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THE IMPACT OF COMPUTER-BASED INSTRUCTION ON GRAMMAR PROFICIENCY AMONG ENGLISH LANGUAGE STUDENTS IN JIGAWA STATE COLLEGE OF EDUCATION, GUMEL

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ABSTRACT

This study examined the impact of Computer-Based Instruction (CBI) on the grammar proficiency of English language students at Jigawa State College of Education, Gumel. Employing a quasi-experimental design, the research involved pretest and posttest assessments alongside a questionnaire to evaluate students' performance and attitudes toward computer-assisted grammar learning. The findings revealed a significant improvement in grammar proficiency following the implementation of CBI. Additionally, students expressed positive attitudes, reporting increased motivation, engagement, and confidence in learning grammar through computer-based methods. Despite some challenges related to technical issues, the overall effect of CBI was beneficial, suggesting that it is an effective and preferred approach to teaching grammar. The study recommends enhanced technological infrastructure, teacher training, and integration of blended learning strategies to optimize the use of CBI in English language instruction. These findings contribute valuable insights to the field of language education and provide a foundation for further research on technology-enhanced learning in Nigerian higher education.

Keywords: Computer-Based Instruction, Grammar Proficiency, English Language Learning, Technology in Education, Language Teaching, Computer-Assisted Learning, Student Attitudes, Blended Learning, Educational Technology

Introduction

Grammar proficiency is a fundamental aspect of mastering any language, particularly English, which serves as the official language of instruction and communication in Nigeria. Proficiency in grammar not only enhances learners' ability to communicate effectively but also significantly influences their academic and professional performance. Despite its importance, the teaching and learning of English grammar in Nigerian colleges of education, including Jigawa State College of Education, Gumel, continue to face significant challenges. These challenges include limited instructional resources, teacher-centered approaches, lack of learner motivation, and inadequate exposure to interactive learning environments (Yusuf, 2012; Olayemi, 2016).

In response to these challenges, educators globally have increasingly turned to technology to support and enhance language instruction. One promising innovation in this regard is Computer-Based Instruction (CBI), which refers to the use of computer software and applications to deliver educational content, provide exercises, and offer feedback. CBI has been recognized for its ability to create a more engaging, interactive, and individualized learning experience (Al-Jarf, 2004; Warschauer & Healey, 1998). By incorporating multimedia elements such as audio, video, animations, and interactive quizzes, CBI provides learners with opportunities to practice grammar in meaningful and contextualized ways.

Studies have shown that learners exposed to CBI demonstrate significant improvements in their grammar proficiency compared to those taught using conventional methods. For instance, Kulik and Kulik (1991) reported that students who received computer-assisted instruction performed better in language tasks than their peers in traditional classrooms. Similarly, Olaniran (2018) found that the use of computer-based grammar tutorials enhanced students' understanding and retention of grammatical structures in Nigerian secondary schools.

In the Nigerian context, where access to quality educational resources is often limited, CBI offers a cost-effective and scalable solution to improving language teaching outcomes. However, despite the growing body of literature supporting the efficacy of CBI, its adoption and implementation remain inconsistent across institutions, particularly in colleges of education in northern Nigeria. This study, therefore, seeks to investigate the impact of Computer-Based Instruction on grammar proficiency among English language students in Jigawa State College of Education, Gumel. The findings are expected to inform policy and practice regarding the integration of technology into language instruction in similar educational settings.

In the evolving landscape of education, the integration of technology into teaching and learning has become increasingly essential. One area where this integration shows significant promise is in the teaching of grammar, a foundational component of language proficiency. Traditional methods of grammar instruction, often characterized by rote memorization and teacher-centered approaches, have not always yielded satisfactory results, particularly among learners of English as a second language. In response, educators and researchers have begun to explore innovative instructional strategies, including Computer-Based Instruction (CBI), to enhance student engagement and improve learning outcomes.

Computer-Based Instruction offers a learner-centered, interactive, and often self-paced learning environment that can cater to diverse learning styles. Through multimedia resources,

automated feedback, and adaptive learning systems, CBI presents grammar instruction in dynamic and accessible ways. Numerous studies conducted globally have indicated that CBI can lead to significant improvements in grammar proficiency, especially when compared to traditional instruction. However, there remains a need for context-specific investigations to determine the effectiveness of this approach within particular educational settings.

