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Motivating Students' Academic Performance and Retention in Chemistry through Asynchronous Learning in Senior Schools.

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ABSTRACT

This study looked at how an asynchronous learning approach impact chemistry students' academic performance and retention in senior secondary schools. All government own co-educational senior secondary schools in three local government areas constituted the population. 180 senior school class 2 chemistry students made up the sample. A quasi-experimental design of pretest, post-test was employed in the investigation. Three null hypotheses were generated for the investigation at 0.05 level of significance. A self-constructed questionnaire consisting of 40 multiple-choice questions called Chemistry Students Performance Test (CSPT) was the instrument utilized for the study. Data collected were analyzed using t-test. Results of the study revealed that students exposed to asynchronous learning approach had better academic performance and retention in chemistry than their counterparts taught using conventional method. The researcher recommended that Government should provide fund and organize seminars and workshops for teachers on the use of asynchronous learning approach. Curriculum planners should incorporate the use of asynchronous tools in chemistry curriculum.

Keywords- Asynchronous, Academic Performance, Retention, Learning, Chemistry, Students.

Aims Research Journal Reference Format:
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1. INTRODUCTION

Science and technology have impacted every aspect of human endeavour in the twenty-first century in varying degrees and dimensions. The fact that man is still alive today is largely due to his understanding of and use of scientific concepts, information, and technical advancements. Lack of ability to appreciate and apply science and technology through developmental efforts is one of the main issues with designing a development strategy for a developing nation like Nigeria (Aina, 2017). Ogunleye & Babajide (2018) assert that as science and technology have made life much easier for people, there is no question about its applicability or significance to sustainable development. Science is the systematic attempt by humans to comprehend the origins and functioning of the natural world, based on observable physical evidence.

It is accomplished by either conducting controlled experiments that mimic natural processes or by keeping an eye out for natural phenomena. Technology is a tool for utilising and harnessing this methodical endeavor. In secondary school education, chemistry is essential since it aims to attain knowledge and give explanations to components in the environment. According to Taber (2014), learning is an individual endeavour in which each pupil must create their own knowledge. In order for learning to be personalized, students must be committed, exhibit interest, and be actively engage in the learning of chemistry concepts in order to comprehend and assimilate the material in a meaningful way. This suggests that when students consider what they have learnt, get interested in the material, and create new knowledge based on what they have understood, learning may be meaningful and productive. Because of this, scientific instruction should be proactive and focuse on the needs of the students in order to promote meaningful learning. Dike (2017) stated that creating curricula is not sufficient; it is even more crucial to set up systems that would guarantee efficient one.

Asynchronous learning is a generic phrase used to describe an online learning among students that do not take place in the same location and at the same time with the teacher. Students learn concepts at their own pace and time. Rido, Prakoso & Perez-Amurao (2023) define asynchronous learning as no time-bound learning which means, teachers and students can do their work from a remote location based on their availability. The above align with the earlier study of Purwati, Suryawati & Eliwarti. (2022) that teachers provide learning materials for the students with more space to study flexibly. Also, asynchronous learners have more control over their schedules, they can still benefit from studying time management skills development. They will get skills in goal-setting, time management, and task division. (Parsad & Lewis, 2018).

According to empirical evidence, students' motivation and interests in science are important factors that promote the key beliefs of academic success and critical thinking in science classes (Jegede, 2017). As a result, students in open and distance learning are motivated to learn independently in e-learning environments based on their level of motivation (Wighting, Liu, & Rovai, 2018; Yukselturk & Bulut, 2017). Therefore, it can be said that motivation is one of the key elements that greatly influences how well pupils study science.

Since there is typically no teacher or counsellor available in e-learning environments to guide and encourage students in their learning process, students studying alone may provide a unique challenge to learners' motivation (Liu, 2017). The shift from four walls of the classroom has brought limits to virtual reality that may create a new normal requires further investigation on impact of asynchronous learning on students' motivation, retention and academic performance in chemistry concepts.

This approach is a "middle-of-the-road teaching technique for instructors desiring to moderate levels of students' participation," according to Jegede (2017). It's possible that the lecture approach is better and suitable if a teachers' main goal is to impact detailed and extensive knowledge to the students. Additionally, it's frequently suggested that classroom learning should allow learners to have ample time to explore learning materials and skills at their own pace if the teacher wants full engagement from every students in each session. This method involves the teachers and students working together to achieve predetermined objectives (Friedland & Millen, 2016). Furthermore, it is a learner-centered approach that gives students the chance to assume accountability for meaningful and in-depth learning.

