

ADVANCING UNDERGRADUATES' ENGLISH ACADEMIC VOCABULARY THROUGH THE DEPLOYMENT OF QUIZZZ FOR GAMIFICATION IN A BLENDED LEARNING FRAMEWORK

APRIMORANDO O VOCABULÁRIO ACADÊMICO DE INGLÊS DE ESTUDANTES DE GRADUAÇÃO POR MEIO DA IMPLEMENTAÇÃO DO QUIZZZ PARA GAMIFICAÇÃO EM UM MODELO DE APRENDIZAGEM HÍBRIDA

Article received on: 7/8/2025

Article accepted on: 20/10/2025

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The authors declare that there is no conflict of interest

Abstract

The need to improve vocabulary in mastering English has grown in higher education of late, as engineering students now have greater employment opportunities. However, vocabulary research has steadily declined across almost all levels of education, especially as students enter higher education. Many academics have advocated the successful use of digital technologies to encourage students to engage

Resumo

A necessidade de aprimorar o vocabulário no domínio do inglês tem crescido no ensino superior nos últimos tempos, visto que os estudantes de engenharia agora têm maiores oportunidades de emprego. No entanto, a pesquisa sobre vocabulário tem diminuído constantemente em quase todos os níveis de ensino, especialmente no ensino superior. Muitos acadêmicos têm defendido o uso bem-



actively in their education, and the utilisation of gamification to engage students in word learning has had a significant impact recently. Adding to the existing research and considering the current need to advance undergraduate students' English vocabulary, this study aimed to employ blended learning via Quizizz for gamification to improve students' vocabulary. In the beginning, the researchers conducted a pre-test for a randomised sample of 53 undergraduates. Based on the results, they bifurcated all the students into two research groups: the control and experimental groups. The control group received traditional instruction, and the experimental group used blended learning. This study used quantitative data from the pre-test and post-test. However, after the training, the researchers conducted a post-test to assess vocabulary improvement in both research groups. Intriguingly, this study found a significant distinction between the two research groups in that test. The statistical evaluation showed that the S_{pooled} value 3.86 differed from the experimental group's standard deviation by 0.77 and from the control group's deviation by 1.2. i.e., the experimental group differs significantly from the control group, which is less than the control group. This weighted average also supported the findings that the experimental group outperformed the control group post-training.

Keywords: Blended Learning. Gamification. Higher Education. Quizizz. Undergraduates. Vocabulary.

sucedido de tecnologias digitais para incentivar os alunos a se engajarem ativamente em sua educação, e a utilização da gamificação para engajar os alunos na aprendizagem de palavras tem tido um impacto significativo recentemente. Complementando as pesquisas existentes e considerando a necessidade atual de aprimorar o vocabulário em inglês de estudantes de graduação, este estudo teve como objetivo empregar o ensino híbrido por meio do Quizizz para gamificação, visando aprimorar o vocabulário dos alunos. Inicialmente, os pesquisadores realizaram um pré-teste com uma amostra aleatória de 53 estudantes de graduação. Com base nos resultados, eles dividiram todos os alunos em dois grupos de pesquisa: o grupo de controle e o grupo experimental. O grupo de controle recebeu instrução tradicional, enquanto o grupo experimental utilizou o ensino híbrido. Este estudo utilizou dados quantitativos do pré-teste e do pós-teste. Após o treinamento, os pesquisadores realizaram um pós-teste para avaliar a melhoria do vocabulário em ambos os grupos de pesquisa. Curiosamente, este estudo encontrou uma distinção significativa entre os dois grupos de pesquisa nesse teste. A avaliação estatística mostrou que o valor S_{pooled} de 3,86 diferiu do desvio padrão do grupo experimental em 0,77 e do desvio padrão do grupo de controle em 1,2. Ou seja, o grupo experimental difere significativamente do grupo de controle, apresentando uma diferença menor. Essa média ponderada também corroborou os resultados de que o grupo experimental teve um desempenho superior ao grupo de controle após o treinamento.

Palavras-chave: Aprendizagem Híbrida. Gamificação. Ensino Superior. Quizizz. Alunos de Graduação. Vocabulário.

