

 Research Article

Evaluation of Community Perception on the Adequacy of Infrastructure for the Implementation of the Physics Curriculum Using Davis Process Model among Unity Colleges in North Central Nigeria: Implications on Education for Sustainable Development

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Abstract

This study evaluated community perception on the adequacy of infrastructure for the implementation of the Physics curriculum using the Davis process model among unity colleges in North-Central Nigeria. The study employed a descriptive survey research design. Six thousand four hundred and twenty-nine (6,429) community members across all Unity colleges in North-Central Nigeria make up the study's population. Purposive sampling was employed to select Niger, Nasarawa, and the Federal Capital Territory out of the seven states in North-central, Nigeria. This is because, the states selected shares boundary and have common characteristics. A sample size of 385 community members were randomly selected from the Unity colleges in the three selected states after forming them into strata for used in the study. A researcher-developed questionnaire based on the Davis Process Model was used for data collection. It was validated by three experts. A reliability coefficient of 0.86 was found after the questionnaire underwent a trial test and the data were statistically analysed using the Cronbach Alpha Correlation Formula. Mean and standard deviation was used to answer the research question while Mann-Whitney U-Test was used to test the hypotheses. The findings of the study revealed that. Community members perceived that, there is inadequacy of infrastructure for the implementation of the Physics Curriculum based on the Davis Process model. The findings of the study also discovered that, both male and female members of the community perceived that, infrastructure is inadequate for implementing the Physics Curriculum. The findings are threats to Education for Sustainable Development (ESD) this is because, the community perceived inadequacy of the available infrastructure for driving curriculum implementation. It was recommended that community members should notify the government and stakeholders on the observed lapses, for immediate action to promote ESD.

Keywords: Curriculum, Davis-Process Model, Evaluation, Performance, Physics, Students

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1. INTRODUCTION

Enhancing the teaching and learning of Science, Technology, and Mathematics (STM) has been recommended by the National Policy on Education (FRN, 2020) as a means of creating a technologically literate workforce that can meet the demands of national development initiatives. This can also serve to enhance the Education Sustainable Development Initiatives. This is due to the fact that science education is widely recognised as being important for both individuals and society as a whole, and it is a vital tool for driving technological advancement. As a result, mastering the sciences becomes increasingly crucial for society as a whole as well as for the individual (Offorma, 2015). According to the National Policy on Education (FRN, 2014), Every senior secondary student in Nigeria is required to offer a science subject

among which are Physics, Biology or Chemistry or Physics as part of their curriculum. This is due to the fact that these disciplines are the prerequisites for any student wishing to enroll in a technologically focused programme at a higher education institution.

More precisely, in order to equip students to thrive in the modern era of science and technology, the Federal Government of Nigeria places a strong emphasis on scientific education, which is taught at all educational levels and made mandatory in both elementary and secondary schools. In order to be admitted to programmes in pure sciences, medical sciences, agricultural sciences, environmental sciences, and engineering, students must take science as a mandatory subject at the postsecondary level. Furthermore, general education courses covering it are offered to students in all disciplines of study at Nigerian universities, polytechnics, and colleges. Similar to this, the ratio of sciences to liberal arts is 60% to 40% for admission to Nigerian higher education institutions, with a functional integration of theory and practice (Amusa, 2015). The three core sciences taught at the Senior Secondary School level are Biology, Chemistry, and Physics. To meet the prerequisites to enroll in Nigeria's higher education institutions to study natural/pure, physical, environmental, agricultural, and engineering sciences, students must successfully complete these topics at the credit level at the end of their senior secondary school. Standard examinations and assessments demonstrated that students' achievements in sciences is below the expected level (Abdullahi & Bichi, 2015), despite the important role that science and technology play in advancing society and the substantial amount of support provided by the government at all levels. In Nigeria's senior secondary schools, students' academic performance in the sciences has been extremely underwhelming (Obinna 2019).

In this extremely competitive atmosphere, academic accomplishment is considered as a barometer for students' future success, making it one of the primary goals of school. According to Abdullahi and Bichi (2015), academic accomplishment is regarded as a crucial indicator for assessing a person's overall potential and capacity. Academic achievement is reflected by the amount of proficiency or mastered concepts that have been acquired by a student. Kelly (2018) opined in their study, that, academic accomplishment also refers to the information acquired and the skills gained in a particular topic over the course of education.

