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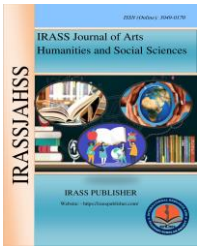

GRAPHIC ORGANIZERS AND SIMULATION GAMES FOR VOCABULARY TEACHING: ENHANCING 21ST CENTURY LEARNING SKILLS IN NIGERIA

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Abstract: This study investigated the effectiveness of graphic organizers and simulation game-based learning in teaching vocabulary as tools for enhancing students' achievement in 21st century learning skills in Nigeria. To achieve this the study tested three research hypotheses were generated to carry out the study. A quasi- experimental pretest-posttest design was used comprising two experimental groups and one control group. Each group consisted of 80 students selected from both urban and rural areas of Ondo metropolis. The study population included all junior secondary school students in Ondo metropolis from which 240 students were selected using non-random sample technique. Vocabulary Achievement Test (VAT) and instructional packages using (graphic organizer and simulation games) were used to carry out the study. Findings revealed a significant difference between the posttest scores of students in the experimental and control group, a significant main effect of school location and students' achievement, gender was not a determining factor of students' achievement in the experimental and control groups. The study recommended that teachers should integrate graphic organizers and simulation games in teaching vocabulary as these can directly influence students' learning outcome in vocabulary, English Language teachers should undergo regular training so as to be more knowledgeable about pedagogy and should always improvise relevant instructional resources that could enhance effective learning

Keywords: Graphic organizers, simulation game, vocabulary, quasi experimental, 21st century learning skills

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Introduction

In the 21st century, educational strategies such as graphic organizers and simulation game-based learning have gained prominence for their potential to enhance student academic performance, engagement and skill acquisition, particularly in Nigeria. Graphic organizers are visual tools that help structure information, facilitating comprehension and retention. Their application in Nigerian education has yielded positive outcomes. Herron (2017) found that using visual graphic organizers led to improved students' performance in comprehension tasks, Graphic organizers are evidence-based tools that teach inference, visual connections, and provide a framework to extract details (Roman, Jones, Basaraba, & Hironaka, 2016) Scott and Dreher (2016) described graphic representations or organizers as spatial displays of key ideas from texts arranged to communicate conceptual hierarchy as well as relationships and connections between ideas, facts, and concepts. In view of this, graphic organizer has a visual relationship and association using images, colours and symbols to connect ideas especially in vocabulary acquisition. Graphic organizers include concept Maps, Mind Maps, Venn Diagram and Flow Charts. Dexter, Park, & Hughes (2011) declared that graphic organizers are intended to promote more meaningful learning and facilitate understanding and retention of new material by making abstract concepts more concrete and by connecting new information with prior knowledge. The use of flow charts could enhance vocabulary acquisition and students' academic performance rather than the traditional method of writing difficult words and meanings on the board which does not enhance critical thinking, students' engagement and academic performance. Simulation game-based learning immerses students in interactive scenarios that mimic real-life situations, promoting active learning and critical thinking. Simulations create a scenario-based environment, where students interact to apply previous knowledge and practical skills to real-world problems, also allowing teachers to reach their own goals. Ranalli (2018) found that the vocabulary gains as a result of using the simulation game were significant among university level international students learning English. Smetana and Bell (2012) examine computer simulations to support instruction and learning in Science. In their comparative study between computer games and traditional games, they conclude that computer games can be as effective, if not more so, than traditional games in promoting knowledge, developing procedural skills and facilitating conceptual change. This supports the efficacy of simulation games in all subject discipline. There is no doubt that if simulation-based learning is integrated into teaching and learning

in Nigeria, it will offer learners a better academic performance in all subject area. This suggests that simulation games could be similarly effective in all fields of study. Akinsola and Animasahun (2007) in their study of effect of simulation-games environment on students' achievement in attitudes to mathematics in secondary school in Osun-State, Nigeria, using a sample of 147 senior secondary school students found that the use of simulation-games environment led to improve achievement and positive attitude towards mathematics. In the same vein, Nnadozie and Otolehi (2021) in their study effect of computer game-based learning on English language vocabulary acquisition of secondary school students in Owerri Education Zone, with a study sample of 20 students who failed first, second and third term examinations in English language. Findings revealed that computer assisted scrabble games improved the academic achievement of students in the treatment group at post-test. Likewise, Ogheneakoke, Obro and Benike (2019) in their study of using simulation games instructional strategy for the teaching and learning of social studies in secondary schools in Owerri, using quasi-experimental design with a study sample of 116 JSS2 students, findings showed that simulation games instructional strategy enhanced students' performance in the social studies than the control group.

