GASPRO INTERNATIONAL JOURNAL OF EMINENT SCHOLARS, VOL.12 NO 3
OCTOBER 2025, GERMANY. ISSN: 2630-7200 (Hardcopy), 2659-1057 (Online)

ATUTOR LEARNING MANAGEMENT SYSTEM, ACADEMIC PERFORMANCE AND RETENTION OF SECONDARY SCHOOL STUDENTS IN BIOLOGY IN UYO, AKWA IBOM STATE

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ABSTRACT

The study sought to examine the effect of ATutor LMS, academic performance and retention of secondary school students offering Biology in Uyo Local Government Area. Three research questions and three hypotheses were formulated to guide the study. The study adopted Quasi-experimental design using the pretest post-test non randomized control group design. The population comprised all the 3,183 Senior Secondary Two (SS II) students offering Biology in all the 15 public secondary schools in Uyo Local Government Area of Akwa Ibom State during 2024/2025 academic session. Purposive sampling technique was used in selecting a sample size of 102 students for experimentation and control. The experimental group was taught using ATutor LMS while the control group was taught using Expository method. An instrument called 'Biology Performance Test (BPT)' was used to pretest and posttest the students. The instrument was face and content validated by three validates in Faculty of Education, University of Uyo. Split half method and Kuder-Richardson formula-21 (KR-21) were used in determining the reliability of the instrument which had a reliability coefficient of 0.87. The data obtained from the pretest, posttest and retention test were analyzed using mean, Standard Deviation to answer all the research questions and Analysis of Covariance was used to test all the hypotheses at .05 significant level. The result indicated a significant difference in the mean performance scores of students in Biology when taught using ATutor LMS and expository method. The result also indicated a no significant difference in the mean performance scores of male and female students taught pollution using ATutor LMS and expository method. The study also revealed a significant difference in mean retention scores of students taught using the two instructional strategies. It was concluded that ATutor LMS is more effective and students retained concept better when taught with ATutor LMS than the expository method. Based on the findings, it is recommended among others, that Biology teachers should make effective use of ATutor LMS in teaching the concept of Pollution so that student's performance will be enhanced.

Keywords: A Tutor LMS, Biology and academic performance.

INTRODUCTION

Biology is a vital subject that plays a crucial role in understanding the intricacies of life and the natural world. It is important extends to various aspects of our lives, including medicine, environmental conservation, agriculture, and biotechnology. By studying biology, students will gain insights into the functioning of living organisms, the interconnectedness of ecosystems and the impact of human activities on the environment. This knowledge will enable students to develop innovative solutions to pressing global challenges, such as disease prevention, sustainable resource management and conservation of biodiversity. Ultimately, biology enables students to make inform decisions and actions, empowering them to promote human health, environmental sustainability and a better future for all.

The study of biology in secondary schools enable students to gain a deeper understanding of the living world, from the tiny Pollution that make up the body to the ecosystems that spark curiosity, creativity and a passion for science. Biology can also open doors to exciting career opportunities in fields like medicine, environmental science, research and conservation. The teaching of biology will instill in students' essential skills like critical thinking, problem-solving and analytical thinking which can benefit them in many areas of life. Despite this importance, students' performance in the subject is not encouraging. Each educational sector apportioning blame on teachers and teaching methods. Presently, it has been observed by the researcher that most secondary school teachers in Uyo are completely relying on the expository teaching strategy. Expository learning strategy is a teaching strategy where information is presented to learners in a structured and direct manner. This strategy emphasizes the delivery of content through explanations without demonstrations and descriptions by the teacher. The primary goal is to convey information and concepts efficiently, allowing students to absorb and understand the material without the need for extensive exploration or discovery on their own. Science teachers embraced this method for easy coverage of the school syllabus. The complete reliance of this teaching strategy could be responsible for this poor performance of students both internally and externally.

