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The impacts of deictic games as predictors of peer learning on english language vocabulary building

ABSTRACT

This study aimed to examine the impact of deictic games as predictors of English vocabulary building among secondary school students. The participants were 120 first-year students (JSS 1) and three teachers from Educational District III of Lagos Island, who were assigned to an experimental group and a control group. Before the intervention, both groups completed a diagnostic pre-test and participated in vocabulary-building activities through planned instructional exercises over four weeks. The experimental group received a treatment protocol based on deictic games and peer learning, while both groups were subsequently assessed through a post-test. A mixed-methods approach was employed, integrating quantitative data from classroom ecology and qualitative data obtained through interviews. Analysis of covariance was conducted to determine differences in English vocabulary-building performance between the groups. The findings revealed significant differences in performance between the experimental and control groups, indicating that peer learning and deictic games influenced vocabulary building. Furthermore, gender did not show a significant effect on peer learning and the game-based activities implemented in the study. Participants' performance was associated with both individual abilities and collective efforts. The results yielded $\alpha =$

0.05, $df = 119$, and $R = 0.784$. Additionally, $t_{obs} = 6.84 > 1.96$ ($\alpha = 0.05$; $df = 118$), providing evidence of a significant relationship between peer learning and deictic games in English vocabulary building.

Keyword: Deictic games; peer learning; game-based learning; vocabulary building

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Los impactos de los juegos deícticos como predictores del aprendizaje entre pares en la construcción del vocabulario en inglés

RESUMEN

Esta investigación tuvo como objetivo examinar el impacto de los juegos deícticos como predictores de la construcción del vocabulario en inglés de estudiantes de educación secundaria. Participaron 120 estudiantes de primer año (JSS 1) y tres docentes del Distrito Educativo III de Lagos Island, asignados a un grupo experimental y otro de control. Antes de la intervención, ambos grupos realizaron un pretest diagnóstico y participaron durante cuatro semanas en actividades de construcción del vocabulario mediante ejercicios planificados. El grupo experimental recibió el protocolo de tratamiento basado en juegos deícticos y aprendizaje entre pares, mientras ambos fueron evaluados mediante un postest. Se empleó un enfoque de métodos mixtos, que integró datos cuantitativos de la ecología del aula y datos cualitativos de entrevistas. Para determinar las diferencias en la construcción del vocabulario se aplicó un análisis de covarianza. Los resultados evidenciaron diferencias significativas en el desempeño entre los grupos experimental y de control, lo que indicó una influencia del aprendizaje entre pares y los juegos deícticos en la construcción del vocabulario. Asimismo, el género no mostró un efecto significativo sobre estas actividades. El desempeño se relacionó con las capacidades individuales y los esfuerzos colectivos. Se obtuvieron $\alpha = 0,05$, $gl = 119$ y $R = 0,784$; además, $t_{obs} = 6,84 > 1,96$ ($\alpha = 0,05$; $gl = 118$), evidenciando una relación significativa entre el aprendizaje entre pares y los juegos deícticos.

Palabras clave: Juegos deícticos; aprendizaje entre pares; aprendizaje basado en juegos; desarrollo del vocabulario.

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Os impactos dos jogos dêiticos como preditores da aprendizagem entre pares na construção do vocabulário em língua inglesa

RESUMO

Esta pesquisa teve como objetivo examinar o impacto dos jogos dêiticos como preditores do desenvolvimento do vocabulário em inglês de estudantes do ensino secundário. Participaram 120 estudantes do primeiro ano (JSS 1) e três professores do Distrito Educacional III de Lagos Island, distribuídos em um grupo experimental e um grupo de controle. Antes da intervenção, ambos os grupos realizaram um pré-teste diagnóstico e participaram, durante quatro semanas, de atividades de desenvolvimento do vocabulário por meio de exercícios instrucionais planejados. O grupo experimental recebeu um protocolo de tratamento baseado em jogos dêiticos e aprendizagem entre pares, enquanto ambos os grupos foram posteriormente avaliados por meio de um pós-teste. Foi adotada uma abordagem de métodos mistos, integrando dados quantitativos provenientes da ecologia da sala de aula e dados qualitativos obtidos por meio de entrevistas. Foi realizada uma análise de covariância para determinar as diferenças no desempenho relacionado ao desenvolvimento do vocabulário em inglês entre os grupos. Os resultados evidenciaram diferenças significativas no desempenho entre os grupos experimental e de controle, indicando que a aprendizagem entre pares e os jogos dêiticos influenciaram o desenvolvimento do vocabulário. Além disso, o gênero não apresentou efeito significativo sobre a aprendizagem entre pares e as atividades lúdicas desenvolvidas no estudo. O desempenho dos participantes esteve relacionado tanto às capacidades individuais quanto aos esforços coletivos. Os resultados apresentaram $\alpha = 0,05$,

gl = 119 e $R = 0,784$. Além disso, $t_{obs} = 6,84 > 1,96$ ($\alpha = 0,05$; gl = 118), evidenciando uma relação significativa entre aprendizagem entre pares e jogos dêiticos no desenvolvimento do vocabulário em inglês.

Palavras-chave: Jogos dêiticos; aprendizagem entre pares; aprendizagem baseada em jogos; desenvolvimento do vocabulário.

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INTRODUCTION

The dynamism of instructional approaches has paved the way for the interest and use of object-based instructional games (used in this context as deictic games and designed for educational purposes) in teaching and learning (Murshidi et al., 2024). The development of effective teaching strategies stems from the quest to optimize learning outcomes in all subjects (Zhang, 2025). Effective teaching strategies are pertinent in most developing countries, particularly Nigeria, where the quality of education is measured in terms of learners' learning outcomes (Ayeni & Afolabi, 2012). Learning outcomes are identified as a function of the quality of teaching to which learners are exposed (Singh & Sarkar, 2015). These teaching qualities are more practical when focusing on peer learning or learner-centered approaches.

Learners' interests and learning habits are more reformed in a new learning culture through optimal control (instructional) games than through traditional learning (Prensky, 2001). Instructional games are identified as effective and efficient instruments to solve difficult and complex instructional procedures because they (i) enhance interactive and decision-making context, (ii) boost mastery skills, (iii) use action and not explanation, (iv) facilitate multiple learning styles and skills, and (v) provide personal satisfaction and motivation (Charles & McAlister, 2004).

Many scholars have conducted empirical research on the impact of instructional games in formal school settings (Zeng & Shang, 2018). The method of examining the impact of a treatment without comparing it with a control group is problematic due to the flaws in empirical studies. These are major hindrances to concluding the impact of instructional games on learners' learning within formal school settings (Mitchell & Savill-Smith, 2004).

Literature reviews have indicated that instructional games improve students' learning achievements and facilitate peer learning (Boud, 2001; Ke & Grabowski, 2006; Moreno, 2002). However, some studies have shown that instructional games are not always effective learning tools (Randel et al., 1992).