"The mastering of major concepts and principles, facts, skills, and strategic knowledge" is one definition of performance in education. Performance is occasionally divided more systematically into knowledge components (Resnick, 2017). He further stated that by working through issues, children could pick up new ideas and abilities. Resnick, (2017) went on to say that when kids are allowed to explore and create new skills, such will enhance the learners' practice of what is learnt and there will be an increase in academic performance. Academic performance can be described as an act of successful output, implying that learners accomplished a task with his/her own abilities and efforts. The level of knowledge acquired during teaching/personal learning is measured by the teacher through test and examinations. While the scores obtained by the student would give the grade points, and degrees to be awarded to the student. Performing well academically could mean receiving excellent marks.

Okeke & Ethel-Echedo (2023) described retention as the ability of the learner to remember learned concepts or information over some period of time. A learner who is able to retain what was learnt for a long period has a better probability of being able to recall such information/concept than that who is not able to retain. Several methodological issues have come up for scholars who have attempted to look into the trace decay idea over the years. Accounting for the processes that take place in between learning and recall is one of the main challenges facing researchers. It is obvious that a variety of things can happen in the interval between learning something and remembering it. To overcome this challenge is to determine whether forgetting that occurs is due to knowledge loss rather than a byproducts of a particular thing.

According to Nebo (2013), successful learning transfer is directly correlated with retention. This indicates that strong retention could result in high learning outcomes, which depend on a variety of factors, including the time elapsed between learning and retrieval, the type of instruction employed, and the surrounding circumstances. Furthermore, Ekundayo (2015) demonstrated how the science teaching strategies used resulted in good performance and retention rates among the students.

Students can best develop their decision-making, assessment, and divergent thinking skills using asynchronous learning approach. However, only a few research has been carried out on the relationship between asynchronous learning, retention and academic performance. Prior research indicates that when students view activities as performance-based, they would prioritize outperforming their peers and making an impression on their teachers. Schun & Pintrich, (2018). However, because there isn't real-time instruction between students and teachers in the study, kids can't directly compete with their peers to impress teachers is one alternate source for learning and effective teaching. One possible explanation for the students' low performance in the asynchronous learning environment could be the absence of in-person interactions between students and their peers.

Working with an asynchronous learning approach is similar to group projects. According to Brown (2019), the terms "self-paced" and "group work" refer to a broad range of instruction in which students are given a task that requires self-initiated discourse. It's also critical to understand that self-paced learning typically entails persons having adequate time for inquiry. The kids will have additional possibilities to share knowledge by completing the task. This indicates that the approach is a manner of recognizing and making use of each student's unique talents and areas of expertise when working in small groups to explore a subject over a constrained amount of time and to maximize opportunities

for group projects. While it is evident that synchronous learning is essential in an online learning environment, asynchronous learning is equally important (Chundur & Prakash, 2019). Online asynchronous learning is facilitated by the usage of several forums consisting of Google Classroom, Moodle, Canvas, YouTube and other accessible online platforms, such as emails, PDFs, PowerPoint, audio, and video. These learning tools enable the students to have interaction with the learning resources such as the lectures, audio, videos and task to be performed. Being able to learn online without having to be online at the same time is one of its greatest features of asynchronous learning (Chen, Sun, & Jin, 2019)

The greatest options for those with busy schedules or asynchronous learning styles are online courses. Students are able to accomplish obligations and manage many responsibilities, such as work and education, because asynchronous learning is flexible (Galikyan & Admiraal, 2019). The institutes of study or education possess internet communication platforms that students can access at any time to interact with the teachers, fellow students, and professionals by downloading documents and turning in assignments through the online learning platforms called portals These activities can be reviewed by the teacher, who can also provide feedback on completed work and interact with the students regarding their development. Compared to synchronous learning, all of these are more beneficial and productive because students find it very user-friendly.

Okoro (2019) carried out a study on the use of the asynchronous technique. According to the study's findings, asynchronous learning improves students' academic performance and retention of knowledge as seen in mean scores of the students. Students that adopt this strategy gain in many ways, including increased self-esteem, focused attention spans, and active involvement in the course (Kordaki & Haris, 2019). The approach makes students to take responsibility of the learning environment and actively participate more in the class (Hedeen, 2013). In addition, compared to traditional teaching approaches, student-student interaction increases. Because of this increased engagement, stronger social ties are fostered among students which may result in social vises. It is against the above mentioned, that this study examined the effects of asynchronous learning approach on students' academic performance and retention in chemistry in Ekiti State.