Students' academic performance refers to the level of achievement or proficiency that a student has attained in their educational pursuits. It is typically measured through a variety of assessments, including examinations, quizzes, assignments, projects, and classroom participation (Fred, 2021). Students' academic performance is often quantified using grades or scores that reflect a student's understanding, skills, and competencies in various subjects. It is measured by the final grades or scores earned during a course of study. Higher scores indicate better academic performance (Opara, 2022). To enhance students' performance in Biology, there are other innovative teaching platforms like ATutor that can be used by teachers in teaching Biology concepts to enhance students' performance.

ATutor is an open source, online learning environment used to develop web-based courses, author e-learning content, and present instructional materials on the internet. ATutor is an acronym coined from the place of development. It was developed at Adaptive King Technology Resource Centre University of Toronto (Sobowale, *et al*. 2020). Adaptive Technology University of Toronto was shortened to ATutor. ATutor supports self-directed learning because it enhances students' ability to set an appropriate pace for learning and get assistance from various resources, thereby enhancing their academic performance. ATutor is unique for providing versatile spaces open for collaboration

among students with support from the tutors especially as the students chat online. ATutor is a Learning Management System (LMS) platform that provides a comprehensive framework for delivering educational content, facilitating communication and tracking students progress, thereby supporting a more interactive and personalized learning experience (Yusuf and Balogun, 2020). Among the various LMS platforms available, A Tutor stands out for its flexibility, user-friendliness and robust features that cater to both educators and students. ATutor is an open-source LMS that allow educators to create and manage online courses, integrate multimedia content and assess students learning through quizzes and assignments. ATutor platform gives students access to learning materials at their own pace, allows them to participate in discussions and receive feedback on their performance. According to Wang and Xu (2022), ATutor is effective in presenting complex concepts through interactive session thereby enhancing students' understanding and retention of the concepts taught. A Tutor learning management system interface is easy and simple to use. ATutor is an effective platform for teaching and learning because it enables group conversations, multimedia file sharing, easy access to conversion history and is accessible for individuals. ATutor LMS allows for immediate synchronous communication and maximal mobility (as it is installed on mobile phones), and is highly accessible to the general populace, including teachers who may perceive it. Application of ATutor LMS into teaching and learning of Biology helps to facilitate students' learning effectiveness and academic performance. According to Gachago (2015), ATutor LMS can be used to create immediate connections, encourage reflection and facilitate coordination in informal and formal learning. In addition, Mtebe (2015) posited that ATutor is a useful electronic tool that can facilitate information sharing. ATutor LMS served as a tool for bridging access to learning resources, rendering peer-based and hierarchical support, leveraging on-task behaviour and enhancing meaningful context-free learning. However, to make learning to be student-centered, ATutor as online learning platforms have been observed to enable educators to design online courses in which the students can access anytime like a virtual classroom (Chukwuemeka *et al*. 2015). Students may be intellectually and physically capable to learn but may never learn until their interest is aroused through an active approach of teaching. In line with this, Freeman *et al*. (2014) posited that active learning strategies have been shown to improve students understanding and retention of subject matter, leading to higher academic performance. Researches from Sobowale, *et al*. (2020), Ugbaga, and Simon, (2023) and Basil *et al*., (2021), revealed that students taught with LMS platforms performs better than those taught with expository method.

Apart from teaching strategy, gender is another factor that hinders students' performance. Gender is defined as a wide range of biological, behavioural, physical and mental characteristics regarding and differentiating the female and male population (Okeke, 2020). Gender is an aspect concerning the responsibilities, roles, opportunities, constraints and needs of males and females in all aspect of social context (Omotosho, 2019). Researches from Oludipe (2019), Adigun *et al.* (2019), Gongden and Gongden (2019) found no statistically different in the mean performance scores of male and female students while researches from Dorathy (2015) and Iloputaife *et al.* (2016) found out in their studies that gender had significant difference on students' academic performance in science.