Physics is a physical science subject that uses experiments and mathematical analysis to discover quantifiable physical laws for everything from the Nanoworld of the microcosmos to the planets, solar systems, and galaxies that occupy the macro universe, according to the Norwegian University of Science and Technology (NTNU, 2016). Physics is a key subject if the goal for Education for Sustainable Development (ESD) is to be achieved, the knowledge of Physics will drive home development in technology. The type of education implemented has a big impact on how a country develops. Such nations' educational policies are based on their needs and ideals. For instance, the Federal Republic of Nigeria's National Policy on Education for Nigeria highlighted the necessity of teaching Nigerian individuals how to influence their environments for societal progress. The policy emphasized that education must lead to man being trained to comprehend his environment. A relevant education system with a suitable curriculum must be put in place for a country to flourish properly.

The goal of teaching Physics in schools is to produce young scientists who will create the technological innovations that will help in the fulfilment of the dreams of Education for Sustainable Development (ESD) and this makes people to live more comfortably and easily go about their daily lives National Policy on Education (FRN, 2014). Despite the introduction of the Physics curriculum to Nigerian schools many years ago, the nation still lacks the technology that may improve living conditions and make life more enjoyable (Ajayi, 2017). Since the goals are not being met, one can wonder if the curriculum is not being implemented effectively. The National Curriculum for Senior Secondary Schools created by the Federal Ministry of Education in 2022 and the National Policy on Education of the Federal Republic of Nigeria (FRN, 2020) both state that Physics instruction in secondary schools should foster the development of students' fundamental scientific knowledge, attitudes, and abilities in order to prepare them for technological applications that will inspire and foster their creativity.

A study by Ajayi (2017), has shown that a number of factors, such as poor instruction, lack of learning resources, student attitudes, governmental policies, parental backgrounds, lack of student readiness, poor management style, and shortage of qualified teachers, have affected the teaching and learning outcomes of Physics over the years. The sort of scientists, technicians, engineers, and doctors that society produces is frequently determined by the type of science that is taught in schools and the depth with which Physics is

covered in curricula. The aim of the Physics curriculum is to advance science and technology in order to improve the environment and make it more hospitable for humans. To give future engineers, technicians, scientists, and medical professionals a strong basis, specialists created the Physics curriculum for senior high school education (FRN, 2020). In senior secondary schools, the course of instruction lasts three years. It includes a number of themes and subtopics that students are required to master before taking the Senior Secondary School Examinations. Each Physics course has a distinct objective that, if not taught, might have an impact on the learner's performance in the Senior Secondary School Examinations and their future profession.

The list of classes and their subjects that are provided at a school or university make up the curriculum. A more comprehensive syllabus serves as the foundation for a prescriptive curriculum, which basically lists the things that should be learnt and the extent it should be learnt in order to acquire a certain grade and qualification. Hence, all of a school's formal activities can be termed curriculum. According to (Kelly, 2018), the school's planning and directing of all learning, whether it is done in collaboratively or alone, within or outside the school, is known as the curriculum. In other words, the curriculum outlines our goals and the methods we will use to attain them. Offorma (2015), stated that a curriculum is a deliberate learning experience that is provided to students. It is a three-part program of studies, consisting of a program of studies, an activity program, and supervision. Thus, to accommodate educational requirements of various courses of study, a curriculum was described as a set of knowledge items and/or subjects by (Amusa, 2015). The curriculum is the vehicle through which information, competence and abilities are inculcated or given to students using the most efficient techniques possible. The curriculum is an organized, prepared and planned study guide that comprises of the learning experiences and objectives that will be achieved in order to attain educational goals. Curriculum is a resource in education that helps to cultivate and educate a full person. The curriculum, according to a modern view, includes all of the information and experiences learners gains within and outside of the school's walls, whether they are scheduled lessons or extracurricular activities.

A brief synopsis of the procedures involved in "assessment of curriculum implementation" is given by the Davis Process Model. It's appropriate for use by individual educators. This model's initial phase is referred to as the delineating sub-process by Davis (1980). The judgements that determine the structure and emphasis of the evaluation are necessary because no examination of classrooms or curricula will be able to capture the entire picture. The information may also differ and might include organisational structures, curriculum performance, learners' performance, community perceptions, educator attitudes, and strategy choices.

