***Original Research Article***

**Effect of Technology based activities on the Pre-Service Teachers' Vocabulary Acquisition Performance**

**Abstract**

Acquiring vocabulary is a crucial component of the process of learning the English language. It facilitates the process of exchanging information and understanding. Therefore, teachers must devise highly efficient methods of instructing this crucial element to the students. This study aimed to examine the impact of technology-based activities for vocabulary instruction on students' vocabulary acquisition performance. The study utilized an action research design. A total of fifty-two (52) pre-service teachers at level 100 were chosen for the study through purposive sampling and were allowed to engage in activities involving technology use. The study included pre-tests and post-tests to see if there were any shifts in the students' performance after engaging them through technology-based (Duolingo App) activities. It was discovered that the utilization of technology-based activities significantly impacted their performance, as all the participants achieved greater post-test scores (M=32.7845) compared to the pre-test scores (M=18.2034). A delayed test was administered 10 weeks after the post-test to assess the ability of pre-service teachers to retain vocabulary skills and knowledge. The results indicated that there was no significant difference between the scores of the post-test (M=32.7845) and the delayed test (M=33.3010), suggesting that the pre-service teachers had retained their vocabulary skills and knowledge exceptionally well. English teachers must utilize many creative methods, including technology, to effectively support students in their learning process.

**Keywords:** *Vocabulary acquisition skills; ; English vocabulary: Duolingo App; technology-based activity; vocabulary performance*

**Introduction**

Students must learn and master English vocabulary as it is a fundamental component of the English language. According to Alqahtani (2015), vocabulary is a crucial aspect of knowledge that significantly contributes to learners' acquisition of the English language. Harmon, Wood, and Keser (2009) and Linse and Nunan (2005) have provided support for the notion that the development of learners' vocabulary is a crucial component of their overall language development. This demonstrates the essential role of lexical knowledge in both communication abilities and the acquisition of a second language. Therefore, a proficient command of vocabulary is essential for language learners as an inadequate grasp of English vocabulary hinders effective communication. However, evidence and observation indicate that even in government schools in various African countries, including Ghana, there is still a significant deficiency in vocabulary mastery. In the words of Alqahtani (2015), research has demonstrated that second language learners heavily depend on their vocabulary knowledge, and the absence of this knowledge is the primary and most significant barrier for English as a Second Language (ESL) learners to overcome. Students frequently demonstrate a lack of vocabulary in their writing, confirming the claim that they do not possess an adequate range of words.

The utilization of computers and the Internet as educational tools, particularly for the acquisition of English language vocabulary, is highly beneficial in the learning process. Computer-based activities are web apps designed to enhance learners' understanding of vocabulary in second language acquisition (Mohd Khairul, 2018). They offer a variety of educational exercises, including gap filling, picture matching, word rearrangement, sentence completion, multiple choice questions, and quizzes. Research on vocabulary and the process of acquiring vocabulary through computer-based methods has revealed that learners are not being explicitly instructed on the bulk of terms that exist in a language (Mohd Khairul, 2018). Recent advancements in educational technology have provided teachers with effective tools to introduce learners to new language and facilitate their learning process. The computer-based activities offer exercises and tasks that enable learners to acquire English language vocabulary from diverse angles.

Furthermore, they offer learners multimedia resources that facilitate visual and auditory comprehension of the acquired vocabulary. The use of vibrant visuals, accompanied by music, video, and interactive elements, has the potential to captivate students' attention and stimulate their interest (Ramasany, Noor & Zaid, 2022). Thus, it is thought that these parameters of computer-based activities have the potential to improve students' attitudes, motivations, and performance in learning English language vocabulary. Computer-based activities can facilitate self-directed learning by creating an autonomous learning environment (Oblinger & Oblinger, 2005; Balmes, 2022). Online learning is a computer-based activity that can be accessed from any location and at any time, provided there is a device such as a computer, smartphone, or iPad with an internet connection. The accessibility of the learning environment enhances the convenience of acquiring vocabulary in a second language.