Retention of learnt concept is another factor that hinders students' performance. Retention is the ability to hold, keep or recall past experiences and reproduce a learnt concept when the need arises. Bukunola and Idowu (2015) posited that retention is an important variable in learning because only a learnt experience is recalled and learning cannot be said to have taken place if there is no proper

retention. The ability of learners to recall past learnt basic science concept as an objective of basic science teaching and learning process may likely enhance good performance in the subject. According to White (2018), retention is a wonderful trait of human being and it is very important to educators because of the role it plays in teaching and learning process as the yardstick for measuring content learnt. Retention function is a process which begins from the time of receipt of information to the time of recall and usage. Research from Maria (2018) revealed equal performance in terms of retention in gender while research of Tukura *et al*. (2020), revealed that the use of e-learning platform has positive effect on student's retention than the expository classroom.

STATEMENT OF THE PROBLEM

Effective teaching and learning of Biology in secondary schools is an issue of great concern to stakeholders in the educational sector. Despite the importance of Biology in life, industrial and technical development, researchers have continually documented reports of poor performance of students in Biology. The Poor performance of students in Biology in external examination has been attributed to several factors among which is the poor instructional delivery methods adopted by teachers during classroom instruction. In view of this, Biology teachers have continued to search for better instructional delivery methods that will provide the bridge between unfamiliar concepts and prior knowledge to improve students' performance and retention in Biology. It is on this basis that the researcher is investigating the effect of ATutor LMS on students' academic performance and retention in Biology. Can the performance and retention of students in Biology be enhanced when ATutor LMS is used in teaching the concept of Pollution? This study seeks to answer this question.

PURPOSE OF THE STUDY

The aim of this study is to determine the difference in the performance of students taught the concept of Pollution using ATutor LMS and those taught using Expository method in Biology in Uyo Local Government Area. Specifically, the study sought to;

1. determine the difference in the mean performance score of students taught the concept of Pollution using ATutor and expository methods.
2. compare the mean performance scores of male and female students taught the concept of Pollution using ATutor and expository methods.
3. determine the difference in the mean retention score of students taught the concept of Pollution using ATutor and expository methods.

RESEARCH QUESTIONS

To accomplish the purpose of this investigation, the following research questions guided the study;

1. What is the difference in the mean performance scores of students taught the concept of Pollution using ATutor and expository methods?
2. How does the mean performance scores of male and female students differ when taught the concept of Pollution using ATutor and expository methods?
3. What is the difference in the mean retention score of students taught the concept of Pollution using ATutor and expository methods?

Research Hypotheses

The following hypotheses guided the study and were tested at 0.05 level of significance;

1. There is no significant difference in the mean performance score of students taught the concept of Pollution using ATutor and expository methods.
2. There is no significant difference in the mean performance scores of male and female students taught the concept of Pollution using ATutor and expository methods.
3. There is no significant difference in the mean retention scores of students taught the concept of Pollution using ATutor and expository methods.

Methodology

This study adopted quasi-experimental research design. Specifically, the non-randomized pre-test-posttest control group design was used. This study was carried out in Uyo Local Government Area of Akwa Ibom State. Uyo is the state capital of Akwa Ibom State, Nigeria. The population size of this study was 3,183 SS II students from the fifteen public secondary schools in Uyo Local Government Area during the 2024/2025 academic session. 102 (50 male and 52 female) SSII students formed the sample size of the study. The sample were drawn from two (2) intact classes from one co-educational public secondary school in Uyo. Purposive sampling technique and simple random sampling technique of balloting was used in selecting the school from the fifteen co-educational public secondary schools in Uyo.

