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COMPARATIVE ANALYSIS OF ONLINE AND OFFLINE CLASSROOM INSTRUCTIONS FOR EFFECTIVE LEARNING OF INTEGRATED SCIENCE

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Abstract
This study is a comparative analysis of teaching students in the online classroom environment and offline platform for effective learning of science courses. It adopted the survey research design. Three research questions and three hypotheses guided the study. A purposive sampling technique was used to select the Ignatius Ajuru University of Education, Port Harcourt for the study. A simple random sampling of balloting was used to select 167 first-year students from the Department of Integrated Science, comprising 60 males and 107 females. An Integrated Science Achievement Test (ISAT) was used to collect data for the study. The instrument was subjected to face and content validation by four experts in the field of science education. Also, the instrument was trial tested on 22 Integrated Science students from the University. A reliability coefficient of 0.75 was obtained by using the Cronbach Alpha formula. Mean and standard deviation were used to answer all the research questions while t-test was used to test the hypotheses at a .05 level of significance. The study found that there is no significant difference in the mean achievement scores of the students exposed to integrated science course through the online and offline platforms, $p > .05$. Also found was that gender has no significant effect on the achievement mean scores of students exposed to integrated science course through online and offline platform respectively. Hence, it is better to expose teachers and students to regular ICT training for efficiency and mastery to enhance effective learning of science course.

Keywords: Comparative Analysis, Online, Offline, Classroom, Instruction, learning, Integrated Science

Introduction

Teaching and learning of science can be meaningful and effective if it is backed up with the necessary resources and a good environment to enrich instruction. Hence, information and communication technology (ICT) can be an indispensable tool to achieve effective science curriculum delivery in our education system, especially in the post-Covid-19 era. Ikemelu (2015) reported that recent development in science education is the application of ICT in science instruction by science teachers. Information and communication technology can assist students to become independent learners, capable of developing critical thinking and problem-solving strategies, collaborative work and inquiry. Also, Oni et al. (2013) asserted that ICT can assist science teachers in adequately presenting a well-planned set of lessons that students will experience in an exciting environment.

However, the differences between Computer Assisted Instruction (CAI) or Information Communication Technology (ICT) and Teacher-led or group instruction make it necessary to analyze teachers' pedagogical effectiveness on students' academic achievement in virtual and conventional classrooms. It is quite explicit that the use of computers creates different types of activities and changes the pace from that of teacher-led or group instruction to individualized learning. Information and communication technologies enable the students to move at their own pace, as they do not allow learners to move until they have mastered the skills. Owoyemi (2014) said that it can be used to teach any topic. Although most strategies that are used in the conventional classroom for the teaching and learning of science are also used in virtual classrooms, such as simulation and scaffolding strategies. The obvious distinction between them is the change in the environment, which requires new competencies for online teaching

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and learning of science courses. The nature of the environment is not limited to the knowledge acquisition of the students but is also linked to the challenges that the teachers face in online communication.

Furthermore, for the fact that students' learning in the conventional environment is teacher-centred and in the virtual environment is student-centred. The capability and efficiency of the teacher to exhibit the potential of improving the quality of education and transforming the learning environment into one that facilitates learning shows the competency of the teacher. Hence, competency has to do with the complex actions that include knowledge, ability and attitude required for the successful completion of a task (Hanza & Umar, 2012; cited in Wagbara & Amakiri 2017). Teachers' competency needs and uses that could show some disparities in conventional and virtual classrooms could be pedagogical, social, managerial, and technical (Amajuooyi, 2012).