In separate studies, Eisen (1999) identified the use of instructional games as facilitators of peer learning. Among the qualities of peer learning identified are (i) the development of learners' ability to take control over their own learning, (ii) catering for individual differences in interest, achievements, and learning styles, (iii) emphasizing building meaning and understanding rather than completing tasks, (iv) improving productivity as different ideas and options are available from which to choose, (v) encouraging better and judicious use of resources, (vi) offering learners an opportunity to learn under different teachers with a variety of talents and skills, (vii) ensuring more effective coverage of content, (viii) involving cooperation, communication, and negotiation, and (ix) creating a supportive environment. Team members can learn from each other's mistakes and achievements. Identifying problems and proffering solutions as a team helps remove individual faults. With the use of instructional games, team members collectively share the successes and failures of their learning experiences.

Peer learning is a method that encourages meaningful learning, involving students teaching and learning from each other (Saraswathi et al., 2023). It involves sharing ideas, knowledge, and experiences, with an emphasis on interdependence, as opposed to independence (Boud, 2001). According to Connelly (1993), if what students learn is the basic output of schooling,

the more they learn in each period, the more “effective” the teaching. There are conflicting viewpoints on the best way to implement peer learning in formal classroom settings.

Peer learning in teaching and learning is informed by constructivist and sociocultural learning theories (Homayouni, 2022; Keerthirathne, 2020). From both theoretical perspectives, the students are the center of all learning and teaching decisions, which the instructional games facilitate (Coleman & Money, 2019; Li et al., 2024; Cheung & Ng, 2021). However, different theoretical perspectives, as well as perspectives from different disciplines and education policy documents, mean that this concept is sometimes misinterpreted and may confuse teachers. Many of the alternative terms used in the literature for this concept, such as personalized learning, independent learning, autonomous learning, inquiry-guided learning, team-based learning, problem-based learning, peer instruction, cooperative learning, and collaborative learning grounded in socio-cultural theory (Black, 2007).

Deictic English Language Game

The deictic game approach is a method of using mathematical game concepts to build English language vocabulary at Junior Secondary School One (JSS 1) through peer learning and interactive classroom processes. Words formed through these processes have their references determined by the context of the learner’s gestures. The activities involve classroom ecology, in which students learn through gaming process.

What is gaming? It involves either a challenge against a task or one or more opponents with common tasks to be tackled individually or in conjunction with others in a group to achieve a specific educational objective. Ayinde (2002) identified the following principles that govern the classification of games as educational: (i) the activity of such a game is governed by a set of rules and has a clear and underlying structure; (ii) the activity normally has distinct finishing points; (iii) the activity has specific cognitive objectives.

Billen (1993) argues that educational games influence cognitive functions and motivation; players are often removed from the real world. Quinn (1997) opines that learning and educational practice need to combine the fun elements of games within a structural and educational system design that involves motivational learning and interactive components.

Gender and Game

Game work provides a way to investigate gender issues in the use of games as instructional tools (Calvo-Morata & Fernández-Manjón, 2023; Lu, 2012; Lukosch et al., 2017). The hyper-sexualization and objectification of the human form in games is problematic, as is the multitude of racial and cultural stereotypes that are often perpetuated (Ansari et al., 2019; Fox et al., 2014). Therefore, it is important to examine the relationship between gameplay and gender, as this implies a difference between the gameplay of females and males in terms of their intrinsic skills.

Kinzie and Joseph (2008) found that females preferred puzzle, adventure, and managerial games while males preferred first-person shooters, role-playing sports, and strategy games. The authors indicated that there are choices that demonstrate underlying gender-related neurocognitive processes. This includes perceptual speed, fine motor skills, and sequenced hand movements for females, and visual-spatial ability (localization, orientation, and mental rotation), target-directed motor skills, and greater risk-taking for males.

Methodological flows in the empirical literature indicate contradictory views, which demand further empirical studies to facilitate and implement the use of games in classrooms. This study was conducted to provide evidence for this by implementing an experimental approach. The previous empirical studies and research gaps discussed were used to design this study. As indicated, instructional games were used as the treatment, performance, and peer learning as dependent variables, and gender as an intervening variable. Unlike previous studies, this study examined the impact of deictic games on teaching vocabulary building in English language among JSS 1 students. Details of this game are provided in the Treatment section.

Purpose of the study

This study adopts a peer learning approach (PLA), as identified with other learner-centered approaches, to stress how learners develop basic drills and knowledge of English vocabulary building through games. The process of transferring such learning to new contexts and applications in an open-ended challenge, such as composition writing, lexis and structure, and reading comprehension, shall be the terminal passage. A search of the teacher education research literature on PLA yielded few studies describing effective teacher practices in English language from a learning perspective. Black (2007) argued that learning in this process should be viewed as both active individual construction and enculturation into classroom practice.

Statement of the Problem

Many Nigerian schools at both primary and secondary levels are facing extreme extinction in terms of enculturation and improvisation of instructional tools. Students have developed a phobia of understanding the teaching of their teachers and, in turn, struggle to learn various concepts abstractly. Teachers also struggle to teach directly from textbooks because there are no teaching resources, and where resources are available, they lack quality. This situation increases anxiety, and as anxiety increases, academic performance and achievement inevitably decrease (Ayinde, 2017). There is a need to infuse problem-solving activities using game-based and peer-learning processes, as suggested in this study.

Research Questions:

1. Can peer learning and the deictic game approach enhance English vocabulary building at the junior secondary level?
2. Does the gender composition of peers affect peer learning/vocabulary building when using peer learning and deictic game approaches?

CONCEPTUAL FRAMEWORK

Scholars' views from existing literature related to the impacts of instructional games identified various conceptual frameworks in their studies, including social constructivism (Lim et al., 2006). Intrinsic learning theory was suggested by Cameron and Dwyer (2005), and experiential theory was proposed by Garris et al. (2002).

Various approaches exist for integrating gaming techniques into teaching. According to Christou et al. (2006), solid theoretical frameworks that provide reliable and innovative reference models are essential for informing the design of rich game-based learning environments. The instrumental approach is a foundational theoretical framework for studying the use of games as instructional tools (Guin & Trouche, 1998). This framework has been applied in studies on English language lexis and structure assessment systems, as well as English language comprehension and composition learning systems. This study was guided by an instrumental approach intertwined with the Technological Pedagogical and Content Knowledge framework (TPACK).

Drijvers and Trouche (2008) acknowledged the double jeopardy of teaching and learning English in a game-based environment: the complexities of teaching and learning and the use of game tools. Drijvers and Trouche (2008, p.164) elucidate the double reference phenomenon, which is the double interpretation of tasks by teachers and learners, giving an example where "tasks that address English language concepts may be perceived to address how the gaming environment would deal with such a task."

