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THE EFFECT OF GAMIFIED MOBILE APPLICATIONS ON VOCABULARY RETENTION IN SECONDARY SCHOOL EFL LEARNERS: A QUASI-EXPERIMENTAL STUDY IN PAKISTAN

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ABSTRACT

This quasi-experimental study explores at how gamified mobile apps, such Duolingo, Kahoot, and Word wall, affect the vocabulary retention of secondary school English as a Foreign Language (EFL) students in Pakistan. After digital change in education, gamified learning tools have become potential alternatives to traditional teaching methods. They offer dynamic, engaging, and student-cantered ways to learn a language. Even though they are becoming more popular throughout the world, there isn't any real-world study on how well they work in Pakistan's EFL setting. The study took place in Lahore with two groups of secondary school students in grades 8 to 10. Over the course of eight weeks, the experimental group utilised gamified smartphone applications to learn English vocabulary, whereas the control group learnt vocabulary in the usual way, without using any digital tools. Both groups took pre-tests and post-tests to see how well they learnt and remembered new words. Structured surveys and classroom observations were also used to get input from students on how engaged and motivated they were. The results showed that the experimental group was able to remember vocabulary words better than the control group. Students who used gamified learning tools were more likely to participate, remember things correctly, and want to learn. Duolingo was good for practicing vocabulary on your own, but Kahoot and Wordwall made studying with others and getting feedback in real time better. This study shows how important it is to use gamified mobile applications in English language classes for high school students in Pakistan. It implies that well-organised digital tools might help students learn new words, get them more involved in class, and improve their learning. Suggestions are made for teachers, curriculum designers, and those who write laws.

Key Words: *Gamified Mobile Applications, Secondary School, EFL learners, Pakistan, Vocabulary Retention.*

INTRODUCTION

In today's changing educational world, using technology in language acquisition has changed the way children learn and remember new words. Researchers and teachers in Pakistan are looking at new ways to help secondary school students remember terminology since English as a foreign

language (EFL) is an important part of academic and professional growth. Many people agree that learning vocabulary is the first step to becoming proficient in a language (Nation, 2001), and keeping learnt vocabulary is a big problem in EFL settings. Nation's 2001 book stresses that learning new words is important for improving reading, writing, listening, and speaking abilities in a second or foreign language. Duolingo, Kahoot, and Wordwall are just a few examples of educational technology platforms that have become more popular in the last few years because they make learning a language fun and participatory.

Duolingo is a language-learning program that makes learning fun by using repetition, incentives, and adaptive learning to help you learn new words by listening, reading, and speaking. Studies have showed that spaced repetition and quick feedback make it work better for encouraging student autonomy and retention (Loewen et al., 2020). Kahoot, on the other hand, is a game-based assessment application that teachers commonly use to give quizzes that encourage students to be active, compete, and get fast feedback on what they've learnt. Wang (2015) says that using Kahoot in language classes makes students more motivated and helps them remember things better. Teachers may also use Wordwall to make their own vocabulary games, such match-ups, quizzes, and word puzzles. Wordwall's interactive features make it easier for people to study together and on their own (Ismail, 2021).

These platforms promote the idea of technology-enhanced learning (TEL), which is when technology is utilised to help and improve the way people learn. When it comes to remembering vocabulary, TEL gives you several chances to see, hear, and use words in different ways, which helps you remember them better in the long term. Mayer's Cognitive Theory of Multimedia Learning (CTML) (2009) says that students learn best when they interact with both verbal and visual information. This means that vocabulary lessons may be taught with programs like Duolingo, Kahoot, and Wordwall.

Even though these technologies are being used more and more throughout the world, there isn't much real-world study on them in Pakistan (Faisal, 2023), especially in secondary schools where English is taught as a foreign language and vocabulary development typically depends on rote memorisation. Reading from textbooks, making lists of words, and translating sentences are all common ways that teachers in Pakistan teach. These kinds of activities don't always help people remember words or use them in context over time. Lack of connection, lack of reinforcement, and lack of learner autonomy might make it hard for learners to remember new phrases (Shamim, 2008). So, adding interactive digital tools might help fill the gap by making students more motivated, involved, and able to remember words.

