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ARTICLE

Employing Digital Educational Games in Teaching English Vocabulary: An Applied Study in First-Cycle Students in North Al Batinah

Nahed Moahamed AlBadi [1] **,** ***Nazrul Anuar Nayan*** [1,2*] **,** ***Norshariani Abd Rahman*** [1]

[1] *Institute of Islam Hadhari (HADHARI), Universiti Kebangsaan Malaysia, Bangi 43600, Malaysia*

[2] *Faculty of Engineering & Built Environment, Universiti Kebangsaan Malaysia, Bangi 43600, Malaysia*

ABSTRACT

This study examines how interactive digital educational games influence English vocabulary acquisition among primary school learners. With technology becoming central to modern classrooms, it is important to evaluate whether gamified tools genuinely enhance engagement, motivation, and retention, especially in English as a Foreign Language (EFL) settings. To address this, a quasi-experimental design was applied with two Grade 4 classes of similar academic ability at Al Musbah First Cycle School in North Al Batinah Governorate, Oman. The study aimed to assess whether digital games could provide a more effective approach to vocabulary learning than traditional instruction. Over one semester, the experimental group was taught vocabulary using carefully selected digital educational games that integrated animated visuals, real-time auditory feedback, and adaptive challenges. These features were aligned with curriculum standards and intended to promote active learner participation. The control group, by contrast, learned through conventional methods such as textbook exercises and teacher-led repetition. Pre- and post-tests were administered to both groups to evaluate vocabulary development. Results showed significant vocabulary gains in the experimental group, highlighting the effectiveness of digital games in EFL instruction. Beyond improved performance, students displayed greater motivation and willingness to participate, suggesting reduced anxiety and stronger engagement. This research contributes empirical evidence to ongoing discussions on educational technology by demonstrating the pedagogical value of gamified learning. It further offers

*CORRESPONDING AUTHOR:

Nazrul Anuar Nayan, Institute of Islam Hadhari (HADHARI), Universiti Kebangsaan Malaysia, Bangi 43600, Malaysia; Faculty of Engineering & Built Environment, Universiti Kebangsaan Malaysia, Bangi 43600, Malaysia; Email: nazrul@ukm.edu.my

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practical recommendations for educators, curriculum developers, and policymakers on integrating digital games into EFL classrooms to foster inclusive, multimodal learning environments that sustain vocabulary growth.
Keywords: Digital Games; Vocabulary Acquisition; Learner Engagement; Teaching English; Educational Technology

1. Introduction

In recent decades, there has been a significant rise in the incorporation of technology within educational settings, particularly in language learning environments. Digitally designed educational games provide engaging and immersive platforms where pedagogical content is embedded within playful activities, thereby increasing student attentiveness. This approach holds particular importance during early stages of education, where fostering enjoyment and engagement is crucial for maintaining focus and reinforcing learning through repetition and responsive feedback. When addressing vocabulary development in primary-level English instruction, initial exposure to interactive and stimulating content is essential for shaping learners' long-term linguistic abilities. Digital gaming tools represent a modern innovation in educational technology, responding to the demands of today's digital society by offering rich, participatory learning experiences. These tools merge instructional goals with gaming dynamics, effectively enhancing learner involvement and encouraging acquisition through play-based activities. The variety of tasks embedded in these games promotes communication skills, cognitive stimulation, and continued motivation. Additionally, they encourage collaboration among peers, nurture autonomous learning, and offer a relaxed setting where experimentation is supported. Such learning environments are known to improve resilience, reduce performance anxiety, and cultivate critical thinking and problem-solving capabilities[1]. The engaging nature of digital gameplay fosters feelings of control and achievement—core elements of self-determination theory[2]—which are vital for sustaining intrinsic motivation. These observations are consistent with educational research in Oman emphasizing the effectiveness of blended learning strategies in fostering student engagement and improving academic results[3]. Despite the national agenda's growing emphasis on educational digitalization, empirical inquiries into its influence on early language learning in Oman remain scarce. This investigation responds to that gap by centring on young English as a Foreign Language (EFL) learners in Oman. In doing so, it contributes to expanding the literature on culturally responsive, age-appropriate applications of digital tools in language instruction. Emphasizing early implementation of such technologies aligns with the objectives of Oman Vision 2040, which highlights innovation and excellence in education as pivotal to national progress. The integration of gamified tools in lower-grade language classrooms reflects Oman's strategic drive toward equitable and inclusive digital learning opportunities. Furthermore, improvements in digital infrastructure across schools in Oman have made the effective deployment of such tools increasingly feasible.