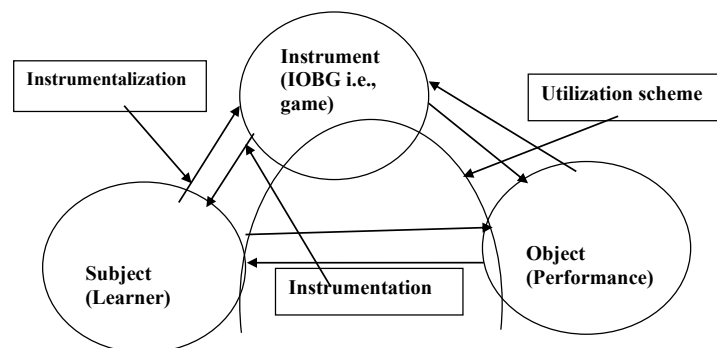
The instrumental approach was developed by Verillon and Rabardel (1995) based on Vygotsky's approach, in which tools are considered mediators of human activity. The instrumental approach involves three constructs: the instrument, subject, and object of an activity (Figure 1). The instrument is the artifact or technological tool (branded as Instructional Object Based Game (IOBG)) that is used by the subject to develop mental schemes for specific tasks (i.e., English language vocabulary building) through a process of

instrumental genesis, in which the subject must learn how to use the tool for executing a task by means of that tool. This instrument is a psychological construct; instrumental genesis involves two processes: instrumentation and instrumentalization. Instrumentation is the construction of a schema oriented towards the game tool and the effects of tool use on the English language task, whereas instrumentalization is the construction of a schema oriented towards the task, that is, the appropriation and transformation of the tool by the student. Laborde et al. (2006) contended that the use of the tool changes the way of learning English language with a specific appropriation of the tool required. Kindermann (1993, p. 6) defines appropriation as "an everyday word associated with making something your own." Hoyles and Noss (2003) refer to this process as the relationship between the tool and the learner, where the tool shapes the thinking of the learner, but the tool is also shaped by the learner's thoughts. Goos et al. (2010) provide an example of teaching English language properties of vocabulary building. The instrumentation process is realized when learners learn how to play the game, and instrumentalization is the process where learners understand what is happening where the game is being played and gives them results. These processes occur simultaneously in the body. The instrument (game) is a mediator between the subject (learner) and object (performance).

Figure 1 illustrates the framework and relationships among the variables in this study. The framework adopted in this study was in line with the three-stage game model suggested by Garris et al. (2002). This conceptual framework provides theoretical evidence for the study's variables and hypotheses. Debriefing through game quizzes produces performance and experiential learning, suggesting that the active participation of learners within the game environment facilitates peer learning. This suggestion formed the basis of the first hypothesis, which sought to determine the impact of deictic gestures on the performance variables.

Figure 1:

Concept of an instrument adopted from Verillon and Rabardel (1995).



INSTRUMENT

Three sets of card games were used in this study: Vowel cards consist of five basic letters, that is, A, E, I, O, U.

These cards were used as specified in class activity one. The reliability coefficient using the Cronbach alpha method after administering to a representative sample of thirty (30) JSS 1 students yielded a value of 0.82. Cards on firming words with difficult consonants such as V, W, X, Y, and Z, as specified in class activity two.

The reliability coefficient using Cronbach's alpha when administered to a representative sample of thirty (30) JSS 1 students yielded a value of 0.86. The third card game, consisting of two-letter words, was first conceptualized by Olatoye Mukaila Ayinde during his PhD studies and was subsequently developed and validated in 2013 in the Department of Educational Technology, University of Botswana. Along with Professor Paul Nleya, to measure the word creation ability of learners within the age range of 10-12 years, with an inter-rater reliability

coefficient of 0.60 using Scott's formula. The cards used in the first, second, and third activities were subjected to face and content validity tests.

Methods:

This study applied a mixed method. Quantitative data were collected to examine the impact of the game on the participants to facilitate the generalization of the findings. On the other hand, the qualitative data was used to confirm the outcome of the quantitative analysis that explored the effects of the game on learning. The study adopts a quasi-experimental technique based on classification made on a similar study conducted by Kerlinger and Lee (2000). Before assigning the students to the treatment and control groups, baseline data were collected through a pre-test from the two groups. Peer learning using deictic games was applied as treatment to the experimental group, while the participants in the control group were taught using traditional methods. In this study, multistage stratified convenience sampling was used to assign participants to reduce, if not avoid, data distribution bias. This multistage sampling helped capture all the schools in the three zones of Education District III. For instance, one school was selected from three zones of the same district III. The inclusion criteria were that the school must be a mixed school (that is, schools admitting male and female students), have play card games facilities such as movable chairs and tables, and have qualified English language teachers willing to participate in the study.

Over forty (40) subjects were recruited and selected from each of the three (3) schools in the education district III (convenience selection), that made a total number of one hundred and twenty (120) subjects. They were then randomly assigned to either the experimental or control group.

Table 1:

Distribution of participants based on male and female gender types

Group	Gender		Total
	Male	Female	
Experimental	30	30	60
Control	30	30	60
Total	60	60	120

Note: The sample consisted of 120 students, equally divided between the experimental and control groups, with 30 men and 30 women in each group.

Source: Author's own elaboration based on research data.

In Table 1, the strategy for the assignment involves the arrangement of the male and female participants serially and equally, followed by randomly assigning the odd and even serial numbers. For example, the serial assignment could be as follows; a female is 1, a male is 2; a male is 3, a female is 4, and so on. The serial counts for female or male could be even or odd in the ratio of one to one, implying that both genders had equal chances of being assigned to odd or even serial numbers. Participants with even serial numbers were subsequently assigned to the experimental group, while those with odd serial numbers were assigned to the control group. Another crucial consideration for the selection of students was their ability levels, which were categorized as above-average, average, and below-average performance for the two groups based on their anecdotal records.

With respect to the selected schools and their teachers, one English language teacher was recruited from each of the three schools. The inclusion criteria for the teachers include five (5) years of teaching experience, and the teacher should be a qualified teacher with a minimum of a bachelor's degree with a focus on education and teaching of English language. The selected teachers were trained in the use of the new content design, instrument material, content presentation, strategies, and logistics in conditioning the teaching activities.

Treatments

The treatment applied to the participants, including a set of Object-Based Instructional Multimedia Card Games (OBIMCG) and lesson plans. The OBIMCG applied in the study was quite distinct from the previously adopted object games by other researchers because it was tailored towards specific instructional content drawn from a curriculum and had a multiplayer option.

English-language Achievement Test (EAT)

The English language achievement test used in this study had types A and B, which were used to collect information on students' performance before and after the treatment. The test items served as cognitive interfaces in the games (Figure 2). The test was based on word formation, such as using one word to replace another word. For example, surprise can replace amazed, and fear can replace scared (lexis and structure, comprehension, and composition). More than 30 multiple-choice questions were constructed using specification tables. The specifications were based on all the cognitive levels in Bloom's taxonomy.

Game

The game was administered only to the experimental group. Each member of the experimental group was scored according to their responses, using a scoring format.

