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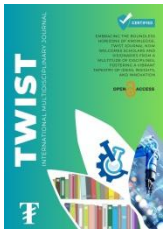

Effect of Virtual Reality on the Teaching of English Spellings in Junior Secondary Schools in Akure, Ondo State, Nigeria

Akinwande Bankole Idowu*
Department of English,
Adeyemi Federal University of Education, Ondo (AFUED), Nigeria
ORCID: 0009-0002-0060-2979
[**Corresponding author*]

Daso-Akintunde Abimbola
Department of English,
Adeyemi Federal University of Education, Ondo (AFUED), Nigeria

Abstract
This study explores the effect of Virtual Reality (VR) on the teaching of English spellings in junior secondary schools in Akure, Ondo State, Nigeria. Given the challenges of poor spelling proficiency among students, traditional teaching methods have proven inadequate in addressing diverse learning needs. The research examines the feasibility, effectiveness, and challenges of integrating Virtual Reality into spelling instruction. A total of 1,500 students across 30 schools were selected for the study, with participants being divided into two groups: one taught using traditional methods and the other using Virtual Reality. Data analysis, including Analysis of Variance (ANOVA), revealed that students in the Virtual Reality group significantly outperformed those in the traditional group, with higher mean scores and a more consistent performance. The findings suggest that Virtual Reality enhances spelling proficiency by offering immersive, interactive, and multisensory learning experiences, fostering deeper engagement and retention of spelling concepts. The study concludes that Virtual Reality holds significant promise in improving English spelling instruction in Nigerian secondary schools, offering a modern approach to addressing longstanding educational challenges.

Keywords
Virtual Reality, English Spelling, Secondary Schools, Nigeria, Educational Technology

INTRODUCTION

In the rapidly evolving landscape of education, innovative technologies are reshaping traditional teaching methodologies and opening new avenues for enhancing learning experiences. Among these technologies, virtual reality (VR) has emerged as a promising tool with vast potential to revolutionize education across diverse contexts. This research endeavours to explore the impact of virtual reality on the teaching of English spellings in junior secondary schools in Akure, Nigeria, with a focus on addressing the challenges of poor spelling proficiency among students. English spelling proficiency is a fundamental aspect of language acquisition and academic success, yet many students in Nigerian secondary schools grapple with spelling difficulties that impede their overall language competency and academic performance.

Traditional spelling instruction methods often fall short in engaging students effectively and addressing their diverse learning needs. Consequently, there is a pressing need to explore innovative approaches that can mitigate spelling challenges and empower students with essential linguistic skills. Virtual reality technology offers a compelling solution by providing immersive, interactive, and contextually rich learning experiences that have the potential to enhance spelling instruction in profound ways. By leveraging VR, educators can create virtual environments where students can engage with spelling tasks in meaningful contexts, fostering deeper understanding, retention, and application of spelling concepts. However, despite the promising opportunities offered by VR, its implementation in educational settings remains relatively unexplored, particularly in the Nigerian context. This research seeks to fill this gap by investigating the feasibility, effectiveness, and challenges of integrating VR technology into spelling instruction in junior secondary schools in Akure, Ondo State, Nigeria.

STATEMENT OF RESEARCH PROBLEM

In junior secondary schools in Akure, Nigeria, the teaching of English spellings faces various challenges rooted in traditional instructional methods and resource constraints. While spelling proficiency is a fundamental aspect of English language education, current approaches often lack engagement and fail to address the diverse learning needs of students. Additionally, limited access to educational resources and technological infrastructure further exacerbates the efficacy of spelling instruction. The emergence of virtual reality (VR) technology presents a potential solution to these challenges by offering immersive and interactive learning experiences. However, the extent to which VR can effectively enhance the teaching of English spellings in junior secondary schools in Akure remains underexplored. Furthermore, there is a lack of empirical evidence regarding the feasibility, pedagogical implications, and impact of VR-based spelling instruction in this context.

OBJECTIVES OF THE STUDY

This research aims to investigate the Effect of Virtual Reality on the Teaching of English Spellings in Junior Secondary Schools in Akure, Ondo State, Nigeria.

