SCHOOL LOCATION AND SCHOOL TYPE AS DETERMINANTS OF ACADEMIC PERFORMANCE OF SENIOR SECONDARY SCHOOL BIOLOGY STUDENTS EXPOSED TO CHATBOT AI OR EXPOSITORY METHOD

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ABSTRACT

The study analyzed school location and school type as determinants of academic performance of senior secondary school biology students exposed to chatbot ai or expository method. This study adopted a quasi-experimental pretest post-test non randomize control group design. This research will be conducted in Akwa Ibom State. The population of this study consisted of 30,985 Senior Secondary School two students offering Biology as a subject in 227 Secondary schools in Akwa Ibom State, Nigeria. A total number of 600 senior secondary school three male and female in sciences offering biology as a subject (280 males and 320 females) were divided into control and treatment groups. The researcher developed instrument called Biology Performance Test (BPT). They validation was done through content, and face validity. The researcher then incorporated all corrections into the work. Kuder-Richardson formula 21. test-retest method was used to accessed the reliability at 0.05 level of reliability. Descriptive Statistics of Mean and Standard Deviation was used to present data for answering research questions. The study showed that urban and rural students performed equally high when exposed to Chatbot AI. And also, that mixed and single sex school students performed equally high when exposed to Chatbot AI. It was also revealed in the study that school location and school type did not significantly affect academic performance in Biology of students exposed to Chatbot AI. On this basis the study concluded that the utilization of Chatbot AI in teaching and learning Biology concepts is more effective than the use of traditional expository method because Chatbot AI engages students in interactive conversations, provide immediate feedback and reinforce biological knowledge which can encourage critical thinking in the students thereby improving their academic performance in Biology. One of the recommendations made was that Akwa Ibom State governments should provide in-service training and professional development opportunities for educators to effectively utilize Chatbot AI technology in the classroom. This can lead to a more educated, updated and skilled workforce.

KEYWORD: School Location, Types, Academic Performance, Senior Secondary School, Biology, Student, Chatbot AI, Expository Method

INTRODUCTION

Chatbot's potential impact on Biology and other fields is immense as it can answer life biological science questions, become a useful learning tool and act as an assistance teacher. But its effectiveness may depend on how it is integrated into the curriculum and the

support students receive from teachers. Chatbot AI for Biology, as established by Hassoun, et al. (2022) will be the cross-cutting technology that will enhance our ability to do biological research at every scale. Biologist anticipate that Chatbot AI will transform biological science in the twenty-first (21st) century, just as statistics did in the 20th century. Chatbot AI can reinforce biological concepts by providing concise explanations and examples which can enable students to review and revise key topics by posing questions to the Chatbot. It can break biological terminologies into bits, establish higher engagement, and create a more interactive and immersive learning environment, which can help students better understand the concept. It can also offer additional information or prompt students to think critically about the subject matter, consolidating their understanding (Cunningham-Nelson et al 2019).

The one- way communication from teacher to students in expository teaching method is not doing students any good, it leads to passive learning, limited engagement and encourages memorization in the place of retention. As established by Llic and Markovic (2016) as well as Bii (2013), there are several benefits associated with implementing Chatbot AI in education, such as reduced costs, quicker response times, enhanced enthusiasm, better interaction, personalized and creative learning, and improved efficiency when used in instruction. Chatbot AI has significant educational potential and positive impact on student learning and can improve student retention and satisfaction through its personalized learning support (Winkler and Söllner, 2018). It can offer immediate, interactive and continuous support service to students, serving as a virtual tutor or study partner. Students can receive prompt and adequate support when needed, even in situations where receiving immediate human assistance is or may be impossible. (Garcia-Brustenga et. al, 2018; Winkler and Söllner, 2018).

