

EFFECTS OF INDIVIDUALIZED INSTRUCTIONAL STRATEGY (IIS) ON THE ACHIEVEMENT OF STUDENTS IN BASIC SCIENCE AND TECHNOLOGY IN A COVID-19 PREVENTIVE CLASSROOM MANAGEMENT IN PLATEAU STATE

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Abstract

This study investigated the impact of individualized instructional strategy on the achievement of students in Basic Science and Technology in a covid-19 preventive classroom management in Plateau State. Three research questions and two hypotheses were formulated to guide the study. Quasi experimental research design was employed. It is a commonly used experimental design because of its strength in controlling threats to internal validity. The sample consisted of 177 (89 males and 88 females) students drawn from 391 junior secondary schools through simple random sampling technique using hat and draw method. The instruments for collecting the data were Basic Science and Technology Achievement Test (BSTAT) with a reliability index of 0.86 and a questionnaire developed to check attitudes of students towards covid19 preventive guidelines during the study. Students in the experimental group were taught types of energy while the control groups were taught the same concepts using conventional lecture method. Research questions were answered using percentage, means and standard deviations and hypotheses were tested at 0.05 level of significance using analysis of covariance. The results revealed that Individualized Instructional Strategy (IIS) is superior to the conventional method in facilitating the achievement of students in Basic Science and Technology. It also revealed that the mean scores for females is higher than that of the males for the group taught with IIS. The results further revealed that students like observing covid-19 preventive guidelines as stipulated for safety. Based on the findings, it was recommended among others that the individualized instructional, strategy should be adopted in the teaching of basic science and technology in a COVID-19 preventive classroom management.

Keywords: Achievement, Individualized Instructional Strategy, Gender, Basic Science and Technology, Covid-19 Preventive guidelines.

Introduction

Science and technology have been described as the primary drivers of progress of nations and have constituted veritable instruments that make material and human development much forward. The nations at the forefront of modern development are those that have invested enormous resources over considerable time in the establishment and nurturing of a stable well-supported science and technology education. The world today is divided into developed and developing countries as a result of level of science and technology development which are attained through education of its citizenry. Science education is crucial to the development of any society and also a crucial element in the attainment of national development. It is in

view of this that Benson-Ogbu, Abonyi, Okafor and Omebe (2016) Ibe (2016) stated that education should produce more members of the society who will be able to benefit from personal and social application of knowledge and will be prepared to support the changes towards sustainable development. The contribution of science and technology to the overall development of any nation therefore, cannot be re-emphasized. Science and Technology play a critical role in providing knowledge, skills and technology advancement for social and economic development (Oludipe, 2012, Udeani, 2013 & Mobark, 2014).

According to Iroegbu, Oko, Abegunrin and Abubakar (2012) basic science and technology is a subject that introduces various aspects of sciences and technologies to students. Basic Science and Technology curriculum is a realignment and restructuring of the revised curricular for Primary Science and Junior Secondary Schools Integrated Science. The overall objectives of basic science and technology curriculum according to the national policy on education (FRN, 2009) is to:

enable the learners to develop interest in science and technology, acquire basic knowledge and skills in science and technology, take the advantage of the numerous careers opportunities offered by science and technology and become prepared for further studies in science and technology (Pg.9).

The impacts of science and to technology to national development is felt in several ways as it provides humanity with knowledge about the environment, attitudes and values for social living, knowledge and skills to explore and transform resources to improve the quality of life. This is the reason why science holds an important position in the curriculum of Nigerian education (Omoregbe&Ewansiba, 2013). According to Nwafor and Aja (2017) Basic Science and technology is indispensable in Nigeria science education programme because it builds the basic foundation for students at the basic level for the study of core science subjects at the post basic level. These core science subjects are Biology, Chemistry and Physics. In Nigeria, a clear path for science project and at the primary and junior secondary school level has been, integration of subjects from the field of science and technology.

