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Content adequacy of primary school basic science and technology curriculum for technological innovative skills

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Abstract
The study aims to determine the extent of content adequacy of current primary school basic science and technology curriculum catered for technical innovative skills in the 21st century as perceived by primary school basic science and technology teachers in FCT, Abuja. The study adopted descriptive survey research design. Five research questions were posed to guide the study. The population of the study included all the public primary school Basic Science and Technology teachers in FCT, Abuja. The sample size for the study was 110 public primary school Basic Science and Technology teachers (57 male teachers and 53 female). The instrument for data collection, is: Content Adequacy Questionnaire on primary school Basic Science and Technology innovations (CAQPS-BSTINO). The overall Reliability Coefficient of internal consistency of the CAQPS-BSTINO was established at 0.91. Data collected were analyzed using mean and standard deviation. The findings of the study revealed that the primary school Basic Science and Technology curriculum content cater inadequately for creative skills, critical thinking skills, divergent thinking skills, exploring skills, and problem solving skills. Thus, the study concluded that, curriculum contents of primary school basic science and technology curriculum should be reviewed to cater for all the required basic science and technological innovational skills especially creative skills, critical thinking skills, divergent thinking skills, exploring skills, and problem solving skills.

Keywords: adequacy, primary school, technology curriculum, skills

Introduction
Curriculum is the center of every educational programme. Hence the success and failure of an educational programme is to a great extent dependent on the planning of the curriculum, mostly selection of the curriculum content and implementation. The quality of every educational programme or system is a direct reflection of the quality of its curriculum. Curriculum is the means through which the laid down educational philosophy of a nation is translated into concrete reality. It contains prescribed course of studies which students must learn in order to reach a certain level of education. Curriculum is concerned with the why, what and how of instruction (Akudolu, 2010). It encompasses the goals and objectives of a particular course of study, selection and organization learning experience of the content area and evaluation of students' academic achievement in that particular subject of study. The importance of the curriculum cannot be over emphasized as it provides a framework for all the learning experiences a learner under goes while schooling. It is an official document that the teacher uses to plan classroom lessons and select appropriate teaching methodologies with which to translate the instructional objectives of the lesson to the understanding of student. Also, curriculum is responsible for the systematic organization of co-curricular and extra- curricular experiences geared towards facilitating the development of the cognitive, physical, psychomotor and affective potentials of students (Offorma, 2002) [13].
Thus, Basic Science and Technology (BST) curriculum is a set of learning experiences designed to enable learners attain the objectives of Basic Science and Technology programme. It is one of the subjects for every Nigerian school child at the primary education level. It is a product of the restructuring and integration of four primary and junior secondary school curricula namely Basic Science, Basic Technology, Physical and Health Education and computer studies/Information technology communication (NERDC, 2012) [10]. The NERDC outlined the objectives of BST to include helping children develop interest in science and technology, acquire basic knowledge and skill in science and technology. Others are to apply scientific and technological knowledge and skills to meet contemporary societal needs, take advantage of the numerous career opportunities provided by science and technology, become prepared for further studies in science and technology, avoid drug abuse and related matters and safety and security consciousness.

In line with the above objectives the trust of BST in primary level of education is to lay good and strong foundation for pupils in science and technology. Basic Science and Technology is often referred to as a subject that offers learners the onset and preliminary knowledge and training to acquire the necessary skills in applied science, technology, agricultural, industrial, commercial, economic development among others and to afford students with early basic scientific awareness to solve problems (Igbokwe, 2018) [6]. Importance of Basic science and technology cannot be overemphasized, since it promotes national development; no nation can develop without recording successes in science and technology. Many developed nations of the world such as America, Germany, France, among others, boast of several scientific inventions which make them to be rated as the world powers (Esseysafe, 2017) [3]. The researcher opine that the recorded success of the developed countries in science and technology is an indication of good foundation laid at the primary level of education.

Primary level of education simply refers to primary school. Though base on preference of nomenclature in one country or another, it may be said to be basic, form among other names. Primary school according to Nzeribe (2004) [12], is a formal education given to children with the age of 6 to 11 and above. The Federal Republic of Nigeria in her National Policy on Education (FRN, 2016) indicated that primary education is the key to the success or failure of the educational system. The policy defined primary education as the education given in institutions for children aged 6-11 years plus. Thus, outlined the objectives of primary education as to: inculcate permanent literacy and numeracy and the ability to communicate effectively; lay a sound basis for scientific and reflective thinking; give citizenship education as a basis for effective participation in and contribute to the life of the society. Others are to mould the character and develop sound attitude and morals in the child; develop in the child the ability to adapt to the child's changing environment; give the child the opportunity for developing manipulative skills that will enable the child function effectively in the society within the limits of the child's capacity; and provide the child with basic tools for further educational advancement, including preparation for trades and crafts of the locality (FRN, 2016). In this study, Primary school education is define as a formal education that its core function is to lay foundation for learners' other levels of education. Recalling that the period of primary education is crucial in the life of an individual in particular and the society in general. Therefore, the introduction of Basic Science and Technology at the primary education level exposes the pupils to logical thinking, critical thinking, scientific methods and innovative skills.