The present study aims to examine how game-based digital applications influence vocabulary acquisition among primary-level learners. In this context, it is essential to investigate not only the cognitive impact of these tools but also their role in shaping students' emotional engagement and classroom participation. Vocabulary plays a foundational role in language development, underpinning the core skills of listening, reading, speaking, and writing. Ensuring effective vocabulary teaching is particularly important for EFL learners, who often face difficulties in retaining new words and applying them contextually[4]. Conventional approaches such as dictionary-based tasks and rote memorization often fail to meet the developmental needs of young learners. Frequently, students copy unfamiliar words into notebooks without comprehending their usage in context, resulting in weak retention[5]. Despite the evolution of pedagogical methods, vocabulary acquisition continues to pose challenges, largely due to the lack of engagement in traditional instruction[6]. Although international research has widely acknowledged the educational potential of digital games for vocabulary learning, there is still a lack of localized empirical evidence assessing their effectiveness in Oman's primary education sector. Given the expanding digital infrastructure in the Sultanate and its national emphasis on educational innovation, investigating how digital game-based learning can be integrated into EFL instruction at the primary level is both necessary and timely. This study seeks to fill this empirical

void by exploring how such tools affect both vocabulary outcomes and learner engagement.

1.1. Research Questions

To better understand the role of gamified learning in English vocabulary development, it is essential to investigate both measurable learning outcomes and the underlying motivational factors influencing student engagement. Drawing from the challenges posed by traditional teaching methods and the potential of digital tools highlighted in prior research, this study formulates targeted research questions. These questions aim to evaluate both the cognitive and affective dimensions of game-based vocabulary instruction.

This paper seeks to answer the following research questions:

1. To what extent do digital educational games contribute to the improvement of English vocabulary acquisition among students?
2. Are there statistically significant differences in vocabulary learning outcomes between students exposed to digital game-based instruction and those receiving conventional teaching methods?
3. How do learners perceive vocabulary learning through digital games in terms of motivation and engagement?

These inquiries are intended to offer a thorough exploration of the dual impact of digital tools on both linguistic proficiency and learner psychology. Gaining insight into these facets is essential for developing educational interventions that are both scalable and pedagogically grounded, while also reflecting the cultural and contextual needs of primary-level language instruction.

1.2. Theoretical Framework

This study is underpinned by constructivist learning theory, which emphasizes that knowledge is not passively received but actively built by learners through meaningful experiences. Within this perspective, digital games offer dynamic and engaging environments that support experiential learning by allowing students to interact with content in purposeful and context-rich ways. Furthermore, Gardner's Theory of Multiple Intelligences supports the use of multimedia stimuli—including visuals, audio, and interaction—that appeal to linguistic, spatial, and interpersonal intelligences. Gamification, which incorporates game elements into non-game contexts to boost engagement, is also a key strategy in modern educational environments[7]. These theories collectively underpin the rationale for employing gamified tools in this study, offering a robust lens to interpret how technology-mediated experiences facilitate vocabulary acquisition and sustained learner engagement. Additionally, according to Self-Determination Theory, students are more intrinsically motivated when they feel independent, effective in their actions, and connected to others, all of which are supported by gamified environments. Digital educational games that offer choices, progress tracking, and social interaction satisfy these psychological needs, resulting in higher engagement and persistence in language tasks.

2. Literature Review

In an empirical literature review covering the period of 2014–2018[8] , summarized findings focused on the use of digital games in second language learning for the 6–18 age group. Out of an initial 578 results, 26 articles were included in the final content analysis. The review identified several popular applications and their core mechanics. For example, A variety of gamified platforms—such as Duolingo, Quizlet, and Kahoot!—have been widely adopted to personalize language learning, motivate learners, and offer instant feedback through competition and repetition.