Also, the variations in teachers' competency needs and uses could be observed conspicuously in courses of determining learning outcomes in the following ways:

- Development of lessons in the conventional classroom; the teacher determines the lesson objectives, the content logicality and accuracy. Whereas in the virtual classroom, the learner determines the objective of the lesson by determining the logicality and accuracy of the content.
- Relevance of the lesson in a conventional classroom is an issue of the teacher because the teacher should have a good mastery of the content to be delivered to either a small group or large group of students and should effectively manage the chalkboard. In the virtual classroom, the mastery of the subject content lies in the hands of the small group of learners, which has to be facilitated by their skills in using the keyboard of their computers.
- Communication skills: In the conventional classroom, teachers' clarity of voice and appropriate use of language is required. While in the virtual classroom, teacher promotion of intellectual ability through higher thinking (Brain-on) is required for problem-solving and improved communication skills (Wagbara & Amakiri, 2017).

Despite the disparities that exist in the use of online and offline platforms in the teaching of science courses, the crux of the matter is the platforms that can enhance the effective learning of science courses in literature. Several pieces of evidence have shown that effective learning of science courses is declining in Nigerian schools (Adejoh, 2011; Okoye, 2013; Achimugu, 2014 cited in Wagbara, 2019). To improve the effective learning of science courses, a new innovative teaching approach that is student-centred and that emphasizes individualized learning can be adopted.

Thus, e-learning has become an avenue to help students to gain knowledge and access reality as it provides them with more flexible access to subject content and instruction. An example is the knowledge and experience students gain from a virtual laboratory. Olojo et al. (2012) reported that e-learning had shown an increased retention rate and utilization of content, which resulted in the acquisition of knowledge, skills, and attitudes. Dawes (2001) also asserted that virtual platforms have the potential to support education across the curriculum and provide opportunities for effective communication between teachers and students. Hence, it is an indisputable fact that learning through virtual platforms is student-centred oriented, especially as virtual learning upholds the idea of brain-on-hands-on activities for students. That makes an online platform cohere with the paradigm shift of modern teaching and learning science, which advocates that learners should indulge in problem-solving activities. Based on the problem of the study, the study investigated the effectiveness of virtual classroom environments and offline platforms on the achievement of integrated science students for effective learning of science.

Statement of the Problem

Based on several reports and evidence from literature, effective learning of science courses is declining in Nigeria. This shows that students, achievement in science courses is low. Given the situation, innovative teaching strategies may be useful for the learning of integrated science courses.

Purpose of the Study

The main purpose of this study was to investigate teaching students in a virtual classroom environment and an offline platform for effective learning of sciences.

Specifically, the study sought to determine the:

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1. effect of online teaching and offline platforms on students' academic achievement in an Integrated Science course.
2. gender effect of the online teaching platform on students' academic achievement in an Integrated Science course.
3. gender effect of the offline teaching platform on students' academic achievement in an Integrated Science course.

Research Questions

1. What are the mean scores of students taught Integrated Science course through an online platform and those taught by the use of the offline platform?
2. What are the mean achievement scores of the male and female students exposed to Integrated Science course through the online platform?
3. What are the mean achievement scores of the male and female students exposed to Integrated Science course through offline platforms?

The following null hypotheses, which were tested at a .05 level of significance, guided the study:

H01: There is no significant difference in the mean achievement scores of students, exposed to integrated science course through online and offline platforms.

H02: There is no significant difference in the mean achievement scores of male and female students taught Integrated Science course through online platform.

H03: There is no significant difference in the mean achievement score of male and female students taught integrated science course through the offline platform.

Materials and Methods

Survey research design was adopted for the study. The purposive sampling technique was used to select the Ignatius Ajuru University of Education, Port Harcourt out of the three public Universities in Rivers State. A simple random sampling by balloting was used to select the Department of Integrated Science out of the six (6) departments in the Faculty of Natural and Applied Sciences. A sample size of one hundred and sixty-seven (167) year one Integrated Science students of the academic years 2020 and 2021, comprising (60) males and (107) females participated in the study. 109 first-year integrated science students of the 2019/2020 academic session, comprising 40 males and 69 females participants in the online study while 58 first-year integrated science students of the 2020/2021 academic session, comprising 20 males and 38 females participated in the study. Integrated Science Achievement Test (ISAT) was used to collect data for the study. The validated instrument was trial tested on 22 integrated science students and a reliability coefficient of 0.75 was obtained by using the Cronbach Alpha formula. The data collected were analyzed by using mean and standard deviation to answer all the research questions while the t-test was used to test the hypotheses at a .05 level of significance.

