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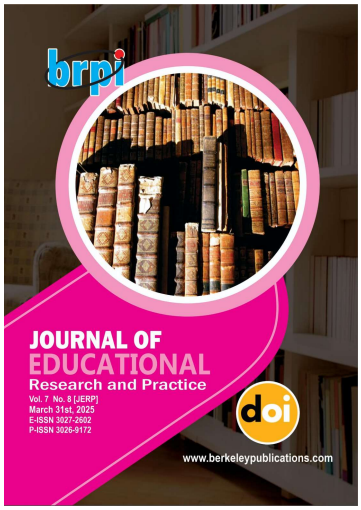

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CHIKE-OKOLI, CHIBUOGWU FELICIA PhD, HALIMA SHEHU (Author)

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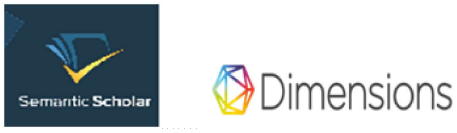

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ABSTRACT

This study aims at enhancing senior secondary school students' achievement and interest in English language reading comprehension using augmented reality in Minna metropolis. The research utilized a quasi-experimental design targeting Senior Secondary II (SSII) students. Purposive sampling was used to select schools and class. The groups (experimental group I & II) comprised one hundred and twenty students, evenly split by gender (60 males and 60 females). Reliability coefficients of 0.99 and 0.86 for static and animated infographics, respectively, were calculated using the PPMC formula. Hypotheses were tested using a T-test, resulting in the acceptance of the null hypothesis. Findings reveal that integrating augmented reality significantly enhanced students' English language reading comprehension achievement, and also impacted positively on the interest of both

Introduction

Information and Communication Technology (ICT) has tremendously affected every facet of human endeavour, which is crucial in shaping our modern world. ICT encompasses using digital tools and technologies to acquire, process, store, and distribute information broadly and dynamically. This is particularly important due to the significant changes in the pedagogies of the 21st Century, which are dependent on the effectiveness and efficiency provided by Information and Communication Technology (ICT) tools such as Web 2.0, smartphones, digital

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male and female students. It is, therefore, concluded that using augmented reality to teach English reading comprehension could effectively address the limitations of conventional teaching methods.

Keywords: Augmented Reality, Enhancing, Reading Comprehension, Students' Achievement

technologies, and so on in education (Mynbayeva, *et al.,* 2018). ICT has revolutionized industries, education, healthcare, and communication by changing how we live, work, and interact with each other. The internet, mobile devices, and social media, up to artificial intelligence, cloud computing, and big data analytics have brought about a new era of unprecedented connectivity and innovation through ICT. Instant global communication and collaboration is now possible due to the bridge it has built between geographical and cultural divides. Furthermore, ICT has become a crucial contributor to economic growth, promoting entrepreneurship, automation, and efficiency across all sectors. Thus, recent literature has paid notable attention to the impact of ICT on economic and human wellbeing (Asongu, 2020).

Augmented reality (AR) is a technology that overlays digital information, such as images, sounds, or other data, onto the real world, enhancing the user's perception of their environment. AR is a way of viewing the real world (either in person or through a device such as a camera that creates real-world visuals) and "adding" to that visual world with computer-generated input (Zailani, 2022). AR adds virtual information not only to the real environment, but also to the streaming video and games, and provides a simpler appearance of reality (Sutopo, 2022). Restika *et al.*, (2021) added that Augmented Reality can provide an in-depth experience and understanding more interactively and interestingly in learning the components of the Total Station tool. AR encourages collaboration through interactive features, enabling students to work together on projects, even from different locations. Furthermore, AR simplifies complex subjects by providing visual aids, making abstract concepts more accessible. These visuals are displayed as infographics which are widely used for learning experiences. Infographics are visual representations that integrate information derived from data and graphics to convey a message. Infographics are classified into static and animated types (Afify, 2018). The static infographics include only texts.

Augmented Reality (AR) integrated circulatory system electronic comic media can increase students' interest in learning (Ningrum *et al.,* 2022). This AR application may only require a Smartphone in its implementation so users can access it anywhere and anytime. This technology fosters better engagement, as students actively participate in lessons rather than passively consuming information. AR has significantly transformed the educational landscape by making learning more immersive, interactive and overlaying digital information onto the real world, enabling students to engage with three-dimensional models, historical events, or scientific concepts in real-time.