In the specific context of Cycle 1 schools in Oman, applications like Wordwall (customizable games), Quizizz (AI-adaptive quizzes), and Baamboozle (simple group games) are popular. For Grade 4 learners, ABCya! offers engaging games like Word Bingo, and ReadTheory provides reading passages with AI-adjusted difficulty.

The majority of studies examined in the review employed a mixed-method design and focused on computer-based educational games. The research was predominantly conducted in formal educational settings in East Asia and the Middle East, with English as the primary target language. In the specific case of Oman, the use of blended systems of learning—balancing global educational trends with localized needs—has been shown to enhance both the effectiveness and adaptability of education strategies[9]. Overall, the findings indicate that digital learning games (DLGs) support

language acquisition, emotional and psychological development, and contemporary skills like participatory learning. They also promote self-regulation and interpersonal skills by framing gameplay as a form of cognitive apprenticeship [10].

In recent years, several platforms have begun localizing content to match learners' cultural contexts. This includes incorporating region-specific visuals, idioms, and linguistic examples that resonate more effectively with learners in Arabic-speaking environments. Such culturally adaptive strategies not only enhance engagement but also ensure content relevance, especially for EFL students in Oman and the broader Gulf region.

Further analysis has identified six key game features that influence learning outcomes: ease of use, optimal challenge (within the zone of proximal development), rewards and feedback, learner autonomy, goal orientation, and interaction. While game-based learning is generally effective, its application within classroom contexts still requires further optimization.

The concept of **gamification**—applying game elements in non-gaming contexts—has also garnered significant interest. A qualitative literature review by Sallem et al. [11], which analysed 15 articles from 2016 to 2020, explored this trend in online education. Their findings show that gamification is increasingly regarded as a valuable pedagogical tool for creating compelling and participatory educational experiences. Key elements such as points, leaderboards, badges, and levels were identified as being particularly effective in boosting student motivation and involvement. This research confirms previous findings and offers valuable directions for the future of gamification in education. This is consistent with research on entrepreneurship education in Oman, which emphasized that hybrid and digital learning environments, particularly when aligned with design thinking, lead to improved engagement and learning outcomes [12].

These conclusions are corroborated by numerous other systematic reviews [13]. These studies show how games and gamification can improve language learning by enhancing motivation, self-confidence, and cognitive skills [14]. Research findings suggest that game-based learning can significantly improve performance in micro-level linguistic skills. This approach cultivates communicative competence by fostering intrinsic motivation, learning autonomy, and self-confidence.

More recent studies continue to affirm the value of digital games. For instance, educational video games have been shown to significantly enhance both short-term retention and vocabulary acquisition in EFL contexts [15]. Similarly, Anjum B.'s conversation with Shaimaa Lazem highlights that digital games help young learners retain vocabulary more efficiently than traditional methods [16]. Research has also demonstrated a positive link between game-based learning and student motivation [17], while mobile educational games have proven especially significant for early-grade EFL learners [18].

Furthermore, Bahari [19] investigated the effectiveness of game-based collaborative vocabulary learning (GBCVL), stressing the dynamic nature of learner motivation. Using a mixed methods design with 95 intermediate EFL learners, the study found that allowing learners to select vocabulary games based on their individual motivational profiles resulted in significant improvements in both the breadth and depth of their vocabulary. These findings accentuate the pedagogical value of GBCVL and emphasize the need for motivation-sensitive approaches in vocabulary instruction to achieve better L2 learning outcomes.

3. Methodology

3.1. Design

This research adopted a **quasi-experimental approach** to assess the impact of **digital educational games** on vocabulary learning among young learners of English as a **Foreign Language (EFL)**. The intervention was carried out at Al Musbah First Cycle School, located in the North Al Batinah Governorate of Oman, over the course of the 2024 academic semester. Two intact Grade 4 classes were selected based on comparable academic performance and demographic characteristics. The **experimental group** (Grade 4-4, n = 33) received vocabulary instruction through computerized educational games specifically aligned with their English curriculum, while the **control group** (Grade 4-2, n = 32) was taught using traditional methods, such as textbook exercises and oral repetition.