The location of a school (Urban and Rural), can potentially impact students' utilization of Chatbot AI and have implications on their academic performance (Lee, Hwang and Chen, 2022). Urban schools generally have better access to technology infrastructure and resources compared to rural schools. This could mean that students in urban areas may have greater opportunities to use Chatbot AI and other technological tools for learning. In contrast, students in rural areas may have limited access to technology, leading to reduced utilization of Chatbot AI. Students in urban areas are typically exposed to technology from their early days as hence the name Gen-Z and they may have more familiarity and comfort with digital tools while their counterpart in the rural areas may have less exposure to technology which could result in lower levels of engagement with Chatbot AI (Chen and Lee 2023). "When technology is created off the back of those data, it ends up benefiting urban populations and so you have a situation where rural data are being used to enrich urban lives". Reliable internet connectivity is crucial for effective utilization of Chatbot AI, urban schools generally have better internet infrastructure and higher internet speeds, ensuring smooth utilization of Chatbot AI. In comparison, rural schools may face challenges with internet connectivity even if they have infrastructure which may limit or disrupt students' usage of technology like Chatbot AI. Moreover, it is essential to note that while Chatbot AI can provide valuable support, it should not replace human Biology teacher entirely but its effective utilization can promote students' retention.

Retention of curriculum learned is a challenge that persists in education, even though many methods help students maintain their knowledge. In this era of digitization, to transform the educational possibilities to ensure knowledge is transferred and retained, teaching methods should be upgraded from teacher-centered to students-centered. The effect of technology on motivation and retention has covered a wide range of subjects. Teachers must find different ways to teach the appropriate materials in a way that students can retain the requisite knowledge and transfer same due to demands of standardized tests. AI technologies such as Chatbots which have the ability to mimic human conversation can offer personalized services which can create an unforgettable experience, enough to help students in retention (Dutta, 2017). Chatbot AI may help provide all needed academic supports to make students' livelihood easier including tailored lesson, timely feedback, learning resources, enhancing retention and academic performance irrespective of the school type.

STATEMENT OF PROBLEM

The traditional educational system faces several issues, including overcrowded classrooms, absence of personalized attention for students, varying learning paces and styles, and the struggle to keep up with the rapid expansion of information and technological advances. In the past four years, COVID-19 has wreaked havoc on several sectors around the world. Even the educational sector, which is considered to be relatively stable and less volatile could not escape the impact of the epidemic. In order to ensure that education was not interrupted again, many modifications have been made in education around the world such as the conversion of conventional classrooms setting to virtual learning or merging of both in a mixed learning method to achieve a win–win situation.

OBJECTIVE OF THE STUDY

- Verify the difference in academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those taught with expository method based on school location.
- Find out the difference in academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those taught with expository method based on school type.

RESEARCH QUESTION

- What is the difference in academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those taught with expository method based on school location?
- What is the difference in academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those taught with expository method based on school type?

RESEARCH HYPOTHESIS

- There is no significant difference in the academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those taught with expository method based on school location.
- There is no significant difference in academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those taught with expository method based on class size.

CONCEPTUAL REVIEW

CHABOT AI AND ACADEMIC PERFORMANCE

In recent times, educators in Nigeria have been increasingly concerned about the need to improve on the academic achievement of students. Parents, teachers and society in general are worried and apprehensive about the best way to improve students' academic standards, achievement and performances, and that is where the utilization of recent technologies like Chatbot AI come in. The results of the study conducted by Wu, and Yu (2023) indicate that AI Chatbots had a large effect on students' learning outcomes. Moreso, AI Chatbots had a greater effect on students in higher education, compared to those in primary education and secondary education. In addition, short term interventions were found to have a stronger effect on students' learning outcomes than long term interventions. It could be explained by the argument that the novelty effects of Chatbots AI could improve learning outcomes in short interventions, but it may be worn off in the long interventions. Beyond academic performance, AI Chatbots have also been instrumental in building relationships with students. As schools engage more students, Chatbots become smarter and better at fostering connections. These relationships play a critical role in driving student retention, reducing summer melt, and improving graduation rates when implemented effectively.