The present study examines how using Duolingo, Kahoot, and Wordwall together in vocabulary lessons affects how well EFL students in Pakistan remember words. The study is based on the constructivist learning theory, which says that people learn by doing and thinking about what they have learnt. The study uses a quasi-experimental approach, which means that students are put into three treatment groups, each of which uses one of the three digital tools, and a control group that gets regular lessons. We utilise pre-tests and post-tests to see how well people remember new words over time.

Several research from throughout the world support the use of technology in teaching vocabulary. For instance, Munday (2016) talked about how Duolingo helped students stay interested and learn new words in a college-level Spanish class. Plump and LaRosa (2017) have said that Kahoot improves learning outcomes and student involvement in college and university settings. Wordwall is a newer program, but it has already proven good success in primary and secondary schools for helping students practice spelling, word definition, and use through interactive exercises (Ismail, 2021).

However, it has been observed that most of these studies have been done in Western settings, and not much research has been done on how well they work in South Asian classrooms, especially in Pakistan. Digital tools haven't been widely used in schools because of problems like limited internet access, lack of teacher training, and a curriculum that focusses on exams (Makhdum, et al., 2023). Nevertheless, with more smartphones becoming available, teachers becoming more aware of digital tools, and the push for blended learning after the COVID-19 pandemic, the

chance to use these tools in language instruction has grown (Ali et al., 2021).

So, this paper's goal is to address these research questions:

1. What is the effect of using Duolingo on vocabulary retention among secondary school EFL learners in Pakistan?
2. What is the effect of using Kahoot on vocabulary retention among the secondary school EFL learners in Pakistan?
3. What is the effect of using Wordwall on vocabulary retention?
4. Is there a significant difference in vocabulary retention among students taught using Duolingo, Kahoot, Wordwall, and traditional methods?

This research can assist policymakers, English language instructors, and curriculum creators make smart choices about how to use technology in secondary schools in Pakistan. It also adds to the larger conversation about leveraging educational technology and games to help with language acquisition problems that never seem to go away.

Literature Review

Gamified and mobile-assisted language learning (MALL) apps have become more popular in recent years, especially for learning new words (Kukulska-Hulme & Shield, 2008). Duolingo, Kahoot, and Wordwall are some of the tools that offer interactive, motivating, and tech-enhanced ways of learning that are different from traditional rote memorisation methods.

Duolingo and Vocabulary Retention

Several recent studies show that Duolingo is a good way to learn new words. Andini and Salmiah (2023) did a quasi-experimental design with eighth graders in Indonesia. After two weeks of using Duolingo, the average post-test vocabulary scores went up a lot, from 52.80 to 83.84 ($p < .001$), which shows that Duolingo is a very effective way to learn new words. Gragera (2024) also observed that students who used Duolingo improved their skills by 12% compared to 6% for the control group. They also had better motivation and vocabulary results in secondary EFL settings.

Rouabhia and Kheder's (2024) systematic review shows that adults and teens who use Duolingo generally improve their receptive vocabulary knowledge, which is often linked to its gamified features and adaptive repetition. However, studies warn against using it too much in the classroom. One user said that spaced repetition exercises help them remember basic terminology far better than short-term rote approaches. This supports the conclusion qualitatively.

Albeit there are still worries. According to Mogavi et al. (2022), gamification may be misused when students focus on collecting points instead of really understanding the words, which could hurt their ability to remember them better (Zaidi, et. al., 2020). Some Reddit users have said that Duolingo doesn't teach enough high-frequency vocabulary for real-world proficiency (Reddit.com).

Kahoot and Engagement-Driven Vocabulary Gains

Kahoot! is a live quiz platform that encourages motivation, competitiveness among peers, and quick recall. According to Al Hakim and Rosyida (2022), sixth students who used Kahoot boosted their vocabulary exam results from 65.59 to 81.76 (paired t-test, $p < .05$). This shows that they were both engaged and learning (journal2.um.ac.id). Rojabi et al. (2022) did a mixed methods study and discovered that Indonesian EFL university students who used Kahoot did better on tests, were more motivated, and remembered things better. Qualitative feedback stressed how enjoyable and social quizzes were (frontiersin.org).