1 INTRODUCTION

Mastering the English language is, more often than not, a complex phenomenon, as learners often struggle to spell words appropriately, learn, remember, and retain them in order to use them in sentences, both in speaking and writing (Alshahrani, 2019). Therefore, vocabulary is essential, as it serves as the basis for all languages (Alqahtani, 2015). The lack of sufficient vocabulary may deter us from expressing our thoughts and ideas, sharing knowledge, understanding one another, and creating strong interpersonal

ties (Khan *et al.*, 2018). A limited vocabulary limits a second-language learner's capacity for effective communication (Seffar, 2015); for this reason, vocabulary knowledge is generally considered a critical skill (Milton, 2013). To understand the language, students must know the vocabulary. Though numerous scholars have advocated several approaches for teaching vocabulary, including conventional and new methods, according to Manipatruni *et al.* (2023), there is always room for improvement in the studies on creating vocabulary acquisition tools, particularly for college students. As a result, vocabulary instruction in higher education requires attention.

Vocabulary can only be mastered through teaching techniques that cater to varied learning types (Elyas & Alfaki, 2014). However, in pursuit of mastering vocabulary, students tend to face several difficulties such as poor reading comprehension, deprivation of regular practice, short-term memory that leads to the inability to recall words, lack of knowledge of words, spelling errors, pronunciation or irrelevant tactics (Raza Shah *et al.*, 2022; Machfudi & Afidah, 2022), while the teachers tend to encounter the challenges like being creative, having limited time to apply several tools to make students' learning intriguing and enjoyable (Liando *et al.*, 2019).

Addressing these challenges, recent studies have buttressed the deployment of various technology-based instructional tools, highlighting their numerous advantages (Manipatruni *et al.*, 2024), which have helped develop learners' vocabulary (Yang *et al.*, 2021; Patra *et al.*, 2022; Hasan *et al.*, 2022). At the same time, some technological tools made students' learning more enjoyable through gamification, a feature that turns activities into games in non-gaming environments (Gao & Pan, 2023). On the other hand, blended learning is increasingly used in higher education institutions (Castro, 2019) as an additional tool to expand students' vocabulary (Pazio, 2010; Vasbieva *et al.*, 2016). Foreign language teachers worldwide are increasingly interested in the blended learning approach, and it is also gradually becoming a choice for undergraduate students (Tosun, 2015). It can also be assumed that blended learning has always existed because educators and learners have always sought to actively balance sessions requiring these skills with more traditional face-to-face teaching sessions ever since the first learning technologies emerged (Mashita, 2020).

The advantages of traditional classroom instruction are combined with those of online learning, and blended learning environments combine in-person and computer-based instruction (Bukhari & Mahmoud Basaffar, 2019). In a blended learning setting,

students learn alone and in person in a classroom with the instructor. Keeping an eye on the time, place, and learning style makes it flexible. It entails teaching students face-to-face in the classroom while also having them engage in multimedia digital activities using computers, cell phones, programs, and specialised tutorials and educational platforms. Thus, blended learning is a novel educational strategy that combines media-rich technology with didactic teaching pedagogy (Ja'ashan, 2015). This teaching method is flexible, as it allows students to use external learning resources alongside regular classroom instruction, tutorials, or practical classes (Alipour, 2020).

Considering all the previous research and recommendations on improving students' vocabulary at undergraduate level (Castro *et al.*, 2024), using technological tools via gamification in a blended learning mode, this study was performed to advance the engineering students' English academic vocabulary via the edtech tool 'Quizizz' in the classroom by gamifying the students' learning along with the traditional instruction as part of teaching, as Manipatruni *et al.*, (2023) claimed that gamification was a crucial factor in how quickly students picked up new terminology, how well they remembered it, and how engaged they remained in class while they were learning. 'Quizizz' was essential in this study's gamification of the English lexicon. The implementation of Quizizz increased students' engagement in learning and elicited unwavering enthusiasm among the research participants.

In this study, the student participants were taught vocabulary in a conventional classroom setting using Semantic Mapping. After the teaching instruction, the student participants were asked to practise their vocabulary using 'Quizizz'. The following research questions have been formulated based on the researchers' assumptions.

- 1) Does the employment of Quizizz in blended learning help improve the experimental group's English Vocabulary?
- 2) Is there any statistically significant difference between the control and experimental groups in the post-test after the training?

2 SIGNIFICANCE OF THE STUDY

This study is the result of the idea of improving students' English vocabulary through blended learning, which is the marriage of traditional and digital learning (Wahed *et al.*, 2013; Djwandono, 2013), given the paucity of vocabulary research in higher

education (Moody *et al.*, 2018; Usein, 2023). It is a productive approach that has recently gained popularity in higher education (Mashita, 2020). This study also discusses how 'Quizizz' helps improve the experimental group's English vocabulary.