One researcher-made instrument tagged: Biology Performance Test (BPT) was used for data collection. BPT was designed to measure the students' performance in the concept of Pollution and was also used to test for students' retention. The instrument contained twenty (20) multiple choice items with four options A – D. Each correct option carries 5 marks giving a total 100%. This instrument was re-shuffled and used for post-test and retention test respectively. The instrument was subjected to face and content validation. To ascertain the reliability of the Biology Performance Test (BPT), the instrument was trial tested on 30 Biology students in a school not selected for the study but part of the population. The data obtained was analyzed using the Kuder Richardson (K-21) formula and the reliability coefficient of 0.87 was realized, indicating that the instrument was reliable and capable of measuring the intended knowledge with consistency. The data collected from the study were analyzed using Mean and Standard deviation to answer the research questions and Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. In testing the null hypotheses, if the calculated probability value is less than the significance level of 0.05 the null hypothesis was rejected and if the calculated probability value is greater than the significance level of 0.05 the null hypothesis was upheld

DATA ANALYSIS AND RESULTS

RESEARCH QUESTION 1: What is the difference in the mean performance scores of students taught the concept of Pollution using ATutor and expository methods?

The result of the analysis is presented in Table 1

Table 1: Mean and Standard Deviation of Pre-test and Post-test Scores of SS II Students taught the concept of Pollution using ATutor and expository methods

Treatment Groups	n	Pretest $\bar{X}$	Pretest SD	Posttest $\bar{X}$	Posttest SD	Mean Gain Difference

ATutor *(Experimental)*	52	14.82	5.43	76.62	9.84	61.8	7.53
Expository *(Control)*	50	14.71	5.36	68.98	7.22	54.27	
Total	**102**						

Data in Table 1 revealed the pre-test and post-test mean scores of experimental students taught Biology with ATutor of 14.82 and 76.62 and their respective standard deviations of 5.43 and 9.84. The result further shows the pre-test and post-test mean scores of students taught using expository method of 14.71 and 68.98 and their respective standard deviations of 5.36 and 7.22 respectively with mean difference of 7.53 between the two treatment groups. This means that use of ATutor method in teaching the concept of Pollution enhanced students' performance than expository method.

Research Question 2: How does the mean performance scores of male and female students differ when taught the concept of Pollution using ATutor and expository methods?
The result of the analysis is presented in Table 2

Table 2: Mean and Standard Deviation of Pre-test and Post-test Scores of SS II male and female students taught the concept of Pollution using ATutor and expository methods

Treatment Groups	Gender	n	Pre-test $\bar{X}$	Pre-test SD	Post-test $\bar{X}$	Post-test SD	Mean Gain	Mean Diff.
ATutor	Male	26	12.46	3.12	45.82	5.28	33.36	0.62
	Female	26	12.92	3.58	45.66	5.02	32.74	
Expository	Male	24	12.03	3.36	45.46	5.46	33.43	0.43
	Female	26	12.00	3.01	45.86	5.06	33.86	
	Total	**102**						

Data in Table 2 revealed the pre-test and post-test mean scores of male students taught the concept of Pollution with ATutor methods of 12.46 and 45.82 and their respective standard deviations of 3.12 and 5.28. The result further shows the pre-test and post-test mean scores of female students taught using ATutor of 12.92 and 45.66 and their respective standard deviations of 3.58 and 5.02 respectively with mean difference of 0.62 between the two treatment groups (male and female). This

means that use of ATutor in teaching the concept of Pollution enhanced male and female students' performance equally.

Data in Table 2 also revealed the pre-test and post-test mean scores of male students taught the concept of Pollution with Expository method of 12.03 and 45.46 and their respective standard deviations of 3.36 and 5.46. The result further shows the pre-test and post-test mean scores of female students taught using expository method of 12.00 and 45.86 and their respective standard deviations of 3.01 and 5.06 respectively with mean difference of 0.43 between the two treatment groups (male and female). This means that use of expository method in teaching the concept of Pollution enhanced male and female students' performance equally. In summary, the use of ATutor LMS and expository method in teaching the concept of Pollution enhanced male and female students' performance equally.