1.1 Statement of the Problem

Numerous reports have surfaced regarding the superb science academic performance of certain secondary school students. However, due to learner variations and other reasons, it is unavoidable that some students are not given enough time to study, reflect on what they have learned, or investigate at their own pace. Schools are losing highly qualified instructors who are always trying to figure out the best ways to teach that which will both meet the needs of a diverse students' body and improve academic performance. The researcher has also seen that many students prefer not to participate in class discussions after learning science concepts through activities that enhance intelligence and learning styles. It is against this, that the study examined the effects of asynchronous learning approach on the academic performance and retention of senior school chemistry students in Ekiti State.

1.2 Research Hypotheses

The following null hypotheses were generated and tested at 0.05 level of significance;

HO_1: There is no significant difference in the academic performance mean scores of students in asynchronous learning and conventional groups before treatment

HO_2: There is no significant difference in the mean scores of students exposed to asynchronous learning approach and conventional groups after treatment

HO_3: There is no significant difference in the retention mean scores of students exposed to asynchronous learning approach and conventional groups after treatment.

2. RESEARCH METHOD

The study employed a pretest posttest, control group quasi-experimental design to determine the effect of asynchronous learning approach on the academic performance and retention of senior school chemistry students in Ekiti State, Nigeria. The population of the study was made up of all senior school class two (SSII) chemistry students in public secondary schools in the three senatorial district in Ekiti. Using multistage technique one local government was sampled from each senatorial district. Secondly, one government own coeducational senior secondary school was then sampled. Furthermore, purposive sampling technique was used to select an intact senior class II (SSII) chemistry students in Ikole, Ikere and Ado-Ekiti. The choice of SSII chemistry students is because these category of students have been taught chemistry in SSI and they are not preparing for Senior Secondary School Certificate Examination. 180 chemistry students constituted the sample for the study.

The instrument used for the study was forty (40) item standardized objective questions named: Chemistry Students Performance Test (CSPT) selected from topics on equilibrium, energy and chemical changes with options A-D. Using split-half method, the reliability coefficient of the instrument was calculated to be 0.74. To administer the instrument, two weeks was used for the pretest, four weeks for the treatment and two weeks for the posttest. Three null hypotheses formulated for the study were tested at 0.05 level of significance while the data collected were analysed using t-test.

3. RESULTS

HO_1: There is no significant difference in the academic performance mean scores of students in asynchronous learning and conventional groups before treatment

Table 1: t-test analysis of academic performance mean scores of students in experimental (Asynchronous Learning) and control (Conventional Teaching) before Treatment.

Strategy	Gender	N	Mean $\bar{x}$	Std. Dev.	df	t_cal	p-value	Remarks
ASYNCHRONOUS	Male	90	18.54	3.989	178	0.512	0.477	NS
	Female	90	16.80	3.002				

P > 0.05 (Result not significant at 0.05 level), NS= Not Significant

As shown in table 1, the experimental (asynchronous learning) and control (Conventional Teaching) groups were statistically compared before the treatment (pre-test), a t-value (t_cal = 0.512) having p > 0.05 alpha level was obtained, which was not significant at 0.05 level. The academic performance mean scores of both groups differ by (18.54 – 16.80) = 1.74. This implies that, there was no significant difference between the experimental and control groups at pre-test. The null hypothesis that states there is no significant difference in the academic performance mean scores of students in asynchronous learning and conventional groups before treatment was upheld.

HO_2: There is no significant difference in the mean scores of students exposed to asynchronous learning approach and conventional groups after treatment.

Table 2: T-test analysis of academic performance mean scores of chemistry students taught using Asynchronous learning approach and students taught using Conventional Teaching method after treatment.

Strategy	N	Mean $\bar{x}$	Std. Dev.	df	t_cal	p-value	Remarks
ASYNCHRONOUS	90	18.54	3.989				
				178	4.93	0.015	*Significant
CONVENTIONAL	90	14.22	2.543				

P < 0.05 (Result significant at 0.05 level) * Significant

Table 2 shows that there is a significant difference between asynchronous learning approach and conventional method groups (t_cal = 4.93, p < 0.05) therefore, the null-hypothesis is rejected. This implies that there is a significant difference between post-test academic performances mean scores of students exposed to asynchronous learning approach and conventional method. The asynchronous learning group has a mean score of ($\bar{x}$ = 18.54) and conventional method ($\bar{x}$ = 14.22).