Individualized instructional strategy is a teaching method employed to meet individual differences. Bruner (1971) and Mobark (2014) stated that learning is an individual thing no matter how many students are to a teacher. Novak(1972) Mang and Mankilik (2015) Dorier and Gaues (2019) envisaged individualized of teaching as a situation where the student gets primary control over what he/she studies for how long, where, when and with whom. According to these researchers it is a means of helping students in areas of their concern since the education is for the student. It is an individual based, student paced strategy to mastery of instruction, wherein students typically learn independently of their classmates. It is designed for use in situations where the time available to students for instructions are restricted and inadequate. It is geared towards teaching individual learners, not group of learners. What is to be learned is divided into units and the students must understand each unit before moving to the other. At each unit, a formative test is administered to determine the level of understanding of each student. This helps to ensure that all students, the fast as well as the slow learners, are exposed to as much course materials as they would ordinarily encounter. At the end of each course, performance test is administered to each student to determine level of mastery.

In 2007, through the directives of Federal Government of Nigeria, the Nigeria Education Research and Development Centre (NERDC) developed a new curriculum to replace the existing one. This led to the abolition of Integrated Science at junior secondary school level and Primary Science at primary school level and a 9-year Basic Science and Technology curriculum was introduced. The 9-year basic science and technology curriculum, according to Adeniyi (2007) is the product of re-alignment and re-structuring of the revised curricula for Primary Science and Integrated Science. According to Ugwu and Nwagbo (2019) the design of the curriculum is based on the spirality of themes which are arranged from year one to year nine, that is; beginning with the lower basic elementary (1-3) to the middle basic elementary (4-6) and to the upper basic junior secondary (1-3). This is continuous across the nine year of basic education in order to sustain the achievement of learners and promote a meaningful learning (Federal Republic of Nigeria (FRN), 2014). In selecting the contents, three major issues shaping the development of nations worldwide, and influencing the world of knowledge today were identified. These are globalization, information and communication technology (ICT) and entrepreneurship education (Obinna, 2013). The desire of Nigeria to be identified with contemporary development worldwide called for the infusion of relevant contents of four non-school curriculum innovations in the areas of environmental education, drug abuse education, family life education, and sexually transmitted infection, including HIV/AIDS (Adeniyi, 2007).

Guidelines for school resumption emphasized that: students should stay apart from one another, teacher should limit interaction and sharing of classrooms between classes as much as possible, and social spacing between individual students to minimize transmission risks, monitoring distances between students inside the classroom and reducing amount of time they are in face to face contacts. With all these challenges facing the educational system in Nigeria which has complicated issues on the achievement of students in Basic Science and Technology, there is need to explore strategies that would not only promote achievement of students in Basic Science and Technology but also encourage them to learn individually in the absence of digital tools and teacher's guidance during challenges like the COVID-19 pandemic that led to the total lockdown of activities in the nation and the world at large, and such is the Individualized Instructional Strategy (IIS).

Individualized Instructional Strategy (IIS) is an individual based, student paced strategy to mastery of instruction, wherein students typically learn independently of their classmates. It is designed for use in situations where the time available to students for instruction are restricted and inadequate. It is geared towards teaching individual learners, not group of learners. What is to be learned is divided into units and the student must understand each unit before moving to the other. At each unit, a formative test is administered to determine the level of understanding of each student. This helps to ensure that all students, the fast as well as the slow learners, are exposed to as much course materials as they would ordinarily encounter. At the end of each course, achievement test is administered to each student to determine level of mastery.

Gender has also continued to be an issue of concern to researchers in science education. This is evident from the reports of Okebukola (2002), Adediji and Longe (2003), Yoloye (2004) and Ezerem (2016) and a hosts of others. These researchers reported gender differences in Basic Science and Technology classrooms instructions and achievements in favour of male students.

This is further confirmed by Adeyemi and Oladipo (2018) who found gender disparity in the use of teaching methods on students' achievement in Basic Science and technology in favour of male students, while researchers such as Oludipe(2012) and Okeke(2018) found no gender differences in the achievement of male and female students in Basic Science and Technology. The study also investigated the influence of gender as moderator variable.