The significance of this study lies in the slight differences in outcomes following blended learning between the experimental and control groups. This study restricted the control group to just traditional learning. It allowed the trained group to practise their new words on "Quizizz," which used gamification to make learning more enjoyable. Both the control group and the experimental group traditionally took their pre-test and post-test on paper. Consequently, this study served as a stimulant for 21st-century learners, particularly those studying English vocabulary.

3 LITERATURE REVIEW

This literature review covers previous studies on improving vocabulary through Quizizz gamification. It also discusses blended learning and its advantages for improving English vocabulary in the context of tertiary education, using previous studies as empirical evidence to support the current study.

3.1 Significance of Vocabulary Knowledge and the strategies to improve it

Vocabulary is the cornerstone of any language. Lack of an extensive vocabulary can make it difficult for even those with solid grammar skills to communicate (Robiya *et al.*, 2024). Many individuals learning a second language have felt frustrated by their inability to recall the right word immediately in a conversation due to limited vocabulary (Smith, 1994). This feeling of inferiority frequently hinders the language's continued evolution. Vocabulary, however, helps language students express themselves and construct meaningful sentences (Nagy & Townsend, 2012). The most effective way to learn any language, including English, is through vocabulary development. However, students must consistently enhance their vocabulary through continuous practice to learn English (August *et al.*, 2005). Hashemi and Na (2020) claimed that a complex series of acts is usually undertaken to develop English vocabulary, which is challenging to master. One of the main reasons our students fail is a lack of vocabulary. ESL learners must succeed in academic contexts where they have a strong command of their vocabulary.

However, a proper and suitable strategy can be a determinant in improving the English vocabulary of learners who pick up English as a second language (Bai, 2018). According to Alshahrani (2019), a few strategies, such as reading comprehension, reading story books, writing, memorising, and remembering spelling, were enlisted as productive strategies. Simamora and Oktaviani (2020) found that learners could improve their English vocabulary by watching English movies, as they provided opportunities to learn new vocabulary from scenes and expressions used by actors and actresses, thereby visualising their vocabulary. Hence, the more they watch English movies, the easier it is for them to learn English vocabulary through this feature. Musa *et al.* (2022) also noted that encouraging students' interest and curiosity, modifying parts of speech, utilising gamification in learning, applying syntactic analysis, and conducting formative assessment could be effective strategies for mastering vocabulary. In addition, Text comprehension, a strategy that helps learners understand the meaning of various texts, has been shown to be a juggernaut in improving English vocabulary, according to the findings of Kärbla *et al.* (2021).

3.2 The Role of blended learning in improving vocabulary

Blended learning, a combination of online and face-to-face learning environments (Watson, 2008), is an effective approach that could improve students' vocabulary acquisition (Jia *et al.*, 2012). According to several research studies on students in higher education settings, blended learning environments can increase student satisfaction and learning outcomes, and the development of new technologies, such as computers, iPods, and particularly mobile devices, can help students learn vocabulary more effectively (Ebadi & Ghuchi, 2018). Albiladi and Alshareef (2019) noted that blended learning is a flexible, adaptable, and meaningful method of teaching and learning, as it provides more learning opportunities that encourage students to participate both in and out of the classroom. In other words, the online element of blended learning enables students to learn whenever and wherever they choose without being constrained to groups or partners. Students can connect, interact, and work on essential projects in both online and in-person settings thanks to blended learning environments. The ability of teachers to conduct class activities both in person and online is one of the distinctive features of blended learning. The research has demonstrated the benefits of blended language

learning for EFL students. This study demonstrates how blended learning can help bridge the gap between learning and teaching. According to the authors, the study's participants regularly acknowledged the benefits of blended learning, including expanded reading options and enhanced English vocabulary (Wahed *et al.*, 2013).

However, across various research populations, educational levels, and treatment lengths, the blended learning strategy generally had a favourable and robust impact on vocabulary performance, learners' EFL abilities, emotions, and behaviours (Qiu *et al.*, 2022). Khalili *et al.* (2015) affirmed that there is a worthwhile harmony between the use of technology and learners' vocabulary learning. Nonetheless, it has been proven that the mere use of technology cannot bring learning to completion, and this is where blended learning is effective. Tayebinik and Puteh (2012) asserted that blended learning was more productive than mere e-learning, as it allowed students to engage with both conventional and digital learning approaches, enabling them to work at their own pace and with autonomy. In other words, it is more dynamic, pulsating, and convenient for learners, thereby allowing them to better comprehend their unique needs in acquiring vocabulary (Hashemi & Na, 2020). It is further supported by the findings of Alsalhi *et al.* (2019), who found that blended learning had a significant positive impact on students' learning achievement. Moreover, this approach proved effective in higher education when combined with face-to-face interaction, as students showed positive attitudes towards its incorporation.