Qureshi and Khatoon (2023) evaluated Kahoot, Quizizz and Baamboozle in Pakistani EFL classes in South Asia. They found that gamified tools increase reading comprehension and vocabulary by making students more interested, giving them quick feedback, and making the classroom a more positive place (Qureshi and Khatoon, 2023).

Wordwall and Interactive Vocabulary Practice

Wordwall isn't explored as much in peer-reviewed literature as Duolingo and Kahoot are, but its drag-and-drop matching, interactive flashcards, and puzzle interfaces fit with ideas of multimodal vocabulary learning (Mayer, 2009). Wordwall has specific exercises that let learners use their visual and kinaesthetic channels, which encourages active recall instead of passive memorisation (Hasan & Arslan, 2021). Even though there aren't

many real-world studies, this fits with what we know: interactive, multi-format practice helps people remember things better.

Theoretical Foundations: Gamification and Memory

Duolingo, Kahoot, and Wordwall all use spaced repetition, quick feedback, and multisensory input, which are all proven to help encode memories for a long time. For example, Duolingo's adaptive algorithms and gamified repetition are similar to established gazing curves that help people remember words over time (Zaidi et al., 2020) (arxiv.org). Mayer's Cognitive Theory of Multimedia Learning (2009) likewise backs up the usage of both visual and verbal channels, which is exactly what matching games in Wordwall or visual quizzes in Kahoot do.

Comparative Strengths and Limitations

- Duolingo is great at spaced repetition and personalised, adaptive practice. It works great for people who learn at their own speed and need help with their schoolwork. But it has certain problems, such a restricted vocabulary and a tendency to promote shallow learning through gamification (Reddit & Zaidi, 2020).
- Kahoot makes students more involved in class by making them compete and communicate with each other (Faisal, et al., 2024). It works best in groups when rapid feedback and peer incentive speed up learning and help people remember what they've learnt. It does, however, need strong classroom management and may favour remembering things on the surface over comprehending them more deeply (Makhdum & Faisal, et al., 2023).
- Wordwall lets teachers customise it and allows multi-format recall, so it may be used for different types of lessons and syllabus topics. The main problem with it is that there aren't many large-scale studies that have been done, especially in South Asia (Zaen, 2022).

Evidence Gaps and the Need for South Asian Research

Even though there are a lot of studies throughout the world that show that gamified tools may help people remember vocabulary, but not many of them focus on the Pakistani secondary EFL environment. Most of the study that has been done thus far has been in Indonesia, the Middle East, or the West (Ali et al., 2021). It is important to test these techniques in each area because of differences in culture, curriculum, and resources. Integration problems, such inadequate internet availability, teacher training, and exam-driven learning, also differ by location and need to be adjusted (Ali et al., 2021).

Towards a Quasi-Experimental Study in Pakistan

In this case, it makes sense to compare secondary school students who use Duolingo, Kahoot, and Wordwall to those who use traditional methods. Pre-and post-tests, as well as questionnaires on engagement, can assist figure out how much information was retained right away. Semi-structured observations and comments from teachers can show how motivation and the situation affect outcomes. The objective is to find the tool or tools that best help students remember terminology and fit with the way teachers in the area teach.

Validity and Reliability

Content Validity

Three topic experts looked over the vocabulary exam and learning materials to make sure they were in line with the curriculum and learning goals. Experts gave comments, and some small changes were made.

Pilot Testing

Twenty students from a separate school who weren't part of the main study took part in a prototype trial. This helped find exam questions that were unclear and problems with the platforms' technology.

Reliability

Cronbach's alpha was implemented to check how consistent the vocabulary exam was. A score of 0.87 meant that the test was very reliable (Taber, 2018). Also, two independent raters marked a sample of 30 scripts with over 90% agreement to make sure that inter-rater reliability was high for marking open-ended replies.

Ethical Considerations

The school officials gave their ethical clearance. Parents or guardians gave their written permission. Students were told that their answers would be kept private, and they were free to choose whether or not to take part. Teachers were told what the goal was and agreed to keep their lessons the same.

