ENHANCING SELF-EFFICACY AND SCIENTIFIC CREATIVITY OF SECONDARY SCHOOL BIOLOGY STUDENTS USING STATION-ROTATION AND FLIPPED BLENDED LEARNING STRATEGIES IN OSUN STATE, NIGERIA

Folake Beatrice YOADE
Department of Curriculum & Instruction, Adeyemi College of Education, Ondo
E-mail: yoadenifemi@gmail.com

Emmanuel Folorunso BAMIDELE, Ph.D
Department of Science and Technology Education, Obafemi Awolowo University, Ile-Ife

Olugbenga Adebola YOADE
Computer Centre,Obafemi Awolowo University, Ile-Ife

Abstract
The study determined the effectiveness of Station-rotation and Flipped-blended learning in improving self-efficacy and Scientific Creativity of students in Osun State Secondary School. The study adopted quasi experimental pre-test, post-test control group design. The population for the study comprised all Biology students in senior secondary schools in Osun State. The sample consisted of 115 senior secondary school Biology students randomly selected from three secondary schools in their intact classes. Each intact class was randomly assigned to experimental and control group. The instrument for the study comprised Student self –efficacy Biology Questionnaire (SSBQ) and Scientific Creativity Test. The result showed that student taught using station-rotation blended learning strategy exhibited better self-efficacy than those taught using flipped blended learning strategy. The result also showed that scientific creativity of students taught using station- rotation strategy were better enhanced than those taught using flipped blended learning strategy. The study concluded that station-rotation and flipped blended learning strategy is more effective in promoting the self-efficacy of student and their creativity in secondary school Biology.

Key words: Blended learning strategies, Self-efficacy, Scientific creativity

Introduction

Self-Efficacy which is a key element in Bandura's Social cognitive learning theory, plays a role of connecting goals, performance, and motivation concepts (Schunk,1995). It is one of the individual related concepts which functions as a mediating mechanism among the concepts. According to Bandura (1986)Self-efficacy determines how people feel, think, motivate themselves and behave. Such beliefs produce these diverse effects through four major processes, which include cognitive, motivational, affective and selection processes. A strong sense of efficacy enhances human accomplishment and personal well-being in many ways, such as academic achievement. This implies that individuals´ self-efficacy judgment concerns beliefs in their own capacities rather than the individuals´ actual capacities (Bong & Skaalvik, 2003). Bandura (1986) argues that an individual´s self-efficacy can be used to predict for example academic achievements, education- and career choices. However, studies have shown that people lacking in self-efficacy have problems with motivating themselves to carry out tasks. According to Jamali, Noroozi and Tahmasobi (2013), academic self-efficacy is the student's perceptions of their competence to do their class work. In other words, Academic self-efficacy refers to individuals convictions that they can successfully perform given academic tasks at designated levels. Hence, the competence individual students possess in performing this task will better enhance their ability to think logically and creatively.

Scientific creativity is an important skill that is expected to be possessed by Biology students who have been engaged with teaching-learning process. Biology is a subject that many students consider difficult to learn (Dumaz, 2007: Zeidan, 2010).This perception affects student achievement thereby makingthe students less motivated to learn the subject. As a result, it is hard for them to achieve a good result of their studies. The difficulty is caused by misconceptions, difficulty in finding relationship between biology topics and the nature of the topic in general. It is hard for the student to learn it since they do not have the relevant skill to learn the specific topics. This is the skill to produce and validate ideas (Mumford, 2010). Some students do not have the skills which makes them have difficulty in learning Biology, however, these skills are required for them to learn biology concepts effectively. They have to be

trained to think, describe and evaluate concepts. Therefore, they need to think creatively, since creativity is a skill to formulate a problem, find out an answer, evaluate and disseminate it to others (Torrance, 1969). In order words, learning Biology is more than grasping alone pre-existing biological concepts or skills associated with it, rather its recipients are also required to manifest some creativity. It is also expected that the acquired knowledge must enable students display some level of scientific creativity in their day-to-day activities.