The fall of 2018, California State University System (CSUN) opted to test CSUNny by allowing half of all first-time freshmen access to the Chatbot and measuring their success against a control group that did not use CSUNny. Three years later, in the fall of 2021, students who were given access to CSUNny were "significantly more likely" to still be enrolled at the university and were more likely to have already graduated (5.6 percent) than their control group counterparts (3.6 percent). Similar success was found by Georgia State University, one of the first institutions to use a Chatbot with the stated goal of reducing summer melt by staying in contact with students when they were away from campus. Pounce, Georgia State's Chatbot, reduced summer melt by 22 percent and has continued to evolve since then. In 2021, Pounce was offered to a group of political science students to remind them of upcoming exams, assignment deadlines and more. Students who used the Chatbot received better grades and were more likely to pass than those who did not. There is significant and diverse literature on what drives student success in the classroom. Scholars have looked at such factors as the impact of different types of instructors (Miskolczi and Rakovics 2018). The utilization of the Chatbot AI has been observed to have a positive impact on academic performance by enhancing learning motivation. Effective and ethical employment of Chatbot AI plays a significant role in promoting educational progress and enhancing academic achievement among students. Researches have shown that active

engagement in Chatbot AI can improve students' critical thinking skills and promote their problem-solving abilities thereby contributing to a better academic performance.

CHATBOT AI AND SCHOOL LOCATION

The digital divide, characterized by disparities in access to and use of technology, presents a significant challenge in education. School location refers to where a given school is situated. It could be in an urban or rural area. A lot of researches had been carried out in respect to school locations and some hold the view that location influences the academic achievement of students in such a school. It is observed that schools located in the urban areas tend to have more facilities, manpower, government attention, etc. as against those located in the rural areas.

A study by Afzal, Khan, Daud, Ahmad, and Butt, (2023) reveal that disparities in household internet access were observed between rural and urban areas, with rural areas experiencing lower connectivity. This means that urban schools may have better access to stable internet connectivity and a wider range of digital devices, allowing for more seamless integration of Chatbot AI into the classroom. Personalized learning is best in larger classrooms helping address individual needs, most schools in the rural areas have larger classes as most schooling is free. Chatbot can provide a virtual learning assistant and bridging digital divide ensuring equal educational opportunities for rural students. Chatbot AI can be used to provide professional development support and utilized to provide ongoing training and support for rural teachers, who may have fewer opportunities for in-person professional development.

CHATBOT AND SCHOOL TYPE

Today, even though most of the schools in the country are coeducational schools, single sex schools are again dominating the society. Research studies have shown that students‟ academic performance depends on many factors such as learning facilities, gender, age differences and school type, etc. (Hansen, 2000; Karunanayake, 2000; Karunanayake and Vimukthi, 2020). So, school type can be taken as one of the influential factors for students‟ academic performance. Some believe that coeducational schools benefit boys, because girl have a "civilizing" effect on the otherwise unruly behavior of boys, especially in the early years of secondary school.

Meanwhile, many parents see boys as distracting their daughters from concentrating on their studies, so they prefer girls to attend an all-girls school where they are not faced with this issue. According to the teacher's perspective, "most of the time, boys don't give girls a chance to participate in academic and extra-curricular activities because boys are known to steal the attention of teachers". Also, children who are attending single-sex schools tend to perform better than their co-educated peers across several educational outcomes. Single-sex environment meets the needs of boys and girls, allowing them to mature at their own pace, makes greater provision for gender role modelling, and address the unique learning styles and interests (Single-sex education, en.wikipedia.org/wiki/single-sex-education). As boys and girls are biologically different, they learn differently, need significantly different teaching methods, and therefore they need single-sex classes if they are to learn effectively.

Competition between girls and boys is more evident in the mixed-gender classrooms and there is the tendency to prove the advantage and supremacy of gender identity (Jackson and Bisset, 2005).