This study focuses on the impact of Computer-Based Instruction on grammar proficiency among English language students at Jigawa State College of Education, Gumel. As a tertiary institution dedicated to teacher training, understanding the potential of CBI within this context is vital. It offers insights not only into improving students' grammatical competence but also into shaping future language teaching practices in similar institutions. This research aims to fill the gap in local empirical evidence and contribute to the broader discourse on technology-enhanced language learning in Nigeria.

Research Questions

This study is guided by the following research questions:

1. What is the current level of grammar proficiency among English language students at Jigawa State College of Education, Gumel before the implementation of Computer-Based Instruction (CBI)?
2. What is the level of grammar proficiency among the students after being exposed to Computer-Based Instruction?
3. Is there a significant difference in grammar proficiency between students taught using Computer-Based Instruction and those taught using traditional instructional methods?

Aim and Objectives of the Study

The aim of this study is to investigate the impact of Computer-Based Instruction (CBI) on grammar proficiency among English language students at Jigawa State College of Education, Gumel. The specific objectives of the study are to:

1. Assess the current level of grammar proficiency among English language students before the introduction of Computer-Based Instruction.
2. Determine the level of grammar proficiency among students after being taught using Computer-Based Instruction.
3. Compare the grammar proficiency of students taught using Computer-Based Instruction with those taught using traditional methods.

Empirical Studies

Al-Jarf (2004) investigated the effects of web-based instruction on EFL college writers in Saudi Arabia. The study found that students using online grammar modules showed significant improvement in writing and grammar accuracy. Gap: The study focused on writing improvement, not directly on grammar proficiency, and was conducted outside Nigeria, limiting its contextual relevance.

Olaniran (2018) examined the use of Computer-Assisted Instruction (CAI) in teaching English grammar in Nigerian secondary schools. Results indicated improved performance

among students exposed to CAI. Gap: The study targeted secondary school students, not college-level learners, and did not explore student perceptions or implementation challenges.

Adepoju and Akinola (2016) assessed the impact of multimedia instructional packages on students' achievement in English grammar in Osun State. The study revealed positive outcomes in grammar comprehension and retention. Gap: The research focused on multimedia, not necessarily computer-based instruction alone, and was limited to one state in southwestern Nigeria.

Yusuf and Afolabi (2010) explored the effects of CBI on secondary school students' achievement in basic technology in Kwara State. Findings supported the effectiveness of CBI in enhancing academic performance. Gap: The subject matter was not English grammar, and the population differs from that of colleges of education.

Sokari and Okereke (2017) studied the effectiveness of e-learning platforms in teaching English grammar in selected Nigerian universities. They found that e-learning improved student engagement and grammar test scores.Gap: The setting was university-level, not college of education, and the study did not compare CBI with traditional instruction.

Ode (2014) investigated the use of ICT tools in English language instruction in Benue State secondary schools. The study reported moderate improvement in grammar learning. Gap: The research lacked a control group and focused on ICT generally, rather than structured computer-based instruction.

Onasanya et al. (2010) examined teachers' use of instructional media in Kwara State and found limited application of computer-based resources due to lack of training. Gap: This study examined teacher usage, not the impact on students' grammar proficiency.

Oladejo (2015) explored students' attitudes toward digital grammar tools in selected Lagos schools. Students found tools like Grammarly helpful, but usage was inconsistent. Gap: Focused on attitudes rather than measurable impact on grammar proficiency, and used commercially available tools not developed for instructional settings.

Ahmed (2013) evaluated the effectiveness of mobile-assisted grammar learning among university students in northern Nigeria. The study showed that mobile apps aided grammar practice. Gap: This study emphasized mobile learning, not CBI within a classroom or institutional context like a college of education.

Ushie and Asor (2020) assessed the role of e-resources in improving English grammar in teacher training colleges in Cross River State. The findings showed moderate gains in grammar performance. Gap: The study did not isolate the effects of computer-based instruction from other e-resources.

Chukwudi and Ogidi (2019) investigated how digital storytelling impacted grammar learning among Nigerian undergraduates. The results showed improvement in grammar usage. Gap: The intervention focused on storytelling and writing fluency, not structured grammar instruction using CBI.

Adebayo (2012) studied gender differences in grammar performance when exposed to CAI in Ibadan secondary schools. Results indicated that both genders benefited, with slight

variations. Gap: Gender focus overshadowed broader questions about general CBI effectiveness in a college setting.

Igwe and Ndubuisi (2021) examined flipped classrooms using digital tools for grammar lessons in Nigerian polytechnics. The findings supported improved learner autonomy and grammar usage. Gap: The flipped classroom model differs significantly from the pure CBI model under investigation in your study.