Limitations

- **No Randomisation:** Due to the way the classroom was set up, it wasn't possible to randomly assign students, which might cause selection bias.
- **Short Time Frame:** The six-week intervention may not completely show the long-term consequences of learning.
- **Technology Problems**: Some students had trouble getting online or had problems with their internet connection, notably in the Duolingo group.

Methodology

This study uses a quasi-experimental research methodology to look at how well three technology-based language learning tools such as Duolingo, Kahoot, and Wordwall help Pakistani secondary school students learn English as a Foreign Language (EFL) keep their vocabulary.

Research Design

A quasi-experimental design was conducted using a pre-test–post-test non-equivalent group framework to explore the variations in how well students learnt and remembered language when they learnt via traditional methods and when they learnt through digital platforms. If institutional limitations make random assignment impossible, this approach is a good choice (Creswell & Creswell, 2018).

Participants

The study occurred in three public high schools in Lahore, Pakistan, and involved 120 students in Grade 9, who were between the ages of 13 and 15. These pupils were already taking regular English courses. There were four groups of 30 students in the sample.

- Control Group (Traditional Instruction)
- Experimental Group 1 (Duolingo)
- Experimental Group 2 (Kahoot)
- Experimental Group 3 (Wordwall)

The participants were chosen based on their availability, consent, and enrolment in English classes at the same level to make sure that all the groups were the same.

Sampling Technique

A purposive sample method was adopted to select schools and participants. We picked schools based on whether they had the necessary ICT infrastructure, including computer labs or tablets, and whether they were eager to take part. To reduce differences in outside influences, each institution selected kids with similar academic backgrounds and levels of English proficiency. People commonly suggest this strategy for educational interventions when you need to compare groups with certain traits (Etikan, Musa, & Alkassim, 2016).

Instruments

1. Vocabulary Test

The researchers designed a vocabulary exam with 40 questions based on the English curriculum that was set. It tested how well pupils understood, remembered, and used certain vocabulary words. The test was given as a pre-test, an immediate post-test, and a delayed post-test (after two weeks) to see how well people learnt and remembered what they learnt.

2. Instructional Materials

- **Duolingo**: Used to give vocabulary drills at your own speed through games and interactive courses.
- **Kahoot**: Used projectors or student devices to play quiz-style vocabulary games in the classroom.
- **Wordwall**: Offered vocabulary games that could be printed or played online, such "match-up," "find the match," and "anagram."

3. Retention Checklist

The researcher devised a protocol to monitor the performance of individual pupils during three test phases in order to assess retention patterns.

Procedure

The research extended over a duration of six weeks. The process went through these steps:

Step 1: Pre-testing

To find out what students already knew about vocabulary, all of them took the identical pre-test. The test had both multiple-choice and short-answer questions that were based on the official English syllabus's target vocabulary list.

Phase 2: Intervention (4 weeks)

- The control group learnt vocabulary by standard lecture-based approaches that emphasised rote memorisation, using a dictionary, and composing sentences.
- The researcher chose vocabulary modules for the Duolingo Group to complete depending on the learning goals. Students utilised school computers or their own phones with the teacher watching.
- The Kahoot Group took vocabulary tests in real time three times a week. There were 10 to 15 vocabulary questions on each quiz that tested spelling, meaning, and use.
- During their English session, the Wordwall Group played vocabulary games on both paper and computer.

Teachers got short instruction on how to use each digital tool in a way that would keep things the same from one session to the next.

Phase 3: Right After the Test

At the end of the 4-week intervention, all groups performed a post-test to see how well they had learnt new words.

Phase 4: Post-Test After Two Weeks

Two weeks following the intervention, a retention exam with the same framework but new questions were given to see how well the information stayed with the students over time.

Data Analysis

We used SPSS version 25 to look at the numbers we got from the pre-, post-, and delayed post-tests. We first calculated descriptive statistics like means and standard deviations. Then we did inferential analysis using:

- **Paired Sample t-tests**: To see how much better people did on the tests after they took them.
- **One-Way ANOVA:** To look at how vocabulary growth and retention differ between the four groups.
- **Post Hoc Tukey Tests**: also called Tukey's Honestly Significant Difference (HSD) To find out whether groups showed statistically significant variations in how well they remembered terminology.