Davis Process Model focuses on the evaluation of, student performance, organizational structure, strategy choice, instructors' attitudes, curriculum performance, and community perception. The public is upset with students' Physics performance, and this is because secondary schools in Nigeria cover non-curriculum topics such topics that are not relevant to students' academic achievement in physics. For instance, despite how crucial Physics is to a country's technological growth, Akuche and Okunola (2017) found that student performance in the subject remained below average. In order to address the alleged causes of students' low performance in Physics, Research has been conducted over the years and is still ongoing. The failure faced in external Physics examinations is could be traced to challenges faced in the implementation of the Physics curriculum and problems associated with curriculum implementation. Some of the basic implementation problems are inadequate and qualified physics teachers, poor teaching methods, inadequate infrastructure, such as enough classroom, school bus, laboratory among others (Isa & Ayodele, 2019). This research work seeks to find out if the Physics curriculum is properly implemented among Unity Colleges in North-Central Nigeria and to further research into the areas of weakness and areas of strength in the Physics curriculum. To this end, the researcher seeks to use the Davis Process Model to evaluate Senior Secondary School Physics Curriculum Implementation in North-Central Nigeria.

The findings of this study will definitely create a pathway to the fulfilment of the dreams of the Education for Sustainable Development (ESD). For there to be Education for Sustainable Development (ESD), the perception of the community on the current state of the educational delivery must be sought to bring about inclusiveness.

1.1. Research Objective

The study aimed to evaluate physics teachers' perceptions on physics students' performance on physics curriculum implementation using the Davis process model among unity colleges in North-Central Nigeria. Specifically, the objectives of the study are:

1. To determine the perception of the community on the adequacy of the available infrastructure for the implementation of the Physics curriculum using Davis Process model in North-Central Nigeria.
2. To determine the perception of the male and female community members on the adequacy of available infrastructure on the implementation of the Physics curriculum using Davis-Process model in North-Central Nigeria.

1.2. Research Questions

1. What is the perception of the community on the adequacy of the available infrastructure for the implementation of the Physics curriculum using Davis Process model in North-Central Nigeria?
2. What is the perception of the male and female community members on the adequacy of available infrastructure on the implementation of the Physics curriculum using Davis-Process model in North-Central Nigeria?

1.3. Research Hypotheses

H₀₁: There is no significant difference in the perception of the male and female community members on the adequacy of available infrastructure on the implementation of the Physics curriculum using Davis-Process model in North-Central Nigeria

2. METHODOLOGY

2.1. Research Design

This research employed a descriptive survey research design, this is because, it will enable the researcher gather vast data from heterogeneous audience.

2.2. Instrument for Data Collection

The instrument for data collection is a questionnaire titled Secondary School Curriculum Evaluation on the adequacy of infrastructure for the Teaching and Learning of Physics Questionnaire for community (SSCEAITLPQM) was used for collecting the data during the study.

2.2.1. Validity of the Instrument

One expert from Veritas University Bwari Abuja and two experts from the Department of Science Education at the Federal University of Technology Minna, Niger State, examined the Face and Content Validity of the Questionnaire.

2.2.2. Reliability of the Instrument

In order to ascertain the instrument's reliability even further, a pilot study was conducted on thirty community members in Niger State. Upon receiving the questionnaires back, the copies were coded and subjected to reliability statistics through the use of Cronbach's Alpha Reliability Test. The results indicated that the instrument is appropriate for the study a reliability index of 0.86.

2.3. Population for the Study

The study's population comprises of 6,429 community members selected from the members of

Parent Teachers' Association (PTA) of the selected schools from all the Federal Unity schools in North-Central Nigeria.

Sample Size: The sample for the study consists of 385 community members both Male and Female randomly selected. There are seven states in the north-central region. The states are formed into strata, that is, Niger and Kogi State, Benue and Kwara State, then Plateau and Nasarawa State. Purposive sampling is then employed to select Niger, Nasarawa, and the Federal Capital Territory. The Federal Capital Territory is selected because of its peculiar position as the capital of Nigeria and its centrality, Niger and Nasarawa is selected because both state shares boundary with the federal capital territory and to keep the volume of work within a manageable proportion two Unity Colleges from the selected states will be use to collect data using the instrument. There are twenty-four (24) Unity schools in the North Central. The states selected have fifteen (15) Unity Colleges, forming 62.5% of the entire Unity Schools as revealed in the table1 below. This sample size was achieved in accordance to sample size determination table by Krejcie and Morgan.