A skill is habit of doing a particular thing competently (Ifeanyi & Okolocha, 2020) [5]. It is the ability to do a task expertly. According to Bolt-Lee and Foster (2003) [2], skill is the art of possessing the ability, power, authority or competency to do the task required of an individual on the job. Iwuagwu *et al* (2017) [8] observed that skills are not innate, but acquired through conscious observing of specify algorithm over a time. On the other hand, skills acquisition is the ability to learn a skill. It is the practical way of developing and acquiring expertise knowledge, clear-cut competencies and technical know-how in learners, which they would use to improve the economic frontiers of their immediate society. However, skills acquired by a person may be irrelevant over time mostly when they are void of innovations. Interestingly, daily experience, has shown that skills go antiquated as a result of continuous lack innovations.

In view of the above observation, Innovation is the other of the day. Innovation refers to the creative, better and modern ways of doing things. Innovation According to Indeed Editorial Team (2021) [7], is viewed as "the ability to generate ideas that create value and improve processes, from inventing a machine to finding a faster route to work". It involves creating an avenue or room where things are seen beyond its contemporary state or standard and creating challenging environment for the pupils to thrive; given room for critical thinking in solving problem (Udo & Bako, 2014) [14], selection of those content that triggers and inculcates technical innovational skills in the pupils. Given that the society is dynamic with rapid changing environment, while conventional ways of operations are given ways to modern ways as posed by science and technology. Thus, the researchers are of the opinion that innovation is driven by science and technological development. It is therefore imperative that science and technological innovative skills and crush be developed in the child at the foundational level.

Thus, Afuwape (2011) [1] identified Basic Science and technological skills to include process skills, such as observing, counting, reporting, organizing, predicting, manipulating, experimenting, designing, modeling, generalizing. In contrast, Basic Science and technological innovational skills refers to set of skills that encourages creativity, critical thinking, divergent thinking, exploring and problem solving ability of the pupils. Specifically, Indeed Editorial Team (2021) [7] identified innovational skills to include creativity, critical thinking, divergent thinking, exploring and problem solving skills. While its content include practical, experiments, projects and work-sample, designing and modelling and information and communication technologies (ICT) which can lead to unintended learning or accidental learning. It include those basic science and technology curriculum contents that engages the learners' full active participation with little guidance from the teacher or instructors. Interestingly, Iwuagwu, Iwuagwu and Akuta, (2018) [9], reported increase in rate dropout rate among secondary school science student in FCT which may not be unconnected with poor foundation on basic science and technology at the primary school level to equip the pupils with the requisite knowledge and technical innovative skills to cope with sciences at secondary school level.

Statement of problem

Till date in this 21st century evidence abound that Nigeria is lacking behind in science and technology development, while some good number of students shy away from toeing the part of science and technology. In view of the above, NDDC IN 2012 came up with the policy of loping together science, technology and

information and communication technology given birth to basic science and technology which is made compulsory in lower basic (primary school) and middle basic (senior primary school) in Nigeria. These efforts by government and other stakeholders in education have not yielded the expected result. Basic science and technology aimed at creating the needed foundation for science and technological skills upon which other science and technology will be built, however evidence abounds that students of junior secondary school level which is the immediate next level after primary school level struggle to cope with basic science and technology at this level and a times develop phobia and hatred for the subject. Thus, the researchers speculates fundamental problems which may be rooted on poor basic science and technological innovational skill at the primary school level which may contribute to poor performance of students in upper basic and consequently shying away from science courses at senior secondary schools. Recalling that science and technology are full of innovation and dynamism, the way and approach things are done may likely change due to inventions living behind learners not grounded in innovative and adaptive skills. Against this background the researchers deemed it necessary to carry out an investigation on the content adequacy of primary basic science and technology curriculum in catering for innovative skills. Thus, the purpose of the study put in question form is to what extent do primary school Basic Science and Technology Curriculum catered for Basic Science and Technological innovational skills of the pupils as perceived by primary school teachers.