HO_3: There is no significant difference in the retention mean scores of students exposed to asynchronous learning approach and conventional groups after treatment

Table 3: t-test analysis of retention mean scores of chemistry students taught using asynchronous learning approach and students taught using Conventional method after treatment.

Strategy	N	Mean $\bar{x}$	Std. Dev.	df	t_cal	p-value	Remarks
ASYNCHRONOUS	90	16.80	3.002				
				178	3.91	0.026	*Significant
CONVENTIONAL	90	12.27	2.145				

P < 0.05 (Result significant at 0.05 level) * Significant

The table 3 t-test showed the retention mean scores of students exposed to asynchronous learning approach and conventional method groups after treatment. The findings revealed that t-value (t_{cal} = 3.91) with $P < 0.05$ was obtained, which was significant at 0.05 level. The academic performance mean score difference (16.80 – 12.27) =4.53. This implies that the use of asynchronous learning approach had a significant impact on the retention of concept learning in chemistry after treatment, consequently, the null hypothesis is rejected.

4. DISCUSSION

Comparing the mean score of the experimental (asynchronous learning approach) with the mean score of the control (Conventional method) groups before treatment in hypothesis 1 revealed no significant difference. This implies that chemistry students in both groups had equal comprehension of the concepts in the CSPT. The hypothesis1 that state there is no significant difference in the academic performance mean scores of students in chemistry in asynchronous group approach and conventional method is therefore upheld.

The hypothesis 2 examines the impact of asynchronous learning approach and conventional method of teaching on the academic performance of chemistry students after treatment in Ekiti State. The result revealed that chemistry students taught using asynchronous learning approach (experimental group) had significantly higher academic performance than their counterparts taught using conventional method (control group). This implies that the hypothesis is rejected, means the experimental group had better academic performance than their counterparts taught using the conventional method. This may be due to the students' ability to access the learning materials continuously and repeatedly at their own pace. This agrees with the statement of Chen, Sun, & Jin, (2019) that the asynchronous learning approach enables students have access to learning resources such as lecture materials, audio, videos among others resulting in a close relationship.

Research hypothesis 3 seek to find out the difference in mean scores of retention of chemistry students taught using asynchronous learning approach (experimental group) and conventional method (control) groups. The findings revealed that there was a significant difference between the retention mean scores of students exposed to asynchronous group approach and conventional method after treatment. This implies that chemistry students exposed to asynchronous learning approach had better retention than their counterparts taught using conventional method. The hypothesis 3 was therefore rejected.

The findings align with the submission of Brown ((2019), Chen, Sun, & Jin, (2019). opined that, teaching methods or approaches, especially in the learning of science and technology are expected not only to enable students acquire knowledge but to retain same over a long period of time. Such learning can assist in improving the understanding, critical thinking skills, problem solving skills, communication skills of learners, increase the involvement of learners, both individually and socially, in exploring and critically solving problems. Kordaki & Haris, (2019) also stated that teachers are of the view that students are more attentive, more collaborative, and more intellectually engaged in science when using asynchronous tools in learning and thus students' interest is enhance in science. The above accounts for a better academic performance by the asynchronous learning group.

Galikyan & Admiraal, (2019), asserted that the flexibility of asynchronous learning allow the students to learn at their own pace and time.

5. CONCLUSION

The study focused on the impact of asynchronous learning approach on the academic performance and retention of chemistry students in senior schools class 2 in Ekiti State, Nigeria. Base on the findings of the study, it can be concluded that asynchronous learning approach is more potent in stimulating chemistry students' interest resulting in better academic performance due to longer retention of concepts among chemistry students is superior to the conventional method. Therefore, in order to further increase better learning outcomes in chemistry, teachers should employ asynchronous learning approach.

6. RECOMMENDATIONS.

Based on the findings, the researcher considers the following recommendations necessary:

1. Chemistry teachers should undergo seminars and workshops on the use of online learning/teaching in the subject.
2. Government at all levels should provide the enabling facilities and fund for use by chemistry teachers in asynchronous learning.
3. Curriculum planners should introduce some asynchronous learning approach in chemistry curriculum to enable teachers to be familiar with such teaching methods.

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