

EFFECTIVENESS OF FLIPPED CLASSROOM INSTRUCTIONAL METHOD ON SECONDARY SCHOOL STUDENTS' ACADEMIC PERFORMANCE IN BIOLOGY IN KATSINA STATE, NIGERIA

Ishiaku Aminu

ishiakuaminu5@gmail.com

Dr. Kabir Sadiq & Prof. Torpev Terver Francis

Department of Educational Foundations

Federal University, Dutsin-ma, Katsina State.

Abstract

The study examined the effectiveness of flipped classroom instructional method on students' academic performance in Biology in Katsina state. One objective and its corresponding research question and hypothesis guided the study to compare the academic performance of Biology students taught using flipped classroom instructional method and those taught using demonstration method. The study adopted quasi-experimental design involving experimental and control groups. The population of the study consists of 2,335 students in public senior secondary schools of which two intact classes with 65 students were selected as sample of the study. A self-developed and experts validated Aquatic Habitats Academic Performance Test (AHAPT) which yielded 0.84 reliability coefficient was used as the instrument for data collection. Mean scores and standard deviation were used to answer the research question, while t-test for independent samples was used to test the hypothesis at 0.05 level of significance. The findings revealed that, students taught Biology using flipped classroom method of instruction performed significantly better than those taught using demonstration method. Based on the finding, the study concluded that flipped classroom instructional method enhances students' academic performance in Biology and recommended that teachers of senior secondary schools should expose Biology students to flipped classroom method of instruction.

Key words: Effectiveness, Flipped Classroom Instructional Method, Academic Performance, Biology

Introduction

Biology is a field of natural science that is concerned with study of living things including their structures, function, growth, origins, evolution and taxonomy (Femi, 2021). In Nigeria, Biology has a great position in secondary school education curriculum due to its significance as a life science. It is also a core subject for Agricultural Science, Nursing, Medical Science, Pharmacy, Synthetic Industry, Textile Science and Chemical Technology. Research evidences have proved that Biology contributes to the quality of life and nation building and in all aspects of human endeavor (Akanbi & Kolawole, 2020).

Based on the above assertion, for any meaningful development to take place, every nation must embark on knowledge and skills of science and technology, especially, Biological sciences for rapid and sustainable social, economic, political and technological advancement (Eze, 2023).

It has become expedient for classroom teacher to be enriched with new and innovative pedagogical skills in order to reinforce learning and maximize the allocated time towards greater students learning effectiveness in Biology. But due to the bulkiness of Biology syllabus and limited classroom period allocated for teaching Biology, teacher needs to create activities based learning and innovative strategies that promote teaching and learning process (Kutigi & Gambari, 2022). There is need to engage the learners in activities that will encourage the acquisition of problem-solving skills and a scientific attitude which is not being achieved as a result of poor laboratory facilities and conventional teaching activities in Biology (Badmus, 2021).

Teachers' teaching strategies plays a significant role towards improving teaching and learning process. Student-centred approach supported by educational media could enhance effective teaching and learning. Among the new educational media for teaching and learning is flipped classroom instructional practice. Leo and Puzio (2020) asserted that flipped instruction is a new method for effective teaching which can be seen as the process by which students gain first hand exposure to learning content outside the class, usually via reading or lecture videos and use the class time to assimilate the knowledge through problem solving, discussion, or debates. Flipped class room is a form of blended learning in which learners learn content by watching video, listening to audio lectures, mostly at their various home and assignment is done together in the class with teachers and students discussing and solving questions. Students can work together on a task, exchange opinions, experience and views, discuss and negotiate strategies, actions and results (Ichinose & Clinkenbeard, 2020). These actions can provide students with opportunity to help, discuss, review, teach, influence each other and thereby enhance a motivational situation for developing and learning community.