Omachonu and Offorma (2016) investigated the effects of games technique on junior secondary school students' achievement in Oral English in Idah Education Zone of Kogi State, Nigeria adopted a quasi-experimental research design involving non-equivalent control group with 304 JS III students drawn from eight intact classes; found out that students exposed to games technique achieved higher than those taught Oral English with the conventional method.

Some Simulation Games Suitable for Junior Secondary School Students

General English & Communication Skills

- The Sims 4 (with storytelling or language mods) – Helps students learn daily life vocabulary related to emotions, activities, and professions.
- Influent – A gamified vocabulary-learning tool that helps students explore objects and learn words in context by identifying and spelling household objects after gameplay

The Sims 4 games could be played by

- Designing and customising Sims with unique characteristics, personalities and traits, asking students to mention what they like and dislike about the person or say what they see about the person in form short story.
- Build and design homes by constructing and furnishing homes, using a variety of objects and decorations and ask students to mention the items in the home thereby developing their vocabulary
- Simulate life by guiding Sims to discuss about daily activities, careers. Life events like birth marriage, death etc. this will enhance their communicative skills and life experiences
- Explore and interact is a way to allow Sims to interact with each other, form relationships and explore various environments. The game involves four participants called SIM4 who work as a team in exchanging conversations related to the topic. While other students are also assigned to their various tasks on other areas such as vocabulary on Business and Economics, Science and technology History and Civilization etc. each group of 4 would tell a short story in form of turn-taking about their topic. This method gives room for collaboration, critical thinking and vocabulary development.

Business & Economics Vocabulary

- Lemonade Tycoon – A simple business simulation where students learn words like "profit," "expenses," and "advertising."
- RollerCoaster Tycoon – Helps students understand concepts like "budget," "customer satisfaction," and "revenue." By exposing students to gameplay they are able to use correct vocabulary when engage in trade, buy and sell without problem and day-to-day economic activities.

Science & Technology Vocabulary

- Kerbal Space Program – Introduces basic space and physics terms like "orbit," "gravity," and "launch." This gameplay enables students to understand the conceptual and contextual learning in relation to everyday life, as well as the practical applications of scientific concepts which helps students to develop problem-solving skills and critical thinking
- Plague Inc**.** – A strategy game that introduces disease-related terms like "infection," "mutation," and "transmission." Using this game enables the students have knowledge of communicable diseases and preventive /safety measures against it.

History & Civilization Vocabulary

- Civilization VI (with guidance) – Teaches historical and geopolitical terms like "empire," "alliance," and "diplomacy."
- Anno 1800 – Helps students learn about industrial-era vocabulary such as "manufacturing," "trade routes," and "expansion." Using game play allows students to have knowledge of vocabulary related to historical concepts, cultural terminology and civic education; such as nationalism, colonization, independence, etc. all these are aligned with the curriculum's focus on national values and critical thinking.

Environmental & Agricultural Vocabulary

- Farming Simulator – Teaches farming-related words like "harvest," "fertilizer," and "crops."
- Eco – Encourages discussions on environmental issues with words like "ecosystem," "pollution," and "sustainability." The use of these vocabulary aligns with Nigeria's education curriculum as it is crucial for promoting sustainable development by emphasising the importance of environmental education and agriculture.

Law & Crime Vocabulary

- Phoenix Wright: Ace Attorney – Introduces legal terms like "evidence," "testimony," and "cross-examination."
- Detective Grimoire – A mystery-solving game that enhances deductive reasoning with words like "suspect," "clue," and "motive." It will be beneficial to students

after using gameplay, by having the knowledge of legal terminology, promoting their civic awareness, enhancing their communicative skills, have respect for the law and also prepares students for future career.