Through the researcher’s interactions with the learners on various exercises and assignments it was evident that many level 100 pre-service teachers exhibit significant deficiencies in vocabulary acquisition. These deficiencies can impede their academic performance and readiness for teaching roles. However, the integration of technology in education has significantly transformed traditional teaching methods, particularly in vocabulary acquisition indicating that technology-enhanced learning tools not only improve vocabulary retention but also cater to diverse learning styles, making the learning experience more engaging and effective (Sohib o‘g‘li & Bustanov, 2024; Arslan, 2024). This transformation is evident through various studies that highlight the advantages of blending traditional and technological approaches (Huszti & Barta, 2024; Tabasi, Tondowala, Tupamahu, Soa’e Sigilipu, & Septiana, 2024; Balmes, 2022). The researchers identified that, there is a notable gap in research focusing on the effectiveness of technology-based activities specifically for level 100 fresh students, particularly pre-service teachers in Ghanaian context, who often struggle with vocabulary skills. This gap is critical as these students are at the beginning of their academic journey and require strong vocabulary foundations for their future teaching careers. Despite the increasing use of technology in educational settings, the specific impact of technology-based activities on improving vocabulary skills among this demographic remains underexplored. This study aims to investigate the impact of utilizing technology-based activities on the vocabulary acquisition performance of first-year pre-service teachers in a college of education.

**Research questions**

1. What is the effect of technology usage on pre-service teachers’ vocabulary acquisition performance?
2. To what extent will the use of technology improve the retention of vocabulary acquisition concepts among pre-service teachers in the English language?

**Literature**

Vocabulary refers to the inventory of words that an individual possesses and uses to construct a language (Linse & Nunan, 2005). As stated by Alqahtani (2015), having a limited vocabulary hinders second language learners from effectively conveying their message. Alqahtani (2015) suggested that a limited vocabulary may hinder an individual's capacity to effectively communicate a coherent message. There are numerous strategies for teaching vocabulary, including pushing students to become autonomous learners, using drilling techniques, and focusing on individual words. Teachers should offer pupils a variety of methods to acquire vocabulary. In the opinion of Mohammad, Abdel-Haq and Al-Hadi (2018), the materials utilized for teaching vocabulary should incorporate exceptional and captivating tools with visually appealing presentations. An effective method for engaging in teaching vocabulary is by utilizing instructional websites. Websites provide access to vocabulary through visual representations, auditory elements, and many forms of written content. Additionally, the language learning tasks for language learners should also vary and cater to students of varied competence levels. Furthermore, it is essential to vary the activities by implementing controlled practice techniques to effectively utilize the language in meaningful contexts. The lesson should encompass various learning styles in the process of acquiring and instructing vocabulary (Wong, 2015).

Furthermore, Aysu (2022) asserted that being an independent learner is a more efficacious approach to vocabulary acquisition since individuals can allocate their time to self-directed study, utilize a range of language acquisition resources, and maintain a comprehensive record of the vocabulary they have acquired. Teachers can enhance students' proficiency in learning a second language and cultivate effective learning habits by incorporating computer and Internet technology as educational resources. The Internet offers an abundance of resources for acquiring English language vocabulary. By providing learners with access to the Internet, they can effectively utilize these resources and achieve independent learning in vocabulary acquisition.

As noted by Oblinger, D., and Oblinger, J. (2005), students acquire knowledge more effectively and efficiently when they have visual or tactile experiences. Computers serve as educational tools that enhance teaching and learning by making lessons more engaging and comprehensible for students. It guarantees that learners adhere to their own schedules and constraints. As a result, learners can allocate more time to topics that may present challenges in the learning process. Learners can review information and redo activities until they are satisfied before progressing to a new topic. The learners can autonomously regulate the learning session, which typically enhances their contentment with the learning process. Chong (2005) conducted a poll on Korean students and discovered that 83 per cent of the participants believed that computers create a supportive environment. This assertion was further corroborated by a research study carried out in Africa by Atteh (2023). The research revealed that students and teachers acknowledged the utilization of ICT has enhanced their learning proficiency in all subjects where English Language (vocabulary acquisition) is not an exemption. Individuals can utilize computers and the Internet as instruments for self-directed learning. Vigdor et al. (2014) emphasized that utilizing computers as educational instruments can provide self-aware language learning. Mohd Khairul (2018) emphasized that computer-based activities might enhance communication through text, hence promoting autonomy by improving students' reading skills.