In flipped classroom instructional method, teacher plays a role of mentor or facilitator of the learning process. The achievement of individual student within the group is shared among the group members. In other words, the role of teacher as the sole provider of what is to be learned is reduced and students' role of being passive is changed to being active learners in the teaching and learning process. This process engages students to be fully part of teaching and learning activities. Furthermore, it is a common trend in literature to associate the term flipped classroom with using videos to deliver lesson content as opposed to methods such as hybrid or blended courses, which can incorporate content through reading assignments (O'Fleherly & Philips, 2015). While some regards flipping as simply moving in-class activities out of class and vice versa, this is inadequate because it does not portray what instructors are doing in the class, which expands the curriculum by incorporating student-centred group based and interactive strategies, instead of merely rearranging activities.

Ajaja and Eravwoke (2019) stated that, the use of flipped classroom instructional method in the teaching of biological concepts should therefore be a rule rather than an option. If we hope to produce students with competency and need to meet the scientific and technological demands of the nation then, the use of traditional methods such as demonstration should be reduced to the minimal. In line with this, Babagana (2021) lamented that flipped classroom

instructional method energizes students' enthusiasm towards learning and in the final analysis, enhances their academic performance. The flipped classroom instructional method has a lot of potential benefits that help develop learning and facilitates performance. These potential benefits according to Gambari (2021) include among others that, learners can watch videos at their own pace or go over the content more than once; lessons can be divided into smaller sections, and learners can view them whenever it is most practical and advantageous in the classroom; active learning, a powerful learning strategy, can be used; students that are struggling can be helped by teachers and this helps establish stronger relationships.

In addition, flipped classroom instruction improves students learning outcome and achievement (Makinde & Yusuf, 2017). Flipped classroom method of instruction increases teacher-student and student-student interactions during lessons, promotes a student-centred learning environment, and consideration of different learning styles. Flipped instruction enable students to learn whenever, wherever and at their own pace, personalize their educational experience, advance their engagement in learning, enhance their capacity for reflection and general competencies, improve their level of self-discipline and self-regulation abilities, increase their learning independence and academic performance (Chebotib, 2022).

On the other hand, demonstration method in teaching can be characterized as giving a demo or performing a specific activity or concept. In other words, the demonstration method is a teaching-learning process carried out in a very routine manner. Demonstration often occurs when students have a difficult time connecting theories to actual practice or when students are unable to understand the application of theories. Demonstration method of instruction is a process used to introduce content of a course of instruction through display of actions or illustrations. The teacher here is able to do some activities while the students are watching, usually the students are able to carefully observe, infer, predict and classify. It is teacher-centered and so it is economical as regards the resources used and teaching aids.

According to Ryan and Reid (2016) criteria for effective demonstration in a classroom include; organizing the demonstration to make it visible to all students, attempting to carry out the demonstration before the lesson begins, avoiding to have too many demonstrations in a lesson not to confuse the students, being systematic, that is performing the demonstration in a scientific manner, attempting to time each demonstration and pace it to enable the students grasp the message, being audible for everyone in the class.

The shortcomings of these traditional methods include making students passive, inactive in the classroom and less productive and that have resulted to the persistent search by researchers for innovative ways to stimulate effective teaching and learning of Biology (Asad, et al, 2022). Recently, flipped learning is receiving more attention in the field of education and thus, to test its effectiveness on students' academic performance as against the traditional methods of instruction such as demonstration method that is long being practiced is of paramount importance.

Despite the benefits of flipped classroom instructional method, there exist some potential drawbacks. These drawbacks could be seen when compared to a conventional method such as lecture and or demonstration where students may perceive the recorded lectures in flipped instruction to be less engaging and experience more interruptions when watching the intervention. Jensen (2020) stated that students may not watch the entire lesson video or have trouble understanding the content, leaving them unprepared for instructional tasks during class sessions or struggling to keep up with other students. Furthermore, the environment in which students watch videos might not be optimal for acquiring new ideas. Students are supposed to be responsible for their educational progress; however, the fact that the virtual version of the flipped class has many distractions could result in inadequate concentration. Students are frequently distracted by other web pages, social media sites, and their surroundings, rendering them unable to completely concentrate on the flipped intervention.