Scoring Format: Game and EAT were scored using an interval scale of three (3) points. Each player recorded every die throw and created a word using the letters on the die. Each word was formed based on the number of letters graded on the right side of Figure 2.

The scores for all completed activities by a player were summed at the end of the game and recorded in an appropriate column against the serial numbers assigned to each participant.

The scoring pattern followed the Likert scale format designed specifically for this study and was used to encode the responses. The EAT scored three points per question, and in the case of a member of the control group who solved a given task correctly, three points were awarded for each question. In addition, one-half a point was awarded to participants for providing words similar to or close in meaning to the correct answer, respectively. The final score was then transferred to the appropriate column for each participant's serial number.

Subsequently, the English language test scores of the previous performance were correlated with the present performance in the game. The sum of the previous performance, pre-test, and post-test formed the learner's ability to learn. This was used to confirm changes in every learner's performance, whether positive or negative.

Procedure for the Generation of Information through Qualitative Data

After determining the participants from the selected schools, the principals provided the necessary logistics and released the English language teachers who participated in the study. This was followed by a two-day training session for the teachers according to the treatment conditions. The training content administered to the recruited teachers included the following:

- (i) The classroom arrangement, which entails the arrangement of chairs and tables for the experiment and smooth implementation of the design game, is illustrated in Figure 2.
- (ii) Ensuring that teachers understand how to assess and score the game and EAT.
- (iii) Design of lesson plan, which involves ensuring that the teachers understand the contents of the game and EAT. The teachers were also briefed on how to present the contents and carry out the evaluation of the learning activities.
- (iv) Teachers were acquainted with how to use the instructional material, such as designing games and EAT, properly.
- (v) Ensuring that the teachers stay on the scope and objectives of each lesson.

Pre and Post-test Activities

Pre-test: Before the teaching activities, a pre-test was conducted for all participants. 30 (thirty) multiple-choice questions that lasted for 40 (forty) minutes were administered to the experimental and control groups. The pre-test was conducted by the experimenter, assisted by three research assistants. The responses of the participants to the questions were collected, marked, and analyzed appropriately.

Post-test: After the game, the participants' responses were collected, marked, and analyzed. To ensure that the participants maintained the same exposure conditions, the experimenter monitored the conduct and administration of both the pre-test and post-test. In addition, the participants were given snacks and soft drinks before the treatments to prevent external factors (these are conditions that militate against meaningful learning, such as malnutrition, broken home effect, peer pressure, etc., while malnutrition is the main factor) influencing the subject, as suggested by Ayinde (2017) in the learner's needs model (intervening variable).

Procedure for the alphabet game-based experimental group

The treatments administered to the experimental group include:

1. Briefing the teacher about the previously taught topic in less than a day and then introducing the new topic for the present day, which is a lesson on the identification of 2 letters word in a word. For instance, in a word like discriminate, 'is' and 'in' appeared. The design game was distributed according to the guidelines provided for the game and the recommended class arrangement. This was followed by an explanation of how the game was used in accordance with the design.
2. Participants engaging in an activity session, involving the students engaging in the game with minimum teacher intervention.
3. Participants were debriefed, which involved an assignment session, collection of materials, and rearrangement of the class for the next lesson.

The treatment lasted for two weeks, with instructions given for two periods of 30 minutes each in the whole sample of schools in the study.

Procedure for the Control Group.

In the control group, the activities carried out by the participants include that.

The teachers followed the traditional teaching method to explain the topic to the students. This involves teachers solving related questions extracted from English language textbook (using lexis and structure and comprehension passages) on a whiteboard. While students write the notes, complete a class work, ask questions when confused and go home with an activity. This activity lasted for two periods of thirty minutes for two weeks in the schools chosen for the study. Subsequently, an EAT was administered to the control group three months later.

Data Preparation: The procedure for data collection and preparation includes the following:

The Game involves the engagement of two players, in which each player records the outcome of every session. The total score for the entire session was rated as a nominal value. The activities were conducted after the pre-test and before the post-test in the chosen schools of each educational district. The participants in the card game had a similar demographic profile as the control group.

At the time EAT was administered, the control and experimental groups played the card game in their class. The responses of EAT from pre-test and post-test were graded as specified, while the data collected were further coded.

The codified responses from the two groups were processed and analyzed with aid of Statistical Package for Social Sciences (SPSS) version 21.

The SPSS was used to compute the mean values, standard deviation, analysis of covariant, Pearson correlation coefficient and two-way analysis of variance at .05 significant levels.

The data collected from the control group was based on the activities and assessment administered by the control group. The purpose was to assess the impact of students' contribution in the traditional learning condition. In this condition, the focus teacher instructs while the students (participants) listen, ask and answer questions asked by the teacher. This process was primarily divided into three stages which include introduction, presentation and conclusion. The Introductory session focused on the 'springboard' together with teacher explanations as in the case of teaching a sub-topic under composition or identification of new words. Under the presentation stage, the teacher explains all the concepts in the sub-topic, while the students take from the teacher's explanation. Also, the students could respond to the verbal or written evaluation. In conclusion stage, the teacher consolidates learning by recapitulating questions that were mainly factual and probe within the topics raised during the teaching process.

Deictic game approach model

This is a rudimentary instructional model developed for teaching English to learners aged 10–12 years. The game content was designed for junior secondary learners in the specified age range.

Selected contents of the game

- (i) Vowel: The use of vowels to form words.
- (ii) Consonant: Forming words with difficult consonants, such as X, W, Y, and Z.
- (iii) Using two-letter words such as at, an, am, by, on, it, is, and if in forming words.

Instructions

The learners were divided into groups.

Teacher's guide: The teacher (he or she) shall monitor the group such that:

A word formed by a group shall not be formed by another group, except that the vowel used by that group is not the same as the previous group.

The word(s) formed are written on a paper or magnetic whiteboard provided for the group.

Class Ecology I

Topic: The use of vowels in word formation

Entry behavior: The learners have learned to identify vowels.

A dictation test should be given to every learner before the commencement of class activities.

Instructional objectives

During these activities, learners should be able to:

- (i) Use all the listed letters to form words.
- (ii) Words are formed by themselves or in groups. Mixing with other peers in forming words.

Contents: Vowels: In basic English language formation, it involves a, e, i, o, u.