Table 1. Sample Size for the Community Members based on Krejcie and Morgan Sample Size Determination

State	Community
Niger	1,875
FCT	3,719
Nasarawa	839
Total	6,429
Sample Size	385

Table 2. Sample Size of Selected School

State	Community
Niger	125
FCT	135
Nasarawa	135
Total	385

Source: Federal Ministry of education Abuja (2023)

The sample distribution of respondents based on gender is presented in Table 3.

Table 3. Sample Distribution of Respondents based on Gender

Respondents	Gender	Frequency	Percent
Community	Male	200	51.9
members	Female	185	48.1

Table 3 shows the sample distribution of respondents based on gender. Two hundred of the community members' respondents are male, representing 51.9% of the sample size. While, representing 48.1% of the community members' respondents were females. This implies that the respondents on the average are close in numerical value.

3. RESULT AND DISCUSSIONS

Two research questions raised in this work were answered using Mean and Standard Deviation. The answers to the questions are presented as follows:

3.1. Research Question 1

RQ1. What is the perception of the community on the adequacy of the available infrastructure for the implementation of the Physics curriculum using Davis Process model in North-Central Nigeria?

Table 4 shows the mean and standard deviation on perception of the community on the adequacy of infrastructure for curriculum implementation in North Central Nigeria. The mean of 2.5 and above was used as the bench mark for 'Adequate' and the mean of less than 2.5 was considered "Not adequate". Consequently 13 items were listed, the table revealed that item 1 and 2 had mean scores of 3.08 and 2.66

which are above the benchmark of 2.5; this implies that the school Physics laboratory is well-equipped with experiment materials and the school has enough classrooms to accommodate the students' population. However, items 3 to 13 had mean scores between 1.93 and 2.34 which falls below the benchmark of 2.5; this implies that community members disagree on the adequacy of infrastructure for curriculum implementation in North Central Nigeria to these items. Table 4 further reveals that the average mean score response to the 13 items is 2.18, which is below the decision mean of 2.5; this indicates that community members disagree on the adequacy of infrastructure for curriculum implementation in North Central Nigeria. Hence, community members perceived that infrastructure are not adequate for curriculum implementation in North Central Nigeria.

Table 4. Mean and Standard Deviation on Perception of the Community on the Adequacy of Infrastructure for Curriculum Implementation in North Central Nigeria

S/N	Items	N	Mean	Std.	Decision
1	The school has enough classroom to accommodate the students' population	334	3.08	0.63	Adequate
2	The school Physics laboratory is well-equipped with experiment materials	334	2.66	0.73	Adequate
3	The school laboratory is spacious enough to accommodate all students for Physics practical	334	2.34	0.66	Not adequate
4	There are adequate facilities in the hostels such as source of water, electricity, bed space etc.	334	2.24	0.72	Not adequate
5	The school has the required number of Physics teachers for the population of the Physics students	334	2.17	0.81	Not adequate
6	The schools Physics practical laboratory is equipped with modern practical materials	334	2.00	0.71	Not adequate
7	The school classrooms have sufficient infrastructure for the number of Physics students	334	1.98	0.74	Not adequate
8	The school environment is conducive for teaching and learning	334	2.00	0.79	Not adequate
9	The physics teachers in the school have teaching aids for Physics lessons	334	2.01	0.78	Not adequate
10	The school has functional school bus that takes the students out for excursion	334	2.04	0.76	Not adequate
11	The school has facilities In Physics department to organize field trip and exhibitions	334	1.93	0.66	Not adequate
12	The Physics department has adequate technical staff	334	1.95	0.65	Not adequate
13	The security infrastructure in the school is adequate and efficient	334	1.93	0.69	Not adequate
	Average	334	2.18	0.72	Not adequate

Decision Mean: 2.5

The standard deviation of the respondents on the perception of the community on the adequacy of infrastructure for curriculum implementation in North Central Nigeria is between 0.63 and 0.81, while the average standard deviation is 0.72; signifying that there was no meaningful deviation of respondents' perception on the adequacy of infrastructure for curriculum implementation from each other and the average standard deviation of the group.

3.2. Research Ruestion 2

RQ2. What is the perception of the male and female community members on the adequacy of available infrastructure on the implementation of the Physics curriculum using Davis-Process model in North-Central Nigeria?