Despite the importance of basic science and technology in national development, the achievement of students at the junior secondary school level is still characterized with lots of challenges. According to Irogbin, Okoh, Abegunrin and Abubakar (2012) the problems facing the teaching and learning of basic science and technology are those related to the students, the teachers, nature of the subject, the school and the society at large. Out of all these, the teacher's factor is seen to be central in having greater effects on basic science and technology learning scenario. Ajayi (2014) Akom and Ugbohubu (2017) provided evidences that the achievement of students at the junior secondary schools has not been impressive. It was further confirmed by the reports of Agogo (2017) Darier and Gauer (2019) who stated that the achievement of junior secondary school students in the area of science and technology is below expectations. This was attributed to lack of proper method of teaching. The essence of teaching is to bring about desirable changes in the behaviour of the learner. Apart from low achievement of students in Basic Science and Technology, the COVID-19 pandemic that engulfed the world including Nigeria worsens the situation where schools were closed on the 23rd March, 2020. This was done as a precautionary measure for preventing the spread of the COVID-19 which has become a global threat to life. During the lockdown period, majority of private schools shifted to online learning, but majority of public schools could not due to lack of digital tools. For instance, Plateau State Government opted for digital learning through television for students, but majority could not access due to lack of internet connection, network problem and failure in electricity supply, while some do not have access to any of the digital tools. It is against this background that this study investigated the effects of Individualized Instructional Strategy (IIS) on the achievement of students in Basic Science and Technology in COVID-19 preventive classroom management.

Purpose of the study

The general purpose of this study was to find out the effects of Individualized Instructional Strategy (IIS) on the achievement of students in Basic Science and Technology in a COVID-19 preventive classroom management. Specifically, the study determined the:

1. effects of Individualized Instructional Strategy (IIS) on achievement of students in Basic Science and Technology.
2. differential effect of Individualized Instructional Strategy (IIS) on the mean achievement scores of male and female students in Basic Science and Technology.
3. attitude of students towards observing COVID-19 guidelines.

Research Questions

The following research questions guided the study:

- a. What is the effect of Individualized Instructional Strategy and conventional method on the mean achievement scores of students in Basic Science and Technology?
- b. What are the mean achievement scores of male and female students taught Basic Science and Technology using Individualized Instructional Strategy?

- c. What is the attitude of students towards observing the COVID-19 preventive guidelines?

Hypotheses

The following null hypotheses were formulated to guide this study and were tested at 0.05 level of significance.

1. There is no statistically significant difference in the mean achievement scores of students taught Basic Science and Technology using Individualized Instructional Strategy and those taught using the conventional lecture method.
2. There is no statistically significant difference in the mean achievement scores of male and female students taught Basic Science and Technology using individualized instructional strategy.

Method

The study employed quasi experiment design of pre-test, post-test, non-equivalent control group research design. The use of intact classes did not allow for randomization of the research participants because the schools' set-up is such that students are already organized into classes and streams and the leaderships of the schools would not allow such classes to be disorganized for the purpose of the study.