Rules of activities

1. Each group shall write their word formed on a computer-based micro-chip with a sensor pen (Magnetic board)
2. Each group shall use at least three of the listed 5 vowels to form words.
3. Each group shall form a minimum of twenty different words with their chosen vowels

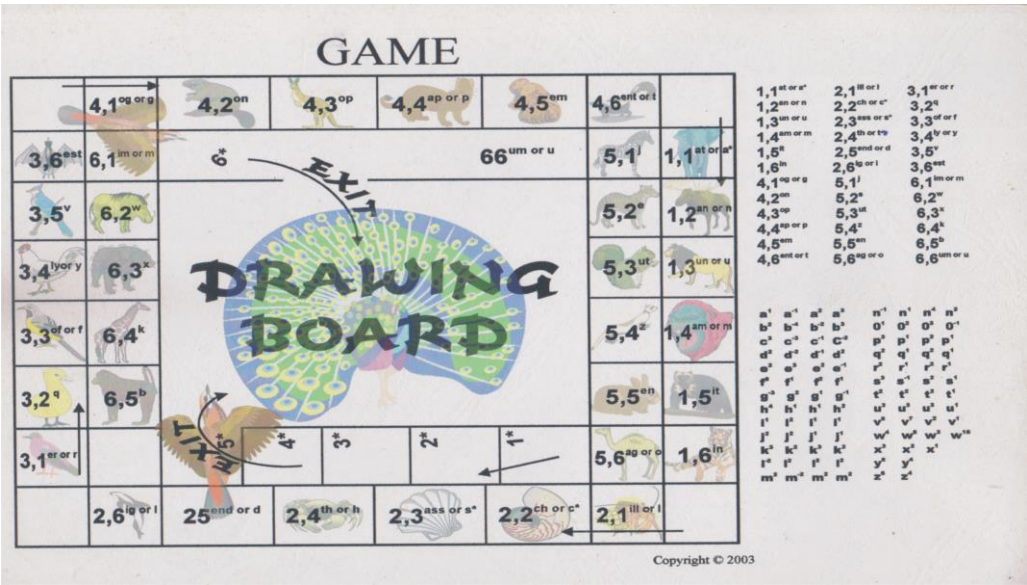
Each letter in a word earns a group of two marks
Example:

Table 2:
Examples of words formed using vowels in deictic play

Aa	Data, armada, Amalgamate	Against, Alabaster, Arcane	Area, available, alas
Ee	Enter, element, Ever, Development,	effective, experience, perceived, seed,	effectiveness, were, need, believes, never exercise
Ii	Initiate, Facilitation, Definition	Individual, Significant, Responsibilities	Facility, Indiscriminate, Availability
Oo	Motivation, Mono, Anthropology	Metro, monopoly	Polite, room, apology,
Uu	Numerous, promiscuous, Avuncular	continuous, ground, August	Usually, Curriculum Augur

Note: Each letter used in word formation earned two points. The examples were used as part of the deictic game activities aimed at developing and expanding English vocabulary.
Source: Author's own elaboration based on the didactic activity described in the study.

Figure 2:
MathEng Game Board



Note: The MathEng board was used as a teaching resource to develop word formation and learning activities through deictic play. The board's layout guided letter selection, word formation, and the scoring system used during the activities.
Evaluation: Learners will be given a summative evaluation test after class activities. They used each letter to form two words without using the words used during class activities. Therefore, each learner should form ten different words.

Assignment

1. The learners were to use each letter to form 20 words, five words per letter.
2. Learners are to use consonant letters, such as W, X, Y, and Z to form two words each, for example, zigzag, year, zero, yes, well, xylem, work, and yam.

Comments for the teacher

The teacher moves around the class to ensure that every member of the group participates in the task (word formation and vocabulary-building) should be collective group work.

Class Work

Activity I

Introduction

The teacher should go around to mark the last assignment in the first activity. By asking the learners to exchange their books. Entry behavior: students have learned the use of vowels in word formation.

Instructional objectives

During the lesson, learners should be able to form words with difficult consonants, such as W, X, Y, and Z.

Contents

Words are formed with five selected consonants: V, W, X, Y, and Z.

Presentation of contents

Learners shall be given a test on the previous (class ecology) activities

Step 1: Each group writes words using V, W, X, Y, and Z to form at least ten words.

Example water, wood, year, yell, zoo, zip,

Step II: The Teacher should go around to ensure that every member of the group participates in word formation.

V	Vessel, Tatvian, View, Valve, Volt, Ivy, Visit, Over	
W	Wrong, Flown, Pew, Write, Own, Raw, Wrist, Owl, Yaw, Worry, Pewit	Yellow
X	Xyster, Juxtaposition, Kay, X-ray, Oxalis, Cylix, Xantippe, Oxazine Immix, Xylem, Oxter, Pyrex	
Y	Youth, Pyramid, Frowsy, Yes, Tyke, Ivy, Yard, Cylix, Jetty, Yellow	Jekyll,
Z	Zealous, Puzzle, Pintz, Zero, fanzine, Fizz, Zing, Bezant, Fuzz, Zoo Piazza, Oyez	

Step III: Class assessment: Each group will be called to write out their words formed on the magnetic board by the group leaders. The letter used shall be underlined, for example, Zig-Zag.

Step IV: Scoring: Each letter used to form a word earns the group three (3) marks.

Evaluation: The teacher shall give a test on word formation with V, X, Y, and Z, using at least two of these four letters to form five words. This should be individual based.

Activity II

Assignment: Every member of the class shall form at least three (3) words each with the following two-letter words:

At	It	To	Be	Up
An	In	No	He	Us
Am	If	Or	me	as
Is	so	we		

Activity III

Topic: Using two-letter words to form a word.

Instruction objective

At the end of these activities, learners should be able to form words with the listed two letters.

Behavioral objectives: During the activities, learners should be able to:

- (i) They interact with each other and learn from each other.
- (ii) Form words in groups and individuals.
- (iii) Use a dictionary to search for the words to be formed.
- (iv) Identify words in which the same letter appears twice.

Contents

Two letter word(s)

See assignment under class ecology II

Examples of two-letter words that appear in word formation below:

- 1 Attend, pity, Item, competitive, Indiscriminate, Amuse, tomato, Can, onion, Hand, antihistamine, Antiperspirant, Argumentation, Aristocrat, Asbestosis, Indiscrimination, Pituitary, Anoint, Incantation

Presentation of contents

Introduction: The learners were asked to pronounce the two-letter word as the teacher wrote it on the board.

Step I: Learners will maintain group activities and will be asked to use the two-letter words written by the teacher to form words. At least ten words with two-letter words of choice. The learners were stopped after 15 minutes. Group members exchanged their books with one another.

Step II: The teacher uses dice to introduce learners to the game, as shown in **Figure 2**. The sample space thrown shall be part of the word he or she will use to form a word, and the learner shall use the alphabet numbered below the sample space indicators on the right side. These letters shall be used one at a time. Mathematical operations on each letter shall be used as a scoring pattern. Examples: in ITEM: the first letter I = 1, second letter T = -2, third E = +2, M = 1, the score is 3; sample space 2, 3 is ass, the learner who forms assist shall earn $1+2-3+1+2+2=5$.

It: item, pity, illicit, pituitary, Itch, invite, misfit

In: inability, lankiness, win, incline, inadequate, sin, latrine

As: assist, embassy, pass, assassin

EVALUATION FORMAT

If the word formed has its letter at the beginning, the learner shall earn two marks; if it is misdialed, the learner shall earn three marks; but if it appears twice or at the end of the word formed, the learner shall earn four marks.