The fear of making errors during classroom learning activities can hinder language acquisition among students. A significant number of students exhibit shyness, resulting in their limited engagement in classroom activities. Thus, the use of computer and Internet technology serves as a remedy for students' uneasiness. The computer and Internet offer a platform for communication where learners have the option to remain anonymous while expressing their thoughts, arguments, and responses. Based on a study conducted by Lin et al. (2011), over 70 per cent of the students reported feeling content when acquiring a second language using a computer. Utilizing computers and the Internet may reduce the affective filter, thereby motivating students to achieve improved outcomes. An anxious, apprehensive, or uninterested learner may reject input, resulting in an incapacity to absorb language (Lightbown & Spada, 2006). Simply put, pupils will typically decline to engage in classroom activities when they perceive a sense of danger. Creating a nurturing and encouraging classroom atmosphere is an effective method for reducing students' emotional barriers. This can be accomplished using a computer and the internet.

The use of computers and the Internet as learning and teaching tools has the benefit of receiving prompt feedback. Utilizing immediate response through computer and Internet platforms is well acknowledged as advantageous for learners (Nakata, 2015). The computers and Internet can provide prompt feedback, depending on the status of the Internet connection. Regarding this matter, students have the opportunity to assess their understanding and thereby acquire knowledge by identifying and rectifying their errors. It is crucial to rectify errors before integrating them into one's knowledge. Brantmeier's (2003) study revealed that 80 percent of the students preferred utilizing computers due to the prompt feedback they received regarding their understanding of literature. A study conducted by Chong (2005) found that 98.7 percent of the participants expressed a preference for receiving rapid response from the computer. This input allowed them to compare their thoughts and ideas and evaluate their own performance, indicating that using ICT in learning has proven more beneficial for learners.

**Methodology**

**Research Design**

The researchers chose to use an action research design for this investigation. It is an extensive investigation by educators for educators on school culture, pedagogy, and student accomplishment (Shanks et al., 2012). To evaluate the effectiveness of their lessons, instructors might employ many behaviors such as observation, active listening, evaluation, questioning, and a sincere desire to enhance their own knowledge (Gyan et al., 2021). The purpose of gathering this data is to gain a deeper comprehension of the educational setting in schools and overall teaching methods, with the aim of implementing significant modifications that enhance student achievements.

**Population, Sample and Sampling Procedure**

The study was conducted at a College of Education located in the Sefwi Wiawso municipal. The study employed a purposive sample strategy to choose the study population. The research population consists of 291 pre-service teachers at the institution who are currently at level 100. The level 100 students were chosen because they have completed a few English courses in the curriculum. The researchers used convenience sampling to determine the sample for this investigation. A total of 52 pre-service teachers from a level 100 class, consisting of 33 females and 19 males, who had received grades of D and lower, participated in the study. The participants in the study are students from various classes at the level 100. The individuals ranged in age from 18 to 23 and had different levels of proficiency in the English language.

**Instruments and Pilot Study**

This study utilized a vocabulary accomplishment test that was specifically designed for the study's objectives. Quantitative data was collected using a pre-test, post-test, and delayed test to measure the outcome of vocabulary learning in pre-service teachers. The test consisted of a total of 6 questions, with the pre-test, post-test, and delayed test all having the same number of questions. The students' test results were documented following the grading of each test, which was based on a maximum of fifty (50) marks. The item was tested in a college of education in the Debiso area with a sample size of 27 pre-service teachers in a pilot study.