This design was chosen due to its **practical applicability in educational settings**, where random assignment of students is typically restricted by administrative, ethical, or logistical constraints [20]. This design, often adopted in educational research where random assignment is imprac-

tical, allows for the analysis of instructional interventions under authentic classroom dynamics. Both groups followed the same curriculum and were taught by their respective classroom teachers to ensure instructional continuity.

By employing this design, the study aimed to assess whether the integration of gamified learning tools produced significant improvements in vocabulary acquisition compared to conventional methods. The quasi-experimental structure enabled the researcher to maintain control over key variables while operating within an authentic classroom environment. This approach allowed for the measurement of treatment effects with minimal disruption to daily school routines, thereby enhancing the ecological validity of the findings. Preserving intact classroom structures ensured that the intervention reflected real-world teaching conditions rather than artificially controlled settings, thus increasing the practical relevance and generalisability of the results.

3.2. Data Collection

To determine the impact of digital educational games on vocabulary development, a systematic data collection process was undertaken, incorporating both pre-intervention and post-intervention assessments. A vocabulary pre-test consisting of 30 multiple-choice items was administered to both the experimental and control groups at the beginning of the academic term to gauge initial proficiency levels. The identical test was later used as a post-test at the conclusion of the intervention phase to measure learning gains. The duration between the two assessments spanned the full academic semester (September to December 2024), allowing adequate time for observable instructional effects. To minimize potential test-related anxiety or anticipatory behaviour, students were not informed in advance of the exact timing of the post-test. This precaution aimed to yield more reliable results by reducing the influence of short-term memorization or test preparation.

The test items were adapted from Ministry of Education-approved textbooks and piloted with a similar cohort to ensure content validity. Internal consistency was verified using Cronbach's alpha ($\alpha = 0.87$), indicating high reliability. The pilot sample ($n = 20$) shared similar demographic and academic characteristics with the study population, ensuring that the instrument's validity was contextually grounded. Feedback from the pilot was used to revise ambiguous questions and calibrate item difficulty to match the cognitive level of Grade 4 students.

3.3. Statistical Analysis

To examine the effectiveness of the intervention, statistical analysis was conducted to compare vocabulary acquisition outcomes between the experimental and control groups. The goal was to determine whether any observed differences were statistically and practically significant.

An independent samples t-test was conducted to examine differences in vocabulary performance between the experimental and control groups, comparing both pre-test and post-test results. Prior to running the t-test, core statistical assumptions—normal distribution, equality of variances, and independent observations—were verified using SPSS version 26. Descriptive measures, including the mean, standard deviation, and confidence intervals, were also computed to offer a clearer picture of score distribution and variability. The extent of the difference between the groups was further evaluated using Cohen's d to estimate effect size, thereby providing a measure of the practical impact of the intervention. A significance threshold of $p < 0.05$ was applied for all inferential tests.

3.4. Ethical Considerations

Ethical approval was obtained from the researcher's university ethics committee. Written informed consent was secured from school administrators and teachers, while verbal assent was obtained from the participating students and their guardians. All participants were assured of confidentiality, and identities were anonymized in all datasets.

4. Results

This section presents the findings from the pre-test and post-test data, comparing the vocabulary acquisition performance of the experimental and control groups.

4.1. Pre-Test Results

To establish baseline equivalence between the two groups, a pre-test was administered to assess their foundational vocabulary knowledge prior to the intervention. The experimental group ($n = 33$) achieved a mean score of

18.4 (SD = 3.2), while the control group (n = 32) recorded a mean score of 18.1 (SD = 3.5). Statistical comparison using independent t-tests indicated a meaningful divergence in vocabulary outcomes between the two groups. This indicates that both groups had comparable vocabulary proficiency before the intervention began. Such baseline equivalence is essential for attributing any subsequent vocabulary gains to the instructional intervention itself, rather than to pre-existing knowledge or group disparities. These results are summarized in **Table 1**, which presents a side-by-side comparison of the pre-test and post-test vocabulary scores for both groups.

Table 1. Pre-Test and Post-Test Mean Vocabulary Scores for Experimental and Control Groups.