Purpose of the Study

The main purpose of the study is to determine the content adequacy of primary school Basic Science and Technology Curriculum innovational skills of the pupils as perceived by primary school teachers in FCT, Abuja. Specifically, the study sought to determine the extent of:

1. primary school basic science and technology curriculum catered for creative skills;
2. primary school basic science and technology curriculum catered for critical thinking skills;
3. primary school basic science and technology curriculum catered for divergent thinking skills;
4. primary school basic science and technology curriculum catered for exploring skills;
5. primary school basic science and technology curriculum catered for problem solving skills;

Research questions

1. What is the teachers' mean rating on the extent primary school basic science and technology curriculum catered for creative skills?
2. What is the teachers' mean rating on the extent primary school basic science and technology curriculum catered for critical thinking skills?
3. What is the teachers' mean rating on the extent primary school basic science and technology curriculum catered for divergent thinking skills?
4. What is the teachers' mean rating on the extent primary school basic science and technology curriculum catered for exploring skills?
5. What is the teachers' mean rating on the extent primary school basic science and technology curriculum catered for problem solving skills?

Methods

The study adopted descriptive survey design. Descriptive research design involves collecting data on, and describing in a systematic manner the characteristic, features or fact about a given object, event, programme or population (Nworgu, 2015) [11]. Population of the study comprised all public primary schools basic science and technological teachers in FCT, Abuja. The sample size for the study was 110 public primary school basic science and technology teachers comprising 57 male teachers and 53 female primary school basic science and technology subject teachers. Drawn across the six area councils in Federal Capital Territory, (FCT) Abuja, using dual stage sampling techniques.

In the first stage the researcher employed non-proportionate random sampling techniques to draw 18 public primary schools: three from each of the six area councils in FCT.

AT the second stage, the researcher employed purposive sampling techniques to draw all the primary school basic science and technology teachers from the sampled secondary schools which amounted to 110 teachers use for the study. The sampling techniques was deemed appropriate to ensure probability sampling and manageable sample size given the method deemed appropriate for data collection for the study.

The instrument for data collection for the study was an observational Schedule titled: "Content Adequacy Questionnaire on primary school Basic Science and Technology innovations (CAQPS-BSTINO)" developed by the researchers. The CAQPS-BSTINO was made up of two parts; A and B. Part A sought for demographic information of the primary school Basic Science and Technology teachers, while part B contained 30 items arranged in five clusters modelled on a four point scale ranging from VA- Very Adequate = 4 points, AD-Adequate = 3 points, IA-Inadequate = 2 points to VIA-Very Inadequate =1 point; to elicit information from Primary School Basic Science and Technology teachers' on the content adequacy of primary school basic science and technology curriculum for technological innovative skills. The instrument was face validated by four experts: one in educational curriculum, one in childhood education and a measurement and evaluation expert all from university of Nigeria Nsukka. These experts were requested to look at the instrument in terms of suitability of the instrument and the items in line with the purpose of the study and research questions. The useful

suggestions made by validators were used in the correction and production of the final instrument (CAQPS-BSTINO) 20 copies of the final instrument were used to collect data from 20 the primary school basic science and technology teachers from Niger state. Data collected were subjected to trial – testing to ascertain the reliability of the instrument using Cronbach Alpha statistical method. The choice of Cronbach Alpha was because the items of the CAQPS-BSTINO were polytomously scored. The reliability coefficients of 0.91 was obtained which proves the instrument to be highly reliable. 12 research assistance made of Ph.D. students of university of Abuja, were employed and trained for three days on how to rate the teachers. The research assistance were sent in pairs to each of the sampled primary schools in the six area councils of FCT upon prior notification of the school heads in writing. Data collection lasted for six weeks, the researcher and research assistant devoted one week for one area council. Thus, data collected were analyzed using mean and standard deviation. All computations were made using Statistical Package for Social Science (SPSS) to ensure accuracy of result. To answer the research questions, the result was interpreted using limit of real numbers: where a mean score of 1.00 - 1.49 was regarded as Very inadequate; 1.50 – 2.49 as inadequate; 2.50 – 3.49 as Adequate while 3.50 – 4.00 as Very adequate.

Results

Research question one

What is the teachers' mean rating on the extent primary school basic science and technology curriculum catered for creative skills?

Table 1: Mean Ratings on the extent of Content adequacy of primary school basic science and technology curriculum catered for creative skills.