The population of the study comprised 26,098 (13,950 males and 12,148 females) junior secondary three students from 391 public schools in Plateau State. The sample was made up of 177 students (89 males and 88 females) drawn from a sample of four schools in the state. The choice of JSSIII was because they were the ones allowed to be in schools to prepare for their Junior Secondary School Certificate Examination (JSSCE) as directed by the Federal Ministry of Education in conjunction with Federal Ministry of Health and National Center for Diseases Control during the lockdown period as a result of the COVID-19 Pandemic that engulfed the nation as earlier stated. The simple random sampling technique was used to select four schools from the 391 schools in Plateau State using the hat and draw method. There was no sampling of students since intact classes were used. Four schools were randomly assigned to two experimental groups and two control groups of intact classes and the schools were far from each other. The experimental group had 88 (45 males and 43 females) while the control group had 87 students (44 males and 43 females). Three research questions and two hypotheses guided the study. The instruments used for data collection were the Basic Science and Technology achievement Test (BSTAT) and Adherence of Students on COVID-19 Preventive Guidelines (ASCPG). The BSTAT had sections A, B and C, section A was for personal data and section B consisted 25 items multiple choice with four options, A, B, C and D each while section C is the ASCPG. Section C was to find out the attitudes of students towards COVID-19 preventive guidelines as the study was strictly conducted during the pandemic crisis. They were to indicate either yes or no as answers. The BSTAT carried 4 marks each giving a total of 100 marks for the 25 items adapted from past questions in Junior Secondary School Certificate Examination and the Basic Science Project Book. The BSTAT questions were prepared and guided by table of specification with special interest on knowledge, understanding and application.

The face and content validity of the instrument was determined using two experts in science education from the Department of Science and Technology Education and one expert in measurement and evaluation from the Department of Educational Foundation, University of Jos. All their comments and suggestions were taken into cognizance.

The reliability of the instrument was established using students outside the study group but similar in characteristics and the reliability index of 0.85 was obtained using Kuder Richardson formation (KR20). BSTAT was administered to both experimental and control groups as pre-test to determine their level of entrance before treatment. The experimental group was taught light energy, sound energy and electrical energy using personalized system of instruction, while the control group was taught the same concept using conventional lecture method. Two research assistants who were trained for one week assisted in carrying out the study. Post-test was administered to both the experimental and control groups after treatment to determine the effects of the instructional strategy on students achievement in Basic Science and Technology. The same experimental and control groups were administered questionnaire to determine their attitude towards observing COVID-19 preventive guidelines. The research questions were answered using percentage, mean and standard deviation, while the hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA).

Results

The results of the study are discussed as follows:

What is the effect of Individualized Instructional Strategy and conventional lecture method on the mean achievement scores of students' in Basic Science and Technology?

Table 1: Mean Achievement and Standard Deviation Scores of Students Taught Basic Science and Technology with Individualized instructional Strategy and Conventional Method

Groups	No of Students	Pre-test Mean	SD	Post-test Mean	SD	Mean Gain Scores
Experiment	89	13.30	3.08	36.46	8.23	21.96
Control	88	13.11	3.00	15.59	3.68	0.47
Total	177					

The result in table 1 shows that students taught Basic Science and Technology using IIS who are the experimental group had a pre-test mean score of 13.30 with standard deviation of 3.08 and a post-test mean score 36.46 with standard deviation of 8.23. The mean gain score was 21.96. The control group that was taught with conventional lecture method had a pre-test mean score of 13.11 with standard deviation of 3.00 and a post-test mean score of 15.59 with standard deviation of 3.68. The mean gain score of this group was 0.47. In each of the group the post-test mean score was higher than the pre-test mean score with the experimental group having the highest mean gain score.

Research Question 2

What are the mean achievement scores of male and female students taught Basic Science using Individualized Instructional Strategy?

Table 2: Mean Achievement and Standard Deviation of Male and Female Students Taught using

Individualized Instructional Strategy

Gender	N	Pre-test Mean	SD	Post-test Mean	SD	Mean Gain Scores	Mean Gain Difference
Male	45	13.82	2.64	34.71	6.95	20.78	
Female	43	12.73	3.30	37.96	8.92	23.15	2.37
Total	89						

The result in table 2 shows that the male group had a pre-test mean score of 13.82 with standard derivation of 2,64 and a post-test mean score of 34.71 with standard deviation of 6.95. The mean gain score of the male group is 20.78. The female group had a pre-test mean score of 12.73 with standard deviation of 3.30 and a post-test mean scores of 37.96 with standard deviation of 3.30 and a post-test mean score of 37.96 with standard deviation of 8.92. The mean gain score of the female group is 23.15. In each of the two groups the post-test mean achievement score is greater than the pre-test mean achievement score with the female group having higher mean achievement score of 3.25. The mean gain score difference is 2.37 in favour of the female group.

