



ABSTRACT

The paper investigated the utilization and implementation of innovative approaches by Basic science and technology teachers in junior secondary schools after Covid -19 in Abuja municipal area council of Abuja, seventy nine teachers (46 Basic science and 33 Basic Technology teachers) was purposely selected from all the junior secondary schools across the Abuja municipal area

THE UTILIZATION AND IMPLEMENTATION OF INNOVATIVE APPROACHES BY BASIC SCIENCE AND TECHNOLOGY TEACHERS AFTER COVID - 19 AT JUNIOR SCONDARY SCHOOLS IN ABUJA MUNICIPAL AREA COUNCIL OF ABUJA NIGERIA

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INTRODUCTION

Sometimes in 2019, there was an outbreak of a viral disease (Coronavirus: COVID-19) in Wuhan, China. This epidemic turned into a ravaging pandemic which posed a serious threat to global public health and eventually led to the total lockdown of major cities globally, Nigeria inclusive (Lin et al., 2020). According to the WHO, signs of infection include fever, cough, and shortness of breath, and breathing difficulties. In more severe cases, it can lead to pneumonia, multiple organ failure, and even death. Current estimates of the incubation period - the time between infection and the onset of symptoms - ranging from one to 14 days. Most infected people show symptoms within five to six days. However, infected patients can also be asymptomatic, meaning they do not display any symptoms despite having the virus in their systems (Ajazeera, 2020).



council of Abuja. A survey design research method was employed for the study, one validated instrument was used with reliability co-efficient of 0.8. Three research questions were formulated and answered using mean and standard deviation while three null hypotheses were tested at 0.05 level of significance using independent t-test. Result showed that innovative approaches can improve instruction in Basis science and technology in Covid – 19 era in junior secondary schools. Instructional skills would also be developed using Innovative instructional approaches by the science teachers. Based on the findings, it is therefore recommended among others that innovative approaches should be utilized to improve instructions in Basic science and technology in Nigeria in the era of Covid – 19, Teacher should be discouraged from using teacher-centered instructional strategy in teaching and learning of Basic science but rather, innovative teaching strategies should be used wherestudents' would be actively involved in the teaching and learning processes and Students should be encouraged to cooperate with their teachers when these strategies are being used in the course of teaching of Basic Science

Keywords: Basic science, Covid – 19, Innovative, Instruction, Technology.

Many measures have been taken by the government to counteract the risk of disease spreading. These measures include travel restrictions, mandatory quarantines for travelers, social distancing, bans on public gatherings, schools and universities closure, business closures, self- isolation, asking people to work at home, curfews, and lockdown (Bedford et al., 2020; Gostin and Wiley, 2020). Authorities in several countries worldwide have declared either lockdown or curfew as a measure to break the fast spread of virus infection (Paital et al., 2020). These measures have a negative worldwide effect on business, education, health, and tourism (Pragholapati, 2020).

Education is no exception. Students from privileged backgrounds, supported by their parents and eager and able to learn, could find their way past closed school doors to alternative learning opportunities. Those from disadvantaged backgrounds often remained shut out when their schools shut down. This crisis has exposed the many inadequacies and inequities in our education systems from



access to the broadband and computers needed for online education, and the supportive environments needed to focus on learning, up to the misalignment between resources and needs.

Abuja municipal area council is one of six area council in Federal Capital Territory Abuja Nigeria. The area council is host to many educational institutions. Among the educational institutions are public senior secondary schools and private senior secondary schools. Sometimes around March 2020 many of the public and private senior secondary schools have been shut down in compliance with the federal government directives that all educational institutions should be shut down to contain the spread of the COVID-19 virus. This paper is aim to investigate how the Basic science and technology teachers can utilize the innovative approaches to improve the instructional delivery during this Covid -19 era junior secondary schools in Abuja municipal area council of Abuja Nigeria