S/N	Extent Primary school Basic Science and Technology Curriculum Content on creative skills:	Mean	SD	DEC
1	challenging environment	2.26	0.96	Inadequate
2	Unintended learning	2.12	1.08	Inadequate
3	Pupils dominated learning	3.01	0.92	Adequate
4	Unguided demonstration	2.14	0.94	Inadequate
5	Thought provoking task	2.52	0.88	Adequate
6	Abstract drawing	1.35	0.86	Very inadequate
7	Abstract painting	1.48	0.76	Very inadequate
Cluster mean		2.13	0.91	Inadequate

N = 110

The result of the study as presented in table 1 shows the mean ratings and standard deviations of primary school basic science and technology curriculum by teachers on the extent of content adequacy of primary school basic science and technology curriculum for creative skills in FCT. The result of the study showed the mean ratings for items 1, 2 and 4, (challenging environment, Unintended learning and Unguided demonstration) are within the mean range of 1.50 – 2.49 set as a criterion for content inadequacy; while items 6 and 7 (Abstract drawing and Abstract painting) fall within the mean range of 1.00 - 1.49 regarded as very inadequate. interestingly, items 3 and 5 (Pupils dominated learning and Thought provoking task) fall within the mean range of 2.50-3.49 set as criterion for Content adequacy with a cluster mean of 2.13 and a standard deviation of 0.91. This result shows that primary school basic science and technology curriculum cratered for creative skill skills is inadequate.

Research question two

What is the teachers' mean rating on the extent primary school basic science and technology curriculum catered for critical thinking skills?

Table 2: Mean Ratings on the extent of Content adequacy of primary school basic science and technology curriculum for critical thinking skills.

S/N	Extent Primary school Basic Science and Technology Curriculum Content on critical thinking skills:	Mean	SD	DEC
8	Observational skills	2.26	0.57	Inadequate
9	Unguided organization	2.12	0.90	Inadequate
10	Predictive skills	2.01	0.95	Inadequate
11	Work sample	2.54	1.94	Adequate
12	Designing skills	2.32	0.68	Inadequate
13	Gap creation in teaching	2.55	0.76	Adequate
Cluster mean		2.30	0.97	Inadequate

N= 110

The result of the study as presented in table 2 shows that the mean ratings and standard deviations of primary school basic science and technology curriculum by teachers on the extent of content adequacy of primary school basic science and technology curriculum for critical thinking skills. The result of the study showed the mean ratings for items 8, 9, 10, and 12 (observational skills, unguided organization, predictive skills, and designing skills) fall within the mean range of 1.50-2.49 set as criterion for content inadequacy. While items 11 and 13 showed adequate content for primary school basic science and technology curriculum for critical thinking skill as they are within 2.50 and above set as criterion for content adequacy. This implies that observational skills, unguided organization, predictive skills, and designing skills are rated inadequate for content adequacy of primary school basic science and technology. However, the cluster mean of 2.30 with a standard deviation of 0.97 showed that that the overall mean ratings and standard deviations of content adequacy of primary school basic science and technology teachers on the extent of content adequacy of content adequacy of primary school basic science and technology curriculum for critical thinking skills in FCT is inadequate.

Research question three

What is the teachers' mean rating on the extent primary school basic science and technology curriculum catered for divergent thinking skills?

Table 3: Mean Ratings on the extent of Content Adequacy of Primary School Basic Science and Technology Curriculum for Divergent Thinking Skills.

S/N	Extent Primary school Basic Science and Technology Curriculum Content on divergent thinking skills:	Mean	SD	DEC
14	Multiple approach to concept	2.10	0.86	Inadequate
15	Improvisation	2.46	0.88	Inadequate
16	Transferred learning	2.14	0.95	Inadequate
17	Application of learning to real life situation	2.30	0.91	Inadequate
18	Modelling of objects	2.40	0.88	Inadequate
	Cluster mean	2.29	0.89	Inadequate

N = 110

The result of the study as presented in table 3 shows the mean ratings and standard deviations of primary school basic science and technology curriculum by teachers on the extent of content adequacy of primary school basic science and technology curriculum for divergent thinking skills. The result of the study showed the mean ratings for items 14, -18. With a cluster mean of 2.29 and a standard deviation of 0.0.89 which is below the range of 2.50 set as criterion for Content adequacy. This result shows that primary school basic science and technology curriculum for divergent thinking skills has inadequate content as rated by public primary school basic science and technology teachers in FCT.

Research question four

What is the teachers' mean rating on the extent primary school basic science and technology curriculum catered for exploring skills?

Table 4: Mean Ratings on the extent of Content Adequacy of Primary School Basic Science and Technology Curriculum for Exploring Skills.