Separate-sex school settings are the best way to teach children, with decreased and fewer distractions to learning. Moral and character education is more effective in a single-sex-environment. Girls felt more confident, exercise leadership, experienced freedom from the caustic screening of the other sex, when these facts are examined critically and deeply, we could understand that there can be significant differences in students‟ academic performance depending on whether they attend a single sex school or a coeducational school in Nigeria. However, Chatbot AI can enhance learning outcomes, improve educational experiences, and contribute to better knowledge retention and reasoning skills. Also, create a more interactive and engaging learning environment for students of all school types.

METHODOLOGY

This study adopted a quasi-experimental pretest post-test non randomize control group design. This research will be conducted in AkwaIbom State. The population of this study consisted of 30,985 Senior Secondary School two students offering Biology as a subject in 227 Secondary schools in AkwaIbom State, Nigeria. A total number of 600 senior secondary school three male and female in sciences offering biology as a subject (280 males and 320 females) were divided into control and treatment groups. The researcher developed instrument called Biology Performance Test (BPT). They validation was done through content, and face validity. The researcher then incorporated all corrections into the work. Kuder-Richardson formula 21. test-retest method was used to accessed the reliability at 0.05 level of reliability. Descriptive Statistics of Mean and Standard Deviation was used to present data for answering research questions.

RESULTS AND DISCUSSION

In this chapter, the results data analysis is presented and discussed. Data for the study are analyzed and presented based on the research questions and hypotheses that guided the study. It is organized in the following subheads:

- The descriptive analysis result and answering the research question
- Testing the research hypothesis

Research Question One: What is the difference in academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those taught with expository method based on school location?

Table 1: Descriptive Statistics of the difference in academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those taught with expository method based on school location

Descriptive Statistics of the difference in academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those taught with expository method based on school location

	Pre-test		Post-test			Mean Gain
Location	Mean ($\bar{X}$)	SD	Mean ($\bar{X}$)	SD	N	
Urban	51.27	3.192	72.91	7.34	198	21.64
Rural	51.22	3.144	72.78	7.45	161	21.56

Data presented in Table 1 indicates that urban students had pre-test mean score of 51.27 with standard deviation of 3.19 and their rural counterpart had pre-test mean score of 51.22 with standard deviation of 3.14, indicating that urban and rural students performed at the same rate before treatment. After treatment, the posttest score of urban students exposed to Chatbot AI had a mean performance score of 72.91 and a standard deviation of 7.34. On the other hand, rural students taught Biology with Chatbot AI had a mean performance score of 72.78 and a standard deviation of 7.45. The mean gained for the urban group was 21.64 while the mean gained for the rural group was 21.56 with a difference of .10 only. This is an indication that urban and rural students performed equally high when exposed to Chatbot AI. This result is in agreement with the research by Vygotsky (1978) who emphasizes the role of social interaction and scaffolding in learning, suggesting that AI-driven interactive tools like Chatbots can effectively simulate such supportive interactions regardless of students' location.

Research Question Two: What is the difference in School type in Biology of Senior Secondary School students exposed to Chatbot AI and those taught with expository method?

Table 2: Descriptive Statistics of the difference in academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those taught with expository method based on school type

	Pre-test		Post-test			Mean Difference
School Type	Mean	SD	Mean	SD	N	
Mixed	51.27	3.158	72.89	7.34	257	21.51
Single	51.19	3.202	72.75	7.50	102	21.56

Source: Field data (2024)

Data presented in Table 2 indicated that the mixed school students had pre-test mean score of 51.27 with standard deviation of 3.16 and their single sexed school counterpart had pre-test mean score of 51.19 with standard deviation of 3.20, indicating that mixed and single sexed schools performed at the same rate before treatment. In posttest, the mixed school students exposed to Chatbot AI had a mean performance score of 72.89 and a standard deviation of 7.34. On the other hand, single sex school students taught Biology with Chatbot AI had a mean performance score of 72.75 and a standard deviation of 7.50. The mean gained for the mixed sex schools was 21.51 while the mean gained for the single sex school was 21.56. There was a difference of 0.5. This is an indication that mixed and single

sex school students performed equally high when exposed to Chatbot AI. The findings is in agreement with the research of (Collins, 2018), who postulated that consistency minimizes variations in instructional quality that may arise from differences in resources between mixed and single sex schools.