**Data Collection Procedure**

Upon administering the pre-test, the researcher saw that a significant proportion of the pre-service teachers obtained scores below the mean on a vocabulary acquisition performance assessment, which evaluated their proficiency in the topic they had previously studied. In order to tackle the issues, the researcher devised a series of intervention activities for the students to engage in utilizing the Duolingo app. Subsequently, a post-test was administered to assess their advancement in overcoming the highlighted challenges. Their scores in both the pre-test and post-test were documented for analysis. A delayed test was carried out ten (10) weeks following the initial assessment to evaluate the learning outcomes of pre-service teachers in terms of their performance in acquiring vocabulary. The postponed examination was administered after the pre-service teachers had covered various curriculum areas. The time gap was designed to assess the extent to which pre-service teachers retain knowledge after using the Duolingo app to address a vocabulary acquisition issue. Both the post-test and the delayed test outcomes were documented for subsequent analysis.

**Intervention Activities**

Interventions are design activities implemented regularly by researchers to accomplish their objectives. The intervention activities are outlined below;

1. First, students were guided to download the Duolingo app from the App Store or Google Play Store on their smartphones and create their accounts. Students had the option to sign up using their email address, Google account, or Facebook account.
2. Learners were guided to select the English language from the list of 45 languages provided.
3. Since all the students had some knowledge of the English language, they were guided to start from the same level and unlock some of the courses. Students were further guided to navigate Duolingo's curriculum at their start level which is designed to gradually introduce vocabulary and grammar concepts, ensuring a solid foundation for one’s learning journey.
4. Students were given some practice time to work their way through the lessons provided by Duolingo. Each lesson focused on a specific theme or topic, introducing new vocabulary along the way. Students were given ample time to absorb the material and were encouraged to ask questions if anything was unclear.
5. Students were tasked to practice with the app regularly, aiming for a few minutes each day. These practice sessions were to reinforce their knowledge. Students explored the various features of the app, such as the flashcard feature where users can review vocabulary words and phrases outside of the regular lessons.
6. Students were guided to periodically revisit previously learned vocabulary to ensure retention. Duolingo's spaced repetition system helps reinforce learning over time, keeping vocabulary fresh in the user’s memory.

**Data Analysis Techniques**

The study utilized descriptive and inferential analysis approaches to provide the research findings. The data obtained from learning outcomes, including pre-test, post-test, and delayed test results, were analyzed using Statistical Package for Social Science (version 23) software. The findings were reported using statistical measures such as frequency, mean, standard deviation, and t-test.

**RESULTS**

The data from the pre-service instructors was examined using version 23 of the Statistical Package for Social Science (SPSS). The data was analyzed using descriptive statistics and a paired sample t-test to evaluate the extent of the impact of the interventions.

**The Effect of Teaching vocabulary acquisition Using Technological tools on Pre-service Teachers’ Achievement**

Table 1 shows the frequencies and percentages of the respective scores for the pre-service teachers in both pre-test and post-test.

**Table 1. Comparing pre-test and post-test scores of participants**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Scores | Pre-test Frequency | Pre-test Percentage (%) | Post-test Frequency | Post-test Percentage (%) |
| 1-10 | 24 | 46.2 | 0 | 0.0 |
| 11-20 | 18 | 34.6 | 9 | 17.3 |
| 21-30 | 2 | 3.8 | 19 | 36.5 |
| 31-40 | 8 | 15.4 | 13 | 25.0 |
| 41-50 | 0 | 0.0 | 11 | 21.2 |
| Total | 52 | 100 | 52 | 100 |

An attentive examination of Table 1 revealed that the pre-service teacher's performance in the pre-test was extremely poor. This indicates their lack of comprehension of fundamental concepts and principles of English vocabulary. Consequently, they were unable to employ suitable strategies and principles to solve the vocabulary problems. Following the intervention activities, the post-test scores in Table 1 demonstrated a significant enhancement in the students' performance regarding the administered questions. This improvement serves as evidence of the effective utilization of the Duolingo app during the various activities conducted for the pre-service teachers.

The researchers conducted inferential analysis on the pre-test and post-test data, which consisted of the scores earned by the students on both assessments. Table 2 indicates the mean and standard deviation of the paired samples.