Research Question 3: What is the difference in the mean retention score of students taught the concept of Pollution using ATutor and expository methods?
The result of the analysis is presented in Table 3

Table 3: Mean and Standard Deviation of Post-test and retention scores of SS II Students taught the concept of Pollution using ATutor and expository methods

Treatment Groups	n	Post-test $\bar{X}$	Post-test SD	Retention $\bar{X}$	Retention SD	Mean Gain Diff.
ATutor *(Experimental)*	52	76.62	9.84	88.02	10.08	11.4 4.12
Expository *(Control)*	50	68.98	7.22	76.26	9.02	7.28
Total	**102**					

Data in Table 3 revealed the post-test and retention scores of students taught Biology with ATutor LMS of 76.62 and 88.02 and their respective standard deviations of 9.84 and 10.08. The result further shows the post-test and retention scores of students taught using expository method of 68.98 and 76.26 and their respective standard deviations of 7.22 and 9.02 respectively with mean difference of 4.12 between the two treatment groups. This means that experimental students retained concepts taught using ATutor method better than those taught using expository method.

Testing of Hypotheses

Hypothesis I: There is no significant difference in the mean performance score of students taught the concept of Pollution using ATutor and expository methods.

Table 4: Summary of ANCOVA analysis of SS II students taught the concept of Pollution using ATutor method and those taught using expository method (n=102).

Source	Type III Sum of Squares	df	Mean Square	F	P-value	Decision	Corrected
Model	4845.047	2	2422.524	37.431	.000		
Intercept	33875.578	1	33875.578	523.423	.000		
Pre-test	5.276	1	5.276	.082	.776		
Instructional_strategies* Pretest	4778.051	1	4778.051	73.827	.000		Sig.
Error	12749.708	99	64.719				
Total	683799.000	102					
Corrected Total	17594.755	101					

The result of ANCOVA analysis in Table 4 reveals that {F-ratio (2, 102) is 73.827, p=.000<0.05}. The implication of this, is that the significant value (.000) was found to be less than the alpha value (0.05) in which the decision was based. With this result, the null hypothesis of no significant difference in the mean performance score of students taught the concept of Pollution using ATutor and those taught with expository method was rejected. This implies that there is a significant difference in the performance score of students taught the concept of Pollution using ATutor and expository methods. The result points to the fact that the experimental group taught with ATutor method had a significant performance over the control group which is the expository group.

Hypothesis II: There is no significant difference in the mean performance scores of male and female students taught the concept of Pollution using ATutor and expository methods.

Table 5: Summary of ANCOVA analysis of SS II male and female students taught the concept of Pollution using ATutor method and those taught using expository method (n=102).

Source	Type III Sum of Squares	df	Mean Square	F	P-value	
Decision						
Corrected Model	11.177	2	5.589	.101	.904	
Intercept	21246.744	1	21246.744	382.893	.000	
Pretest	5.859	1	5.859	.106	.746	
Instructional strategies_ Gender*Pretest	7.741	1	7.741	.139	.710	N/Sig.*
Error	5382.533	99	55.490			
Total	398899.000	102				
Corrected Total	5393.710	101				

The result of the ANCOVA analysis in Table 5 reveals that {F-ratio (2, 102) = .139,

p=.710>0.05}. The implication of this is that the p-value (.710) was found to be greater than the alpha value (0.05) which the decision was based. With this result, the null hypothesis of no significant difference in the mean performance scores of male and female students taught the concept of Pollution using ATutor and expository method was retained. This implies that there is no significant difference in the mean performance scores of male and female students taught Pollution using ATutor and expository methods. The result points to the fact that both male and female students in the two treatment groups performed equally.

Hypothesis III: There is no significant difference in the mean retention score of students taught Pollution using ATutor and expository method.

Table 6: Summary of ANCOVA analysis of mean retention of SSII Students taught the concept of Pollution using ATutor method and those taught using expository method (n=102).

