Effects of Gallery Walk Instructional Strategy on Senior School Students' Achievement in Cell Division in Ilorin, Nigeria

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ABSTRACT

This study investigated the effects of gallery walk instructional strategy (GWIS) on senior school students' achievement in cell division in Ilorin, Nigeria. Three research questions with corresponding hypotheses were raised and tested. The study was quasi-experimental with a sample size of 79 senior school one students. Gallery walk instructional package and cell division achievement test (CDAT) were used in gathering data. Data were analyzed using mean gains, *t-test* and ANCOVA. Findings from the study revealed that there was a significant difference in the achievement of students who were learn using gallery walk and those learn using the conventional method. However, no significant difference was found between the achievement of male and female students exposed to GWIS. There was also a significant difference in the achievement of low, medium, and high scoring students learn using GWIS. It was therefore concluded that GWIS can be used to teach cell division and other hard-to-teach biological concepts. It was recommended that, GWIS should be used by teachers to teach cell division and other similar difficult concepts.

Key words: Conventional teaching method, Gallery walk, Achievement, Biology

INTRODUCTION

Science is a great enterprise which nations depend on to advance technologically. Science, therefore, is receiving much emphasis in education because of its significance and relevance to life and the society (Nwagbo, 2010). The relevance of science and technology to humans and the world at large has impacted different areas of human endeavor such as medicine, communication, transportation, agriculture, education and so forth. Abimbola (2013) defined science as a body of knowledge, a way of investigating and thinking in the pursuit of an understanding of nature. Nwagbo (2010) explained science as an intellectual activity carried out by humans, designed to

discover information about the natural world in which we live and to discover the ways in which this information can be organized to benefit human race.

The goals of Science Education according to FRN (2013) are; acquisition of knowledge, skills, inquiry and rational mind for conduct of good life, to produce scientist for national development, service studies in technology and the cause of technology advancement and provide knowledge and understanding of the complexity of the physical world, the forms and conduct of life. In achieving these goals, curriculum planners advocated the teaching of science subjects like Biology, Chemistry, Physics and Mathematics at all tiers of educational sectors in Nigeria.

Biology as part of science education is a branch of natural science that deals with the study of living organisms, including their structures, functions, evolution, distribution, origin and growth (Bagley, 2017). Biology as one of the branches of science involves the study of living things ranging from microscopic cellular molecules to the biosphere which encompasses the earth surface. Biology occupies a unique position in the senior school education curriculum because of its importance as the science of life. Biology is a very important science subject that stands as the bedrock upon which many other science disciplines like Medicine, Pharmacy, Nursing, Biochemistry, Genetics, Agriculture and so forth are built on. Biology as a subject enjoys wide popularity among students because of its closeness to life.

Despite the high number of students' enrolment in Biology in the senior school examinations conducted by West African Examinations Council (WAEC) and National Examinations Council (NECO), reports from scholars and educators (WAEC Chief Examiner's Report, 2007; Abimbola, 2013;Towolawi & Onuka, 2018; Adebanjo & Shogunle, 2020; Onu *et al*, 2020) indicated that students' achievement in Biology is poor. Studies by (Nnorom & Uchegbu, 2017; John et al, 2018; Samba et al, 2020) reported the use of teacher-centered methods to teach biology and the inability of teachers to relate what is learn to daily life of the students (Çimer, 2012) are some of the factors affecting students' achievement. Isiugo-Abanihe, LongJohn and Ibiene (2010) specifically reported that the poor achievement of students in Biology in external examinations is linked to the use of conventional method in teaching.

This conventional method of teaching stresses more on the transmission of knowledge in a manner that emphasizes rote memorization hence they have been characterized by some researchers (Hamzat et al, 2017; Kirshner, Sweller, & Clark, 2006) as a poor method of teaching biology and other science subjects. Guisti (2008) referred to the conventional teaching method as

teacher-centered approach in the sense that the teacher is the possessor of knowledge to be transferred to the students, and as such decides how the knowledge transfer takes place. The one way flow of information in this method makes students passive learners and unable to construct meaningful knowledge in the teaching and learning of biology. The shortcomings of this teaching method resulted to the persistent search for an effective method of teaching and learning biology which culminated to the suggestions by some researchers (Mandor, 2002; Nwagbo, 2006), for the use of innovative teaching methods such as project based technique, concept mappings, simulation and games, jigsaw, problem based learning. These innovative methods are considered as learner-centered methods that can improve students' achievement and enhance active participation in learning of Biology (Campbell, 2006). Because of the unique position of Biology as the basis for other life sciences course, there is the need for teachers to adopt the use of innovative instructional strategies that will bring about conceptual understanding among the students.