In Nigeria, secondary schools are operated in sessions. Each session comprises of three terms, in each of the terms we have up to 13-14 weeks of active teaching and learning. With the presence of COVID-19 in Nigeria, secondary schools are under lock and key. Students' effort and preparation towards their examination have been adversely affected by this global pandemic which has forced everyone into unprepared self-isolation. Nigeria does not have a well- developed e-learning platform for schools that can cushion the effect associated with loss of learning hours. Therefore the impact of the pandemic strongly felt more by the final year candidates whose national examination comes up later in the year due to the loss of contact hours (Sintema and Phiri, 2018). Existing records from a study conducted by Sakiyo and Badau (2015) revealed that there was an undesirable trend in the performance of students that wrote Physics, Chemistry and Biology in WASSCE from 2008 to 2012 in Nigeria. Their average performances were 56.01% in Physics, 46.30% in Chemistry and 37.27% in Biology, in addition to an increasing failure rate in Biology and Chemistry (Sakiyo and Badau, 2015) are on ground before COVID-19. Another study carried out by Badmus and Omosewo (2018) shows that students perform poorly generally in national examinations and most especially in science subjects (Biology, Chemistry and Physics) before the pandemic (Badmus and Omosewo, 2018). To this end, little has been said on the potential impact of COVID-19 on the educational sector in Nigeria, especially its effects on the performance of science students who wrote the national examinations (West Africa Senior Secondary Certificate Examination as well as



National Examination Council). The present situation calls for urgent intervention as these are core subjects which are required for admission into tertiary institutions. Hence, the purpose of this study is to evaluate how the Basic science and technology teachers can utilize the innovative approaches to improve the mode of instructions during this COVID-19 era on Basic science and Technology learning According to Bilesanmi and Awoderu (2012), learning is a change in behaviour as a result of past experience. Learning is the aim of education activities, the intended outcomes of educational processes and practices. Despite government's efforts to encourage science teaching and learning among Nigerian students right from the junior secondary school level, the enrolment of students in core science subjects and science oriented courses at the Senior Secondary School level and tertiary institutions level respectively, is not encouraging. This is as a result of junior secondary school students' negative attitude towards Basic Science and belief that science subjects are difficult.

Basic Science plays vital roles in Nigeria's science education Programme because it prepares pupils at the Junior Secondary School level for the study of core science subjects at the Senior Secondary School level which in turn brings about students' interest in science oriented courses at the tertiary institutions.

According to NERDC (2012), the overall objectives of the Basic Science and Technology curriculum are to enable learners to: develop interest in science and technology, acquire basic knowledge and skills in science and technology, apply scientific knowledge and skills to meet societal needs, take advantage of the numerous career opportunities offered by science, become prepared for further studies, avoid drug abuse and related vices, be safety and security conscious. The enumerated objectives among other reasons, are supposed to prepare upper basic students for the study of science at the Senior Secondary School level. This could be one of the reasons why the contents of the Basic Science and Technology curriculum are sequenced in spiral form beginning with the simplest to the most complex.

In the past, research efforts had been focused on identifying factors that militate against student's learning outcomes in Basic Science. Despite the recommendation of NERDC (2012) that teaching and learning of sciences should be Inquiry based,, most teachers still dispense information using traditional lecture methods without regard to student's learning abilities in Science and factors such as inadequate instructional materials, teachers' poor improvisation



skills, specialty and competency, among others, as some of the causative factors of low achievement in science. They have also proffered recommendations such as the use of innovative such as inquiry, cooperative, Jigsaw instructional strategies, among others, as the way forward. However, despite these efforts, students' achievement and interest in science have not shown appreciable improvement. This could probably be related to the inability of the instructional strategy employed in the teaching of Basic Science to guide learners unto developing and adopting the appropriate learning strategy for learning Science. The question then is what is the way out? Identification of a problem they say, is a step towards its solution. There is need to search for a strategy where students must be given sufficient opportunity for creative activity so that each can bring out his/her own measure of talent and thereby display his/her personality.

Adesina (2019) indicated that in a bid to make the science package knowledge tantalizing to the buyer (the learners), the science teachers should be innovative incongruence to the learners' styles, learning habits, mental ability, self-efficacy, intellectual capability and even the learners' emotional intelligence, so that when the learner tastes the package he/she will yearn for more.