**Table 2: Paired sample statistics of pre-test and post-test scores**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Mean | N | Std. Deviation | Std. Error Mean |
| Pair 1 | Pretest | 18.2034 | 52 | 6.47246 | .94251 |
| Posttest | 32.7845 | 52 | 8.27837 | 1.21012 |

The results indicated that the scores obtained in the post-test were superior to those obtained in the pre-test. The average scores of the pre-test and post-test were 18.2034 and 32.1845, respectively, resulting in a mean difference of 14.6, suggesting a significant difference. These findings indicate that pre-service instructors had enhanced learning outcomes in the post-test. This can be linked to the intervention methods that the researchers guided the students through.

**Table 3: Paired T-test analysis of means of pre-test and post-test result**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Mean | Std Deviation | T | Df | Sig (2-tailed) |
| Pre-test & post-test | -14.6 | 8.1 | -13.8 | 51 | .000 |

The analysis in Table 3 revealed a paired-samples t-test with a test statistic of -13.8 and a p-value of 0.000, based on 51 degrees of freedom. The two-tailed p-value of 0.000 is significantly lower than the traditional level of significance of 0.05. There is sufficient evidence to establish that there is a significant difference between the average scores of the pre-service teacher's pre-test and post-test. The findings indicate that the use of the Duolingo app during the intervention improved the vocabulary acquisition of pre-service teachers.

**The Retention of retention of vocabulary acquisition concepts among pre-service teachers in the English language after Learning through Technological tools**

Following the pre-test, an intervention was implemented using technology-based activities to enhance vocabulary learning. A post-test was then administered to quantify the students' achievement. Subsequently, a delayed test was conducted ten (10) weeks after the post-test. The delayed test was carried out after the treatment of various content areas with the pre-service teachers. The purpose of the time-lapse was to determine the extent to which pre-service teachers retained knowledge of the topics covered during the intervention. The post-test items were utilized for the delayed test to guarantee test consistency. Table 4 displays the frequencies and percentages of the corresponding scores for both the post-test and the delayed test.

**Table 4. Comparing post-test and delayed-test scores of participants**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Scores | Post-test Frequency | Post-test Percentage (%) | Delayed-test Frequency | Delayed-test Percentage (%) |
| 1-10 | 0 | 0.0 | 0 | 0.0 |
| 11-20 | 9 | 17.3 | 8 | 15.4 |
| 21-30 | 19 | 36.5 | 18 | 34.6 |
| 31-40 | 13 | 25.0 | 14 | 26.9 |
| 41-50 | 11 | 21.2 | 12 | 23.1 |
| Total | 52 | 100 | 52 | 100 |

Table 4 indicated that there were no significant changes in the performance of the pre-service teachers when it came to solving the delayed test that was given to them. This study demonstrated that the utilization of the Duolingo app has a beneficial impact on the ability of pre-service teachers at the introductory level to retain vocabulary acquisition principles. Table 5 displays the mean and standard deviation of the paired samples (post-test and delayed test).

**Table 5: Paired sample statistics of post-test and delayed-test scores**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | |
|  | | Mean | N | Std. Deviation | Std. Error Mean |
| Pair 1 | Posttest | 32.7845 | 52 | 8.27837 | 1.21012 |
| Delayed test | 33.3010 | 52 | 6.17827 | 1.01032 |

The post-test and delayed test mean scores, as shown in Table 5, were 32.7845 and 33.3010, respectively. The mean difference between the two scores was 0.5, suggesting that there was not a significant difference. Given the lack of a statistically significant difference between the scores on the post-test and delayed test, it may be inferred that students maintained a substantial amount of knowledge related to the vocabulary acquisition principles taught throughout the treatments. This is attributed, once more, to the intervention procedures implemented by the researchers, which the students were required to undergo.

**Table 6: Paired T-test analysis of means of post-test and delayed-test result**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Mean | Std Deviation | T | Df | Sig (2-tailed) |
| Pre-test & post-test | -0.5 | 6.2 | -1.6 | 51 | .092 |

The analysis conducted in Table 6 revealed a paired-sample t-test with a test statistic of -1.6 and a p-value of 0.092, based on 51 degrees of freedom. The two-tailed p-value of 0.092 exceeds the standard level of significance of 0.05 (p>0.05). There is sufficient evidence to establish that there is no significant difference between the mean scores of the pre-service teacher's post-test and delayed test. There is a strong indication that pre-service teachers retain vocabulary acquisition principles well when they were taught using the Duolingo app.