According to Hu and Adey (2002) scientific creativity is a sort of mental capacity creating or conceivably delivering a specific item that is original and has social or individual esteem, composed with a specific reason. The author further added that creativity is a product of cognition. Chumo (2014) describes scientific creativity as an inborn ability which is hidden in all human beings in varying degrees and at the same time every person has the capacity to be scientifically creative when provided with appropriate experiences and opportunities. Studies have shown that scientific creativity may be enhanced through appropriate instructional strategies (Chumo, 2014). These are activity -based approaches which tend to actively engage students in teaching and learning situation. One of the ways to engage students in this is the use of technology

Emerging technologies and mobile devices have enabled improved quality of learning outcomes in the field of Education. With the opportunities provided by innovative, emerging tools, traditional ways of learning have been enhanced.The methods students implement to learn new materials have changed due to the revolution of teaching techniques which has occurred in recent decades. One of the emerging innovations in teaching methods is the blended learning models.

According to Horn & Staker, 2015 blended learning is "a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home.). In the recent past, schools have started looking at the blended learning model as a way to provide differentiation within their traditional walls and have also begun implementing this unique learning environment into their systems. The term "blended learning" in general refers to the use of technology to give students the opportunity to learn at different times, locations, and paces. Many models of blended learning exist in today's classrooms. Here, four widely accepted models that are being adopted by educators are the following: the Station Rotation model, the Lab Rotation model, the Flex model, and the Flipped Classroom model (Staker & Horn, 2012; Walne, 2012).

The adoption of blended learning in a classroom requires the careful selection of the learning model(s) that will be the most effective for the classroom in which it will be implemented (Horn & Staker, 2015). The Station-rotation model is a blended learning model in which the teacher divides the students within a classroom into three to four groups. These groups rotate through a series of stations, one of which must be technology based (Horn & Staker, 2015; Walne, 2012). On the other hand, the learning model known as the flipped classroom is also one of the developing thoughts in education. In the flipped classroom, students are given initial information outside of the classroom and use class time to build their knowledge base (Bergmann and Sams, 2012). It is on the basis of the relevance of these models that this study seeks to examine the effectiveness of the models on self-efficacy and scientific creativity.

Objectives of the Study

a) determine the effectiveness of station-rotation blended learning strategy (SRBLS), flipped blended learning strategy (FBLS) and conventional Teaching Strategy in promoting students' self-efficacy in Biology
b) examine the effectiveness of the blended learning strategies and conventional Teaching Strategy in enhancing scientific creativity of students in Biology;

Hypothesis

1. There is no significant difference in the Self-efficacy of students taught using Station-rotation blended learning strategy (SRBLS), Flipped blended learning strategy (FBLS) and those taught using the Conventional Teaching Strategy (CTS).
2. There is no significant difference in the scientific creativity of students taught using Station-rotation blended learning strategy (SRBLS), Flipped blended learning strategy (FBLS) and those taught using the Conventional Teaching Strategy (CTS).

Methodology

The study adopted quasi experimental pre-test, post-test control group design. The population for the study comprised all senior secondary school Biology students in Osun State. The sample consisted of 115 Biology students in their intact class randomly

selected from three secondary school in one local Government Area of Osun State. Each intact class from the selected schools was randomly assigned to experimental groups and control group. Experimental group A was taught using station-rotation blended learning, experimental group B was taught using flipped blended learning and control group was taught using conventional teaching strategy. The instruments for the study were Students self-efficacy Biology Questionnaire (SSBQ) and Scientific Creativity Test (SCT). In order to establish the reliability of the instruments, they were administered on 40 respondents in a school different from the schools for the study. Their responses were subjected to Cronbach Alpha reliability test. The SSBQ has a reliability coeffiecient of 0.74 while that of SCT is 0.75. These values are significant at 0.05 level.

Results

Hypothesis one

There is no significant difference in the self-efficacy of students taught using Station- Rotation Blended Learning Strategy (SRBLS), Flipped Blended Learning Strategy (FBLS) and those taught using the Conventional Teaching Strategy (CTS).