3.3 Impact of gamification on learning

Gamification is an emerging trend that leverages gaming mechanics to motivate and enhance learners' experience, and it has provided optimal solutions in the context of education and learning (Armstrong & Landers, 2017; Zainuddin *et al.*, 2020). In gamification, a game is defined as a system in which participants engage in an abstract task defined by rules, interactivity, and feedback that leads to a quantifiable outcome, often provoking an emotional response. Similar to its role in education, it integrates students into learning through digital games that help them accomplish goals and provide feedback on their learning (Caponetto *et al.*, 2014). Online interactive games allow students to be self-directed learners and to acquire practical skills for contemporary life (Sailer & Homner, 2020), which is rapidly revolving around the field of ICT. Game-based

learning can facilitate a smoother, more engaging, and more efficient learning experience by placing the student at the centre of the learning process. This aligns with 21st-century learning principles, which emphasise student-centred learning and encourage activities that are enjoyable and stimulating (Yunus & Hua, 2021).

Moreover, it is the process of incorporating game elements into something to make it more motivating and encouraging for people to engage with it. It is used in educational contexts, particularly in non-gaming environments (Seaborn & Fels, 2015). Gamification uses elements of games —such as points, earning badges, challenges, top positions on leaderboards, awards, and incentives —to apply them to pedagogy and encourage students to engage at a deeper, more meaningful level (Barata *et al.*, 2017). It can be utilised as an evaluation and assessment technique (Pitoyo & Asib, 2020), and it was reported that the effects of gamification on various performance features were found effective in educational assessment (Attali & Arieli-Attali, 2015). Considering all the utility of gamification, this study, in compliance with the recommendations of Zainuddin *et al.* (2020), employed gamification through Quizizz via a blended learning setting, as Quizizz is a tool of gamification (Handoko *et al.*, 2021), and the association between vocabulary acquisition and Quizizz proved effective in the findings of Huei *et al.* (2021).

3.4 Quizizz in improving english vocabulary

Quizizz is a cutting-edge tool that enables educators to grade learners in a gamified manner and provides instant asynchronous feedback through class reports that students and teachers can view (De La *et al.*, 2021). It can inspire learners, allow group interaction, provide quick responses, and save time. Either mobile devices or computers with internet access can use "Quizizz." Quizizz strongly supports the revolutionary movement in ELT from Computer-Assisted Language Learning to Mobile-Assisted Language Learning. At this juncture, deploying "Quizizz" in schools where English is taught to increase vocabulary was strongly advised, given the accessibility of mobile phones and students' aptitude for using them (Degirmenci, 2021). Additionally, according to Parinduri and Mahmud (2023), Quizizz enabled teachers to create precise and authentic assessments. According to Artırmak and Samet (2018), the experimental group, which practised vocabulary learning, outscored the control group, which used the conventional learning approach.

Recognizing the importance of technology and gamification for student learning with fun and excitement, many teachers employ a few educational technology tools that make learning more engaging (Morat *et al.*, 2016). In this context, according to Hussain *et al.* (2023), the use of Quizizz to acquire English vocabulary has gained momentum recently due to its gamification features. The idea of incorporating Quizizz for learning English vocabulary has been backed up by the findings of Mei *et al.* (2018) in terms of bolstering students' morale by creating an encouraging environment and thus improving students' vocabulary learning (Emelia *et al.*, 2024), by the findings of Abdullah *et al.* (2019), who claimed that Quizizz could augment 40 suburban students' vocabulary achievement levels by helping them master English idioms and also the outcomes of Hussain *et al.* (2023), who concluded that the deployment of Quizizz for mastering English vocabulary had yielded significant improvement.

4 METHODOLOGY

4.1 Participants

53 Computer Science and Technology students from Vasavi Engineering College participated in our study via simple random sampling, a probability sampling method favoured in quantitative research designs (Noor *et al.*, 2022), which mitigates bias and increases the generalisability of the findings (Tin & Bui, 2024). These participants ranged in age from 19 to 20. The participants in this study were second-year, first-semester CST students in the 2025-26 collegiate year. This study was conducted as part of their coursework, 'Professional Communication Skills-I,' a second-year course at Vasavi College in Andhra Pradesh, India, where this research was conducted. All of the participants were from rural areas. The intervention of the trained group in advancing their English vocabulary learning in a blended learning setting using Quizizz has been considered the independent variable, while the findings obtained through statistical evaluation have been taken as the dependent variable in this study.