In addition, students prefer that an instructor be present during the lesson so they can ask questions. According to Chen (2016) one significant challenge is the students' opposition to a completely different teaching style. Due to their familiarity with traditional teaching formats, students found it difficult to shift to an innovative teaching approach that included new routines, obligations, and demands. Some students struggle more than others to plan, organize, and complete their outside-of-classwork study (Srilath, 2018). Also, there may be a decline in reading assignment compliance when students view recorded lectures. Pre-class activities may take up too much of the students' free time. Strayer (2019) lamented that the flipped classroom places a considerably higher demand on learners due to their new roles.

However, all arguments against the flipped classroom instruction are countered when students are exposed to its intervention. Anashie-Otakpa and Andor (2021) maintained that the enhanced learning environment in the flipped instruction can lead to an improvement in academic performance as students are better able to visualize and understand complex biological concepts through interactive and multimedia lessons. To this end, the enhancements in the flipped instruction lead to superior academic outcomes compared to traditional teaching methods such as lecture and demonstration.

The term academic performance in this study encompasses both flipped and demonstration instructional methods. It refers to the level of achievement or success that students demonstrate in their academic pursuits. Conceptually, academic performance reflects a student's ability to understand and apply the learned concepts effectively. It encompasses various factors such as knowledge acquisition, critical thinking skills, problem-solving abilities, and application of learned theories (Abruzzi, et al, 2016).

Statement of the Problem

Despite the importance of Biology education to nation building, students' performance in Biology at senior secondary school level is not encouraging. From the analysis of the 2019-2023 NECO chief examiner reports nationwide, the percentage of students' failure stands at

68.3%, 61%, 56.8%, 52.1% and 53.4%, respectively. Though the trajectory of the failure shows some signs of decreasing, but it is far from normal and or out of danger. Subsequently, the failure rises again with more than a percentage point. Several studies have also revealed a decline in performance of students in science subjects including Biology (Cobasi, 2020, Ugwuanyi, 2020, Okeke, 2022, & Obochi, 2023). Such students' performance in Biology created a gap that necessitated studies of this nature. Although some studies were conducted with different methods such as lecture, discussion and laboratory to mention just a few, the need to study other innovative and relevant methods in an attempt to discover suitable and effective ones that will help bridged the gap created by the use of traditional methods as well as enhancing students' academic performance can never be overstated.

Objective of the Study

The study is guided by the following objective:

1. To find out the difference in the academic performance of students taught Biology using flipped classroom instructional method and those taught using demonstration instructional method in Dutsin-ma zonal education quality assurance, Katsina state.

Research Question

The study answered the following question:

1. What is the difference in the academic performance of Biology students taught using flipped classroom instructional method and those taught using demonstration instructional method in Dutsin-ma zonal education quality assurance, Katsina state?

Hypothesis

The following corresponding hypothesis was formulated and tested at 0.05 level of significance:

1. There is no significant difference in the academic performance of Biology students taught using flipped classroom instructional method and those taught using demonstration instructional method in Dutsin-ma zonal education quality assurance, Katsina state.

Methodology

This study used quasi-experimental design which involves pre-test, treatment and post-test. Two schools were randomly selected, one as experimental and the other as a control group. In the experimental group, 31 students with smart phones were selected purposively, thus, smart phones are essential requirement for the flipped classroom. On the other hand, an intact class of 34 students was used in the control group. The experimental group was taught concept of aquatic habitat using flipped classroom instructional method, while the control group was taught the same concept using demonstration method.

Aquatic habitat academic performance test (AHAPT) was used for data collection regarding students' performance. The AHAPT contains 30 multiple choice questions developed by the researcher and validated by experts in curriculum and instruction, biology education as well as educational measurement and evaluation. Using Pearson product moment correlation coefficient (PPMCC), the AHAPT yielded 0.84 reliability index. At the initial stage, pre-test was administered to both groups. After five weeks of intervention delivered by the researcher to both the flipped classroom and demonstration instructional methods, a post-test was also administered to both groups. The data were collected and analyzed statistically. Mean and standard deviations were used to answer the research question while, t-test for independent sample was used to test the hypothesis at the 0.05 level of significance.