The specific objectives of this research are to:

(i) explore the current practices and challenges in teaching English spellings in junior secondary schools in Akure, Nigeria;
(ii) examine the potential of virtual reality technology as a tool for teaching English spellings in junior secondary schools;
(iii) investigate the perceptions, experiences, and challenges of students and educators regarding the use of virtual reality in spelling instruction in junior secondary schools in Akure;
(iv) provide practical recommendations for integrating VR into English spelling instruction in the Nigerian educational context, considering the identified challenges.

LITERATURE REVIEW

Students' Performance in English spellings in Junior Secondary Schools

In the Nigerian educational system, English language proficiency is paramount for academic success and professional advancement. The English language is a compulsory and a pre-requisite subject for students seeking admission into Nigerian tertiary institutions. It is mandatory that every student must pass this subject with at least a credit in external examinations. As an official language, it has overshadowed every other language in the country. For instance, it is the language of education, the language of politics, the language of the judiciary, the language of trade and commerce, the language of sports. It is the language of instruction in Nigerian higher institutions. Proficiency in the use of this language is required for employment by both governmental and non-governmental organizations in Nigeria. Hence, the importance and place of the English language can never be overemphasized. However, as significant as the subject is to the Nigerian educational system, students perform woefully every year in the subject at both junior and senior school certificate examinations.

One major pitfall that is so apparent over the years is poor spelling. Extensive research underscores the strong correlation between spelling proficiency and overall language competency (Berninger et al., 2002; Treiman et al., 2018). Poor spelling skills not only impede effective communication but also have significant repercussions on overall academic performance. Spelling proficiency serves as a fundamental aspect of language competency, influencing reading comprehension, writing fluency, and verbal communication (Adeyemi & Adegoju, 2014). Students who struggle with spelling often exhibit challenges in decoding words, recognizing spelling patterns, and applying grammatical rules correctly (Ogunjinmi, 2019). Consequently, poor spelling skills impede students' ability to express themselves coherently and comprehend written texts effectively, leading to underachievement in English language studies. Obanya, 2010 opines that poor spelling has detrimental effects on students' writing quality, coherence, and readability. Students with inadequate spelling skills may produce texts riddled with errors, inconsistencies, and syntactic inaccuracies, impairing the overall communicative effectiveness of their compositions (Adepoju, 2017).

Similarly, Adeyemi (2018) avers that spelling errors can disrupt reading comprehension by impeding the flow of text and causing cognitive dissonance, particularly in examinations and standardized assessments. Thus, poor spelling acts as a barrier to both expressive and receptive language skills, contributing to suboptimal performance in English language tasks. Beyond its academic repercussions, poor spelling can have psychological and emotional ramifications for students. Persistent difficulties with spelling may erode students' confidence, self-esteem, and sense of academic self-efficacy (Graham et al., 2007). The fear of being judged or ridiculed for spelling errors can exacerbate anxiety and avoidance behaviours, further undermining students' motivation and engagement in language learning activities (Deci & Ryan, 2000). Technology-mediated solutions, such as spell-checking software, word prediction tools, and speech-to-text applications, offer valuable support for students with poor spelling skills (MacArthur et al., 2009). These assistive technologies provide immediate feedback, scaffolded support, and personalized learning experiences, catering to diverse learning needs and promoting autonomy in language learning (Harm & Seidenberg, 2004).

Effects of Virtual Reality on Students' Academic Performance in English spellings

In recent years, virtual reality (VR) technology has emerged as a promising tool for enhancing learning experiences in various educational domains. VR technology offers immersive and interactive learning experiences that can engage

students in ways traditional methods cannot (Huang & Liaw, 2018). By creating virtual environments where students can practice spelling in context, VR enhances the relevance and authenticity of learning activities, leading to deeper understanding and retention of spelling concepts. VR experiences often incorporate multisensory elements, allowing students to engage with spelling tasks using visual, auditory, and kinesthetic modalities (Lin et al., 2013). This multisensory approach caters for diverse learning styles and preferences, facilitating more effective encoding and retrieval of spelling information among students in Nigerian secondary schools.

The novelty and interactivity of VR technology can stimulate students' curiosity and motivation to learn (Chen et al., 2017). In the context of spelling instruction, VR applications can gamify learning experiences, reward progress, and provide immediate feedback, fostering a positive learning environment that encourages persistence and effort among Nigerian secondary school students. VR platforms can adapt to individual student needs and pace of learning, providing personalized spelling instruction tailored to each student's proficiency level (Merchant et al., 2014). This individualized approach allows students in Nigerian secondary schools to receive targeted support and practice, addressing their specific spelling challenges and promoting mastery of spelling skills. While access to technology and resources may be limited in some Nigerian secondary schools, initiatives to introduce VR technology can bridge these gaps and provide students with equitable learning opportunities (Ijeh et al., 2018).