4.2 Materials

Quizizz Software, PCs provided by Vasavi Engineering College, and student mobile phones were all used in our study in the category of incorporating technical devices. On the other hand, as a component of the 2nd-year CST students' curriculum, 'Professional Communication Skills-I', a vocabulary book comprising words from 'Word Power Made Easy' by Norman Lewis has been used in the teaching and learning process. To gamify students' education and make it more enjoyable, "Quizizz" was selected. Through the assessment examinations, the researchers evaluated the students' vocabulary learning. A few worksheets were used in the study hall for this study's teaching and learning.

4.3 Procedure

Given the scarcity of vocabulary research (Moody *et al.*, 2018; Twenge *et al.*, 2019; Usein, 2023; Jahedizadeh *et al.*, 2025), the researchers conducted this study for about 4 months, from June 2, 2025, to September 1, 2025, for 14 weeks, with 3 hours each (a total of 42 hours), involving 53 volunteer student participants from CST at Vasavi Engineering College, Andhra Pradesh. As part of the 3rd-semester coursework "Professional Communication Skills-I" in the academic year 2025-2026, 53 students voluntarily participated in this pursuit. This study used a quantitative research design, collecting and analyzing numerical data from the initial and final test scores of the research, control, and experimental groups. As part of the intervention, 10 vocabulary sessions, each comprising 10 words from 'Word Power Made Easy' by Norman Lewis, prescribed in the coursework 'Professional Communication Skills-I', were considered.

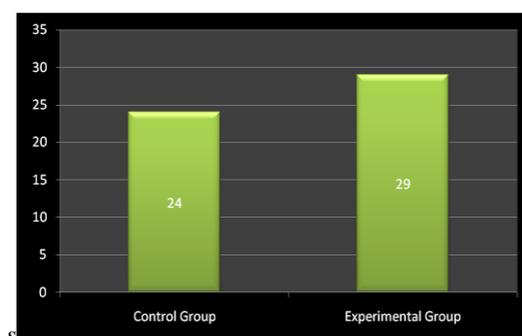
This research opened the gateway through the pre-test conducted for all 53 ($n=53$) students on Quizizz on June 2, 2025. The pre-test consisted of 30 multiple-choice questions for 30 marks. Based on the pre-test results, the researchers formulated the control and the experimental groups. According to the pre-test results, 24 students scored over 15 marks and were therefore considered the control group ($n_1=24$). In contrast, the remaining 29 students did not reach the 15-mark threshold and were therefore considered the experimental group ($n_2=29$). The control group received traditional instruction throughout, while the experimental group received training via the blended learning method. The experimental group, in particular, received traditional classroom instruction, as did the control group. In addition, they used 'Quizizz' for gamification in practice sessions to advance their English vocabulary.

During the 12-week intervention, excluding the first and last weeks for the pretest and posttest, the targeted group practised their vocabulary on 'Quizizz' alongside their traditional learning, on par with their counterparts, who were limited to traditional learning. This way, though both research groups participated, only the targeted group received training in a blended learning mode and, as a result, expanded their vocabulary learning in the final test, outperforming the control group, as evidenced by the statistical analysis. After approximately 4 months of intervention, the control and experimental groups took the post-test on September 1, 2025. This test consisted of 30 questions, each worth 30 marks, like the pre-test. However, this test recorded better results for the experimental group. Based on the post-test results, the researchers statistically analysed the research groups' results by calculating the Mean, Variance, Standard Deviation, and Pooled Standard Deviation to differentiate between the two groups.

5 RESULTS

5.1 Pre-test

The researchers conducted a pre-test for all 53 participants on Quizizz on June 2, 2025, to form the research groups —the control group and the experimental group — based on the scores achieved by the student participants. Students who earned more than 15 marks were considered the control group and received traditional instruction throughout the study. The control group ($n_1=24$) consists of 24 students who received >15 marks on the pre-test. In contrast, the students who could not get over 15 marks were considered the experimental group ($n_2=29$), which consists of 29 students with < 15 marks out of 30 marks, and they trained through blended learning, i.e., traditional instruction in the classroom along with the control group and digital learning through Quizizz to gamify the learning in the practice sessions. After the pre-test, the training lasted about 4 months, i.e., 14 weeks, with 3 hours each. Fig. 1 shows the research groups and the number of student participants.