Step III: The teacher asks the learners, according to step II, to form twenty different words using at least five listed two-letter words under assignment in class ecology II.

Assignment: Learners were asked to form thirty (30) different words using at least ten (10) two-letter words at home.

Procedure for the Quantitative Data Collection

Responses from the instruments on a five-point Likert scale, containing nominal values of 1, 2, 3, 4, 5 used for coding. This implies that (a) the previous performance of the participants; (b) the pre-test; and (c) the post-test were categorized into 0 – 39, 40 – 49, 50 – 59, 60 – 69, 70 and above, corresponding to nominal values of 1, 2, 3, 4, 5, respectively. The experimental group was administered with game, and the pre-tests were carried out before the second term of the game, while the post-test on the instruments was conducted three months after the game. The responses from all the subjects based on the game and EAT were scored.

Data collection

The scores obtained by the subjects before and after each activity were analyzed using SPSS, and the results provided meaningful insight that could answer the research questions.

Discussion of results

Research Question 1: Can peer learning and the deictic game approach enhance English vocabulary building at the junior secondary level?

Table 3 shows a correlation coefficient of 0.784, which is positive and significant at 0.05 level. This implies that peer learning and deictic games are related to vocabulary building among learners at the junior secondary level of English language vocabulary.

Table 3:

Test of the relationship between peer learning and deictic games in vocabulary building.

Variable	N	df	R	P
Peer learning and deictic games	120	119	0.784	0.05

Note: The correlation coefficient obtained was ($r = 0.784$), indicating a positive association between peer learning, deictic games, and vocabulary building. The significance level was reported at $p = 0.05$.

Table 4 shows that research question one cannot be upheld since the t observed is greater than the critical t_{value} (i.e., $6.84 > 1.96$) at 0.05 level of significance. Hence, there is a significant relationship between peer learning and deictic games on vocabulary building of learners aged 10–12 years.

Table 4:

Manifestation of peer learning and deictic games on vocabulary building.

Variable	N	X	S	T_{obs}	df	t_{crit}
Peer learning	60	0.80	0.65	6.84	118	1.96
deictic games	60	1.30	0.52			

Note: The t -test reported in the study showed an observed value of 6.84, with 118 degrees of freedom, versus a critical value of 1.96. The result was interpreted at 0.05 significance level.

Table 5 contains F_{value} of 12.483, which is significant at 0.05 level. This implies that peer learning and deictic games significantly influence vocabulary building. $df = 119$, $f = 12.483$, significant at 0.00 level.

Table 5:

Summary of analysis of covariance on post-test

Test for the influence of peer learning and deictic games on vocabulary building.

Item	Sum of squares	df	Mean square	F	Sig
Regression	4273.567	1	4273.567		
Residual	14934.669	119	145.997	12.483	0.00
Total	19208.236	120			

Note: The analysis reported presents a regression sum of squares of 4273.567 and a residual sum of squares of 14934.669, with an F-value of 12.483 and a reported significance of $p = 0.00$.

Research Question 2: Does the gender composition of peers affect peer learning/vocabulary building when using peer learning and deictic game approaches?

Table 6:

Test of the relationship between gender composition, peer, and deictic game on vocabulary building.

Variable	N	df	R	P
Gender composition and deictic game in vocabulary building	120	119	0.285	0.05

Note: The reported correlation coefficient was ($r = 0.285$), interpreted as a non-significant association at 0.05 level. This result was used to establish that gender composition did not show a significant relationship with the use of deictic play and vocabulary construction

Table 7:

Comparison of Male and Female Learners' Performance in Vocabulary Building Using the Deictic Game

Gender	N	Mean	SD	Tcal	Tcritical	p
Male	60	36.831	4.100	1.3952	1.97	0.05
Female	60	37.051	4.231			

Note: The comparison of the mean scores of male and female learners yielded a calculated t value of 1.3952, which was lower than the critical t value of 1.97 at the 0.05 significance level. Therefore, the difference between the two groups was not statistically significant. This result indicates that male and female learners demonstrated comparable performance in vocabulary building through the use of the deictic game.

Interpretation of Table 7

Table 7 presents the comparison of male and female learners' performance in vocabulary building through the use of the deictic game. The male learners obtained a mean score of 36.831 ($SD = 4.100$), whereas the female learners obtained a slightly higher mean score of 37.051 ($SD = 4.231$). The calculated t value was 1.3952, which was lower than the critical value of 1.97 at 0.05 significance level. Thus, the difference between the mean scores was not statistically significant. This finding suggests that gender did not significantly influence learners' vocabulary-building performance when using the deictic game. Therefore, male and female learners showed comparable levels of performance.

Answer to Research Question 2

To answer Research Question 2, an independent-samples *t*-test was conducted to determine whether there was a statistically significant difference between male and female learners in vocabulary-building performance through the use of the deictic game. The results presented in Table 7 indicate that the calculated *t* value (1.3952) was lower than the critical *t* value (1.97) at the 0.05 significance level. Therefore, the difference was not statistically significant. The null hypothesis was consequently retained, indicating that there was no statistically significant difference between male and female learners' performance in vocabulary building through the use of the deictic game.

These findings aligned with those of Black (2007), Boud (2001), and Eisen (1999), who noted that peer learning involves the sharing of ideas, knowledge, and experiences as opposed to independent learning. They affirmed the constructivist view on the learning theories, which highlighted an active individual construction and a process of enculturation into classroom practice using the gaming process. In line with these authors, this study suggests that using deictic games as a peer learning tool will enhance the learner's ability to take control of their own learning outcome. This is because the game allows cooperation, communication, closeness, and mutual understanding of topic content due to the intensity of the partnership.

These findings were also in line with the contribution of Quinn (1997), who believed that learning and educational practice involved in such a game that enhances fun, facilitates motivational learning.

However, these findings were not in agreement with those of Kinzie and Joseph (2008), who discovered that female learners preferred certain games and performed better in certain cognitive gaming than their male counterparts.

Implication for pedagogical practice

This study has serious implications for both theory and practice in classroom ecology. The result suggests that deictic games, when used as a peer learning tool, serve as an effective constructivist approach that combines collaborative interaction with individual development, significantly enhancing English vocabulary acquisition in learning domains. Also, the self-motivated scenes in the game capture a new dimension of study. Additionally, future research could consider multivariate studies that will help to ascertain the extent to which gaming (object-based gaming used in this study) affects or facilitates learning in other subjects.

Education authorities need to take into consideration how gender differences affect innovative policies on learning. They should administer these policies in schools to facilitate meaningful learning.

CONCLUSION

In the context of teaching and learning, teachers are always faced with the challenges of limited access to appropriate instructional materials that aid comprehension of content. The traditional method does not give room for active engagement and peer collaboration. This study examines the effect of gaming activities and peer engagement on the learning outcome. The results of the study found a strong relationship between peer learning and deictic games. Moreover, there is a significant effect of the duo on the learning outcome. This suggests that the use of gaming activities facilitates peer learning and vocabulary building among learners aged 10-12 years in Lagos State, Nigeria.