Table 5. Mean Rank and Sum of Ranks on the perception of male and female community members on the adequacy of infrastructure with respect to Physics curriculum implementation in North Central Nigeria

Gender	N	Mean Rank	Sum of Ranks	Mean Rank Difference
Male	200	162.51	24539.00	9.11
Female	185	171.62	31406.00	

From Table 5 above, the mean rank and sum of ranks of male community members are 162.51 and 24539.00. While, the mean rank and sum of ranks of female community members are 171.62 and 31406.00. the mean rank difference is 9.11, which is almost insignificant, indicating that, both male and female community members share similar perceptions on the adequacy of infrastructure for the implementation of Physics curriculum in North Central Nigeria. Based on the result of the research question one, both male and female community members are of the perception that, the infrastructure for the implementation of the Physics curriculum based on Davis Process Model of curriculum implementation is not adequate.

3.3. Hypothesis

H_0 : There is no significant difference in the perception of the male and female community members on the adequacy of available infrastructure on the implementation of the physics curriculum using Davis-Process model in North-Central Nigeria

There is no significance difference in the perception of male and female community members on the adequacy of infrastructure in Physics on curriculum implementation in North Central Nigeria among Unity Colleges.

In testing the hypothesis, the mean response on the perception of male and female community members on the adequacy of infrastructure in Physics on curriculum implementation was analysed using Mann-Whitney U test as presented in Table 6.

Table 6. Mann-Whitney U Test on Perception of Male and Female Community Members on the Adequacy of Infrastructure in Physics on Curriculum Implementation

Gender	N	Mean Rank	Sum of Ranks	Mann-Whitney U	P-value
Male	200	162.51	642.00	177.000	0.403 ^{ns}
Female	185	171.62	348.00		

NS: Not Significant at 0.05 ($p > 0.05$)

Table 6 shows the Mann-Whitney U test on perception of male and female community members on the adequacy of infrastructure in Physics on curriculum implementation. From the table, the mean rank and sum of ranks of male teachers are 162.51 and 642.00. While, the mean rank and sum of ranks of female teachers are 171.62 and 348.00 with a U-value = 177.000, $p = 0.403$. The p-value is greater than the level of significance, hence the hypothesis is not rejected. Hence, there is no significance difference in the perception of male and female community members on the adequacy of infrastructure in Physics on curriculum implementation; this implies that both male and female community members perception on the adequacy of infrastructure in Physics on curriculum implementation are the same. Hence, both gender perceived that there is no adequate infrastructure for the implementation of Physics curriculum in North central Nigeria base on Davis Process Model of Curriculum implementation.

4. DISCUSSION AND CONCLUSION

Finding emanating from this research showed revealed that community members who are members of the Parent Teachers Association of the sampled schools among Unity colleges in North Central Nigeria have the perception that there is no adequate infrastructure for the implementation of the Physics curriculum among unity colleges in North-Central Nigeria. This finding agrees with that of Newzat (2016) and that of Meryem and Gorecek (2014) whose finding indicated that community perceptions on infrastructural adequacy in schools is negative. The study by Bamikole and Elizabeth (2020) also indicated that much still need to be done in the provision of infrastructure for curriculum implementation. while the findings of this work did not agree with the work of Mulana et al. (2021) which opined that, there is adequate infrastructure for the implementation of the curriculum. The findings of this Research is a threat to the Sustainable Development goal, because inadequacy of infrastructure will affect technological advancement, due to the fact that physics is a major Science subjects in terms of engineering and sciences.

The study affirmed that both male and female community members have negative perception on the adequacy of infrastructure for the implementation of the physics curriculum in North-Central Nigeria in line with Davis-Process Model of curriculum evaluation. The study discovered that community members hold the view that, the available infrastructure is inadequate to implement the Physics curriculum in accordance with Davis-Process model. Which will adversely affect the achievement of the Sustainable Development Agenda if not checked.

Based on the findings of this work, it is recommended that, community members should be made to document and submit their expectations to the school management and the Government with regards to infrastructure lapses to enable the school the Government close the gap, for effective curriculum implementation in Physics. It is also recommended that community members should be part of the development agenda for all institution, for the purpose of ensuring adequacy in the infrastructure.

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Research Ethics. In carrying out this research, the researcher ensured that, there was no bridge of ethical issue on research. All research ethics was strictly adhered to.

Data Availability Statement. All the data used in this research work can be shared publicly in any open access journal, as adequate permission was sought from the authorities concerned.

Conflicts of Interest. The research is single-authored, as a result, there is no conflict of interest.

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