Olagunju and Ige (2013) pin-pointed nine heuristic instructional strategies towards innovative science teaching and learning; laboratory/investigative method, project, field trips, demonstration, individualized instruction, problem solving, case-studies and assignment or Dalton method. The duo recommended that to firmly impress in the mind of the learners the scientific concepts, facts, laws, theories, and principle should be critically selected along with the relevant instructional materials with appropriate stated objectives, map out different activities for students to learn either as individual or groups, plan the instructions with skills and techniques, organize discussion, debates, quizzes, assignments and projects to stir learners' inquisitiveness and explorativeness. Inquiry learning occurs when students are doing things and thinking about what they are doing, and meaningful learning happens when students integrate new information into what they already know (Adodo, 2013). Through active learning, students are engaged in series of activities such as reading, discussing and writing, which also increases students' motivation to learning. Students can receive immediate feedback from their instructors and are involved in higher order thinking (analysis, synthesis and evaluation). Empirical evidence has shown that studies on effects of using the learning method in Basic Science teaching (Qarareh, 2012),



demonstration strategy (Giridharan and Raju, 2016), jigsaw method (Abdulkadir, 2016), concept mapping (Ahmed and Oyasola, 2019), experiential and generative learning strategies (Adeyemi and Awolere, 2016), on academic achievement of students in Basic Science and other science subjects which had significant effects on their learning outcomes. Although most of these innovative instructional strategies proved to be significant when compared with conventional strategies used by the regular science teachers, the results of these studies are such that there are significant effect of the different teaching strategies on students' achievement in science subjects.

Irinoye et al (2015) investigated the relative effectiveness of guided inquiry as form of innovative and demonstration methods on students 'performance among secondary school chemistry students They discovered that students achieved and retained more chemistry concepts with guided inquiry instruction than those with demonstration method.

Olawuwo (2019), carried out a study on the effects of guided discovery and demonstration teaching methods on the academic achievement of Biology students with different learning styles. The findings of the study indicated, among others, that the guided discovery approach had significant effect on academic achievement of the Biology students with different learning styles than their counterparts taught with demonstration method.

In the study of Udofia (2015) it was observed that the success of some known innovative and effective methods may be predicated on the level of exposure students have had in basic day-to-day method of discovery. Today is the era of science and technology with a great need to improve quality of education, specifically of science education, this could be possible by bring fundamental changes through innovative techniques through which teachers could provide student-centered learning environment that could make learning process interesting and understandable to the young learners.

Research Questions

1. To what extent would the following Innovative Approaches improve instructions in Basic Science and Technology learning in COVID-19 era in junior secondary schools of FCT?
2. To what extent would a teacher utilize these Innovative Approaches to improve Instructional delivery in COVID-19 era in junior secondary schools



of FCT?

3. To what extent would the instructional skills in Basic Science and Technology education be developed when using Innovative approaches in improving instructions in COVID-19 era in junior secondary schools of FCT

Hypotheses

1. There is no significant difference between the use of Innovative Approaches and Basic Science and Technology education in COVID-19 era in junior secondary schools of FCT
2. There is no significant difference between the utilization of Innovative Approaches and academic achievement of Basic Science and Technology students in junior secondary schools of FCT
3. There is no significant difference between extent the instructional skills in Basic Science and Technology education be developed when using Innovative approaches in improving instructions in COVID-19 era in junior secondary schools in FCT?

Method

A survey design was employed for the study. The population consisted of 79 Basic Science and Technology teachers in junior secondary schools of FCT purposively used for the study. Three research questions guided the study and three null hypotheses were tested at 0.05 level of significance. The researchers developed instrument tagged 'Innovative Approach for teaching Basic Science and Technology questionnaire' (IAFTBSTQ) was used for data collection

The instrument had three sections, A, B and C, Section A and B had 18 items each on Innovative approaches to instruction and extent of utilization of Innovative approaches respectively while Section C had 13 items on instructional skills development. Four- point response options on Very High Extent (VHE) = 4, High Extent (HE) = 3, Low Extent (LE) = 2, and Very Low Extent (VLE) = 1 was used. Three expert from faculty of Education Nasarawa state University validated the instrument and were incorporated to produce the final copy of the instrument. Reliability index of 0.8 was obtained for section A and B and 0.85 for section C using Cronbach Alpha statistic. The research questions were answered using mean and standard deviation. The means were interpreted using the real limits of four points viz: VHE = 3.5 - 4.0, HE = 2.50 - 3.49, LE = 1.50 - 2.49 and VLE = 0.50 - 1.49;



Independent t-test was used to test the null hypotheses at 0.05 level of significance

Research question 1: To what extent would the following Innovative Approaches improve instructions in Basic Science and Technology learning in COVID-19 era in junior secondary schools of FCT?