Result

Research Question: What is the difference in the academic performance of Biology students taught using flipped classroom instructional method and those taught using demonstration instructional method in Dutsin-ma zonal education quality assurance, Katsina state?

Table 1: Difference in Students academic performance between flipped and demonstration instructional methods

Groups	N	Mean Pre-test	SD	Mean Post-test	SD	Mean Difference
Experimental (Flipped)	31	10.00	1.001	49.00	5.000	9.97
Control (Demonstration)	34	10.83	1.100	39.03	4.145	

Table 1 revealed that the experimental group taught using flipped instructional method has a pre-test mean score of 10.00 and standard deviation of 1.001; and a post-test mean score of 49.00 and standard deviation of 5.000, while the control group taught using demonstration instructional method has a pre-test mean score of 10.83 and standard deviation of 1.100; and a post-test mean score of 39.03 and standard deviation of 4.145, respectively. This indicates that the interventions are effective to both the experimental and control groups. In addition, a mean score difference of 9.97 was calculated in favour of the experimental group. This indicates that the students of experimental group taught using flipped instructional method performed significantly better than those at the control group taught using demonstration instructional method.

Hypothesis: There is no significant difference in the academic performance of Biology students taught using flipped classroom instructional method and those taught using demonstration instructional method in Dutsin-ma zonal education quality assurance, Katsina state.

Table 2: t-test analysis of students' performance between flipped and demonstration methods

Groups	N	Mean	SD	df	t-value	p-value	Decision
Experimental (Flipped)	31	49.00	5.000				
				63	8.78	0.000	Significant
Control (Demonstration)	34	39.03	4.145				

Table 2 revealed that the t-value computed was 8.78 and the p-value was 0.000. Since the obtained p-value of 0.000 is less than the alpha value of 0.05, this study rejected the null hypothesis which states that there is no significant difference in the academic performance of Biology students taught using flipped classroom instructional method and those taught using demonstration instructional method in Katsina state. This implies that, flipped classroom instructional method enhances students' academic performance in Biology than the demonstration instructional method in secondary schools in Katsina state.

Discussion of Findings

The findings of the research question and hypothesis revealed that there is a significant difference in the mean academic performance of Biology students taught using flipped classroom method of instruction and those taught using demonstration method in Dutsin-Ma, zonal education quality assurance, Katsina state. This indicates that the students in experimental group performed significantly better than control group after treatment with flipped classroom method. This finding is in line with the findings of Aneshie-Otakpa and Andor (2021) which showed that the flipped classroom instruction had a significantly positive effect on students' critical thinking and achievement in matrices and determinants. The finding also agreed with that of Femi (2021), which showed that the flipped classroom strategy employed by the teachers in teaching Biology improved the academic achievement of students. The findings of this study is also in line with the findings of Babagana (2021) which revealed that flipped method of instruction is effective in enhancing students' academic performance in Biology than the demonstration method. This finding also justified the concluding findings of Gambari (2021), Makinde and Yusuf (2017) and Chebotib (2022) that flipped classroom instructional method facilitates learning and improves students' academic performance than the conventional lecture method. The finding of this study also disagrees with Strayer (2019) which asserted that flipped instruction puts high demand on students. On the contrary, flipped instruction offers students an avenue to study and learn in groups and independently at their own pace.

Conclusion

This study concluded that, flipped classroom instructional method significantly enhances students' academic performance in Biology than the demonstration instructional method.

Recommendations

Finally, the study recommended that teachers of senior secondary schools should expose Biology students to flipped classroom method of instruction as it enhances students' academic performance. In addition, curriculum developers should also enshrine the employment of flipped classroom instructional method in the Biology curriculum as it is proved effective in enhancing student' academic performance in secondary schools. Government and other education statutory bodies should also ensure that Biology teachers employ and utilize the flipped instructional method in lesson delivery.

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