To test the hypothesis, the scores of the respondents to the Students' Self-efficacy Biology Questionnaire (SSBQ) were collected from the pre-test and post-test and then were subjected to Analysis of Covariance (ANCOVA). The pre-test scores act as covariate to provide a background knowledge on the performance of the students before the treatment was administered. The posttest was then administered after the treatment has been administered to the students. The result of the analysis is presented below;

Table 1: Analysis of Covariance(ANCOVA) of Posttest Scores of SRBLS, FBLS and CTS on Students' self-efficacy in Biology

Sources	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7536.448[a]	3	2512.149	176.523	.000	.827
Intercept	290.923	1	290.923	20.442	.000	.156
PRE SELF FEFF	3817.152	1	3817.162	268.223	.000	.707
Group	582.321	2	291.161	20.459	.000	.269
Error	1579.674	111	14.231			
Total	398998.000	115				
Corrected Total	9116.122	114				

The result on Table 1 showed that $F = 20.459$, $p < 0.05$. This implies that a significant difference existed in the effect of Station- rotation blended learning strategy , flipped blended learning strategy and conventional teaching strategy on self-efficacy of secondary school students in Biology in Osun State. Hence, the null hypothesis states that there is no significant difference in the self-efficacy of students taught using Station-rotation blended learning strategy (SRBLS), flipped blended learning strategy (FBLS) and those taught using the conventional teaching strategy (CTS). This hypothesis was rejected. A Partial Eta Squared value of 0.269 showed that the strategies used accounted for 26.9% variation in the self-efficacy of the students exposed to the strategies. However, to determine the instructional strategy that accounted for the significant pair wise comparison analysis was performed on the data using Scheffe post hoc. The results are presented in Table 2

Table 2: Scheffe Posthoc Analysis of the three Instructional Strategies (SRBLS, FBLS and CTS) on students' Self- Efficacy in Biology.

Dependent Variable: Post-Test scores for SSBQ

		Mean Difference (I-J)			95% Confidence Interval for Difference[b]	
(I) group	(J) group		Std. Error	Sig[b]	Lower Bound	Upper Bound
SRBL	FBL	1.107	.856	.198	.198	2.803
	CTS	5.900*	.947	.000	.000	7.777
FBL	SRBL	-1.107	.856	.198	.198	.588
	CTS	4.793*	.875	.000	.000	6.724
CTS	SRBL	-5.900*	.947	.000	.000	-4.024
	FBL	-4.793*	.975	.000	.000	-2.862

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

The pair wise comparison in Table 2 showed that those exposed to Station- rotation blended learning strategy had better self -efficacy than those exposed to flipped blended learning strategy with a mean difference of 1.107 while those exposed to conventional Teaching strategy with a mean difference of 5.900. The resultal so revealed that those exposed to flipped blended learning had better self- efficacy than those exposed to conventional strategy with a mean difference of 4.793. This shows that the students exposed to station-rotation blended learning had a better self-efficacy while those exposed to the conventional teaching strategy had the least self-efficacy. This implies that station-rotation is more effective in enhancing the self-efficacy of students than flipped blended learning and conventional teaching strategy.

Hypothesis two

There is no significant difference in the scientific creativity of students taught using Station-Rotation Blended Learning Strategy (SRBLS), Flipped Blended Learning Strategy (FBLS) and those taught using the Conventional Teaching Strategy (CTS).

To test the hypothesis, the scores of the respondents to the Scientific creativity Test (SHI) were collected before and after the treatment and were subjected to Analysis of Covariance (ANCOVA). The total scores before treatment administration served as covariates to provide a background knowledge on the study habit of the students before the treatment was administered and cater for discrepancies that may occur. The post treatment scientific creativity was then administered to the students. The results were analyzed using ANCOVA and Scheffe Posthoc test as presented below;

Table 3: Analysis of Covariance (ANCOVA) of posttest scores of SRBLS, FBLS, CTS on scientific creativity of students in Biology

Sources	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	366.926[a]	2	183.463	8.319	.000	.126
Intercept	1720.565	1	1720.565	78.017	.000	.404
Group	366.926	2	183.463	8.319	.000	.126
Error	2536.167	115	22.054			
Total	4673.000	118				
Corrected Total	2903.093	117				

The result on Table 3showed that $F = 8.319$, $p < 0.05$. This implies that a significant difference existed in the effectiveness of Station- rotation blended learning strategy, flipped blended learning strategy and conventional teaching strategy on scientific creativity of secondary school students in Biology in Osun state. Hence, the null hypothesis that states that there is no significant difference in the scientific creativity of students taught using Station- rotation blended learning strategy (SRBLS), flipped blended learning strategy (FBLS) and those taught using the conventional teaching strategy (CTS).was rejected. A Partial Eta Squared value of 0.126 showed that the strategies used accounted for 12.6% variation in the scientific creativity of the students exposed to the strategies. To determine the instructional strategy that accounted for the significant difference, pair wise analysis was performed using Scheffe post hoc analysis. The results are presented in Table 4.