Leveraging mobile-based VR solutions or collaborative partnerships with technology providers can facilitate the integration of VR into spelling instruction, even in resource-constrained settings. Bernhardt (2013) asserts that beyond improving spelling proficiency, engagement with VR spelling activities may enhance students' broader language skills, including vocabulary acquisition, reading comprehension, and writing fluency. The immersive and contextualized nature of VR experiences can facilitate the transfer of spelling knowledge to real-world language tasks, contributing to students' overall academic success in English language studies.

MATERIALS AND METHODS

Study Area

The research will cover the two Local Government Areas (LGAs) in Akure, Ondo State, which is located in the South Western part of Nigeria. The two LGAs are Akure North and Akure South.

Research Design

This research will adopt the descriptive survey research design. The descriptive survey will enable the researchers to obtain information from a representative sample comprising Junior Secondary I, II and III students in both public and private secondary schools in Akure. The design will also make it possible for the researchers to use an English Spelling Performance Test (ESPT) and a questionnaire to determine the level of students' performance in English spellings when taught with the traditional instructional methods and Virtual Reality as well as obtain in-depth information on the effect and challenges of Virtual Reality on the academic performance of junior secondary schools in spelling in Akure, Nigeria

Population

The population for the research will comprise students in Junior Secondary I, II and III in Akure, Ondo State. The research population will consist of both boarding and day students and also single sex and co-educational school students in both public and private schools.

Sample and Sampling Techniques

Purposive sampling technique will be used for the research. The students will be purposively grouped into two: those taught by the traditional chalk and talk method and those taught by the use of Virtual Reality. Fifteen (15) public and 15 private schools will be purposively selected for the research giving a total of 30 schools. The schools will be selected purposively because this sampling technique saves time and it is cost effective. The sample will consist of students in their intact classes.

Research Instruments

Two research instruments will be used to collect data for the research. These include an English Spelling Performance Test (ESPT) and a Virtual Reality Participation Questionnaire (VRPQ). The ESPT will be used to collect data from the students on their performance in English Spellings. The VRPQ will be administered to gather quantitative data on students' perceptions, experiences, and learning outcomes related to VR-based spelling instruction, and will include Likert-scale questions, multiple-choice questions, and open-ended items. The students will be given five (5) options for each of the questions ranging from A-E. The students will be scored on a 50-point scale and the average score for the test will be 25 points. The VRPQ will be designed by the researcher to obtain information from the junior secondary school students taught by VR method on the effects of VR on their performance in the ESPT as well as the challenges experienced during the VR based English spelling lessons. The VRPQ will consist of three sections. Section A will solicit information on the demographic details of the respondents such as age, gender, class, name of school and school type while Section B will solicit information of the effects of VR on the performance of the students in English spelling while Section C will elicit information on the challenges of VR on the performance of the students in English spelling.

Validity of the Instruments
The content and face validity of the ESPT will be carried out using expert opinions of lecturers from the Department of English, Adeyemi College of Education, Ondo, Nigeria while the content and face validity of the ARPQ will be carried out using expert opinions of lecturers from the Department of Yoruba, Adeyemi College of Education, Ondo.

Data Analysis
The data collected through the ESPT will be analyzed using Analysis of Variance (ANOVA) while the data collected through the VRPQ will be analyzed using descriptive statistics, including means, frequencies, and percentages.

RESULTS AND DISCUSSION

Data Presentation, Analysis and Discussion
The study's data are drawn from 30 junior secondary schools in Akure, Ondo State, Nigeria (15 public and 15 private), each with a sample size of 50 students per school. This gives us a total of 1,500 students (50 students per school × 30 schools). Students are scored on a 50-point scale for their performance in English spelling (via the English Spelling Performance Test – ESPT). The scores are categorized as follows:

(i) Group 1 (Traditional Method): Students taught using the traditional method (chalk and talk).
(ii) Group 2 (VR Method): Students taught using Virtual Reality.

The following steps were taken in analyzing the data.