Figure 1*Number of student participant*

Source: Authors

5.2 Post-test

After around 4 months of intervention, the researchers administered a post-test to both the control and experimental groups on September 1, 2025. This test showed better results for the experimental group, suggesting a considerable difference in vocabulary improvement after training. The post-test also demonstrated that the experimental group outperformed the control group after nearly four months of training. The results of both the control and experimental groups, including the statistical analysis, are presented below.

5.3 The findings of the control group after the intervention

The post-test brought out the control group scores as displayed below.

Two students could procure 14 marks each, one student 15 marks, one student 16 marks, three students 17 marks each, two students 18 marks each, three students 19 marks each, four students 20 marks each, three students 21 marks each, three students procured 22 marks each, and two students 23 marks each. Counting on these findings, the researchers determined that the control group's Mean (μ_1), Variance (S_1^2), and Standard Deviation (S_1) in the post-test were 19.08, 7.11, and 2.66, respectively. The post-test findings for the control group are statistically analysed below.

5.4 Statistical evaluation of post-test results for the control group

$$\text{Mean} = \frac{\text{Sum of the observations}}{\text{Total number of observations}} \quad (1)$$

$$\mu_1 =$$

$$(14+14+15+16+17+17+17+18+18+19+19+19+20+20+20+20+21+21+21+22+22+22+23+23)/24$$

$$= \frac{458}{24} = 19.08 \quad (2)$$

$$\text{Variance } (S_1^2) = \sum_{i=1}^n \frac{(x_i - \mu_1)^2}{n-1} \quad (3)$$

$$\begin{aligned} S_1^2 &= (14-19.08)^2 + (14-19.08)^2 + (15-19.08)^2 + (16-19.08)^2 + (17-19.08)^2 + (17-19.08)^2 + (17-19.08)^2 + (18-19.08)^2 + (18-19.08)^2 + (19-19.08)^2 + (19-19.08)^2 + (19-19.08)^2 + (20-19.08)^2 + (20-19.08)^2 + (20-19.08)^2 + (20-19.08)^2 + (21-19.08)^2 + (21-19.08)^2 + (21-19.08)^2 + (22-19.08)^2 + (22-19.08)^2 + (22-19.08)^2 + (23-19.08)^2 + (23-19.08)^2 / 23 \\ &= (5.08)^2 + (5.08)^2 + (4.08)^2 + (3.08)^2 + (2.08)^2 + (2.08)^2 + (2.08)^2 + (1.08)^2 + (1.08)^2 + (0.08)^2 + (0.08)^2 + (0.08)^2 + (0.92)^2 + (0.92)^2 + (0.92)^2 + (0.92)^2 + (1.92)^2 + (1.92)^2 + (1.92)^2 + (2.92)^2 + (2.92)^2 + (2.92)^2 + (3.92)^2 + (3.92)^2 / 23 \\ &= (25.80) + (25.80) + (16.64) + (9.48) + (4.32) + (4.32) + (4.32) + (1.16) + (1.16) + (0.0064) + (0.0064) + (0.0064) + (0.84) + (0.84) + (0.84) + (0.84) + (3.68) + (3.68) + (3.68) + (8.52) + (8.52) + (8.52) + (15.36) + (15.36) / 23 \\ &= 163.69/23 \\ &= 7.11 \\ S_1 &= \sqrt{S_1^2} = \sqrt{7.11} = 2.66 \quad (4) \end{aligned}$$

5.5 The findings of the experimental group after the intervention

The trained group, which had twenty-nine students, received instruction via the blended learning method, resulting in the sequential outcomes on the post-test. Among twenty-nine students from the experimental group, two students could get 16 marks each, three students 17 marks each, two students 18 marks each, two students 19 marks each, two students 20 marks each, two students 21 marks each, two students 22 marks each,

three students 23 marks each, two students 24 marks each, two students 25 marks each, two students 26 marks each, two students 27 marks each and the other three members could get 9, 10 and 15 respectively. It states that 89.65% of the students scored more than 15 marks on the post-test. According to these findings, the researchers calculated that the experimental group's Mean (μ_2), Variance (S_2^2), and Standard Deviation (S_2) in the post-test were 20.34, 21.44, and 4.63, respectively. The results indicate that the experimental group did considerably better than the control group in the post-test. The post-test findings for the experimental group are statistically analysed below.