Infographics are data visualisations that present complex information quickly and clearly, which includes signs, photos, maps, graphics, and charts. and graphics without integrating any animated elements. While animated infographics have data, pictures, motion, and animated features, they are in a state of continuous movement. The animated infographics are used to convey and communicate a message and simplify the presentation of the data. The employment of proper teaching methods is what constitutes good teaching and learning of school subjects like English Language. Infographics have been used to swiftly communicate a message, make enormous volumes of data easier to understand, show data patterns and linkages, and track changes in variables over time (Basco, 2020). Infographics are designed to convey information quickly and effectively, making them a popular tool for representing statistics, facts, summaries, or comparisons. The World Health Organization (WHO), the United States Center for Disease Control (CDC) and other public health organizations worldwide turn to infographics to quickly and clearly convey complex information using textual and visual elements (Dalen, 2021). As graphic tools, they are intended to help students learn and retain the information acquired through visual representations, perceive the relationship between selected pieces of information in graphic format, and connect abstract concepts and principles to concrete representation. The attraction of infographics seems to be inherent within their nature, since people are drawn to the visualizations, colours, and images of the infographics itself. An infographic can transfer knowledge about a topic faster and more effectively than pure text. However, this condition depends on the quality and presentation of the infographics. Feldman, *et al.,* (2022) added that infographics facilitate the association and creation of mental representations of words that help improve learning and memory performance in both children and adults.

English language is one of the most commonly used languages in the world. In Nigeria, despite the presence of other languages in use, the prominence of English language is undeniable. It is the official and primary language of transaction at various tiers of government. It is widely seen as a symbol of unification of various linguistic groups and a means of intercultural exchange. In education, English language is the medium of instruction in schools from the fourth year of primary education to the tertiary level. It is also a compulsory subject of study at the primary and secondary levels of education. In view of the strategic position of English language in the lives of many Nigerians, it is expected that literacy level would be high in it especially among students at various levels. However, this is contrary to reality as many secondary school students find it difficult to read with understanding.

The general academic performance of students could be traced to reading comprehension ability because academic advancement of learners is rooted on reading and comprehension effectiveness. Year in year out, chief examiners of external examinations continue to point out lack of basic comprehension ability as the bane of students' success in examinations because of their inability to answer comprehension questions intelligibly. Specifically, the WAEC, NECO, and NABTEB chief examiner's reports on achievement of students in Reading comprehension from 2020 to 2023 show that students that passed SSCE at credit level and above were consistently less than 50%. These are examinations in which reading, comprehension, summary writing and letter writing are allotted marks specifically. Good writing is dependent on effective reading and comprehension and reading comprehension, in turn, involves the ability to understand, interpret, and analyze written texts or a given context and also answering questions based on that context (Dzendzik *et al.,* 2021; Zeng *et al.,* 2020).

The challenge before language educators is how to prepare and equip learners with modern comprehension skills for better learning. For English as-a-second-language learners, learning English can be problematic. Thus, learners need to be motivated during learning because the teaching method adopted by the teacher is capable of encouraging or discouraging learning and influencing comprehension in any subject area. The old conventional pedagogy that gives teachers dominance and control of classroom learning activities needs to be replaced with the use of modern technological learning devices like augmented reality (AR). However, research shows that many language teachers lack

knowledge of appropriate modern teaching methods and hence rely on the conventional methods. Thus, Xie and Xing (2017) stated that achieving high performance in reading comprehension tasks requires not only effective encoding of textual information, but also sophisticated reasoning and inference abilities to derive answers from the context accurately.

There are advantages that AR can afford in learning, Shaumiwaty *et al.,* (2022) opined that using AR-based instructional media could improve English subject-matter learning results. According to Wedyan *et al* (2022), teachers and students feel that learning is more enjoyable under the AR learning process because it provides learners the needed immersive language learning experiences, real-world context, and quick feedback. Additionally, it decreases students' anxiety, boosts their creativity, and promotes teamwork and involvement.

Gender disparity in educational achievement has been a major area of interest to educators, scholars, and researchers and a common area of investigation. Many studies revealed no significant difference between males and females while others observed a significant difference between the two genders (Kuta *et al.,* 2024). A study conducted by Humble (2020), strongly opined that there is a relationship between gender differences, attitude to learning and academic performance of students.