Travel & Hospitality Vocabulary

- Hotel Giant – Teaches tourism-related words such as "reservation," "hospitality," and "customer service."
- Airline Tycoon – Introduces travel industry terms like "itinerary," "check-in," and "boarding pass." The Nigeria's curriculum aligns this vocabulary into teaching and learning so as promote tourism, cultural exchange economic development cultural heritage as well as to recognise the importance of hospitality.

There is no gainsaying that the expertise of the teacher could determine the type of gameplay to be used. It is observed that many English language teachers engage in traditional method of teaching vocabulary which has informed researchers to investigate whether the use of games in teaching vocabulary could enhance student's performance, communicative skill and critical thinking.

Theoretical Framework

The study is anchored on Constructivism, influenced by Piaget and Vygotsky, who emphasized the active role of learners in constructing knowledge through interaction with their environment. Constructivist approaches to learning focus on meaningful, collaborative, and inquiry-based activities that promote understanding and problem-solving. Sim4 game based and graphic organizer are learner-centred strategies are in line with constructivism approach which encourage collaboration, active participation, critical thinking and problem solving as students are able to use correct vocabulary to express their ideas, feelings and thoughts.

Research Hypotheses

Three research hypotheses were generated to carry out the study;

1. There is no significant difference between the posttest scores of students in the experimental and control groups in vocabulary
2. There is no significant main effect of school location (rural and urban) on students' achievement in vocabulary
3. There is no significant interaction effect of treatment and gender on students' achievement in vocabulary

Methodology

The research design adopted for the study was quasi-experimental design involving pretest- posttest two groups and a control group. This design is considered appropriate as it accommodates non-random sampling technique to select the samples for the study. Experimental group one is Simulation Games learning, experimental group two is Graphic organizer group while group three is the control group. The population of the study consisted of all junior secondary school students in Ondo Metropolis. For accessibility and convenience, two hundred and forty (240) students was selected for the study. Experimental group 1 consisted of eighty students, drawn from rural and urban areas, experimental group 2 also consisted of eighty (80) students from urban and rural areas while the control group equally consisted of eighty (80) students from rural and urban areas of Ondo metropolis. These selections were made so as to determine whether location would have influence on students' achievements in vocabulary.

The instruments used to gather data were achievement test titled Vocabulary Achievement Test (VAT) consisting of twenty objective questions and instructional packages involving the SIM 4 simulation games and graphic organizer lesson packages

The following activities were carried out by experimental group 1 (Simulation game)

- Students were arranged into 4 groups
- Group A was asked to create a Sim containing a well-designed, unique physical characteristics, personalities and traits of a person
- Group B was asked to create a Sim containing a well-designed, furnished and decorated building
- Group C was asked to create a Sim containing a wedding ceremony
- Group D was asked to create a Sim containing an accident scene
- Students in each group were asked to tell a story on the Sims they created using appropriate vocabulary
  Using Sim enables the students to involve in interaction using vocabulary in a fun and meaningful way, thereby promoting language skills.
  The following activities were carries out in experimental group 2 (Graphic Organizer)
- In this case, whole class method was used. Students sat in their normal classroom arrangement

A vocabulary tree structure on 'a person, a building, a wedding ceremony and an accident scene' are pasted on the wall and students are asked to discuss them by showing the relationships between words on each of them. This approach enables students illustrate relationships between words, making vocabulary more meaningful and memorable. The reliability of the instrument was ascertained using test-retest on forty (40) students who were not part of the study. Data collected were subjected to statistical analysis using Pearson product moment correlation co-efficient and the result yielded 0.82 which considered the instrument reliable and adequate for the study. Pre-test and post-test were administered by research assistant. The researcher engaged in carrying out instructions on the experimental groups using Simulation Games techniques (SIM4) for experimental group 1 and graphic organizer for experimental group 2.and the control group was left with their normal classroom instructions. The exercise was carried out for ten (10) weeks. Pre-test was administered for a period of two (2) weeks to all the groups, instructions were given to only the experimental groups for a period of six (6) weeks by the researcher. Thereafter, post-test was administered to all the groups for another two (2) weeks, to determine which method could enhance students' achievement in vocabulary.