Research Question 3

What is the attitude of students towards observing the Covid19 preventive guidelines?

Table 3: Attitude of Experimental and Control Groups Towards Observing the Covid19 Preventive Guidelines

Response Items	Frequency(Percentage)		Mean	SD
	Yes	No		
1. I like wearing facemask to school.	107(61.1)	68(38.9)	0.75	0.43
2. I like washing hands after touching objects.	96(55.8)	79(45.2)	0.66	0.48
3. I like using hand sanitizer before touching objects	63(36)	112(64)	0.86	0.35
4. I like covering my mouth and nose with my elbow, when coughing and sneezing	54(30.9)	121(69.1)	0.57	0.35
5. I like the way my school provides hand wash and hand sanitizer at the gate every day.	161(92)	14(8)	0.98	0.14
6. I like the way hand wash and hand sanitizer are provided in my class every day	144(82.2)	31(17.8)	0.95	0.22
			0.14	0.98

7. I like maintaining distance between me and my school mates in and outside the classroom	14(8)	161(92)		
			0.57	0.49
8. I like the distance between me and my teacher when communicating.	141(80.6)	34(19.4)	0.98	0.14
9. I like the way my temperature is checked every day at the school gate.	161(92)	14(8)	0.95	0.22
10. my teacher wears facemask and use hand sanitizer during teaching and marking of books.	144(82.2)	31(17.8)		
Average Mean	0.78			

Table 3 shows that students like observing COVID-19 preventive guidelines with a grand mean of 0.78 out of the ten items listed as guidelines, students like items 1,2,5,6,7,8 and 10 while they do not like items 3,4 and 7. It also shows that 55% and above like observing COVID-19 preventive guidelines while 36% and below do not.

Hypotheses

Hypothesis 1

There is no statistically significant difference in the mean achievement scores of students taught Basic Science and Technology using Individualized Instructional Strategy and those taught using conventional lecture method.

Table 4: Analysis of Covariance of Mean Achievement Scores of Students taught with Individualized Instructional strategy and Those Taught with Conventional lecture Method.

Source of Variance	Type III Sum of Squares	df	Mean Square	f. Sig	Local Sig
Corrected Model	3064.445	2	1532.222	8.011	.001
Intercept	34031.412	1	34031.412	177.932	.000
Pre-test achievement	170.005	1	1170.005	.889	.348
Treatment	2224.685	1	12224.685	11.632	.001
Error	18552.315	191	261.261		
Total	326100.000	100			
Corrected Total	21616.760	99			

The result in table 4 shows that the f-ratio for treatment is significant at .001 and less than .05 alpha level and so the null hypothesis is not accepted. This means that there is a significant difference in the mean achievement of students taught Basic Science and Technology using individualized instructional strategy and those taught using conventional lecture method.

Hypothesis 2

There is no significant difference in the mean achievement scores of male and female students taught Basic Science and Technology using Individualized Instructional Strategy.

Table 5: Analysis of Covariance of Male and Female Students taught with Individualized Instructional strategy.

Source of Variance	Type III Sum of Squares	df	Mean Square	f. Sig	Local Sig
Corrected Model	3023.198	2	1511.599	7.865	.001
Intercept	17882.626	1	17882.626	93.045	.000
Pre-test Methods	52.096	1	52.096	.270	.605
Gender	2940.023	1	192.194	12.297	.000
Error	9033.122	47			
Total	19543.200	50			
Corrected Total	12056.320	49			

The result in table 5 shows significant difference in the mean achievement scores of male and female students taught Basic Science and Technology using Individualized Instructional Strategy. Since the probability value of .000 was less than 0.05 set as level of significance, the null hypothesis is rejected implying significant difference in the mean achievement scores of male and female students exposed to Individualized Instructional Strategy.