Group	Pre-Test Mean (SD)	Post-Test Mean (SD)
Experimental (n = 33)	18.4 (3.2)	25.2 (2.8)
Control (n = 32)	18.1 (3.5)	20.3 (3.1)

These findings in **Table 1** further validate the effectiveness of gamified learning tools in supporting vocabulary acquisition among young EFL learners. The post-test improvements among the experimental group can be attributed to the increased interactivity and reinforcement mechanisms embedded in the digital games, which are known to enhance both short-term recall and long-term memory encoding.

The results provide a strong foundation for the discussion of implications and limitations in the following sections.

4.2. Intervention Period

The instructional intervention was implemented over the course of one academic semester, from the beginning of September to the end of December 2024. The experimental group received vocabulary instruction using digital educational games in a computer lab under the researcher's supervision, ensuring consistency in delivery and technical support. The primary platforms utilized included Wordwall (interactive word-matching games), Quizizz (quiz-based challenges with live feedback), and ABCya (phonics and spelling games). Each tool was used in sessions lasting approximately 30–40 minutes, twice weekly, over a 12-week period. All games were aligned with the Ministry of Education's vocabulary themes. Learners interacted individually and in pairs under researcher supervision, and game scores were reviewed after each session to offer immediate reinforcement. The control group, meanwhile, was taught vocabulary through conventional classroom-based methods by their regular English teacher. Both groups followed the same vocabulary content outlined in the Ministry of Education's curriculum, thereby maintaining consistency in instructional objectives. The primary difference lay in the mode of content delivery, with the experimental group engaging in gamified vocabulary exercises, while the control group relied on traditional textbook-based instruction.

4.3. Post-Test Results

Following the completion of the intervention period, the same 30-item vocabulary test was administered as a post-test to both groups to evaluate vocabulary gains. A mean score of 25.2 (SD = 2.8) was achieved by the experimental group. In contrast, the control group, taught using traditional methods, recorded a mean score of 20.3 (SD = 3.1). An independent samples test revealed a statistically significant difference between the two groups ($t(63) = 6.91$, $p < 0.001$), indicating that the experimental group outperformed the control group by a substantial margin. The calculated effect size using Cohen's d (d = 1.72) suggests a large practical effect, affirming the positive impact of gamified instruction on vocabulary acquisition. These results are presented in **Table 1** and illustrated in **Figure 1**.

As illustrated in **Figure 1**, the experimental group exhibited a marked improvement in vocabulary acquisition following the gamified intervention, whereas the control group showed only a modest increase. This visual representation reinforces the statistical findings, confirming that digital game-based learning is considerably more effective than traditional instruction in enhancing vocabulary performance among Grade 4 students. The substantial difference in post-test scores highlights the positive impact of gamification on learning outcomes, aligning with previous studies emphasizing the motivational and cognitive benefits of educational games in language learning contexts [21].

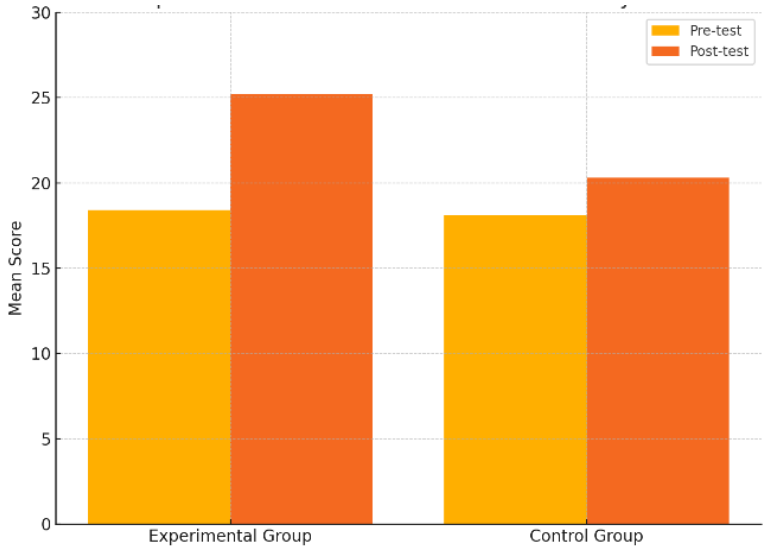

Figure 1. Comparison of Pre-test and Post-test Vocabulary Scores.