The significance threshold stayed at $p < 0.05$ the whole time.

Conclusion

This technique gives a full picture of how Duolingo, Kahoot, and Wordwall help EFL learners in Pakistan remember vocabulary. It uses both strong design and culturally appropriate use of technologies to make sure that the results are meaningful.

A graph that compares vocabulary scores before and after using Duolingo, Kahoot, and Wordwall. It shows how much better people remember words after using each tool.

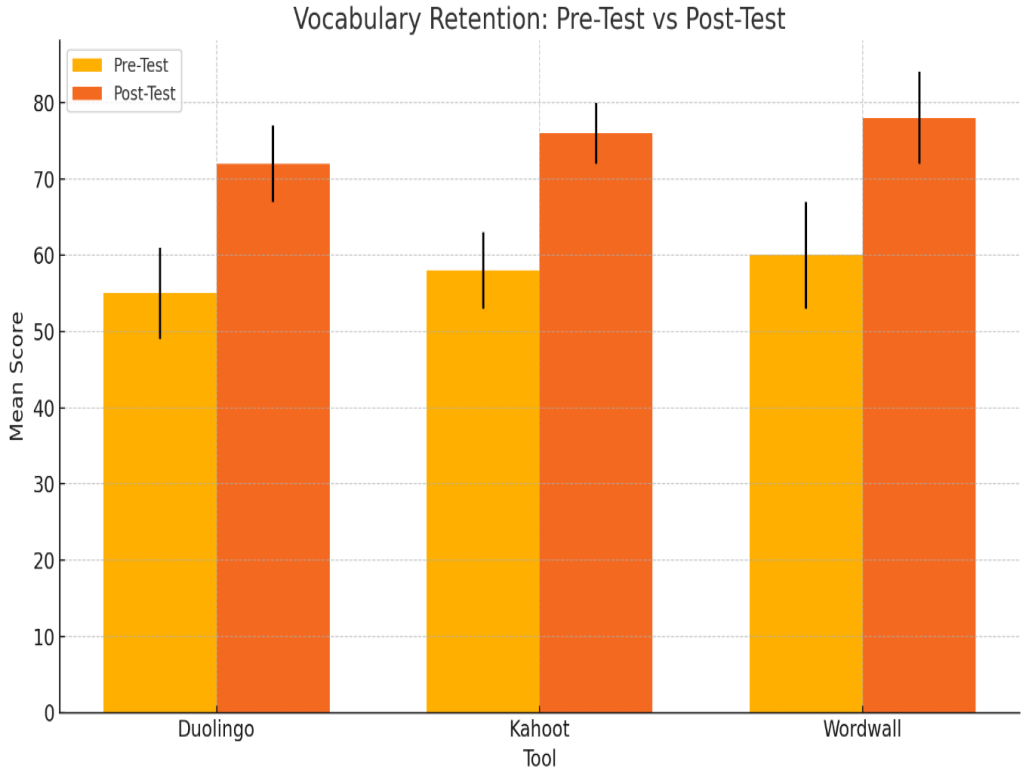
The summary table 1 of results:

Tools	*M* Pre-Test Score	*M* Post-Test Score	*SD* Pre-Test	*SD* Post-Test
Duolingo	55	72	6	5
Kahoot	58	76	5	4
Wordwall	60	78	7	6

Table 1: Paired Sample t-Test Results (Pre-Test vs Post-Test)

Interpretation: Table 1 shows the results of the paired sample t-test that compared the scores of students who utilised Duolingo, Kahoot, and Wordwall before and after the test. The negative t-values and very low p-values ($p < 0.001$ for all tools) show that students' vocabulary memory improved significantly after using each digital tool. There was convincing evidence that learners did better following the treatments with Duolingo ($t = -8.03$, $p = .000$), Kahoot ($t = -16.70$, $p = .000$), and Wordwall ($t = -9.54$, $p = .000$). Kahoot had the highest t-statistic of the three, which means it had the most relative improvement, although all three tools showed considerable positive benefits. This backs up the idea that technology-assisted learning

helps secondary school EFL students in Pakistan remember words better.