Discussion

The result in table 1 revealed that the mean achievement score of the experimental group in post-test is higher than that of the control group. This shows that the use of Individualized Instructional Strategy improved students' achievement in Basic Science and Technology. The result is confirmed by the result in table 4, which revealed that the method was a significant factor on students' achievement in Basic Science and Technology. Hitherto, students who were taught Basic Science and Technology using Individualized Instructional Strategy achieved higher than those taught using conventional method. The findings of this study support the findings of previous researchers such as Oludipe(2012), Morbark (2014) and Nwafor (2017) where the Experimental group achieved higher than the control group. These researchers used jigsaw, cooperative and constructivist approaches respectively. The findings equally agreed with that of Obinna (2013)Akom and Ugbodubu (2017) who confirmed that the use of appropriate instructional method in teaching and learning leads to students' improvement in sciences, generally and particularly, Basic Science and Technology. This might have been as a result of individual involvement of students in the learning process. This

also confirms the reports of Skinner (1984), Ajayi (2014), Agogo (2017) Dorier and Gauer (2019) who opined that teaching methods should be such that students are actively involved and handled based on individual pace setting in the learning process. The use of Individualized Instructional Strategy have helped students develop self-confidence and enthusiasm in solving problems in Basic Science and Technology. It also motivated them to have interest in Basic Science and Technology in a covid19 preventive measures. This type of exposure has made Basic Science and Technology easy to understand thereby resulting to higher achievement.

The result in table 2 revealed a significant difference in the mean achievement scores of male and female students taught Basic Science and Technology using Individualized Instructional Strategy instruction with the female students performing higher than the male students. The result is confirmed in the result in table 5 which revealed that female students outperformed the male students in Basic Science and Technology by obtaining higher mean achieving scores through the use of Individualized Instructional Strategy. This finding is in agreement with Okebukola (2002); Adediji and Longe (2003) Yolo (2004) and Ezirim (2006) and hosts of others whose studies discovered the females achieving higher than their male counterpart in Basic Science and Technology. The result of this study is also in compliance with the findings of Adeyemi and Oladipo (2018) and Okeke (2018) who found among other things that the achievement of girls in some co-educational school was significantly better than their male counterparts in Basic Science and Technology. The result of this study is also contradicts the studies of Dawson (2016) and Oladipe (2018) which revealed no significant difference in the achievement of male and female students in Basic Science and Technology. However, the result of this study is in line with those of Dcan and Kuhn (2016) who documented female superiority over males in special ability. Also Omoregbe and Ewanjiba (2013), Nwafor and Aja (2017) and Oladipe (2018) reported significant difference in achievement in favour of girls. This result has proven that Individualized Instructional Strategy of instruction is gender friendly and would change the behaviour of the society on girl child education especially in the aspect of science particularly Basic Science and Technology.

The result in table 3 showed that majority of students like observing COVID-19 preventing guidelines as directed by the Federal Ministries of Health and Education (FMH, FME 2020) respectively. Though not all the guidelines were 100% adhered to, this has given the teachers opportunities to intensify more efforts on maintaining COVID-19 guidelines in schools to avoid further occurrence of such pandemic.

Conclusion and Recommendations

The results of this study show that Individualized Instructional Strategy has enhanced students' achievement in Basic Science and Technology than the conventional method. There was a significant difference in the achievement of male and female students taught Basic Science and Technology using the Individualized Instructional Strategy.

Based on the findings of the study, the following recommendations were made:

1. Basic Science and Technology teachers should adopt the Individualized Instructional Strategy in teaching Basic Science as it enhances the achievement of students in the subject
2. Government, through the Ministry of Education and relevant agencies should incorporate Individualized Instructional Strategy approach in their Basic Science and

Technology methods courses, to ensure proper training of teachers in the innovative strategy.

3. Basic Science and Technology teachers should use gender-friendly instructional strategies such as Individualized Instructional Strategy.
4. Government should put in place all the necessary tools needed to prevent the spread of COVID-19 during teaching and learning process.

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