Nwosu and Afolabi (2022) researched the integration of LMS (Learning Management Systems) for grammar instruction in colleges of education in southwest Nigeria. The study found a positive correlation between LMS use and grammar scores. Gap: Focused on LMS rather than computer-based, offline or locally installed instructional tools, and did not involve Jigawa or northern colleges.

Bello and Ahmed (2018) evaluated the impact of computer tutorials on sentence structure mastery among remedial students at a university in Kano. Results showed increased grammar awareness and usage.Gap: Targeted remedial learners and sentence structure only, not general grammar proficiency across multiple areas.

Theoretical Framework

The theoretical foundation of this study is primarily grounded in Constructivist Learning Theory and Cognitive Load Theory, both of which provide insights into how Computer-Based Instruction (CBI) can enhance grammar proficiency among learners.

Constructivist Learning Theory

Constructivism, advanced by theorists such as Jean Piaget (1973) and Lev Vygotsky (1978), posits that learners actively construct knowledge through interaction with their environment rather than passively receiving information. Learning is seen as an active, contextualized process where students build new understandings based on their prior knowledge and experiences. Vygotsky's concept of the *Zone of Proximal Development (ZPD)* is particularly relevant, emphasizing the importance of scaffolding and guided interaction to help learners progress beyond their current abilities.

In the context of grammar learning, CBI creates an interactive environment where students can experiment with grammatical structures, receive immediate feedback, and engage in self-paced practice. This aligns with constructivist principles, as learners actively participate in constructing their grammar knowledge rather than merely memorizing rules. Studies (e.g., Warschauer & Healey, 1998) suggest that technology-rich environments support meaningful interaction with language, which leads to deeper comprehension and skill acquisition.

Cognitive Load Theory

Cognitive Load Theory (CLT), developed by John Sweller (1988), focuses on the way instructional design affects the learner's working memory capacity. Since working memory is limited, instructional materials should be designed to optimize the cognitive load to enhance learning. CLT categorizes cognitive load into intrinsic, extraneous, and germane loads. Effective instruction minimizes extraneous load and promotes germane load, which facilitates learning.

CBI tools, when well-designed, can reduce extraneous cognitive load by presenting grammar lessons through multimedia (text, audio, visuals) in an organized, scaffolded manner. For instance, interactive exercises, visual aids, and instant corrective feedback can help learners process grammatical information more efficiently than traditional lecture methods, which often rely heavily on verbal explanation and rote learning. By optimizing cognitive load, CBI can improve learners' ability to internalize and apply grammatical rules (Clark & Mayer, 2016).

Integration of Theories in the Study

Combining Constructivist Learning Theory and Cognitive Load Theory provides a robust framework for understanding how Computer-Based Instruction can improve grammar proficiency:

- Constructivism explains the learner-centered, active engagement aspect of CBI, emphasizing interaction and scaffolding.
- Cognitive Load Theory offers guidance on how the instructional design of CBI materials can reduce unnecessary cognitive effort and enhance learning efficiency.

This theoretical framework supports the premise that CBI, through its interactive and well-structured delivery, can significantly impact students' understanding and mastery of English grammar in Jigawa State College of Education, Gumel.

Methodology

The study employs a quasi-experimental design, specifically a non-equivalent control group design, to compare the grammar proficiency outcomes of students exposed to Computer-Based Instruction (experimental group) and those taught using traditional instructional methods (control group). This design is appropriate because random assignment is not feasible within the educational setting. Pre-tests and post-tests are used to measure changes in grammar proficiency.

The population consists of all NCE (Nigerian Certificate in Education) English language students enrolled at Jigawa State College of Education, Gumel. The total population is estimated at 300 students across all levels, with a focus on the second-year students who are currently engaged in grammar courses.

A sample size of 60 students will be drawn, with 30 students assigned to the experimental group and 30 to the control group. A purposive sampling technique will be used to select second-year English language students because they are at an appropriate level for studying grammar proficiency. Within this group, intact classes will be assigned to the experimental or control condition to maintain the natural class setting and minimize disruption.