S/N	Extent Primary school Basic Science and Technology Curriculum Content on Exploring skills:	Mean	SD	DEC
19	Challenging Assignment	2.52	0.76	Adequate
20	Thought triggering Projects	2.31	0.42	Inadequate
21	Teacher Guided Experiments	2.54	0.62	Adequate
22	Non teacher guided experiment	1.24	0.94	Very inadequate
23	Teacher guided Practical	2.57	0.55	Adequate
24	Non teacher guided Practical	1.35	0.81	Very inadequate
	Cluster mean	2.08	0.70	Inadequate

N = 110

The result of the study as presented in table 4 shows the mean ratings and standard deviations of primary school basic science and technology curriculum by public primary school teachers on the extent of content adequacy of primary school basic science and technology curriculum for exploring skills. The result of the study showed that the mean ratings for items 19, 21, and 23 were within the range of 2.50 and above set as criterion for content adequacy. It implies that challenging assignment, teacher guided experiments, and teacher guided practical were adequately catered for in the primary school basic science and technology curriculum. However, items 20 (thought triggering projects) falls within the range of 1.50 to 2.49 set for inadequacy of content. While items 22 and 24 (non -teacher guided experiment and non- teacher guided practical) fall within the range of 1 to 1.49 set

criterion for very inadequate. The table further show a cluster mean of 2. 08 and a standard deviation of 0.70 which is within the range of 1.50- 2.49 set as criterion for content inadequacy. This result implies that primary school basic science and technology curriculum for exploring skills has inadequate content as rated by public primary school basic science and technology teachers in FCT.

Research question five
What is the teachers' mean rating on the extent primary school basic science and technology curriculum catered for problem solving skills?

Table 5: Mean Ratings on the extent of Content Adequacy of Primary School Basic Science and Technology Curriculum for problem solving Skills.

S/N	Extent Primary school Basic Science and Technology Curriculum Content on problem solving skills:	Mean	SD	DEC
25	Systematic approach to issues	2.80	0.76	Adequate
26	Trial and error	2.30	0.86	Inadequate
27	Application of knowledge to real life situation	2.18	0.18	Inadequate
28	Basic Computer techniques	2.28	0.84	Inadequate
29	Basic information and communication technology	2.40	0.88	Inadequate
30	Internet browsing	2.06	0.56	Inadequate
Cluster mean		2.33	0.68	Inadequate

N= 110

Given the result of the study as presented in table 5 above showed that the mean ratings and standard deviations of primary school basic science and technology curriculum by teachers on the extent of content adequacy of primary school basic science and technology curriculum for problem solving skills. The result of the study showed the mean ratings for items 25 (systematic approach to issues) 2.80 with a standard deviation of 0.76 was perceived by the teachers to be adequately catered for by primary school basic science and technology curriculum hence its mean rating falls within 2.50 -3.49 set as criterion for content adequacy. While items 26 -30 (trial and error, application of knowledge to real life situation, basic computer techniques, basic information and communication technology, and internet browsing) have mean ratings of 2.30, 2.18, 2.28, 2,40, and 2.06; with standard deviation of 0.86, 0.18, 0.84, 0.88, and 0.56 respectively which fall within the range of 1.50- 2.49 set as criterion for content inadequacy. The table also showed a cluster mean of 2.33 and a standard deviation of 0.68 which within the range of 1.50- 2.49. This implies that the extent primary basic science and technology curriculum content catered for problem solving skills for primary school pupils is perceived by primary school teachers to be inadequate.

Discussion of findings
Findings of the study indicated that primary school basic science and technology curriculum is inadequate for technological innovative skills. The findings of the study revealed that the primary basic science and technology curriculum content. for creative skills, critical thinking skills, divergent thinking skills, exploring skills and problem solving skills are inadequate. This implies that primary school basic science and technology curriculum content did not provide adequate learning experience for basic science and technological innovative skills.

Conclusion
Given the findings of the study, the researchers conclude that the extent primary school basic science and technology curriculum content catered for innovative skills of pupils are inadequate. Thus, opined that some difficulties experience by some students at junior, secondary and tertiary institutions to cope with dynamism of science and technology may be as a result of carryover effects of content inadequacy of primary school basic science and technology curriculum for innovative skills.

Recommendations
Based on the findings of the study, the researchers recommend that the content of primary school basic science and technology curriculum should be reviewed with emphasis on how it will effectively cater for:
1. Creative skills.
2. Critical thinking skills.
3. Divergent thinking skills.
4. exploring skills, and
5. Problem solving skills.

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