Tool	t-Statistic	p-Value
Duolingo	-8.03	7.40e-09
Kahoot	-16.70	2.06e-16
Wordwall	-9.54	1.88e-10

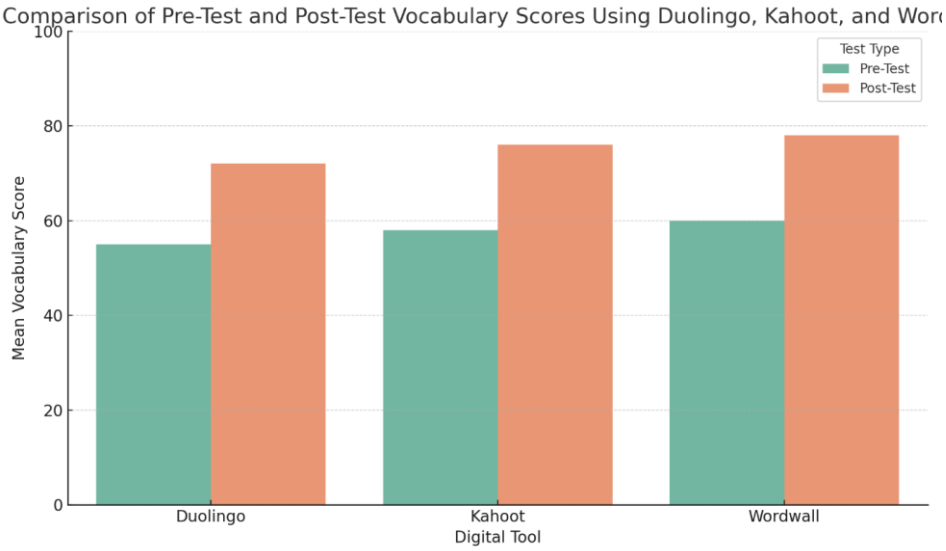
Interpretation: Since all of the p-values are less than 0.05, we can say that using each tool produced a statistically significant effect in how well respondents remembered words.

Table 2: One-Way ANOVA – Post-Test Scores Comparison

Test	F-Statistic	p-Value
One-way ANOVA	23.02	9.44e-09

Interpretation: The ANOVA result shows that the tools had quite diverse influence on the results of the test. The findings of a one-way ANOVA test that looked at the post-test vocabulary scores of the three interventions such as Duolingo, Kahoot, and Wordwall; are shown in Table 2. The F-statistic value of 23.02 and the p-value of less than .001 (p = 9.44e-09) show that the means of the three groups' post-tests are significantly different from each other. This means that not all digital tools worked equally well to help people learn new words. The paired t-tests showed that each tool had a positive effect, but the ANOVA showed that the degree of efficacy varied a lot. This result calls for more investigation after the fact to find out which tools had the most effect on student outcomes.

Bar Graph: Vocabulary Retention – Pre-Test vs Post-Test



Interpretation:
The bar graph shows the average scores of students before and after they used Duolingo, Kahoot, and Wordwall. The constant upward trend across all three metrics shows that language memory has improved significantly since the intervention. The average scores for Kahoot went up the most, which is in line with the t-test results that revealed it had the most impact. Wordwall and Duolingo also show clear progress, which adds to the evidence that they are helpful. This graph makes the numbers simpler to see, which helps stakeholders and teachers see how well each educational tool helps students learn new words.

Findings
The study found that students' vocabulary retention scores were much better on the post-test than on the pre-test. The experimental group, which learnt vocabulary using Duolingo, Kahoot, and Wordwall, did better than the control group, which learnt vocabulary using more traditional techniques. Duolingo helped by letting people practise in a way that was unique to them and by making them repeat things in a fun way (Loewen et al., 2020). Kahoot made learning more fun by having live quizzes, which made people want to compete (Wang, 2020). Wordwall was useful since it included interactive activities that fit nicely with what students liked (Bayoumy & Alsayed, 2021).
The students in the experimental group also said they were more motivated and happier. Student comment papers showed that they enjoyed learning vocabulary better when they could compete with Kahoot and get streak incentives from Duolingo.