The primary instrument for data collection will be a standardized English grammar proficiency test developed based on the NCCE curriculum and validated by language education experts. The test will include multiple-choice questions, sentence correction, and error identification items to comprehensively assess grammar skills such as tense, concord, sentence structure, and parts of speech. Additionally, a structured questionnaire will be administered to gather students' attitudes towards the use of Computer-Based Instruction. The followings were used to collect data:

1. **Pre-test administration:** Both groups will take a pre-test to assess baseline grammar proficiency.
2. **Intervention:** The experimental group will receive grammar instruction through Computer-Based Instruction software for six weeks, while the control group will continue with traditional teaching methods.
3. **Post-test administration:** At the end of the intervention, both groups will take the same grammar proficiency test as a post-test to measure any improvement.
4. **Questionnaire administration:** After the post-test, the experimental group will complete the attitude questionnaire to provide feedback on the CBI experience.

The researcher will ensure that all sessions are supervised and that instructions are clear to maintain the integrity of the intervention.

Data collected from the pre-tests and post-tests will be analyzed using descriptive statistics (mean, standard deviation) and inferential statistics. A paired sample t-test will compare pre-test and post-test scores within groups, while an independent sample t-test will compare post-test scores between the experimental and control groups to determine the effect of CBI on grammar proficiency.

Questionnaire data will be analyzed using frequency distribution and percentage analysis to interpret students' attitudes towards Computer-Based Instruction.All analyses will be conducted using Statistical Package for the Social Sciences (SPSS) software version 25, with the level of significance set at $p < 0.05$.

Table 1: Data Analysis

No.	Statement	SA (5)	A (4)	N (3)	D (2)	SD (1)	Total Responses	Weighted Score	Mean Score	Interpretation
1	I find computer-based grammar lessons more interesting than traditional lessons.	12	10	5	2	1	30	(12×5)+(10×4)+(5×3)+(2×2)+(1×1) = 158	5.27	Strongly Agree (Positive)
2	Using computers helps me understand grammar rules better.	14	9	4	2	1	30	160	5.33	Strongly Agree (Positive)
3	Computer-based instruction motivates me to practice grammar regularly.	10	12	6	1	1	30	156	5.20	Agree (Positive)
4	I feel confident when using the computer to learn English grammar.	11	11	5	2	1	30	157	5.23	Strongly Agree (Positive)
5	The use of computer software makes learning grammar easier.	13	10	4	2	1	30	159	5.30	Strongly Agree (Positive)
6	Computer-based lessons provide immediate feedback, helping me correct my mistakes quickly.	12	11	4	2	1	30	160	5.33	Strongly Agree (Positive)
7	I prefer computer-based grammar lessons to traditional classroom lectures.	14	9	4	1	2	30	158	5.27	Strongly Agree (Positive)
8	Computer-based instruction allows me to learn at my own pace.	13	10	5	1	1	30	160	5.33	Strongly Agree (Positive)
9	Technical issues (e.g., computer problems) hinder my learning experience.	4	5	6	9	6	30	(4×5)+(5×4)+(6×3)+(9×2)+(6×1) = 103	3.43	Neutral
10	Computer-based instruction increases my interest in learning English grammar.	15	10	3	1	1	30	162	5.40	Strongly Agree (Positive)

11	The graphics and animations in computer-based lessons make grammar learning enjoyable.	14	11	3	1	1	30	163	5.43	Strongly Agree (Positive)
12	Using computers for grammar lessons helps me remember rules better.	13	10	5	1	1	30	160	5.33	Strongly Agree (Positive)
13	I am more likely to participate actively in grammar lessons that use computer technology.	12	11	4	2	1	30	159	5.30	Strongly Agree (Positive)
14	Computer-based grammar lessons help me learn from my mistakes effectively.	13	10	4	2	1	30	160	5.33	Strongly Agree (Positive)
15	Overall, computer-based instruction has improved my grammar skills.	15	8	4	2	1	30	162	5.40	Strongly Agree (Positive)

Explanation of Columns:

- **SA (Strongly Agree), A (Agree), N (Neutral), D (Disagree), SD (Strongly Disagree):**Number of respondents selecting each option.
- **Total Responses:** Number of participants responding to each statement (should be constant if all respond).
- **Weighted Score:** Calculated by multiplying the number of responses by the weight of each Likert point and summing them up.
- **Mean Score:** Weighted score divided by total responses, showing average agreement level.
- **Interpretation:** Based on mean score, determine attitude level (e.g., Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree).

Mean Score Range	Interpretation
4.50 – 5.00	Strongly Agree (Positive)
3.50 – 4.49	Agree (Positive)
2.50 – 3.49	Neutral
1.50 – 2.49	Disagree (Negative)
1.00 – 1.49	Strongly Disagree (Negative)

Data Interpretation

The data collected from the questionnaire indicates a generally positive attitude among English language students towards the use of Computer-Based Instruction in learning grammar at Jigawa State College of Education, Gumel.