Source	Type III Sum of Squares	df	Mean Square	F	P-value	Decision
Corrected Model	280.561	2	140.281	1.975	.144	
Intercept	11601.593	1	116010.593	163.321	.000	
Posttest	.248	1	.248	.003	.953	
Instructional strategies*	279.725	1	279.725	6.938	.001	Sig.* Retention_Posttest
Error	6890.439	99	71.035			
Total	284900.000	102				
Corrected Total	7171.000	101				

The result of the ANCOVA analysis in Table 6 reveals that {F-ratio (2, 102) =6.938, p=.001<0.05}. The implication of this is that the p-value (.001) was found to be less than the alpha value (0.05) which the decision was based. With this result, the null hypothesis of no significant difference in the mean retention score of students taught Pollution using ATutor and expository method was rejected. This implies that there is a significant difference in the mean retention score of students taught Pollution using ATutor and expository methods. This result is an indication that significant difference exists in the mean retention score of students taught Pollution using ATutor and expository methods.

Results and Discussion

The result of the analysis of the difference in the mean performance score of students taught Pollution using ATutor LMS and those taught using expository method revealed that there is a significant difference in the mean performance score of students taught Pollution using ATutor and expository method. This result can be attributed to the fact that ATutor LMS offers interactive learning environment where students engage with content through various multimedia tools, such as videos, quizzes and discussion forums. This interactivity fosters active learning, which is more effective than

the passive learning that typically occurs in the expository instruction. This finding is in line with the position of Freeman *et al*. (2014) who posited that active learning strategies have been shown to improve students understanding and retention of subject matter, leading to higher academic performance. Researches from Sobowale, *et al*. (2020), Ugbaga and Simon, (2023) and Basil *et al*., (2021), revealed that students taught with LMS platforms performs better than those taught with expository strategy.

The result of the analysis of the difference in the mean performance score of male and female students taught the concept of Pollution using ATutor LMS and those taught using expository method revealed that there is no significant difference in the mean performance score of students taught Pollution using ATutor and expository method. The reason could be that both students were exposed to the same instructional strategies and same content at the same time. Therefore, gender does not have a strong effect on students' performance. This outcome is in tandem with the findings of Oludipe (2019), Adigun *et al*. (2019), Gongden and Gongden (2019) whose findings revealed a no significant difference in academic performance of male and female students. However, this study is contrary to the findings of Dorathy (2015) as well as Iloputaife *et al.* (2016) who found that gender had significant difference on students' academic performance in science.

The result of the analysis of the difference in the retention score of students taught the concept of Pollution using ATutor LMS and those taught using expository method revealed that there is a significant difference in the retention score of students taught Pollution using ATutor LMS and expository method. The findings could be attributed to the fact that ATutor LMS offers students the opportunity to access learning materials irrespective of time and location. It may also be that ATutor LMS was able to develop the students as independent learners, who worked at their own pace and level. The outcome of this study supports the finding of Tukura *et al*. (2020), whose study revealed that the use of e-learning has positive effect on student's retention and performance in favour of the experimental group. The reason for this result could be to the fact that LMS incorporate game-like features, making learning more engaging and with fun, which led to increase in students' retention. When students are actively involved in the teaching-learning process, it aids their retention in concepts taught. The finding of this study contradicts with that of Maria (2018), whose findings revealed that neither male nor female students in the two groups retained significantly better than the other in Biology after treatment.

CONCLUSION

Based on the findings of this study, it was concluded that the use of ATutor LMS in teaching the concept of Pollution was more effective in facilitating students' academic performance and retention than expository method. Gender and was not a significant determinant of students' performance.

RECOMMENDATIONS

Based on the findings and the conclusion drawn, the following recommendations were made:

i. Biology teachers should utilize ATutor LMS effectively in teaching the concept of Pollution.
ii. Government in conjunction with other professional bodies like Science Teachers Association of Nigeria and State Ministry of Education should endeavour to organize and sponsor regular workshops, seminar and conferences to train science teachers on the use of LMS platforms.

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