5. Discussion

5.1. Summary of Key Findings

The findings of this study provide strong support for using digital learning games as an effective tool to enhance vocabulary acquisition among elementary students. The significant improvement in the experimental group's post-test scores compared to the control group underscores the positive cognitive impact of gamified learning. This quantitative result is further supported by observations of higher motivation, engagement, and classroom participation, adding to the evidence that gamification benefits not only academic performance but also the emotional and social aspects of learning.

Although no formal qualitative data collection methods (e.g., interviews or surveys) were employed, the researcher documented classroom behaviors and verbal feedback informally during instructional sessions. These observations, while anecdotal, provided insight into students' enthusiasm, motivation, and willingness to participate during gamified sessions.

The quasi-experimental design was chosen for this research because random assignment of participants was not practical in the school setting. Using two intact Grade 4 classes is a common scenario where researchers cannot randomly assign students to different groups due to administrative or ethical constraints. This design is frequently applied in real-world settings where it may be impractical or unethical to deny certain groups access to potentially beneficial interventions. Therefore, quasi-experiments allow researchers to study interventions in authentic environments, which increases the ecological validity of the findings [22].

These results are consistent with several previous studies that have explored the integration of gamified elements into vocabulary instruction. Related studies in Oman further show that alertness to innovation and adaptability is crucial for the resilience of educational and business models during crises, underscoring the broader applicability of digital strategies [23]. Previous research by Al Ghunaimi, Al Kharusi, and Al Buwaiqi confirmed the link between collaborative game-based tasks and deeper vocabulary processing, aligning with our study's observed outcomes [24]. Similarly, Witzenberger, Gulson, Sellar, and colleagues noted that gamification leads to improved user interaction, motivation, and learning outcomes [25], confirming the broader educational benefits observed in this study. The work of Adame, Morsey, Bassman, and co-authors further supports these conclusions, documenting the positive impact of video games on English vocabulary learning [26]. Their study concludes that incorporating video games and interactive activities through gamification improves vocabulary acquisition, retention, and overall language proficiency. Across these studies, a common trend emerges that gamification enables learners [27] to acquire knowledge more effectively and enjoyably. These findings align with broader research in Oman indicating that heightened alertness and innovativeness improve not only educational but also entrepreneurial resilience

during crises [28]. This reinforces the value of fostering these traits early through educational interventions. These findings underscore the potential for integrating digital educational games into formal curricula as a strategic means to enhance learner engagement, improve language outcomes, and align classroom practices with digital learning trends globally. The robust quantitative findings, complemented by supportive qualitative observations, highlight the promise of gamification in transforming vocabulary instruction.

5.2. Limitations

Despite the encouraging findings, several limitations must be acknowledged:

1. **Restricted Generalizability**: The study employed a quasi-experimental design in a single public school, involving only two Grade 4 classes. This limits the generalizability of the results across different age groups, school systems, and geographical settings.
2. **Sample Size Constraints**: Due to the limited sample scope (n = 65), the ability to extend these findings to broader student populations remains constrained.
3. **Contextual Specificity**: The study focused exclusively on Omani EFL learners in a primary education context, thereby limiting applicability to other linguistic, cultural, or educational environments.
4. **Short-Term Assessment**: Vocabulary acquisition was assessed through immediate pre- and post-tests. Long-term retention or delayed effects of gamified instruction were not examined, leaving gaps in understanding sustained impact over time.
5. **Lack of Qualitative Insights**: The study relied solely on quantitative methods. The inclusion of qualitative data—such as student interviews, focus groups, classroom observations, or reflective journals—could have offered deeper insight into learners' experiences, perceptions, and engagement during the intervention.

Future studies are encouraged to address these limitations by employing larger, more diverse samples, using randomized controlled trials where feasible, conducting longitudinal assessments, and incorporating mixed-method approaches that combine statistical analysis with rich qualitative insights.

It is acknowledged that the large effect size (Cohen's d = 1.72) observed in this study, while statistically accurate, may reflect contextual factors such as novelty effects, limited prior digital exposure, or heightened learner enthusiasm due to gamified content. Future research should replicate the study across varied settings to validate this magnitude of impact.