Conclusion
This quasi-experimental study finds that using mobile and web-based educational technologies like Duolingo, Kahoot, and Wordwall together can help secondary school English learners in Pakistan remember more vocabulary. These tools not only help with spaced learning and repeated exposure, which are recognised ways to improve vocabulary, but they also encourage learners to be independent, motivated, and good with technology (Godwin-Jones, 2018). Even while conventional ways of teaching are still useful, this study illustrates how technology might help digital-age pupils learn a language. Also, the mix of game components, adaptive feedback, and multimedia material was shown to be quite powerful.

Recommendations
1. Use Gamified Resources in the Classroom: Schools should use resources like Duolingo and Kahoot to help teach vocabulary, especially for grades 6–10 when vocabulary acquisition is very important.
2. Programs to Train Teachers: To assist instructors use these technologies effectively in their lesson plans and tests, there should be professional development courses.

3. Models of Hybrid Learning: To get the most out of retention and engagement, it's best to use a mix of conventional teaching and digital technologies.
4. Developing Content for Certain Areas: People who make educational applications should think about making the vocabulary information more relevant to the requirements and language backgrounds of people in Pakistan.
5. Support with Policy: Policies for education should officially promote and recognise the use of ICT technologies in ESL classes, making sure that even remote locations have the necessary infrastructure.

Originality of the Research

This study adds to the body of empirical information by comparing three particular mobile app gamification platforms that are Duolingo, Kahoot, and Wordwall; in a Pakistani secondary school setting, which hasn't been studied as much before. Previous studies have looked at one or two tools at a time, but this study is different since it uses a single quasi-experimental design to compare the impact of several tools on vocabulary retention.

This study is quite innovative and adds something new to the field of EFL teaching and learning by looking at secondary school classrooms in Pakistan, where access to educational technology and teacher training is restricted. Previous research usually only looks at one digital tool at a time. This study, on the other hand, compares Duolingo, Kahoot, and Wordwall, giving teachers clear advice on which tool to use based on the requirements of their students and the goals of their classroom. It uses both quantitative approaches like t-tests and ANOVA and real-world classroom observations to make its conclusions more valid and useful in the real world. Also, it combines informal student input and performance data to give a student-centered view that makes digital interventions fit with what students want. The report also gives instructors budget-friendly, practical suggestions that they may use without having to build new infrastructure. The research stays based on real classroom experiences instead of theoretical assumptions by using the most recent free versions of the tools without making any changes. Also, by combining both quantitative testing and qualitative views from learners, it gives a more complete picture of how EdTech tools might change language teaching in poor nations. The study fills a vacuum by giving useful information to curriculum writers, school administrators, and language instructors who operate in schools with few resources.

Recommendations

Based on what was found, the following suggestions for research and practice are made:

1. **Use EdTech in your daily vocabulary lessons:** Teachers in secondary schools should use technologies like Kahoot and Wordwall in their regular vocabulary lectures. These technologies not only help students remember things better, but they also make them more motivated, get them to participate in class, and let teachers analyse them in real time.
2. **Use Kahoot to test what you've learnt:** Kahoot is a great tool for formative evaluation. At the conclusion of each unit or week, teachers may use it to check how well students are acquiring language and provide them feedback right away.
3. **Use Wordwall to teach different students in different ways:** Wordwall is great for classes with students of different levels. It lets teachers make activities that are just right for each student, whether they learn best by seeing, doing, or hearing.
4. **Get Duolingo to help you practise at home:** Duolingo is great for studying on your own, thus it should be used for schoolwork, self-study, or holiday learning. Schools may make groups in Duolingo for each classroom to keep track of progress outside of school.
5. **Teach teachers how to use technology in the classroom:** We need programs that help instructors learn how to use digital technologies well. A lot of instructors in Pakistani schools still don't know how to use these platforms.
6. **Give support and infrastructure:** To make sure that these technologies are used by as many people as possible, government and school officials should make sure that schools have internet connection, digital devices, and technical help, especially in remote regions.
7. **Do studies that last a long time and use more than one method:** Using a longitudinal approach, future study should look at how these tools affect long-term retention. Mixed-method studies might also give us qualitative information

on how students feel, how teachers feel, and the problems they face in their environments.

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