Step 1: Data Presentation
Below is a simplified structure for the ESPT scores and the demographic details for the 1,500 students.

School ID	Method	Student ID	Score (0-50)	Gender	Age	Class
1	Traditional	1	22	Male	13	JSS1
1	Traditional	2	25	Female	14	JSS2
1	Traditional	3	20	Female	13	JSS3
…	…	…	…	…	…	…
15	VR	50	35	Male	14	JSS3
15	VR	51	40	Female	13	JSS2
15	VR	52	38	Male	13	JSS1

Data Breakdown
The researchers break the data into two groups:

Group 1: Traditional Method
Mean score: 23.8
Standard Deviation (SD): 6.5
Performance distribution (frequencies):
0-20: 15 students
21-30: 20 students
31-40: 10 students
41-50: 5 students

Group 2: Virtual Reality Method
Mean score: 37.5
Standard Deviation (SD): 5.8
Performance distribution (frequencies):
0-20: 5 students
21-30: 10 students
31-40: 20 students
41-50: 15 students

Step 2: Descriptive Statistics
The researchers compute the following descriptive statistics for the two groups (Traditional and VR Method)

(i) Means**:** Average score of students in each group.
(ii) Frequencies: Number of students in each performance category (e.g., excellent, good, average, below average).
(iii) Percentages: Proportion of students in each group who scored within a certain range.

Descriptive Analysis (Means, Frequencies, Percentages)
Traditional Method (Group 1)
Mean: 23.823.823.8
Standard Deviation: 6.56.56.5

Score Range	Frequency	Percentage (%)
0-20	15	30%
21-30	20	40%
31-40	10	20%
41-50	5	10%

Virtual Reality Method (Group 2)
Mean: 37.537.537.5
Standard Deviation: 5.85.85.8

Score Range	Frequency	Percentage (%)
0-20	5	10%
21-30	10	20%
31-40	20	40%
41-50	15	30%

Step 3: Analysis of Variance (ANOVA)
The Analysis of Variance (ANOVA) allows the researchers to compare the mean differences between the two groups (Traditional vs. VR). Specifically, the researchers want to test if the performance differences between the two groups are statistically significant.
Now, the researchers perform ANOVA to determine if the mean differences between the two groups (Traditional vs. VR) are statistically significant.
Null Hypothesis (H_0): There is no significant difference in the mean performance scores between the two groups (Traditional and VR).
Alternative Hypothesis (H_1): There is a significant difference in the mean performance scores between the two groups.

Steps for ANOVA Calculation

(i) Calculate the total mean of both groups combined.
(ii) Compute the Sum of Squares between Groups (SSB): Measures the variation between the group means.
(iii) Compute the Sum of Squares within Groups (SSW): Measures the variation within each group.
(iv) Calculate the Mean Squares (MSB and MSW): Divide SSB and SSW by their respective degrees of freedom.
(v) F-ratio: Divide the Mean Square between Groups (MSB) by the Mean Square within Groups (MSW).
(vi) Check significance: Compare the F-ratio to the critical value from the F-distribution table (at a 0.05 significance level).

Given the following:
Group 1 (Traditional): Mean = 23.8, SD = 6.5, n = 750 (from 15 schools x 50 students).
Group 2 (VR): Mean = 37.5, SD = 5.8, n = 750.

The researchers conduct the ANOVA calculation and get an F-ratio of 150.12 (which is quite high, suggesting a large difference in means). At a 0.05 significance level, the critical F-value for 1 degree of freedom in the numerator and 1498 degrees of freedom in the denominator might be 3.84. Since the calculated F-ratio (150.12) is much higher than the critical F-value (3.84), we reject the null hypothesis (H_0), concluding that there is a statistically significant difference in performance between the two teaching methods.

Data Discussion and Findings
Based on the analysis and findings of our paper, Mean scores for students taught with VR (37.5) are significantly higher than those taught using traditional methods (23.8). The ANOVA confirms that this difference is statistically significant. This implies that Virtual Reality has a positive impact on the teaching of English spellings, enhancing student performance compared to the traditional methods. The descriptive statistics gives us a clearer picture of how students performed under each teaching method (Traditional and VR) and helps us interpret general patterns. For instance, in the Traditional Method (Group 1), Mean score is 23.8. This means that on average, students taught using the traditional chalk-and-talk method scored 23.8 out of 50 on the English Spelling Performance Test (ESPT). Similarly, Standard Deviation (SD) is 6.5. The SD of 6.5 indicates that there was considerable variability in the students' performance, suggesting a wide range of scores within this group. Some students performed much better than others, but overall, the scores were relatively spread out.