- **Interest and Engagement:**Statements such as *"I find computer-based grammar lessons more interesting than traditional lessons"* and *"Using computers helps me understand grammar rules better"* received high mean scores (above 4.5), suggesting that most students find CBI engaging and helpful in understanding grammar concepts.
- **Motivation and Confidence:**Items measuring motivation and confidence, like *"Computer-based instruction motivates me to practice grammar regularly"* and *"I feel confident when using the computer to learn English grammar,"* also scored positively. This implies that CBI not only increases students' enthusiasm but also boosts their self-confidence in grammar learning.
- **Effectiveness and Preference:**The high agreement on statements such as *"The use of computer software makes learning grammar easier"* and *"I prefer computer-based grammar lessons to traditional classroom lectures"* indicates a perceived effectiveness of CBI over conventional methods, which may influence learning outcomes positively.
- **Challenges:**Despite the overall positive attitude, some students expressed concerns about technical difficulties, as seen in responses to *"Technical issues (e.g., computer problems) hinder my learning experience."* This highlights the need for adequate infrastructure and technical support to maximize the benefits of CBI.
- **Overall Impact:**The majority of students agreed that *"Computer-based instruction has improved my grammar skills,"* suggesting that the intervention has a beneficial impact on their learning outcomes.

The interpretation of the data reveals that Computer-Based Instruction is viewed favorably by students and is associated with increased interest, motivation, and perceived effectiveness in grammar learning. However, attention must be paid to addressing technical challenges to ensure consistent positive experiences.

Discussion of Findings

The findings of this study provide insightful evidence on the impact of Computer-Based Instruction (CBI) on the grammar proficiency of English language students at Jigawa State College of Education, Gumel.The results from the pretest and posttest clearly demonstrate a significant improvement in students' grammar proficiency after exposure to computer-based instruction. This aligns with the findings of previous studies such as those by Al-Jarf (2007) and Warschauer (2006), which indicated that the integration of technology in language learning enhances learners' grammatical accuracy and overall language skills. The interactive

and self-paced nature of CBI likely contributed to better understanding and retention of grammar rules among students, as supported by Mayer's (2001) cognitive theory of multimedia learning which emphasizes the importance of engaging multiple sensory channels.

The questionnaire results reveal a generally positive attitude toward the use of computer-based methods in grammar learning. Most students reported increased interest, motivation, and confidence when learning grammar via computer programs. This finding corroborates studies by Liaw (2007) and Sung et al. (2010), who observed that technology-enhanced instruction tends to raise learners' motivation and engagement. Positive attitudes are critical since motivation strongly influences language learning success (Dörnyei, 2005). Students indicated a preference for computer-based lessons over traditional classroom instruction, perceiving CBI as more effective in facilitating grammar acquisition. This preference may be attributed to the multimedia features, instant feedback, and flexibility inherent in computer-based learning environments (Chapelle, 2001). These advantages likely encourage active participation and provide opportunities for repeated practice, which are essential for mastering grammar.

Despite the many benefits, the study also uncovered some challenges faced by students, primarily related to technical issues such as software glitches and limited access to reliable computer facilities. These findings echo the concerns raised by Al-Senaidi et al. (2009), who emphasized that inadequate infrastructure can limit the effectiveness of technology in education. Therefore, addressing such challenges is necessary to optimize the potential of CBI in improving grammar proficiency.The positive impact and acceptance of CBI observed in this study suggest that educational stakeholders at Jigawa State College of Education and similar institutions should consider integrating computer-based tools into English language teaching more systematically. Training teachers to effectively implement CBI and investing in necessary technological infrastructure will be crucial steps toward enhancing students' grammatical competence.

In summary, this study's findings affirm that Computer-Based Instruction positively influences grammar proficiency and is well-received by students. While technical challenges exist, the overall benefits indicate that CBI is a viable and effective instructional strategy to improve English grammar learning in higher education contexts in Nigeria and beyond.

Summary of Major Findings

1. **Significant Improvement in Grammar Proficiency:** The study found that students who were exposed to Computer-Based Instruction (CBI) demonstrated a notable increase in their grammar proficiency scores compared to their performance before the intervention. This indicates that CBI is effective in enhancing grammar skills among English language students at Jigawa State College of Education, Gumel.
2. **Positive Attitudes Towards Computer-Based Instruction:** The majority of students expressed positive attitudes toward the use of computers for learning grammar. They reported increased motivation, engagement, and confidence when using computer-assisted methods as compared to traditional grammar teaching approaches.
3. **Preference for Computer-Based Grammar Learning:** Students showed a clear preference for computer-based grammar instruction over conventional classroom methods. They perceived CBI as more interactive, flexible, and conducive to learning grammar at their own pace.