Interest is a variable considered in this study. Interest is a feeling of concern or curiosity in any subject matter that leads to attention towards it. It consists of feelings and tendencies towards a concrete matter. It has been argued that interest is one of the factors that influence students' academic achievement in different content arears. Adeyemi (2012) asserted that the aim of teaching is to secure students' attention through arousing and maintaining interest in lessons. A characteristic feature of Interest is a manifestation of different preferences towards actions, events or plans. Interest is significantly correlated with teaching methods to enhance students' achievement in different content arears. A students' interest in academic achievement will induce him to behave and act in a certain way towards his studies (Ogbonnaya & Owoduni, 2013).

However, different methods and approaches were used by different researchers such as the use of an interactive whiteboard, concept map, and peer-led guided instruction to solve the problem, but it has persisted therefore, the strategy considered by the researcher to salvage the persistent poor learning outcome might be the use of augmented reality (infographics). Therefore, the study

investigated senior secondary school students' learning outcomes in English reading comprehension using augmented reality in Minna metropolis.

Statement of Problem

Among the factors that may have accounted for poor performance in English reading comprehension are quality of instructional strategy employed by the teacher, learning environment, the text itself and student related factors. In spite of teachers' efforts to solve these problems, which are mostly teacher-centred, the issue of students' poor performance remains unresolved. Scholars have called for the use of instructional strategies that are student-centred and participatory in the classroom. Despite the success recorded in the use of modern technologies in improving learning, much attention has not been paid to their use in teaching reading comprehension passages Against this background, this study focused on enhancing senior secondary school students' achievement in reading comprehension using AR in Minna, Niger State, Nigeria. The moderating effects of gender on the dependent variables was also determined.

Research Questions

1. Is there any significant main effect of static and animated infographics on the achievement mean scores of senior secondary school students in English reading comprehension in Minna metropolis, Niger State?
2. Is there any significant effect of static and animated infographics on the interest mean scores of senior secondary school students in English reading comprehension in Minna metropolis, Niger State?

HO - There is no significant gender effect on interest among students taught English reading comprehension using static and animated infographics in Senior Secondary Schools in Niger State.

Methodology.

A quasi-experimental design was adopted, encompassing two treatment groups: one exposed to augmented static infographic reality and the other to animated infographic reality. The sample comprised secondary school students selected from four different schools to ensure demographic variability. The independent variable was the type of augmented reality infographic (static and animated), while the dependent variables were students' achievement, and interest. Gender was the moderating variable used in this study. A pilot test was carried out on senior secondary school students outside the study population to determine the

reliability of the instrument. The results were collated and a reliability index of 0.99 and 0.86 were realised for static and animated infographics respectively. The 40-item (EAT) was administered on twenty (120) randomly selected SSII students from the population of the study. A purposive sampling technique was employed in the selection of the schools and the arms of the classes while a simple random sampling was employed to select the participants in the study. An equivalent sample of one hundred and twenty students for both experimental groups was drawn on equal ratio of 60 males and 60 females. Two Research Questions were answered while one Hypothesis was tested. The validated instruments for data collection: English Language Achievement Test (EAT) and Interest Questionnaire (IQ) were administered on the treatment groups. The treatment instrument was developed by the researchers based on research and development (R&D) guidelines using ADDIE model to set up the treatment tool. The R&D guidelines prescribed the steps, principles, and methodologies used to carry out research activities (Schumann Jr et al., 1995; Kerssens-van Drongelen et al., 2000; Gustiani, 2019). Before treatment, the experimental participants were distributed in the classrooms. The two groups were pretested to determine the entry knowledge level of the participants. The animation-package was uploaded on the computers for teaching and the static on a chart hanged on the board, and the students were taught using the packages. After the treatment, achievement (EAT) and (IQ) were administered

Method of Data Analysis

Data collected was analysed using descriptive statistics of mean and standard deviation while the hypothesis was tested using t-test at 0.05 alpha level of significance.

Results and Discussion

Research Question 1. Is there any significant main effect of static and animated infographics on the achievement mean scores of Senior Secondary School students' in English Reading
Comprehension in Minna metropolis, Niger State?