HYPOTHESIS TESTING

Hypothesis One: There is no significant difference in the academic performance in Biology of Senior Secondary School students exposed to Chatbot AI based on school location.

Table 4: ANCOVA analysis of the difference in academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those exposed to expository method based on school location

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	1.421[a]	2	.710	.013	.987	NS
Intercept	31302.586	1	31302.586	565.850	.000	**
Pretest	7.183	1	7.183	.000	.999	**
Location	1.420	1	1.420	.026	.873	NS
Error	19693.755	356	55.320			
Total	1925076.000	359				
Corrected Total	19695.175	358				

a. R Squared = .000 (Adjusted R Squared = -.006)

b. Source: Field data

Table 4 shows that the Analysis of Covariance (ANCOVA) of mean performance scores of students exposed to Chatbot AI based on school location. The result showed that F-Cal value of .026 was found to be not significant in .873 which is greater than 0.05 ($P<0.05$) at 0.05 level of significant set for the study. The null hypothesis three was therefore retained indicating that there is no significant difference in the academic performance in Biology of Senior Secondary School students exposed to Chatbot AI based on school location.

Hypothesis Two: There is no significant difference in academic performance in Biology of Secondary School students exposed to Chatbot AI based on school-type.

Table 5: ANCOVA analysis of the difference in academic performance in Biology of Senior Secondary School students exposed to Chatbot AI and those exposed to expository method based on school type

Source	Type III Sum of Squares	df	Mean Square	F	Sig.@p <.05	Decision
Corrected Model	1.354[a]	2	.677	.012	.988	NS
Intercept	31191.559	1	31191.559	563.842	.000	**
Pre-test	.000	1	.000	.000	.999	NS
School Type	1.353	1	1.353	.024	.876	NS
Error	19693.822	356	55.320			
Total	1925076.000	359				
Corrected Total	19695.175	358				

a. R Squared = .000 (Adjusted R Squared = -.006)

b. Source: Field data

Table 5 shows that the Analysis of Covariance (ANCOVA) of mean performance scores of students exposed to Chatbot AI based on school type. The result showed that F-Cal value of .024 was found to be not significant in .876 which is greater than 0.05 ($P<0.05$) at 0.05 level of significant set for the study. The null hypothesis four was therefore retained indicating that there is no significant difference in the academic performance in Biology of Senior Secondary School students exposed to Chatbot AI based on school type.

CONCLUSION

The study concludes that utilization of Chatbot AI in teaching and learning Biology concepts is more effective than the use of traditional expository method because Chatbot AI engages students in interactive conversations, provide immediate feedback and reinforce biological knowledge which can encourage critical thinking in the students thereby improving their academic performance in Biology. School location did not significantly affect the academic performance in Biology of Senior Secondary. Two students exposed to Chatbot AI because students in rural schools were able to enjoy the continuous accessibility feature of Chatbot AI through per-loaded data as well as those in urban schools did, lack of internet connectivity wasn't a challenge. Both rural and urban schools benefited from real-time assistance. Students in both locations were able to revisit biology topics at their own pace. School type also did not significantly affect academic performance in Biology of students exposed to Chatbot AI. This is because the adaptive nature of Chatbot AI which adapted to specific needs of students offered them customized learning path tailored to their strengths and areas for improvement, so both school-typed benefited equally.

RECOMMENDATIONS

- Akwa Ibom State governments should provide in-service training and professional development opportunities for educators to effectively utilize Chatbot AI technology in the classroom. This can lead to a more educated, updated and skilled workforce.
- Akwa Ibom State governments through the Ministry of Education should establish mechanism for collaboration between educational institutions, technology developers, and police makers to share or establish networks for sharing knowledge and experiences
  to support the effective utilization of Chatbot AI in education.

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