Table 4: Scheffe Posthoc Analysis of the Three Instructional Strategies (SRBLS, FBLS and CTS) on students' Scientific Creativity in Biology

		Mean Difference (I-J)			95% Confidence Interval for Difference[b]	
(I) group	(J) group		Std. Error	Sig.	Lower Bound	Upper Bound
CTS	SRBL	-2.4902	1.04366	.062	-5.0785	.0980
	FBL	1.8530	1.06486	.224	-.7878	4.4938
SRBLS	CTS	2.4902	1.04366	.062	-.0980	5.0785
	FBL	4.2432*	1.07116	.000	1.6868	6.9997
FBLS	CTS	-1.8530	1.06486	.224	-4.4938	.7878
	SRBL	-4.3432	1.07116	.000	-6.9997	-1.6868

The pairwise comparison in Table 4 showed that those exposed to Station- rotation blended learning strategy had better scientific creativity than those exposed to flipped blended learning strategy with a mean difference of 4.34 and those exposed to conventional teaching strategy with a mean difference of 2.49. The result also revealed that those exposed to conventional teaching strategy had better scientific creativity than those exposed to flipped blended learning strategy with a mean difference of 1.85. This shows that students exposed to station- rotation blended learning had a better scientific creativity than those exposed to the conventional Teaching strategy and flipped blended learning strategy

Discussion of Findings

The results of the study showed that there was a significant difference in the effectiveness of station-rotation, flipped blended learning instructional strategies and conventional teaching strategy on students' self–efficacy in Biology. This is evident as students' self-efficacy in Biology as a result of the treatments accounted for 26.9% variation. This implies that these instructional strategies had effect on students' self-efficacy in Biology. This also indicates that students' self-efficacy was better promoted after the treatments on students. This result is in consonance with Arslan (2013) who identified in a study, the reciprocal effect between self-efficacy and academic achievement with self-efficacy predicting achievement and achievement as a source of self-efficacy. Students that possess higher self-efficacy have also shown to perform better in math and science classes. This suggests that promoting students' self-efficacy in Biology using innovative strategies would help students acquire better understanding of various concepts in the subject, hence, this could assist in improving other learning outcomes.

Furthermore, the study found out that there is significant effect of station-rotation and flipped blended learning strategies and conventional teaching strategy on students' scientific creativity. The change in students' scientific creativity in Biology as a result of the treatments accounted for 12.6% variation in the scientific creativity test. Students that were exposed to station-rotation and flipped blended learning had better performance in Biology than students' taught using the conventional teaching strategy. The study further revealed the amount of effect of each of the strategies had on students' scientific creativity in Biology. The performance mean difference between station-rotation and flipped blended learning is 4.34. This implies that station-rotation blended learning strategy is more effective in enhancing the scientific creativity of students in Biology than flipped blended learning strategies. This result is in agreement with the findings of Saliba and Rankine (2013) who found that blended learning increases access and flexibility for students and better creativity for students. Moreover, the finding is also supported by the findings of Hallam (2015) who observed that station-rotation blended learning strategy had significant effect on scientific creativity of students. This implies that enhancing scientific creativity of students in Biology using innovative strategies like blended learning strategies would help students acquire creative thinking skills which could improve their learning outcomes

Conclusion

The results of the study provided the empirical evidence on the reason to integrate the use of station-rotation blended learning instructional strategies into the teaching of Biology in senior Secondary Schools. Station-rotation blended learning strategy is more effective in improving the learning outcomes of students in Biology than flipped blended learning and conventional teaching strategy

Recommendations

Arising from the findings of this study the following recommendations are made;

- Teachers are to use station-rotation blended learning strategy in teaching Biology concepts by considering the suitability of the materials to be taught
- Workshop, seminars and conferences should be organized on regular basis in order to acquaint teachers on innovative instructional strategies of teaching Biology, and
- The online and face-to-face elements involved in blended learning should be aligned in order to improve students' self- efficacy and scientific creativity

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