5.3 Statistical evaluation of post-test results for the experimental group

$$\text{Mean} = \frac{\text{Sum of the observations}}{\text{Total number of observations}} \quad (5)$$

$$\begin{aligned} \mu_2 &= \\ &(9+10+15+16+16+17+17+17+18+18+19+19+20+20+21+21+22+22+23+23+23+24+24 \\ &+25+25+26+26+27+27)/29 \\ &= \frac{590}{29} = 20.34 \quad (6) \end{aligned}$$

$$\text{Variance } (S_2^2) = \sum_{i=1}^n \frac{(x_i - \mu_2)^2}{n-1} \quad (7)$$

$$\begin{aligned} &= (9-20.34)^2 + (10-20.34)^2 + (15-20.34)^2 + (16-20.34)^2 + (16-20.34)^2 + (17-20.34)^2 + (17- \\ &20.34)^2 + (17-20.34)^2 + (18-20.34)^2 + (18-20.34)^2 + (19-20.34)^2 + (19-20.34)^2 + (20- \\ &20.34)^2 + (20-20.34)^2 + (21-20.34)^2 + (21-20.34)^2 + (22-20.34)^2 + (22-20.34)^2 + (23- \\ &20.34)^2 + (23-20.34)^2 + (23-20.34)^2 + (24-20.34)^2 + (24-20.34)^2 + (25-20.34)^2 + (25- \\ &20.34)^2 + (26-20.34)^2 + (26-20.34)^2 + (27-20.34)^2 + (27-20.34)^2 / 28 \\ &= (-11.34)^2 + (-10.34)^2 + (-5.34)^2 + (-4.34)^2 + (-4.34)^2 + (-3.34)^2 + (-3.34)^2 + (-3.34)^2 + (-2.34)^2 + (- \\ &2.34)^2 + (- \\ &1.34)^2 + (1.34)^2 + (0.34)^2 + (0.34)^2 + (0.66)^2 + (0.66)^2 + (1.66)^2 + (1.66)^2 + (2.66)^2 + (2.66)^2 + (2.66) \\ &^2 + (3.66)^2 + (3.66)^2 + (4.66)^2 + (4.66)^2 + (5.66)^2 + (5.66)^2 + (6.66)^2 + (6.66)^2 / 28 \\ &= (128.59) + (106.91) + (28.51) + (18.83) + (18.83) + (11.15) + (11.15) + (11.15) + (5.47) + (5.47) + \\ &(1.79) + (1.79) + (0.11) + (0.11) + (0.43) + (0.43) + (2.75) + (2.75) + (7.07) + (7.07) + (7.07) + (13.39) \\ &+ (13.39) + (21.71) + (21.71) + (32.03) + (32.03) + (44.35) + (44.35) / 28 \end{aligned}$$

$$= 600.39/28= 21.44$$

$$S_2= \sqrt{S_2^2}= \sqrt{21.44}= 4.63 \quad (8)$$

5.4 Pooled standard deviation

The experimental group was designated as n_2 , and the control group was named n_1 . The researchers also designated the standard deviations of the control and experimental groups as S_1 and S_2 , respectively. They measured the pooled standard deviation based on the standard deviation of both groups to determine the vocabulary advancement of each group and the substantial distinction between the two groups' vocabulary learning. Table 1 provides a statistical evaluation of the findings of both groups. Between the two groups, the S_{pooled} was 3.86. However, it differed from (S_1) by 1.2 and from (S_2) by 0.77, as in Table 1.

$$S_1= 2.66 \quad S_2= 4.63 \quad (9)$$

$$n_1= 24 \quad n_2= 29 \quad (10)$$

$$\begin{aligned} S_{pooled} &= \sqrt{\frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2}} \\ &= \sqrt{\frac{(24-1)7.11+(29-1)21.44}{24+29-2}} \\ &= \sqrt{\frac{163.53+600.32}{51}} \\ &= \sqrt{\frac{763.85}{51}} \\ &= \sqrt{14.97} \\ &= 3.86 \end{aligned} \quad (11)$$

The post-test findings are shown in Table 1 below, which exhibits quantitative analysis of the findings.

Table 1*Quantitative analysis of the findings*

Research Group	Mean	Variance	Standard Deviation	Pooled Standard Deviation	Variation between Group's Standard Deviation and Pooled Standard Deviation
Control group	19.08	7.11	2.66	3.86	1.2
Experimental group	20.34	21.44	4.63		0.77

Source: Authors

This research showed that students who learned through blended learning outperformed those who learned through traditional instruction in vocabulary growth (Hong & Stapa, 2023). To be precise, the outcomes demonstrated that the experimental group outperformed the control group on the post-test, and they indicated that combining 'Quizizz' with conventional learning for the experimental group produced noteworthy improvements, answering the study's first research question. These findings also indicate that, in the final test results, the experimental group differs less significantly than the control group, meeting the second research question.