Results

Research Question I: What are the mean achievement scores of students taught Integrated Science course through an online platform and those taught by the use of offline conventional classroom?

Table I: Mean and standard deviation achievement scores of students taught Integrated Sciences through an online platform and those of offline conventional classroom.

Platform	N	Mean ($\bar{x}$)	SD
Offline	109	46.00	13.71
Online	58	49.33	10.31
Mean diff.		3.33	

The result in Table I revealed that the mean score of the online group was 49.33 with an associated standard deviation of 10.31 whereas the mean score of the offline platform group was 46.00 with a standard deviation of 13.71. This indicates that the online group had a higher mean than the offline platform group with a mean difference of 3.33. The higher standard deviation of the offline platform shows that their scores deviated more from the mean

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than that of the online platform learners. This indicates that the higher mean of the online platform learners may be real as it appears.

Hypothesis I: There is no significant difference in the mean achievement scores of students exposed to Integrated Science course through online and offline platforms.

Table 2: t-test comparison of the students exposed to integrated science through online and offline platforms.

Platform	N	Mean ($\bar{x}$)	SD	df	t	p	Decision
Offline	109	46.00	13.71				
				165	-.513	.37	Not significant
Online	58	49.33	10.31				

The result in Table 2 shows that t-value is -.513 and the P-value of .37 was compared with .05 and it was greater than .05, ($p > .05$). Hence, the null hypothesis one Ho_1 which states that, there is no significant difference in the mean achievement score of students exposed to integrated science course through online and offline platforms was upheld.

Research Question 2: What are the mean achievement scores of the male and female students exposed to integrated science course through online platform?

Table 3: Mean and standard deviation achievement scores of male and female students exposed to integrated science course through online platform

Gender	N	Mean ($\bar{x}$)	SD
Male	20	58.87	12.53
Female	38	44.88	12.26
Mean diff		13.99	

Table 3: Mean and standard deviation achievement scores of male and female students exposed to integrated science course through online platform. Table 3 shows that the mean score of the males was 58.87 with a standard deviation of 12..53 while the mean score of the females was 44.88 with an associated standard deviation of 12.26. This shows that the male students had a higher mean than the female students with a mean difference of 13.99. However, the higher standard deviation of the males shows that their scores deviated more than that of the female from the mean. Hence, the higher mean of the males may not be real as it appears.

Hypothesis 2: There is no significant difference in the mean achievement scores of male and female students taught integrated science course through online platform.

Table 4: t-test of the significant difference between the mean scores of the male and female students taught integrated science course through an online platform.

Gender	N	Mean ($\bar{x}$)	SD	df	t	p	Decision
Male	20	58.87	12.53				
				76	.768	.31	Not significant
Female	38	49.33	10.31				

The result in Table 4 shows that the t-value is .768 and the probability value is 0.31. The probability value of .31 was compared with .05 and it was found to be greater than .05 ($p > .05$). Hence, the null hypothesis two, HO_2 states

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that, there is no significant difference in the mean achievement scores of the male and female students taught integrated science course through online platform was upheld.

Research Question 3: What are the mean achievement scores of the male and female students exposed to integrated science course through offline platform?

Table 5: Mean and standard deviation achievement scores of male and female students exposed to integrated science course through offline platform.

Gender	N	Mean ($\bar{x}$)	SD
Male	40	40.00	17.03
Female	69	57.50	14.04
Mean diff		17.50	

The result in Table 5 shows that the mean score of the male students was 40.00 with a standard deviation of 17.03 whereas the mean score of the female students was 57.50 with an associated standard deviation of 14.04. This indicates that the female students had a higher mean score than the male students with a mean difference of 17.50. The higher standard deviation of the male students shows that their scores deviated from the mean more than that of the female students. Hence, the higher mean of the females may be real as it appears.