Table 1: Mean and standard deviation of respondents on the Extent to which Innovative Approaches would improve instruction in Basic Science and Technology learning N= 79

S/N	To what extent would the following Innovative approaches would improve instructions in Basic Science and Technology Education?	X	SD	Decision
1	Metacognitive strategy	3.14	0.69	HE
2	Cooperative learning	3.72	0.45	VHE
3	Science Project	3.28	0.45	HE
4	Experiential strategy	3.37	0.94	HE
5	Simulation	3.60	0.50	VHE
6	Multimedia approach	2.90	0.67	HE
7	ICT approach	3.27	0.70	HE
8	Problem solving	3.45	0.50	HE
9	Inquiry-based	3.24	0.43	HE
10	Blended learning	2.62	0.77	HE
11	Laboratory method	3.00	0.77	HE
12	Exploratory-discovery	3.00	0.80	HE
13	Concept map	2.83	0.65	HE
14	Field trip	3.10	0.61	HE
15	Game-based	2.76	0.73	HE
16	Science quiz	2.79	0.90	HE
17	Discussion	2.86	0.35	HE
18	Elaborative-generative	2.72	0.88	HE

Table 1 presents the mean and standard deviation of responses of Basic science and technology teachers on the extent to which innovative approaches would



improve instruction in Basic Science and Technology learning. Out of the 18 methods, cooperative learning and simulation instructional approach were rated to a very high extent with close standard deviations while the remaining 16 items were to a high extent. Deduction was that only two out of 18 innovative approaches would to a very high extent improve instructions while 16 methods would a high extent improve instructions in Basic Science and Technology.

Research Question 2: To what extent would a teacher utilize these Innovative Approaches to improve Instructional delivery in COVID-19 era in junior secondary schools of FCT?

Table 2: Mean and standard deviation of respondents on the extent to which a teacher would utilize these Innovative Approaches to improve Instructional Delivery
N= 79

S/N	To what extent would a teacher utilize these innovative approaches to improved instructional delivery?	\bar{X}	SD	Decision
1	Metacognitive strategy	2.97	0.56	HE
2	Cooperative learning	2.93	0.96	HE
3	Science Project	3.07	0.84	HE
4	Experiential strategy	3.00	0.75	HE
5	Simulation	2.82	0.03	HE
6	Multimedia approach	2.37	0.77	LE
7	ICT approach	3.00	0.80	HE
8	Problem solving	2.89	0.61	HE
9	Inquiry-based	2.93	0.99	HE
10	Blended learning	3.07	0.66	HE
11	Laboratory method	2.83	0.84	HE
12	Exploratory-discovery	2.52	1.05	HE
13	Concept map	2.55	0.50	HE
14	Field trip	2.78	0.72	HE
15	Game-based	2.39	0.67	LE
16	Science quiz	3.14	0.64	HE
17	Discussion	2.59	0.94	HE



18	Elaborative-generative	2.41	0.50	LE
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Table 2 shows that the teachers would highly utilize 16 out of 18 items of innovative approach to teaching Basic Science and Technology. Items 15 and 18, game based and elaborative-generative were considered low extent. It is deduced that teachers would highly utilize the approach to improve instructions in Basic Science and Technology.

Research Question 3: To what extent would the instructional skills in Basic Science and Technology be developed when using Innovative approaches in teaching instructions in COVID-19 era in junior secondary schools in FCT?