New instructional strategies are being developed and implemented in classrooms on an almost daily basis, therefore, the need for teachers to be creative and employ a number of them in the classroom (Meador, 2018). The importance of effective instructional strategies is that it provides a delivery mechanism for presenting content, provide teachers with the flexibility needed to meet individual needs and it also makes teaching and learning fun. Majority of students learn best through active, engaging learning opportunities (Meador, 2018). In an attempt to ensure active participation of students in the classroom, Setyawan *et al* (2016) suggested that activity- oriented strategies be employed by teachers. As such, teachers who utilize activity- oriented strategies such as gallery walk are constantly engaging their students' in having meaningful learning of abstract biology concepts.

The need for biology teachers to employ innovative and learner-centered strategies cannot be overemphasized. As such adopting gallery walk as a discussion and collaborative technique that allows students to be actively engaged as they walk throughout the classroom becomes imperative. Gallery walk allows the learners work together in small groups to share ideas and respond to questions, documents, images, problem–solving situations or texts. This technique gets students out of their chairs and into a mode of active engagement (Francek, 2006). Gallery walk is a good way to assess what students have learned about the content being learn (Edel-Malizia, 2015). The artifacts of a gallery walk can be anything from open-ended questions about the content being learn , to photographs related to the content, or even demonstrations or finished projects. Often

students walk through a gallery walk in pairs or small groups. Each group visits each display station, taking notes on what they learn, and then talking afterward to reflect upon their learning. Studies carried out by (Sunarti & Septiana, 2019; Setyawan *et al*, 2016) revealed that gallery walk encourages active participation of learners in the teaching and learning process thereby enhancing ability to express their opinion and ideas. Their involvement during discussions and in the setting up of the classroom brings out the creative ability (flexibility, originality and elaboration) in the learners. This strategy stimulates both convergent and divergent thinking in students which is important in bringing about creative and innovative ways of solving problems (Radzi *et al*, 2020). This is corroborated by Nwanekezi *et al* (2018) who asserted that gallery walk strategy activates student's inquisitiveness, involves learners actively and make learners acquire critical learning skills. Gallery walk can be used as an opening, closing or review activity as decided by the teacher, however, it serve learners with varying learning style (Puspitasari, 2019).

Studies have indicated the adoption of gallery walk instructional strategy is a potent tool that can enhance students' academic achievement. For instance Makmun, Yin and Zakariya (2019) examined the effects of mobile gallery walk on students' interest and performance in economics. The study adopted the quasi experimental design and the population for the study was 320 students randomly selected from schools located in Zon Sepang region of Malaysia. Findings from the study revealed that students exposed to the use of mobile gallery walk achieved significantly better than those exposed to the use of gallery walk instructional strategy alone, however students' exposed to gallery walk also achieved significantly better than the control group of students that were learn using the conventional teaching strategy. Nwankezi, Walele and Eruchi (2018) also conducted a study that examined effects of gallery walk teaching strategy on the performance of students in basic science concepts. The study was quasi in nature and was conducted among 120 Upper universal Basic Education students in Rivers State. Findings from the study revealed that students exposed to instruction using gallery walk teaching strategy achieved significantly better than their counterpart that were learn basic science concepts using conventional teaching strategy and that gender had no influence of students exposed to the use of gallery walk teaching strategy.

Chin, Khor and The (2015) examined the effect of gallery walk on the teaching and learning of Biology. The study involved 21 A-level Biology students and researcher designed questionnaire was used in gathering data. Result from the study revealed that gallery walk improved the

achievement of students and that 15 of the students representing 71.43% understood the concept of vascular diseases better and also found the lessons interesting and interactive.