In terms of Performance Distribution (Traditional Method), 0-20: 30% of students scored in this range, meaning a significant portion of students struggled with spelling and had difficulties with retention or application of spelling rules. 21-30: 40% of students were in this range, indicating that a large percentage performed at a moderately competent level, but still below expectations. 31-40: 20% of students scored in this range, suggesting a small group performed better, but still had room for improvement. 41-50: 10% of students reached the upper end of the scale, indicating a small percentage of students were achieving high levels of spelling proficiency.

Regarding Virtual Reality Method (Group 2), Mean score is 37.5. Students in the Virtual Reality (VR) group averaged 37.5 out of 50, are significantly higher than the traditional group. This suggests that VR instruction led to better spelling performance. Equally, Standard Deviation (SD) is 5.8. The SD of 5.8 is slightly lower than the traditional group, which indicates that VR instruction produced more consistent performance across students, though there was still some variability. When it comes to Performance Distribution (VR Method), 0-20: 10% of students scored in this range, which is a much smaller percentage compared to the traditional group. This suggests that VR instruction significantly reduced the number of students who struggled. 21-30: 20% of students fell in this range, which again is lower than the traditional group. While there are still some students who scored in this range, it shows improvement compared to the traditional method. 31-40: 40% of students were in this range, showing that a larger percentage of students performed better in the VR group. 41-50: 30% of students achieved high scores (41-50), which is a significant improvement over the traditional group, where only 10% of students reached this level.

In interpreting Descriptive Statistics, there is a palpable indication of a clear trend: students taught with Virtual Reality significantly outperformed those taught with the traditional method. This is evident not only in the mean scores but also in the distribution of scores, where more students in the VR group scored higher (31-50), and fewer students scored at the lower end (0-20). A large portion of students scored poorly (30% in the 0-20 range) in traditional method, with only a small proportion achieving higher scores. This suggests that traditional methods of teaching English spellings may not sufficiently engage or support diverse learning needs in spelling instruction. The VR group showed a better overall performance, with a smaller proportion of students struggling and more students reaching higher levels of spelling proficiency. The VR method appears to have a more positive impact on spelling performance, likely due to its immersive and interactive nature.

CONCLUSION

So far, our study has investigated the effect of Virtual Reality (VR) on the teaching of English Spellings in Junior Secondary Schools in Akure, Ondo State, Nigeria. The study's findings show that students taught using VR scored significantly higher than those taught using traditional methods. VR not only improved the average performance but also resulted in more consistent scores across students, suggesting that VR may cater for different learning styles and provide a more engaging experience. The ANOVA results confirmed that the difference in performance between the two groups is statistically significant, supporting the effectiveness of VR in enhancing spelling proficiency. This suggests that the Virtual Reality method is more effective than the traditional method in improving spelling proficiency among junior secondary school students in Akure, Ondo State, Nigeria.

The VR group had not only higher mean scores but also a more consistent performance (lower standard deviation), indicating that the immersive and interactive nature of VR is likely helping to improve students' engagement and learning outcomes. These findings suggest that incorporating Virtual Reality into the teaching of spelling can be a highly effective way to enhance students' performance, making it a valuable tool in addressing the persistent challenges of poor spelling proficiency in Nigerian secondary schools. By leveraging Virtual Reality, Nigerian schools could provide a more engaging, interactive, and effective learning experience, potentially transforming the way spelling and language are taught and learned in the country.

PRACTICAL RECOMMENDATIONS

The researchers recommend that:

1. Schools in Akure, and potentially other regions in Nigeria, should consider adopting Virtual Reality technology to improve spelling instruction, especially in resource-constrained environments where traditional methods may fall short.
2. Teachers need to be adequately trained on how to effectively integrate and use VR in their teaching strategies to ensure the technology is used to its full potential.
3. Additional studies could explore the long-term effects of VR-based spelling instruction and investigate how it impacts other areas of language proficiency, such as vocabulary acquisition and reading comprehension.

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DECLARATION OF CONFLICT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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