Data collected were subjected to statistical testing. All hypotheses were tested at 0.05 level of significance. All hypotheses were analysed using mean and Analysis of covariance (ANOVA)

Results

- **H_{01} There is no significant difference between the posttest scores of students in the experimental and control groups**

Table 1: Analysis of Covariance ANCOVA of students' achievement scores exposed to different treatments

Tests of Between-Subjects Effects						
Dependent Variable: Post-Test						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	63682.672[a]	3	21227.557	419.053	.000	.842
Intercept	17797.982	1	17797.982	351.350	.000	.598
Pre_Test	31.063	1	31.063	.613	.434	.003
Group	63680.416	2	31840.208	628.557	.000	.842
Error	11954.824	236	50.656			
Total	1123587.000	240				
Corrected Total	75637.496	239				
a. R Squared = .842 (Adjusted R Squared = .840)						

Since the p-value for Group (0.000) is less than 0.05, it indicates a significant difference in posttest scores between the groups. Hence, the null hypothesis is rejected. It can therefore be inferred that there is a significant difference between the posttest scores of students in the experimental and control groups.

Therefore, the treatment (instructional methods) influenced vocabulary achievement of students

- **Ho2: There is no significant main effect of school location (rural and urban) on students' achievement in vocabulary**

Table 2: ANCOVA of students' achievement based on school location

Tests of Between-Subjects Effects								
Dependent Variable: Post-Test								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	7255.873[a]	2	3627.934	12.57	0.000	0.096	25.148	.996
Intercept	17032.622	1	17032.62	59.03	0.000	0.199	59.032	1.000
Pre_Test	13.362	1	13.36	0.046	0.830	0.000	0.046	0.055
Sch_Location	7253.618	1	7253.62	25.14	0.000	0.096	25.140	0.999
Error	68381.623	237	288.53					
Total	1123587.000	240						
Corrected Total	75637.496	239						
a. R Squared = 0.096 (Adjusted R Squared =0.088)								
b. Computed using alpha = 0.05								

As shown in table 2, ANCOVA results reveal that school location (categorized as rural or urban) has a significant impact on students' achievement in Vocabulary Specifically, the main effect of school location is statistically significant, with an F-value of 25.14 and a p-value of 0.000, along with a Partial Eta Squared of 0.096. This significance level P lesser than 0.05 ($p < 0.05$) indicates that students' achievement in vocabulary is influenced by location, that is, whether they ae in a rural or urban school setting and the Partial Eta Squared value of 0.096 suggests that approximately 9.6% of the variance in post-test scores can be attributed to school location.

However, since the p-value of school location is 0.000 which is lesser than 0.05 level of significant, the null hypothesis is therefore rejected. It can be therefore be inferred that there is a significant main effect of school location (rural and urban) on students' achievement in Vocabulary.

- **$H_0$3: There is no significant interaction effect of treatment and gender on students' achievement in vocabulary**

Table 3: Summary of ANCOVA of treatment and gender on students' achievement in vocabulary

Tests of Between-Subjects Effects								
Dependent Variable: Post-Test								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	64100.280[a]	6	10683.380	215.756	.000	.847	1294.538	1.000
Intercept	17173.308	1	17173.308	346.824	.000	.598	346.824	1.000
Pre_Test	24.097	1	24.097	.487	.486	.002	.487	.107
Group	60561.605	2	30280.802	611.536	.000	.840	1223.073	1.000

Gender	165.968	1	165.968	3.352	.068	.014	3.352	.446
Group * Gender	251.668	2	125.834	2.541	.081	.021	5.083	.505
Error	11537.215	233	49.516					
Total	1123587.000	240						
Corrected Total	75637.496	239						
a. R Squared = .847 (Adjusted R Squared = .844)								
b. Computed using alpha = .05								

ANCOVA results reveal a significant impact on the post-test scores with a Type III Sum of Squares of 64,100.280, a mean square of 10,683.380, an F-value of 215.756, and a p-value of 0.000, indicating that the model explains a considerable proportion of the variance in post-test scores, with a high partial eta squared of 0.847, suggesting that approximately 84.7% of the variability in post-test scores can be attributed to the factors in the model (group, gender, and their interaction).