Although teaching strategy can affect students' achievement, its potency is more pronounced when compared with other factors such as students' gender and score levels. Gender is one of the important factors that should be taking into recognition when one is concerned with measuring students' achievement in biology because there has not been a conclusive finding on its effects on students' achievement (Badmus, Bello, Hamzat & Sulaiman, 2019). Badmus *et al*. (2019); Okoronka and Wada (2014); Dania (2014); Daniel (2012); Ugwuadu and Abdullahi (2012) contended that gender does not have any significant influence on the achievement of students in sciences, while on the other hand Olarewaju (2015); Ahmad and Munawar (2013) posited that a significant difference exists between the achievement of male and female students in sciences in favour of the male students. Similarly, students differs significantly in the rate at which they process information and understand scientific concepts based on their score levels which tends to be impacted by the degree to which they are affected by particular teaching and learning strategies. Badmus *et al,* (2019); Adeoye and Abimbola (2016); Ayanda, Abimbola and Ahmed (2012) in their separate researches submitted that significant differences exists between the achievement of low, medium and high scorers. However, Adeniji, Ameen, Danbatta and Orilonise (2018): Saidu and Suleiman (2014) affirmed that there was no significant difference in the achievement of low, medium and high scorer students. It is, therefore, against this background, that this study focused on examining the effect of the use of gallery walk instructional strategy on students' achievement in biology.

The theory of constructivism is generally attributed to Bruner (1960) who articulated that knowledge is internalized by learners through the process of accommodation and assimilation. This implies that when individuals assimilate, they incorporate the new experience into an already existing framework without changing that framework. Constructivism is also a philosophical viewpoint about the nature of knowledge. Social constructivism emphasizes the importance of a learner being actively involved in the learning process, unlike previous educational viewpoints where the responsibility rested with the instructor to teach and where the learner played a passive, receptive role. According to constructivist theory, learning is a social advancement that involves language, real world situations, interaction and collaboration among learners. The learner is considered to be central in the learning process. It transforms today's classroom into a knowledge

construction site where information is absorbed and knowledge is built by the learner. Constructivism is the process in which learners compare new information with old, within the context of their current conceptual framework and so reconstruct their knowledge (Harrison, 2001). Neo and Neo (2009) found that constructivism helps students develop problem-solving skills, critical thinking and creative skills and apply them in meaningful ways.

Students work in groups to approach problems and issues in real world situations. This in turn leads to the creation of practical solutions. Constructivist learning environment encourages the learner to gather, filter, analyze and reflect on the information provided and to comment on this knowledge so that it will result in individualized comprehension and private learning. The general purpose of this study was to investigate the effects of gallery walk instructional strategy on senior school students' achievement in cell division.

RESEARCH METHODS

The population of this study comprised of all senior school students in Ilorin. The target population were all first year senior school students (SSI) offering biology in Ilorin town. The sample for the study comprised intact classes of two co- educational senior schools in Ilorin drawn using simple random sampling technique. This study was a quasi-experimental design using non-randomized, non-equivalent, pre test and post test control group involving $2\times2\times3$ factorial design. The design indicates the independent variable at two levels are gallery walk instructional strategy and the conventional method, gender at two levels are male and female and score level at three levels are low, medium and high scorers. It involved carrying out a pre-test on the experimental group and control groups.

Two instruments were used in this study: Cell Division Achievement Test (CAT) and Gallery walk Instructional Package. The CAT was divided into two sections; section A and section B with section A containing information on the personal bio data of the students such as gender and name of school while section B contained 25 multiple choice questions and three essay questions constructed by the researcher and validated by experts. All the questions were on cell division. To teach using gallery walk instructional strategy, gallery walk instructional package was prepared by the researcher. To determine the validity of the research instruments, the test items were given to four science educators for vetting. After scrutiny of the test items, it was administered to SS1 students not participating in the study to determine the reliability. To

determine the reliability of the items, Split-Half was used (Kuder-Richardson formula 20). Reliability coefficient ranges from 0 to 1; the closer the score is to 1, the more reliable the test. Item analysis was also carried out to determine the difficulty and discrimination indices and item options that serve as distracters. This gave the researcher a focus and to ensure that the test items are both valid and reliable.

To collect data needed for the study, an introductory letter was given to the principals of the schools seeking their permission to engage their students and teachers. The researcher also sought the consent of parents to allow their children participate in the research by administering informed consent forms to them. Informed consent forms were also issued to the teachers and students with ethical issues taken into consideration. After approval was granted by the school, the students in both groups were pre tested. Scores from the pretest was used to rank the students into low, medium and high scorers using percentile. The experimental group was learn using gallery walk instructional strategy while the control group was learn using conventional method. The teaching of cell division in both groups took place during the time scheduled for biology lesson on the school time table. Afterwards, the groups were post tested to determine if there was any improvement in the achievement of the students. The Research questions were answered using mean gain. Research hypotheses one and two was tested using t test, while hypothesis three was tested using Analysis of Covariance (Ancova) at 0.05 level of significance.