6 DISCUSSION

The role of vocabulary in learning a language is always of paramount importance, and the English language is no exception to it. However, a lack of vocabulary is one of the key reasons why most students struggle to achieve. It is the primary barrier to learning, especially English (Habib, 2023). In particular, the difficulty in remembering the contextual use of vocabulary, as recognised by most students, is likely due to their unawareness of effective strategies to enhance their English vocabulary (Çelik & Kocaman, 2016). However, to excel in academic settings, ESL students must have a good command of their vocabulary (Hashemi & Na, 2020). Yet surprisingly, vocabulary research has steadily declined across almost all levels of education, especially as students enter higher education (Twenge *et al.*, 2019). At this juncture, many academics advocated for the effective use of digital technologies to foster active student engagement in their education, and digital gamification to engage students in word learning had a significant impact (Moody *et al.*, 2018). In addition, recent research has not supported conventional approaches to vocabulary instruction and acquisition in the classroom. According to

Djiwandono (2013), a blended learning environment significantly influences students' vocabulary development by promoting student interaction and collaboration.

Therefore, our study was carried out using blended learning by employing 'Quizizz' in the classroom for gamification in the practice sessions for the experimental group, apart from the traditional instruction for both research groups. The utility of Quizizz in practice sessions greatly improved students' vocabulary, supporting the first research question of the study. Statistically, the researchers calculated the control group's Mean (μ_1), Variance (S_1^2), and Standard Deviation (S_1) in the post-test and found that they were 19.08, 7.11, and 2.66, respectively, after almost four months of training. The experimental group's Mean (μ_2), Variance (S_2^2), and Standard Deviation (S_2) in the post-test, on the other hand, were calculated and found to be, respectively, 20.34, 21.44, and 4.63. Based on these findings, the S_{pooled} value was determined to be 3.86. The distinction between the weighted average and research groups' standard deviation identified the little discrepancy between the two groups. The S_{pooled} showed that it differed from the S_1 of the control group by 1.2 and from the S_2 of the experimental group by 0.77.

Consequently, the post-test following training revealed a statistically significant distinction between the experimental and control groups, supporting the study's second research question. The experimental group outperformed its counterpart in the final test following a four-month blended intervention, according to this quantitative analysis. Therefore, using Quizizz, which gamifies learning, this research adds to our understanding of advancing English vocabulary, corroborating the findings of Robin and Aziz (2022), who claimed that gamified learning via Quizizz increased students' motivation and improved their vocabulary learning. This research has also been backed up by the findings of Nordin (2023) and Castro *et al.* (2024), who proved that Quizizz was an effective tool of educational technology for vocabulary enhancement due to its gamification feature, which was enjoyable for the students to practice their vocabulary and get immediate feedback on their performance.

7 CONCLUSION

This study was based on the recognition of the dearth of academic vocabulary research, especially in higher education settings, where students naturally find vocabulary

learning monotonous due to long lectures on vocabulary concepts. Notwithstanding this, there was a likelihood that the undergraduates would find vocabulary learning quite engaging, given the interference of technology and its gamification, which has intrigued their learning thus far. Owing to this empirical evidence, provided by the previous research on vocabulary and bridging the research gap of finding an innovative approach to improving undergraduates' English vocabulary, this research deployed an edtech tool 'Quizizz' in its experiment for the experimental group to practise their vocabulary in a blended learning framework, as the targeted research group utilised both traditional learning method and digital learning method in their pursuit of enhancing their vocabulary. This research, after rigorous training, came to fruition in the experimental group, which outperformed its counterpart in the final test by a small margin. This study introduced a new productive approach to the research community through its effective results and therefore also advises future researchers to employ a longitudinal study with a large sample on the use of "Quizizz" for digital gamification across different levels of education to achieve better outcomes.

ACKNOWLEDGMENTS

The authors would like to extend thanks to Prince Sattam bin Abdulaziz University.

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Authors' Contribution

Both authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

How to cite this article (APA):

Manipatruni, V. R., Rajeswari, T., Kumar, N. S., Karim, M. R., & Chundru, T. (2025). ADVANCING UNDERGRADUATES' ENGLISH ACADEMIC VOCABULARY THROUGH THE DEPLOYMENT OF QUIZIZZ FOR GAMIFICATION IN A BLENDED LEARNING FRAMEWORK. *Veredas Do Direito*, 22(3), e223627. <https://doi.org/10.18623/rvd.v22.n3.3627>