The Intercept is also significant (F = 346.824, p = 0.000) with a partial eta squared of 0.598, indicating that the overall mean level of post-test scores is expressively different from zero. Pre-Test score, with the F-value of 0.487, and a p-value of 0.486, shows that the pre-test score is not a significant predictor of the post-test scores in the model having partial eta squared of 0.002. The lack of significance proposes that initial performance (pre-test scores) did not significantly influence the post-test outcomes when accounting for the other factors in the model.

The Group variable, representing the different instructional strategies (graphic organizer, simulation game, and control Group), is highly significant (F = 611.536, p = 0.000) with a substantial partial eta squared of 0.840 which implies that the instructional strategy (treatments) have a very large effect on the post-test scores. Precisely, it indicates 84% of the variance in post-test scores can be attributed to the instructional group.

The gender effect is not statistically significant, with an F-value of 3.352 and a p-value of 0.068. The partial eta squared for gender is 0.014, indicating that only 1.4% of the variance in post-test scores is associated with gender differences, and this effect is not strong enough to be considered statistically meaningful.

The Group * Gender interaction has an F-value of 2.541 and a p-value of 0.081, which is above the 0.05 level of significance. With a partial eta squared of 0.021, the interaction between group and gender accounts for only 2.1% of the variance in post-test scores. This result shows that there is no significant interaction effect between treatment group and gender, indicating that the effect of the instructional strategy on post-test scores does not differ significantly between male and female students. The null hypothesis is thereby accepted and it can be deduced that there is no significant interaction effect of treatment (graphic organizers or simulation games) and gender on students' achievement in vocabulary.

Discussion of Findings

Findings show a significant effect of the treatment on students' achievement in Vocabulary. The finding aligns with Bash etal (2020) who reported similar effects of graphic organizer and experiential learning on students' achievement in Basic Science and Technology.

Furthermore, the findings of the study revealed that using Graphic Organizers and Simulation Games can enhance students' retention and comprehension of vocabulary building; this is in tandem with Herron (2017) who found that using visual graphic organizers enhances student's multimodal engagement and contextual learning which thereby led to improved performance in comprehension tasks. In the same manner, findings revealed that simulation games, have a contextual learning benefits, which align with Ang and Zaphiris (2016) and Connolly et al. (2018), that such games foster deeper language processing and retention. The findings revealed a statistically significant difference in students' achievement in vocabulary based on school location. Students in rural schools achieved higher post-test scores than those in urban schools, indicating that school location does play a role in students' achievement in vocabulary due to small class size and motivation. Results align with Adeyemi and Adekunle (2017) and Adepoju (2019) that suggest smaller classes, common in rural areas, can positively impact students' comprehension and retention of complex material, such as vocabulary development. Results reveal that gender effect is not statistically significant, with an F-value of 3.352 and a p-value of 0.068. The partial eta squared for gender is 0.014, indicating that only 1.4% of the variance in post-test scores is associated with gender differences, Herron (2017) also align with this, showing that graphic organizers support improved learning outcomes without differentiation based on student's gender, and Connolly et al. (2018) and Gee (2018) who posited that simulation-based learning environments encourage participation and critical thinking in language learning, benefiting students of all genders

Conclusion

The study concluded that there was a significant difference between the posttest scores of students in the experimental and control groups; and there was a significant main effect of school location on students' achievement in the experimental and control group, and gender did not have influence on student's achievement in vocabulary.

Recommendations

The following recommendations were made in line with the study. These include:

- Teachers should integrate graphic organizer into vocabulary teaching as it enhances students' learning outcomes.
- Simulation games should be adopted into the teaching of vocabulary at junior secondary school levels.
- Edtech providers should assist in developing graphic organizers and simulation games that could enhance vocabulary learning
- Government should provide adequate and relevant instructional materials for English language especially vocabulary teaching.

- English Language teachers should undergo regular professional development to stay current with 21st – century pedagogical strategies.

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