radiation (ii) how radioactivity can be applied in the medical field and industry and (iii) radioactive radiation and what they do to the human body. Radioactive elements and types of radiation were rated as highly relevant (mean = 4.75) and appropriate (mean = 4.82) by the students and science teachers respectively. The second subtopic, how radioactivity can be applied in the medical field is considered as highly relevant (mean = 4.91) based on students' rating, while it is also rated as moderately appropriate (mean = 3.46) by the science teachers in response to the questionnaire. The last subtopic, radioactive radiation and what they do to the human body was rated as highly relevant (mean = 4.74) and appropriate (mean = 4.87) by the students and science teachers respectively. The cluster means for appropriateness and relevance ratings of the topics, radioactivity in the Basic Science Curriculum are 4.34 and 4.84 respectively.

DISCUSSION AND IMPLICATIONS FOR CURRICULUM IMPROVEMENT AND INSTRUCTION

The current study has qualitatively shed light on the vital issues raised with regard to the appropriateness and relevance of the Basic Science Curriculum. The finding of the study revealed that two topics, genetics, and the nervous system and sense organs were considered moderately appropriate at this level of schooling. These topics were rated by the students as highly relevant. They were also found to be moderately appropriate based on teachers' rating. The curriculum developers focused more attention on presentation of basic factual knowledge to the students. This was responsible for making the depth and breadth of treatment to be a little bit different from the content at the senior secondary school level. This finding is in agreement with research outcomes (Barnett, Parry, & Coate, 2001; Dowden, 2007; Vellopoulou & Ravanis, 2010) that any curriculum structured around subjects and the accumulation of information has little chance of being relevant to the learners. On the other hand, any curriculum designed to cater for the students' needs and interests has a very good chance of being relevant. As clearly observed, the emphasis is on laying a solid foundation of biology to students rather than putting in place a more relevant curriculum. It was not a surprise considering the above topics to be highly relevant when one considers the students curiosity in learning science. Students would like to know what happens if a person quickly removes his/her hand on accidentally touching a hot object. They would like to know how eye sees objects, how ear hears word/sound, how offsprings resemble their parents. However, in an attempt to learn those abstract topics, things they consider interesting to them, science teachers must possess a sound pedagogical content knowledge to be able to transform the content into a form that can be easily assimilated by the learners. What is most unaccepted is that the curriculum developers replicated the contents in respect of genetics and sense organs as they appeared in the third year senior secondary school curriculum just the same way in the third year junior secondary school curriculum with little difference. Simply, they overlooked the influence of learner's cognitive development and prior knowledge in determining the depth and breadth of treatment of the contents.

Another disappointing finding of the study is that all the contents (light energy, sound energy, magnetism and electrical energy) related to the physics content were considered highly irrelevant by the students while these topics were rated by the science teachers as moderately appropriate at the third year junior secondary school. This result supported relevant research's submission that the curriculum planners are not concerned with relevance rather they are concerned with efficiency of curriculum contents in providing solid foundation for further study (Hudson, 2012; Mabejane & Ravanis, 2018; Parker, 2003). Students' judgment of those topics as irrelevant may be due to their inability to recognize the links and connections between the physics contents of the curriculum and their everyday life. In future, this can result in students' disengagement from learning physics or leading to low student enrolment in physics class if those contents were not taught in such a way that personal relevance of science is obvious to students. In order to enhance the teaching of the physics aspects of the Basic Science Curriculum, concerted efforts are to be made by science teachers to establish strong links between science teaching and society. For instance, in teaching light to students at the third year of Junior Secondary School, teachers should be ready to engage learners in activities that involve investigating how mirror and other shining surfaces are good reflector of light, exploring how objects may be magnified using simple lenses or magnifier, and demonstrating that light is made up of many different colours, demonstrating that light refracts as it passes from air glass, air to water, glass to air, water to air and designing and conducting an investigation to show how shadows are formed. Like light energy, electricity can also be made more relevant in the sight of the learners if science teachers planned their lessons in such a way that students can learn that: (a) a complete circuit is needed before electricity can flow, (b) a battery provides the energy for the electricity to move around the circuit, (c) metals allow electricity to flow through them and can be used as switches to complete a circuit and make links between the batteries, bulbs and buzzers, (d) increasing the number of batteries used (voltage) in a circuit increases the current, (e) several batteries can be used together in a circuit. As a way of developing students' interest in electricity, teachers can conclude this section by discussing sample electricity bills prepared by electric supply companies for homes and how to read meter or reload prepaid cards.

Another important finding of this study is that topics such as environmental hazards, drug abuse, reproductive health and resources from living and non-living things were rated as highly relevant and highly appropriate. The finding tallied with the Camara, O'Connor, Mattern and Hanson's (2015) submission that when practical problems of the learners' community are utilized as the major framework for designing a new school curriculum, there is tendency that the curriculum will be more relevant to the learners. This finding is not surprising because those topics are related to indigenous scientific knowledge. As conceived by Warren (1991), it is knowledge that served as basis for local level decision making in agriculture, medicine, food preparation, natural disaster management and material resources management. Due to their relevance, many African science educators (Meyer, 2008; Orlore, Roncoli, & Kabugo, 2010) suggested their inclusion into the school curriculum instead of rendering them obsolete in the face of modern science and technologies. However, care must be taken to ensure that they pass the test of intellectual, developmental and satisfy other requirements before integration into the curriculum.

Regarding the biological science contents (e.g. genetics and the nervous system) and physical science contents (e.g. light energy, sound energy, electricity and magnetism) of the Basic Science Curriculum, the findings of the study revealed that the curriculum developers and educational planners have done little to show the social relevance of those contents to the students. This implies that the planners have not done a thorough need analysis during the planning stage of curriculum development. It is therefore, recommended that science education researchers, curriculum development agencies and Science Teachers Association of Nigeria (STAN) should collaborate in designing a (1) socially relevant curriculum through infusion of more indigenous scientific knowledge into Basic Science Curriculum and (2) developmentally appropriate curriculum through thorough analysis of the curriculum contents for its cognitive demands with a view to achieve appropriate match between students' cognitive levels and the demands of the curriculum.

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