Table 1: Mean scores and standard deviation of experimental groups at pre-test and post-test

Group	N	Pre-test ($\bar{x}$)	SD	Post-test ($\bar{x}$)	SD	Mean Gain
Experimental GroupI	60	28.25	6.92	63.98	11.27	35.73
Experimental GroupII	60	25.47	7.89	59.10	11.04	33.63

Table 1 reveals that students in experimental group I (those exposed to Static Infographics) had a mean score of 28.25 and a standard deviation of 6.92 at the pre-test, and a mean score of 63.98 and a standard deviation of 11.27 at the post-test.

Table 1 further reveals that students in experimental group II (those exposed to Animated infographics) had a mean score of 25.47 and a standard deviation of 7.89 on the pre-test, and a mean score of 59.10 and a standard deviation of 11.04 at the post-test. The mean gain scores of 35.73 and 33.63 recorded for experimental groups I and II respectively, reveal that differences exist in the mean achievement scores of the two groups. Those in group II achieved more than those in group I after treatment.

Research Question 2. Is there any significant effect of static and animated infographics on the interest mean scores of senior secondary school students in English reading comprehension in Minna metropolis, Niger State?

Table 2: Mean scores and standard deviation of experimental groups at post-test and Interest

Group	N	Post-test ($\bar{x}$)	SD	Interest ($\bar{x}$)	SD	Difference
Experimental GroupI	60	63.98	11.27	51.93	13.56	6.05
Experimental GroupII	60	59.10	11.04	57.53	11.88	7.57

Table 2 reveals that students in experimental group I (those exposed to Static Infographics) had a mean score of 63.98 with a standard deviation of 11.27 at the post-test, and mean score of 51.93, and a standard deviation of 11.88 at Interest.

Table 2 further reveals that students in experimental group II (those exposed to Animated Infographics) had a higher mean score of 59.10 with a standard deviation of 11.04 at the post-test and a mean score of 57.53 with a standard deviation of 11.88 at Interest. The mean difference scores of 6.05 and 7.57 recorded for experimental groups I and II respectively, reveal that difference exists in the Interest scores.

HO - There is no significant gender effect on interest among students taught English reading comprehension using static and animated infographics in Senior Secondary Schools in Niger State. Data shows no significant difference in the interest mean scores of male and female students exposed to static and animated infographics in English language reading comprehension in the senior secondary school in Minna metropolis, Niger State.

Table 3. t-test comparison of interest of male and female students toward English language after exposure to static and animated infographics

Group	N	Mean (x)	SD	df	t	p-value
Male	60	3.65	0.18			
Female	60	3.73	0.17	1	-4.00	0.156

NS: Significant @ p=0.05

Table 3 reveals that the calculated t-value (t=-4.00, df=1, p>0.05) is insignificant at the alpha level, hence, the Hypothesis is not rejected. This implies that significant differences do not exist in the interest of male and female students after exposure to static and animated infographics isn English reading comprehension.

Discussion of Findings

Findings from this study reveal that augmented reality significantly improved the students' achievement scores in English language in reading comprehension. The study also shows a shift in Interest scores which implies that respondents in both treatment groups had high interest scores. However, students who were exposed to animated infographics exhibited significantly higher interest scores than those who were exposed to infographics. This finding suggests that while animations may improve immediate achievement by enhancing engagement and clarity of concepts, static images may offer advantages when it comes to long-term interest.

Conclusion

In this study, efforts have been made on enhancing senior secondary school students' learning outcomes in english reading comprehension using augumented reality in Minna metropolis. Achievement, retention, and interest were variably affected by the administration of Augumeented reality treatment tools as it provided a significant learning outcome which is a strong performance indicator for English language students, using a more effective medium can improve their performance and might influence their interest in learning. Also, based on these findings, instructional content disseminated through Static infographics reading comprehension (SIRC) and Animated infographics reading comprehension (AIRC) was attractive to English language students hence, it helps to improve their learning outcomes. While (AIRC) appears to have the edge in promoting engagement, (SIRC) may hold advantages for long-term retention.

The lack of gender differences suggests that both male and female students can equally benefit from these visual learning tools. By integrating both (SIRC) and (AIRC) into their teaching practices, educators can create a more dynamic and effective learning experience for their students.

Recommendations

Based on findings in this study, it is recommended that

1. AR be used in the English language classroom for teaching reading comprehension.
2. the use of AR in the English language classroom be reflected in the school curriculum.
3. more teachers be trained on the use of AR in teaching other aspects of language.
4. modern technologies be made available by education providers to provide more opportunities for the use of AR for learning.

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