**DISCUSSION**

The findings of this study support the idea that integrating technological tools into education enhances students' vocabulary learning by creating an atmosphere that is favourable to successful learning and provides stimulating opportunities for practice. The data obtained from the assessment of pre-service teachers' performance revealed that the average score on the post-test was considerably higher (32.7845) than the average score on the pre-test (18.2034), with a mean difference of 14.5811 with a significance value (P) of 0.00. The results indicated a rise in the academic performance of aspiring teachers' lexical comprehension following the implementation of technology-based activities. This result aligns with a study conducted by Yunus and Suliman (2014), where 89.6 per cent of the 58 students who participated in the survey acknowledged that utilizing ICT has enhanced their language proficiency as a whole. Similarly, a study conducted by Kung and Chuo (2002) determined that students saw learning English through technology-based applications as engaging, efficient, and indispensable. The data indicated that the learners exhibited enthusiasm for acquiring knowledge through technology-driven activities.

However, a delayed test was conducted to measure the retention or long-term impact of the intervention in comparison with the post-test results of pre-service teachers after 10 weeks of the intervention. The data analysed through the test achievement of pre-service teachers disclosed that the delayed-test mean score of 33.3010 was not significantly higher than the post-test mean score of 32.7845 with a mean difference of 0.5165 and a significance value (P) of 0.092. These findings revealed that there was good retention of vocabulary knowledge among pre-service teachers after the use of technological tools. The results align with a study conducted by Arthur, Asiedu-Addo, and Assuah (2017) that recognized the effectiveness of employing innovative pedagogical strategies to actively involve students in the learning process. This approach enhances students' comprehension of concepts and subsequently improves their retention of acquired knowledge. This indicates improvement of students’ retention of concepts in learning through the use of technology-based activities.

**Major Findings**

1. The use of technology-based activities had a positive impact on pre-service teachers' vocabulary achievement since there was a significant difference between their pre-test and post-test scores in favour of the post-test results.
2. The use of technology-based activities had a positive impact on pre-service teachers by aiding good retention of vocabulary knowledge among them since there was no significant difference between their post-test and delayed-test results.

**Conclusion**

The findings obtained from the pre-test and post-test conducted during the study indicated that the pre-service teachers showed an enhancement in their performance in the post-test. The post-test results indicate that the intervention effectively enhanced the respondents' vocabulary knowledge. After being exposed to a wide range of vocabulary exercises using the Duolingo app, the respondents were able to select the specific content areas that attracted them. Consequently, this allowed them to enhance their vocabulary proficiency in the post-test. The intervention had a cascading impact by enhancing the retention of vocabulary knowledge among pre-service teachers, as evidenced by their improved performance on a delayed test after ten (10) weeks.

**Limitation**

One of the primary limitations of this study is the potential for a small sample size, which might limit the generalizability of the findings. Since the research is conducted within a single institution and selected classes, it may not represent the broader population of level 100 pre-service teachers across different educational institutions. Variations in curriculum, teaching methodologies, and access to technology can significantly impact the outcomes of technology-based vocabulary acquisition activities. The effectiveness of technology-based activities can vary widely based on the specific tools used, the extent of their integration into the curriculum, and the individual preferences of students. Additionally, differences in students' technological proficiency and comfort levels can further complicate the interpretation of results. These limitations may hinder the applicability of the results to other settings or groups.

**Recommendations**

The study recommended that;

1. future research should involve a larger and more diverse sample of pre-service teachers from multiple institutions to make generalization of study's findings possible. This approach would provide a more comprehensive understanding of how various factors influence vocabulary acquisition across different educational environments.
2. future research should employ a mixed-method approach that combines quantitative assessments with qualitative data (e.g., interviews or focus groups) in order to offer a more comprehensive understanding of the students' experiences and perceptions regarding technology-based activities. This approach could help identify barriers to effective vocabulary acquisition and inform tailored interventions.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

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