Hypothesis 3: There is no significant difference score of male and female students taught integrated science course through offline platform.

Table 6: t-test of the significant difference between the mean scores of the male and female students taught integrated science course through offline platform.

Gender	N	Mean ($\bar{x}$)	SD	df	t	p	Decision
Male	40	40.00	17.03	107	1.101	.29	Not significant
Female	69	57.50	14.04				

The result in Table 6 shows that a t-value of 1.101 was obtained and a probability value is .29. The probability value of .29 was compared with .05 and it was found to be greater than .05, ($p > .05$). Hence, the null hypothesis three, Ho_3 which states that there is no significant difference in the mean achievement score of male and female students taught integrated science course through offline platform was upheld.

Discussion

The result of the t-test used in testing hypothesis one which was shown in Table 2 shows that a t-value of -.513 was obtained at df = 14 and a p-value of .37. The result showed that > .05 which indicates that, there is no significant difference in the mean scores of students exposed to integrated science course through online and offline platforms. Hence, null hypothesis one (Ho1) was accepted. The findings of this study agree with the findings of Asebiomo and Fayomi (2016) as they asserted that there is no significant difference between the digital competencies of science teachers and humanities. However, the findings of Ikeh et al.(2016) did not support the findings of this study as they reported that teaching students with a computer-assisted instructional package was significant in favour of those taught with animation. The findings of this study have confirmed that teaching students through online platform do not have a significant difference in mean achievement score with that of offline platform teaching of students integrated science course.

Table 4 result shows that the t-value of -.768 was obtained at df = 3 and P-value .31. The result shows that there is no significant difference in the mean scores of the male and female students taught integrated science course through online platform. Hence, null hypothesis two (Ho_2) was accepted. The findings of this study were in line with the

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findings of Asebiomo and Fayomi (2016) as they reported that there is no significant difference in digital literacy between males and females. Omah and Obi (2016) also agree with the findings of this study as they stated that, there is no significant gender effect on the achievement and interest of the students in computer networking. Hence, this study confirmed that there is no significant difference in the mean achievement scores of male and female students taught integrated science course through online platform.

The result in Table 6 showed that a t-value of 1.101 was obtained at df = 8 and a probability value of .29. The result indicates that $p > .05$ which shows that, there is no significant difference in the mean achievement scores of male and female students taught integrated science course through the offline platform. Hence, null hypothesis three (Ho_3) was accepted. The findings of this study were supported by the findings of Okoye and Nzewi (2013) as they reported that gender does not have a significant effect on students' interest and achievement in Basic science by the use of four-mode application instructional models. This study has confirmed that there is no significant difference in the mean achievement scores of male and female students exposed to integrated science course through the offline conventional classroom.

Conclusion

Firstly, the result of this study has shown that teaching students Integrated Science course through online platform do not have a significant effect on their academic achievement mean score. The students exposed to online platform did better than those who were offline but the mean difference was too low. Secondly, the result of the study found that gender does not have a significant effect on the mean achievement scores of students taught Integrated Science course through online platform. There was no significant difference between the achievement mean scores of the male and female students taught Integrated Science through an online platform.

Recommendations

1. The science teachers who are involved in teaching students on an online platform should be endowed with the course content and adequate methodology for teaching the courses.
2. Adequate materials to facilitate the activities required for online teaching and learning should be available for teachers and students for better commitment and performance in science courses.
3. Regular training should be organized for teachers to rehabilitate them in the use of the online platform to improve learning. The students should also be oriented on how to use a computer keyboard and measures of assessing information online with their computers and phones.
4. All science students should be given equal attention and treatment in the teaching of students through online platform irrespective of their gender as the study has confirmed that both male and female students learn at the same rate in an online platform.

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