Moreover, it is general knowledge that students learn faster from their peers because there are no psychological barriers, such as fear of mistakes, fear of judgment, and possibility of reprimand from a person of status. This aligns with Gogus (2012) affirmation that peer learning involves the acquisition of knowledge and skills through active helping and support among peers who are equals in standing or matching companions. When interpreted from these stands, it becomes clear how the addition of game-based activities in learning process among peers could complement the conventional method and enhance learning outcomes.

Jääskä and Aaltonen (2022) findings supported the result that game-based learning can produce positive effects on student engagement, manifesting as increased interest, motivation, and learning from peers.

Invariably, this study revealed that gender composition has no significant effect on peer learning and gaming activities. Because male and female learners who were treated with deictic games do not differ significantly by their gender difference in vocabulary building. This is consistent with the findings from Almusharraf et al. (2023), who found that gender does not, in fact, impact the learner's level of motivation and engagement within game-based classrooms.

The implication of these findings is quite interesting, because it reinforces the importance of integrating structured gamified activities in teaching and learning, especially in primary and secondary schools. Despite the strengths of the study, there are several limitations, including the small age group (10-12 years), which may hinder generalization of our findings. Moreover, the study only used a type of game activity known as deictic, and duration of the intervention was relatively short.

Future research can further explore other game types, such as digital gamified learning aids, examine long-term effects of game-based peer learning on achievement and cover wider regions in the context of Nigeria.

Finally, this study has contributed to reinforcing the existing evidence in peer learning and game-based learning activities. This method offers effective and engaging alternatives to traditional methods that would aid teachers in delivering content and offer a richer learning experience to students, especially in vocabulary building. The goal is to support improved academic performance and quality of basic education.

REFERENCES

- Almusharraf, N., Aljasser, M., Dalbani, H., & Alsheikh, D. (2023). Gender differences in utilizing a game-based approach within the EFL online classrooms. *Heliyon*, 9(2), e13136. <https://doi.org/10.1016/j.heliyon.2023.e13136>
- Ansari, R., Abdul Jaffar, B., Riaz, S., Kaur, M. J., & Mushtaq, A. (2019). Datamining to alert the formation of women objectification stereotypes in video games. In 2019 Amity International Conference on Artificial Intelligence (AICAI) (pp. 521–526). IEEE. <https://doi.org/10.1109/AICAI.2019.8701256>
- Ayeni, A. J., & Afolabi, E.R.I. (2012). Teachers' instructional task performance and quality assurance of students' learning outcomes in Nigerian secondary schools. *International Journal of Research Studies in Educational Technology*, 1(1). <https://doi.org/10.5861/ijrset.2012.v1i1.47>
- Ayinde, O. M. (2002). Computer-based instruction in primary schools: A case for mathematics and English. *Educational Perspective: A Journal of the Faculty of Education, Lagos State University*, 5(2), 28-32.
- Ayinde, O. M. (2017). Structured Instructional Process and performance of Junior Secondary School 2 students in Mathematics. *Journal Pendidikan Malaysia*, 42(2), 135–145. <https://doi.org/10.17576/jpen-2017-42.02-07>
- Billen, A. (1993). Could it be the end for supermario? The observer 27th June.
- Black, R. (2007). Crossing the bridge: Overcoming entrenched disadvantage through student-centred learning. Education Foundation Australia. Retrieved from <https://eric.ed.gov/?id=ED501899>

- Boud, D. (2001). Making the move to peer learning. In Boud, D., Cohen, R. & Sampson, J. (Eds.) (2001). *Peer Learning in Higher Education: Learning from and with each other*. London: Kogan Page (now Routledge), 1-20.
- Calvo-Morata, A., & Fernández-Manjón, B. (2023). Serious games for social problems. In *Lecture notes in computer science* (pp. 98–109). https://doi.org/10.1007/978-3-031-33023-0_9
- Cameron, B., & Dwyer, F. (2005). The Effect of Online Gaming, Cognition and Feedback Type in Facilitating Delayed Achievement of Different Learning Objectives. *Journal of Interactive Learning Research*, 16(3), 243–258.
- Charles, D., & McAlister, M. (2004). Integrating Ideas About Invisible Playgrounds from Play Theory into Online Educational Digital Games. In *Lecture notes in computer science* (pp. 598–601). https://doi.org/10.1007/978-3-540-28643-1_79
- Cheung, S. Y., & Ng, K. Y. (2021). Application of the educational game to enhance student learning. *Frontiers in Education*, 6. <https://doi.org/10.3389/feduc.2021.623793>
- Christou, C., Jones, K., Mousoulides, N. and Pittalis, M. (2006). Developing the 3DMath Dynamic Geometry Software: theoretical perspectives on design, *International Journal for Technology in Mathematics Education*, 13(4), 168-174.
- Coleman, T. E., & Money, A. G. (2019). Student-centred digital game-based learning: a conceptual framework and survey of the state of the art. *Higher Education*, 79(3), 415–457. <https://doi.org/10.1007/s10734-019-00417-0>
- Connelly, M. F. (1993). Teacher Evaluation. A critical review and a plea for supervised reflective practice. In Farrell, J and J. Oliveria (Eds). *Teacher in Developing countries*. Washington, D.C.
- Drijvers, P. & Trouche, L. (2008). From artifacts to instruments: A theoretical framework behind orchestra metaphor. In M. K. Heid & G. W. Blume (Eds.) *Research on Technology and the Teaching and Learning of mathematics: Research Syntheses*, 1, 155-206. Charlotte, NC: Information Age.
- Eisen, M. J. (1999). Peer learning partnerships: A qualitative case study of teaching partners professional development efforts. Unpublished doctoral dissertation, teachers college, Columbia university, USA.
- Fox, J., Ralston, R. A., Cooper, C. K., & Jones, K. A. (2014). Sexualized avatars lead to women's Self-Objectification and acceptance of rape myths. *Psychology of Women Quarterly*, 39(3), 349–362. <https://doi.org/10.1177/0361684314553578>
- Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, Motivation, and Learning: A research and practice model. *Simulation & Gaming*, 33(4), 441–467. <https://doi.org/10.1177/1046878102238607>
- Gogus, A. (2012). Peer Learning and Assessment. In: Seel, N.M. (eds) *Encyclopedia of the Sciences of Learning*. Springer, Boston, MA. https://doi.org/10.1007/978-1-4419-1428-6_146
- Goos, M., Soury-Lavergne, S., Assude, T., Brown, J., Kong, C., Glover, D., Grugeon, B., Larbode, C., Lavicza, Z., Miller, D. & Sinclair, M. (2010). Teachers and teaching: Theoretical perspectives and issues concerning classroom implementation. In C. Hoyle & J.B. Lagrange (Eds.) *Mathematics Education and Technology-Rethinking the terrain*, 311-328. https://doi.org/10.1007/978-1-4419-0146-0_14
- Guin, D., & Trouche, L. (1998). The Complex Process of Converting Tools into Mathematical Instruments: The Case of Calculators. *International Journal of Computers for Mathematical Learning*, 3(3), 195–227. <https://doi.org/10.1023/a:1009892720043>