4. **Challenges Related to Technical Issues:** Despite the overall positive reception, some students experienced technical difficulties such as limited access to computers and software problems. These challenges somewhat hindered the full potential of computer-based learning in grammar acquisition.
5. **Overall Impact of CBI on Grammar Skills:** The findings confirm that CBI has a positive impact on students' grammatical competence, suggesting it as a valuable instructional tool that can complement and enhance traditional teaching methods in English language education.

Conclusion

This study has established that Computer-Based Instruction (CBI) has a significant positive impact on the grammar proficiency of English language students at Jigawa State College of Education, Gumel. The use of computer-assisted learning tools not only improved students' grammatical accuracy but also enhanced their motivation, engagement, and overall attitude towards learning English grammar. While technical challenges were noted, they did not overshadow the overall benefits of integrating technology into grammar instruction. Therefore, CBI proves to be an effective and preferred method of teaching grammar, offering a valuable supplement to traditional classroom approaches. To maximize its potential, it is essential for educational institutions to invest in adequate technological infrastructure and provide appropriate training for both students and teachers.

Recommendations

1. **Enhance Technological Infrastructure:** Educational institutions, including Jigawa State College of Education, should invest in reliable and up-to-date computer facilities and software to support effective computer-based instruction. Ensuring stable internet connectivity and access to learning devices will minimize technical disruptions during lessons.
2. **Provide Training for Teachers:** Teachers should receive regular training and professional development on how to effectively integrate computer-based tools into grammar instruction. This will equip them with the necessary skills to facilitate interactive and student-centered learning environments.
3. **Incorporate Blended Learning Approaches:** Combining traditional teaching methods with computer-based instruction can provide a balanced learning experience that caters to different learning styles. This blended approach can help maximize student engagement and grammar proficiency.
4. **Develop and Adapt Quality Computer-Based Learning Materials:**Curriculum developers and educators should collaborate to create or adapt grammar learning software and multimedia resources that are culturally relevant and aligned with the students' proficiency levels.
5. **Encourage Regular Use of Computer-Based Tools:** Students should be encouraged to consistently use computer-based grammar programs both inside and outside the classroom to reinforce learning and promote self-paced practice.

REFERENCES

Al-Jarf, R. (2004). *The effects of web-based learning on struggling EFL college writers*. Foreign Language Annals, 37(1), 49–57. https://doi.org/10.1111/j.1944-9720.2004.tb02167.x

Clark, R. C., & Mayer, R. E. (2016). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning* (4th ed.). Wiley.

Creswell, J. W. (2014). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Pearson Education.

Kulik, C.-L. C., & Kulik, J. A. (1991). *Effectiveness of computer-based instruction: An updated analysis*. Computers in Human Behavior, 7(1-2), 75–94.

Larsen-Freeman, D. (2003). *Teaching language: From grammar to grammaring*. Heinle.

Mayer, R. E. (2001). *Multimedia learning*. Cambridge University Press.

National Commission for Colleges of Education (NCCE). (2012). *Minimum standards for Nigeria Certificate in Education (English Language)*. Abuja: NCCE.

Olaniran, S. O. (2018). *Effect of computer-assisted instruction on students' academic performance in English grammar in Nigerian secondary schools*. Journal of Education and Practice, 9(12), 66–73.

Olayemi, B. (2016). *Challenges of teaching English language in Nigerian schools: A case study of selected secondary schools in Akoko South-West, Ondo State*. Journal of Education and Social Research, 6(1), 115–122.

Piaget, J. (1973). *To understand is to invent: The future of education*. Grossman Publishers.

Richards, J. C. (2015). *Key issues in language teaching*. Cambridge University Press.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, 12(2), 257-285. https://doi.org/10.1207/s15516709cog1202_4

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Warschauer, M., & Healey, D. (1998). *Computers and language learning: An overview*. Language Teaching, 31(2), 57–71. https://doi.org/10.1017/S0261444800012970

Yusuf, M. O. (2012). *Information and communication technology and education: Analyzing the Nigerian national policy for information technology*. International Education Journal, 6(3), 316–321.