RESULTS AND DISCUSSION

Results

The results are presented according to the research questions and hypotheses

Research Question 1: Is there any effect on the achievement of students in cell division learn using gallery walk and those learn using conventional method?

Table 1. Difference between Pretest and Posttest Scores of Students in the Experimental and Control Group

Group	Mean	Pre-test	Post-test	Mean gain
Experimental	Mean	39.77	50.03	10.26
	N	31	31	
	SD	9.78	4.31	
Control	Mean	31.94	39.77	7.84
	N	34	34	

Table 1 indicated that the experimental group had a mean gain score of 10.26 while the control group had 7.84. It is evident that the mean gain score was higher in the experimental group than in the control group. Therefore, there was an effect on the achievement of students learn cell division in favor of those learn using gallery walk. Therefore there is no significant difference in the achievement of students learn   cell division using gallery walk and those learn   using conventional method.

Table 2. The t-Test Analysis Showing Difference in the Achievement of Students Learn   Cell Division using Gallery Walk and those Learn using the Conventional Method

Group	N	Mean Gain Score	SD	df	t	Sig.	Decision
Experimental	31	10.26	4.31				
				63	4.80	.00	S
Control	34	7.84	9.69				

p<0.05

The hypothesis was tested using t-test as shown in Table 2. The result of the analysis indicated that the *p*-value (0.00) was less than 0.05, as such, the null hypothesis was rejected. This means that there was a significant difference in the achievement of students learn cell division using gallery walk and those learn using conventional method. The students in the experimental group significantly outperformed the students in the control group.

Research Question 2: What is the effect on the achievement of male and female students learn cell division using gallery walk?

Table 3. Difference between Pretest and Posttest Scores of Male and Female Students learn using Gallery Walk

Gender	Mean	Pre-test	Post-test	Mean gain
Male	Mean	38.23	49.23	11
	N	13	13	
	SD	6.53	5.37	
Female	Mean	40.89	50.50	9.61
	N	18	18	
	SD	11.64	7.92	

Table 3 indicated that, 13 males and 18 females participated in the experimental group and had mean gain scores of 11 and 9.61 respectively. The mean gain score revealed that, gallery walk had an effect on both the male and female students. This effect reflected in the improved

achievement in the post-test for both males and females. They benefitted from gallery walk instructional strategy.

Research Hypothesis: There is no significant difference in the achievement of male and female students learn cell division using gallery walk.

Table 4. The analysis showing Difference in the Achievement of Male and Female Students learn using Gallery Walk

Gender	N	Mean gain	SD	df	t	Sig.	Decision
Male	13	11	5.37				
				29	0.69	.49	NS
Female	18	9.61	7.92				

p>0.05

Hypothesis 2 was tested using *t*-test as shown in Table 4. The result of the analysis (0.05(t(29)=0.49: *p*>.05) indicated that the p-value (0.49) is greater than 0.05. Consequently, the researcher failed to reject the null hypothesis and this means that there was no significant difference in the achievement of male and female students learn cell division using gallery walk. As such, gallery walk improved the achievement of both the males and females in the same way.

Research Question 3: Does gallery walk have any effect on the achievement of low, medium and high scoring students learn cell division?

Table 5. Difference between Pretest and Posttest Scores of Low, Medium and High Scorers Learn Using GalleryWalk

Level	Mean	Pre-test	Post-test	Mean gain
Low	Mean	29.75	44.88	15.13
	N	8	8	
	SD	2.76	3.72	
Medium	Mean	40.55	49.75	9.2
	N	20	20	
	SD	5.36	4.54	
High	Mean	57.67	61.33	3.66
	N	3	3	
	SD	13.65	5.50	

Table 5 indicated the difference between the pre-test score and post-test scores of students learn using gallery walk. Low scorers had a mean gain of 15.13; medium scorers had 9.2 while the high scorers had a mean gain of 3.66. That is to say that low scorers benefitted most, followed

by the medium scorers and least that benefitted were the high scorers when learn cell division using gallery walk.

Research Hypothesis: There is no significant difference in the achievement of low, medium and high scoring students learn cell division using gallery walk.