- Homayouni, M. (2022). Peer assessment in group-oriented classroom contexts: on the effectiveness of peer assessment coupled with scaffolding and group work on speaking skills and vocabulary learning. *Language Testing in Asia*, 12(1). <https://doi.org/10.1186/s40468-022-00211-3>
- Hoyles, C. & Noss, R. (2003). 'What can digital technologies take from and bring to research in mathematical education?' In A. Bishop, M. A. Clements, C. Keitel, J. Kilpatrick & F.K.S. Leung (eds.). *Second International Handbook of Mathematics Education*, 323-349. Kluwer Academic Publishers, Dordrecht. https://doi.org/10.1007/978-94-010-0273-8_11
- Jääskä, E., & Aaltonen, K. (2022). Teachers' experiences of using game-based learning methods in project management higher education. *Project Leadership and Society*, 3, 100041. <https://doi.org/10.1016/j.plas.2022.100041>
- Ke, F., & Grabowski, B. (2006). Gameplaying for maths learning: cooperative or not? *British Journal of Educational Technology*, 38(2), 249-259. <https://doi.org/10.1111/j.1467-8535.2006.00593.x>
- Keerthirathne, W. K. D. (2020). Peer learning: an overview. *International Journal of Scientific Engineering and Science*, 4(11), 1-6. Retrieved from <https://ijses.com/wp-content/uploads/2020/11/151-IJSES-V4N10.pdf>
- Kerlinger, F. N & Lee, H. B. (2000). *Foundations of Behavioural Research*. Published by Nelson Thomson Learning, 1120, Birchmount Road Toronto, OnitarioMik 5G4 Canada.
- Kindermann, T. A. (1993). Natural peer groups as contexts for individual development: The case of children's motivation in school. *Developmental Psychology*, 29, 970-977. <https://doi.org/10.1037/0012-1649.29.6.970>
- Kinzie, M. B., & Joseph, D. R. D. (2008). Gender differences in game activity preferences of middle school children: implications for educational game design. *Educational Technology Research and Development*, 56(5-6), 643-663. <https://doi.org/10.1007/s11423-007-9076-z>
- Laborde, C., Kynigos, C., Hollebrands, K., & Strasser, R. (2006). Teaching and Learning geometry with technology. In A. Gutierrez & P. Boera (Eds.), *Handbook of research on the psychology of mathematics education: past, present and future* (pp. 275-304). Rotterdam, The Netherlands: sense Publishers.
- Li, Y., Chen, D., & Deng, X. (2024). The impact of digital educational games on student's motivation for learning: The mediating effect of learning engagement and the moderating effect of the digital environment. *PLoS ONE*, 19(1), e0294350. <https://doi.org/10.1371/journal.pone.0294350>
- Lim, C. P., Nonis, D., & Hedberg, J. (2006). Gaming in a 3D multiuser virtual environment: engaging students in Science lessons. *British Journal of Educational Technology*, 37(2), 211-231. <https://doi.org/10.1111/j.1467-8535.2006.00531.x>
- Lu, H. (2012). Rethinking Game-based Learning from a Gender Perspective: A Case Study of a Male English Language Learner in China. *Gender Technology and Development*, 16(1), 49-70. <https://doi.org/10.1177/097185241101600103>
- Lukosch, H., Kurapati, S., Groen, D., & Verbraeck, A. (2017). Gender and cultural differences in game-based learning experiences. *Electronic Journal of e-Learning*, 15(4), 310-319. Retrieved from <https://academic-publishing.org/index.php/ejel/article/view/1840>
- Mitchell, A., & Savill-Smith, C. (2004). *The use of computer and video games for learning: A Review of the Literature*. Learning and skills development agency. Retrieved from <http://www.lsda.org.uk/files/PDF/1529.pdf>

- Moreno, R. (2002). Who Learns Best with Multiple Representations? Cognitive Theory Predictions on Individual Differences in Multimedia Learning. 2002(1), 1380–1385. Retrieved from <https://www.learntechlib.org/p/10238/>
- Murshidi, G. A., Wahyudi, A. B., Islam, M. M., Karthiga, S. V., & Rahmatika, L. (2024). Exploring United Arab Emirates school teachers' perceptions, motivation and benefits of Game-Based teaching and learning environments. *Alberta Journal of Educational Research*, 70(2), 310–327. <https://doi.org/10.55016/ojs/ajer.v70i2.78197>
- Prensky, M. (2001). Digital game-based learning. New York: McGraw-Hill.
- Quinn, C N (1997) Engaging Learning. Instructional Technology Forum. Retrieved from <http://itech1.coe.uga/itforum/paper18/paper18.html>
- Randel, J. M., Morris, B. A., Wetzel, C. D., & Whitehill, B. V. (1992). The Effectiveness of games for Educational Purposes: A review of recent research. *Simulation & Gaming*, 23(3), 261–276. <https://doi.org/10.1177/1046878192233001>
- Saraswathi M.R., Saranya R., Neeraja U., Senthil S.K. (2023). Best peer active learning strategies for problem solving using C programming. *Journal of Engineering Education/Journal of Engineering Education Transformations/Journal of Engineering Education Transformation*, 36(4), 140-149. <https://doi.org/10.16920/jeet/2023/v36i4/23124>
- Singh, R., & Sarkar, S. (2015). Does teaching quality matter? Students learning outcome related to teaching quality in public and private primary schools in India. *International Journal of Educational Development*, 41, 153–163. <https://doi.org/10.1016/j.ijedudev.2015.02.009>
- Verillon, P., & Rabardel, P. (1995). Cognition and artifacts: A contribution to the study of though in relation to instrumented activity. *European Journal of Psychology of Education*, 10(1), 77–103. <https://doi.org/10.1007/bf03172796>
- Vygotsky, L. S. (1978). Front Matter. In M. Cole, V. Jolm-Steiner, S. Scribner, & E. Souberman (Eds.), *Mind in Society: Development of Higher Psychological Processes* (pp. i–viii). Harvard University Press. <https://doi.org/10.2307/j.ctvjf9vz4.1>
- Zeng, J., & Shang, J. (2018). A review of empirical studies on educational games: 2013-2017. In *ICCE 2018 - 26th International Conference on Computers in Education*, main conference proceedings (pp. 533-542). Asia-Pacific Society for Computers in Education. Retrieved from <https://library.apsce.net/index.php/ICCE/article/view/3706>
- Zhang, W. (2025). Investigating the Role of Instructional Strategies in Shaping College English Learning Outcomes under the Triangular OffConorm from a Practical Perspective. *Zenodo*. <https://doi.org/10.5281/zenodo.15238808>