Table 3: Mean and standard deviation of respondents on the extent of instructional skills development using innovative approaches in instructional delivery **N= 79**

S/N	To what extent would the following instructional skills be developed when using innovative approaches?	\bar{X}	SD	Decision
1	Problem Solving	3.28	0.45	HE
2	Manipulative	3.24	0.73	HE
3	Creative thinking	3.31	0.47	HE
4	Leadership	3.14	0.63	HE
5	Intra-personal	2.89	0.67	HE
6	ICT- versatility	3.41	0.50	HE
7	Communication	3.41	0.50	HE
8	Reasoning	3.17	0.65	HE
9	Social life	2.96	0.86	HE
10	Life learning	2.93	0.65	HE
11	Psychomotor skill	3.69	0.47	VHE
12	Cognitive skill	3.55	0.50	VHE
13	Organizational skill	3.06	0.70	HE
14	Teaching skill	3.03	0.68	HE

Table 3 indicates that two of the items, (11 and 12) were the skills that could be developed to a very high extent while the remaining 12 items could be developed to high extent (HE). Deducing from the table, skills 1-10 and 13-14 would be



developed to a high extent while 11-12 would be developed to a very high extent by teachers when using Innovative instructional approach in instructions in Basic Science and Technology lessons.

Hypothesis 1: There is no significant difference between the use of Innovative Approaches and Basic Science and Technology education in COVID-19 era in junior secondary schools of FCT

Table 4: *t*-test Analysis of respondents on the Extent to which Innovative Approaches would improve instruction in Basic Science and Technology Education

Variables	Status	n	\bar{X}	SD	df	t-cal	t-crit	Sig
	Basic Sci	46	35.25	12.51				
					27	5.24	2.05	0.000
Instructions								Improved Science
	Technology	33	55.23	6.26				

*Not significant at 0.05 level of significance; df 27 ($p > 0.05$)

The result presented in the table 4 shows that the calculated t-value of 5.24 is greater than the t-critical of 2.05 at .05 level of significance at 27 degree of freedom. Thus, the null hypothesis was rejected, meaning that Basic Science and Technology teachers differ in their responses about the extent to which Innovative approaches would improve instructions in Basic Science and Technology.

Hypothesis 2: There is no significant difference between the utilization of Innovative Approaches and academic achievement of Basic Science and Technology students in junior secondary schools of FCT

Table 5: *t*-test Analysis of respondents on the Extent to which a teacher would utilize these Innovative Approach for improved instructional Delivery in Science and Technology

Variables	Status	n	\bar{X}	SD	df	t-cal	t-crit	Sig
	Basic Sci	46	42.50	10.40				*
					27	3.14	2.05	0.04
Utilization of innovative Approaches								
	Basic Tech.	33	53.38	7.65				



*Significant at 0.05 level of significance; df 27 ($p > 0.05$)

The result presented in table 5 shows that the calculated t-value is 3.14 which is greater than the t-critical of 2.05 at 0.05 level of significance and 27 degree of freedom. Hence, the null hypothesis which states that there is no significant difference in the responses of Basic Science and Technology teachers on the extent of utilization of Innovative approaches to improve instructional delivery in Basic Science and Technology was rejected. This means that there is significant difference in the responses of Basic Science and Technology teachers on the extent of utilization of Innovative approaches to improve instructions in Science and Technology.

Hypothesis 3: There is no significant difference between extent the instructional skills in Basic Science and Technology education be developed when using Innovative approaches in improving instructions in COVID-19 era in junior secondary schools in FCT?

Table 6: t-test Analysis of respondents of Basic science and Technology Teachers on the extent of instructional skills development using innovative approaches

Variables	Status	n	\bar{X}	SD	df	t-cal	t-crit	Sig
Utilization of innovative Approaches	Basic Science	46	34.37	7.88	27	4.32	2.05	*
	Basic Technology	33	45.07	4.57				0.000

*Significant at 0.05 level of significance; df 27 ($p > 0.05$)

The result in Table 6 shows the calculated t-value of 4.32 which is greater than the t-critical of 2.05 at .05 level of significance at 27 degree of freedom. Thus the null hypothesis was rejected, meaning that Basic Science and Technology teachers differ in their responses about the extent to which Innovative instructional approaches would enhance instructional skills in Basic science and technology.

Discussion of Findings

The findings from research question 1, shows that all the 18 items could be used for improving instructions in Basic Science and Technology education.