6. Conclusion

Overall, the research affirms the positive influence of gamified instructional tools on vocabulary acquisition among primary EFL learners in Oman. The statistical and classroom observations together reinforce the pedagogical value of integrating technology-supported vocabulary interventions. The findings of the current study throw insightful light on the pedagogic potential of gamification in Omani EFL. The dramatic gains documented in the experiment group are not merely statistically significant but also practically important, for they illustrate how children respond positively to technology-mediated environments. Unlike traditional methods, where vocabulary learning is confined to memorization and practice in every training session, computer games present interactive and fun experiences. These elements stimulate a number of senses and make learning new words enjoyable and memorable.

- **Pre-Test Findings**: Both groups exhibited nearly identical vocabulary knowledge at baseline. The experimental group recorded a mean score of 18.4 (SD = 3.2), while the control group scored 18.1 (SD = 3.5).
- **Post-Test Outcomes**: Following the intervention, the experimental group's mean score increased to 25.2 (SD = 2.8), outperforming the control group's 20.3 (SD = 3.1). These differences were statistically significant.
- **Instructional Impact**: It was confirmed that vocabulary learning was significantly enhanced through the use of digital learning games.
- **Observational Evidence**: Qualitative classroom observations and informal feedback indicated that students exposed to digital games reported higher enjoyment, increased motivation, and improved participation. Teachers noted enhanced attentiveness and enthusiasm in game-based sessions.

Beyond affirming existing literature, this study con-

tributes new, culturally relevant evidence from a Middle Eastern EFL context—offering practical implications for curriculum reform and instructional strategies aligned with Oman Vision 2040.

6.1. Future Studies Recommendations

AI is a major influence on the state of education today, and the implications are huge. AI has the potential to transform how our education system operates, heighten the competitiveness of institutions, and empower teachers and learners of all abilities.

These enthusiasms are predicated around on distinct forms of emerging educational technologies. First we are seeing the emergence of a raft of post-COVID forms of technology-based reconfigurations of face-to-face schooling. Alongside the continued adoption of 'learning management systems' to facilitate the sharing of resources and group communication, there is growing institutional enthusiasm for 'blended', 'hybrid' and 'hyflex' approaches that involve teaching to be hosted (at least partially) online. Also of note are online social learning platforms (such as Noon Academy), where young people can study together outside of school and be assessed against each other. The shift to remote learning is often associated with the complete relocation of education provision to for-profit platforms—as illustrated by online tutoring platforms catering for additional after-school tuition such as GSX and OutSchool. That said, as students around the world gradually return to face-to-face schooling, interest is growing in the potential of mainstream shifts over to combined classroom and online provision.

Second, is the continued rise of personalised (or more accurately individualised) learning systems designed to direct individual students' engagement with online learning resources through the use of sophisticated data-driven analytics to guide student decision-making. Here, each student is claimed to benefit from the vast quantities of data being analysed—reckoned by some vendors to give these systems the capability to know more about any individual's learning than a 'real-life' teacher could ever hope.

Third, there is a range of other forms of AI-driven technology—mostly designed to support automated decision making for institutions, teachers and students. This includes system-wide 'automated education governance' based on AI-driven modelling [29] and institution-specific use of AI-driven recruitment, procurement and predictive 'business analytics [30]. Alongside these institutional forms of AI, a number of other AI-driven technologies are also now available to take on tasks that previously would have been carried out by teachers. This includes live facial and neurological detection systems to monitor students' attention levels and emotional states, as well as AI-based 'language stylometrics' and automated essay assessment—so-called 'robo-grading'. Advocates for these technologies promise:

- Education efficiencies. These are technologies that promise to lead to cost-efficiencies, time-saving and speeding up of education processes, and a general avoidance of institutional inertia. Automated technologies promise to achieve greater efficiencies by reducing (or removing) the number of 'humans in the loop'.
- 'Precision' education: These are technologies that promise to tailor educational interventions around an individual's personal needs and characteristics which are often gleaned from personal data. This precision also offers a basis for prediction—foreseeing likely development and progress, and altering actions accordingly.
- Differentiation of learning: These are technologies that promise to support varied forms of learning that best fit an individual's needs. This is one of the key aspects of 'personalised learning' technologies—i.e., the notion that individuals are best placed to alter and 'self-regulate' their own learning in light of feedback from machines.
- Enhanced 'insight' and 'knowing': These are technologies that promise to offer insights into otherwise unseen and unknowable aspects of education. 'Always-on' monitoring and comprehensive data collection raise the prospect of being able to know everything—what Andrejevic and Selwyn describe as a logic of 'frame lessons' [27].
- Seamless eradication of inequalities: These are technologies that are presented as a means (through efficiencies) to 'level the playing field' for all children, overcoming barriers of distance, of lack of professional teachers and of access to resources.

The old model of everybody gathering in physical classrooms with the teacher at the front has become increasingly challenged by technological advancements. As Al-Hattami et al. observe, student acceptance of digital learning reflects

a readiness to move beyond this traditional approach[31]. Similarly, Awashreh and Al Ghunaimi highlight how hybrid systems thinking can support transitions away from rigid educational structures toward more adaptive models[32].

Just as the past 40 years have seen the development of a robust body of research in the field of educational technology, so too has the study of scientific and technological innovation progressed. A critical feature of these studies is their insight that the envisaged 'end-user' of the tools fundamentally shapes the design of new technologies. At present, the educational imagination for edtech is premised around the charismatic allure of efficiency, precision, individualization and the search for the total knowledge of the child, irrespective of the environmental and educational costs of such an approach. Our analysis of the history of digital technologies in education is that this imagination, focused on the disembodied learner, separated from her communities and from the existing material conditions of her education, at best, will produce mixed outcomes. At worst, it can cause significant intensification of educational inequalities. A new approach is required—one that operates with a different imagination that foregrounds and envisages students and teachers as working in highly divergent, socially and contextually situated learning spaces, and where the tools will have their value precisely in their mobilization and practice, not despite them.

To deepen understanding and advance the educational use of digital games, the following recommendations are offered:

- **Longitudinal Research**: Extend studies over multiple semesters or academic years to assess long-term retention, transfer of learning, and lasting improvements in language proficiency.
- **Pedagogically Informed Game Design**: Ensure that digital games are pedagogically grounded, with embedded features (e.g., feedback, rewards, progress tracking) explicitly aligned with vocabulary learning objectives such as synonyms, word families, or thematic sets. Pedagogical Benefits of Gamified Learning.

Besides, gamification easily supports formative assessment principles. Features such as immediate feedback, levels of progression, and reward structures provide students with regular indicators of their performance. This is consistent with best practices in teaching languages, in which corrective feedback is provided in real-time in order to maximize learning gains. These systems are also beneficial to instructors since they get data-driven feedback on the progress and areas of a student requiring more support.

- **Motivational Analytics**: Employ motivation-related instruments—including learner attitude surveys, classroom ethnographies, or in-game engagement analytics—to examine how digital games influence learner persistence, emotional investment, and autonomous learning.
- **Broader Language Skill Integration**: While the study is performed within the Omani EFL context, its applicability extends to other Middle Eastern and global contexts where English is taught as a foreign language. All countries face the same difficulties of a lack of student motivation, over-reliance on conventional teaching, and limited experiences for the authentic use of the language. Gamification, with careful adaptation, can address the challenges by transforming classrooms into interactive, student-focused learning environments. Future research should investigate how digital games can also support grammar, reading comprehension, and writing skills to promote holistic language acquisition.

These future directions will help educators, policymakers, and edtech developers design more targeted, effective, and inclusive digital tools for language education. Extended Discussion and Implications.

Author Contributions

N.M.A.: Conceptualization, Methodology, Data Collection, Formal Analysis, Writing—Original Draft Preparation; N.A.N.: Supervision, Validation, Writing—Review & Editing; N.A.R.: Methodology, Resources, Data Curation, Writing—Review & Editing. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of

the researcher's school. No formal protocol code or approval number was issued.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. All datasets were anonymized to protect the confidentiality of participating students, teachers, and administrators.

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Conflicts of Interest

The authors declare no conflict of interest.

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