Table 6. Ancova analysis showing the achievement of students in low, medium and high scoring groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	620.936[a]	3	206.979	206.979	.000
Intercept	2344.099	1	2344.099	2344.099	.000
Pretest	41.868	1	41.868	41.868	.014
Group	466.453	2	233.226	38.221	.000
Error	164.741	27	6.102		
Total	49035.000	31			
Corrected Total	785.677	30			

R Squared = 0.790 (Adjusted R Squared = 0.767)

A One-way Ancova was conducted to determine statistically significant difference between the achievement of low, medium and high scoring students learn cell division using gallery walk while controlling for pretest. The result of the analysis ($F_{(2, 27)} = 38.22$, $p < .05$) indicated that the p value was less than 0.05. Hence, hypothesis 3 was rejected .This means that, there was a significant difference in the achievement of students across the score levels when learn cell division using gallery walk.

Discussion

Findings from the study revealed that students learn using gallery walk performed better than those learn using conventional method. This result may be due to the fact the gallery walk stations contained pictures of stages in cell division process which most likely facilitated meaningful learning. In addition, students engaged in dialogue on the contents of each gallery walk station thereby learning from each other. The tasks completed by the students may have contributed to their achievement. This result implies that gallery walk instructional strategy could be used to enhance students' achievement in cell division and other similar hard-to-teach and hard-

to-learn topics in biology. This study agrees with the findings of Dinata and Anggraini (2017); Chin, khor and Teh (2015); Lestari (2017); Tan and Alcantara (2017) that gallery walk instructional strategy can be used to improve students understanding of concepts, increase participation of students, foster team work in a subject matter and as such improve their achievement.

It also revealed that there was no significant difference in the achievement of male and female students who were learn cell division using gallery walk instructional strategy. This result may be due to the fact that the pictures on each gallery walk station appealed to both gender equally. The implication of this result is that gallery walk could be used to teach in mixed schools as obtainable in most Nigerian secondary schools. The findings on gender corroborate that of Dania (2014); Daniel (2012); Ugwuadu and Abdullahi (2012) that male and female students benefitted in a similar way when allowed to work in group.

Students at various gallery display stations carrying out learning tasks during the study in the experimental class. Each student group moved from class area (station) 1 to 4 to complete the learning tasks in the stations through brainstorming, sharing ideas, and learning together.
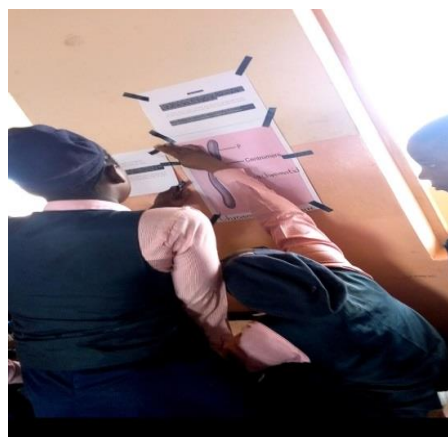
(a)   (b)

Figure 1.The Students Activities in Class Area

The findings on the achievement of low, medium and high scoring students showed that, low scorers benefitted the most, followed by medium scorers and least by high scorers when allowed to work in group. This result may be attributed to the fact that the group of students in each station had different abilities and as such opportunity was created for interaction between the different score levels which might have made the low scorers benefit the most from gallery walk.

The implication of this finding is that gallery walk could be used to enhance the achievement of students in a mixed ability class such as what is obtainable in most Nigerian schools. However, its uses should be in combination with other strategies to take care of the high and medium scorers. The finding agrees with those of Adeoye and Abimbola (2016); Ayanda, Abimbola and Ahmed (2012) who submitted that achievement differed among the groups of low, medium and high scorers.

CONCLUSION

The study concluded that the use of gallery walk as an instructional strategy significantly enhanced the achievement of students in cell division. It was also concluded that the instructional strategy is not gender biased and can be effectively utilized in a mixed gender classroom. Based on the findings from the study, it was also concluded that GWIS should be used with other instructional strategies such as problem solving instructional strategy so as to cater for the medium and high scoring students.

Recommendations, based on the findings of this study, the following recommendations were made, gallery walk instructional strategy should be used by teachers to enhance the achievement of students in hard to teach and hard to learn topics such as cell division. It used to provide equal opportunity for both male and female students to engage in social construction of knowledge process and gallery walk should be used in a mixed ability class.

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