Cooperative learning and simulation instructional methods were considered to be the best methods. This means that all the Innovative instructional approaches would improve instructions in Basic Science and Technology education. This is in support of the view of Ekong, et al (2009) who noted that teaching strategies adopted by the teachers for instructional delivery can facilitate the realization of learning outcome.

The findings from research question 2 revealed that teachers highly agreed to utilize metacognitive teaching, cooperative learning, project, experiential, simulation, multimedia, problem-solving, ICT and inquiry methods among other Innovative instructional approaches for improving instruction in Basic Science and Technology education. This is in conformity with Udofia (2015) who viewed instructional strategies such as cooperative learning, problem based instruction, generative, experiential and metacognitive as promoting active students' involvement and group interaction to benefit from their peers, reflect and gain understanding.

The finding from research question 3 revealed that two (11 and 12) out of 14 items were considered to be Very high extent (VHE) while the remaining 12 items were rated to a High extent (HE). It could be deduced from the findings that all the skills- problem solving, manipulative, creative thinking, reasoning, leadership, intra-personal among others could be developed as outcome of using Innovative instructional approaches in teaching Science and Technology education by teachers.

The finding in Table 4 shows that Basic Science and Technology teachers differed in their responses on the extent to which Innovative approach would improve instructions in Science and Technology education. This may be due to the reason that Basic Science education is more of a field oriented and activity based subject than the other subjects. Adodo (2013) and Muhammed (2012) had emphasized that teaching and learning of Basic science in junior secondary schools should focus more on transmission of facts to the students and to build students' personality transformation with equipped hard, soft and goal getting skills derived from hands- on experiences as a way out in meeting the demands of the 21st century instructions in the schools. Certainly, using Innovative approaches demands teachers' inclined to Basic Science and Technology education to adopt, adapt and be innovative in instructional delivery that would suit 21st century demands in the society.



Result in Table 5 indicated that Basic Science and Technology teachers differed in their responses on the extent of utilization of Innovative instructional approaches in improving Science and Technology education. Basic Science teachers had higher mean score of 53.38 than Technology counterparts with 42.50. The result could be better explained by assertions of Adesina (2019) that in a bid to make the science package knowledge tantalizing to the buyer (the learners), the science teachers should be innovative in congruence to the learners' styles, learning habits, mental ability, self-efficacy, intellectual capability and even the learners' emotional intelligence, so that when the learner tastes the package he/she will yearn for more. Olagunju and Ige (2013) stated that science teachers must look for new solutions to the problems of teaching particularly Basic Science and Technology since the tools of yesterday cannot solve the problems of today-COVID-19 era. T-test analysis of hypothesis as shown in Table 6 indicated that there are significant difference in the responses between Basic Science and Technology teachers about instructional skills development in teaching and learning of Basic Science and Technology. The finding authenticates Von Bertalanffy-System Theory which stated that an organized enterprise does not exist in isolation but depend on its input from the environment. This aligns with the assertions of Akinsolu (2013) that teaching as being multidimensional with appropriate teaching contents, objectives (goal), methodology and robust teacher evaluation. That secondary education should be characterized by having worldview of teaching, nurturing learning, research culture and community services for a nation to develop. This could be achieved by the use of innovative instructional approaches to create critical mass of citizens in Basic Science and Technology education.

Recommendation

From the findings of the study the following recommendation were made

- Based on the findings it is recommended that Innovative instructional approaches should be applied to improve in Basic Science and Technology education in Nigeria in the circumstances of COVID-19 for progress in education and of course the economy of Nigeria
- Teacher should be discouraged from using teacher-centered instructional strategy in teaching and learning of Basic science but rather, innovative teaching strategies should be used wherestudents'



would be actively involved in the teaching and learning processes.

- Students should be encouraged to cooperate with their teachers when these strategies are being used in the course of teaching of Basic Science
- Education stakeholders should put in place seminars and workshops for secondary school Basic Science teachers as yearly training programmes to introduce and demonstrate diverse innovative strategies.

Conclusion

Basic Science and Technology teachers should try as much as possible to adopt the innovative strategies of instruction in delivering their lesson to improve teaching and learning Basic science and Technology especially in this period of COVID-19 era in FCT and in all other part of the country.

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