Enhancing Vocabulary Acquisition in EFL Education: A Mixed-Methods Analysis of Digital Minimalism and Technology Use

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Abstract

This study evaluates the effects of digital minimalism versus digital tool-assisted learning on the vocabulary retention of EFL students in the higher education context. It explores vocabulary acquisition using technology avoidance learning strategies as well as technology-assisted ones to inform the effectiveness of both means and identify the helpful learning strategies in boosting vocabulary acquisition. A quasi-experimental mixed methods design was adopted, and 87 participants were placed in either the digital tools or digital minimalism group. Pre-and post-tests with the given vocabulary items were conducted to assess the results, and qualitative data collection subsequently assisted researchers in recording learner experiences. The digital tools group performed better in post-test evaluation as their interactive digital tools provided comprehensive feedback and better learning outcomes. The digital minimalism approach produced students who demonstrated better focus, fewer distractions and enhanced task engagement. The study reveals that while digital tools enhance learning participation, digital minimalism practices improve mental processing and sustainable education methods. The research results validate hybrid instruction frameworks and emphasize the need to control cognitive load when using technology-based systems. Further research is required to explore long-term retention and the role of student self-regulation to optimize digital learning methods.

Keywords: digital minimalism, vocabulary retention, EFL Learners, cognitive load management, technology-enhanced Language Learning

1. Introduction

In the 21st century, the use of digital devices has become a way of life with smartphones, tablets, and laptops taking over as essential items required for day-to-day work and communication. The advent of such pervasive technology has meant that it is widely integrated into every aspect of life, including education. One particular field in which digital tools and pertinent teaching methods are being widely used is language education (Sule, 204). Studies have proven that the surge in the use of digital resources in language studies is mainly due to their ability to enhance learning outcomes (Zhang & Zou, 2022). Although there are many well-known advantages of digital tools, like the wide availability of a variety of language learning apps, audio, video, and gaming resources, these can often serve as a means of distraction in class and can hinder learning. Concentration is broken when notifications pop up, and there is always the danger of becoming too engrossed in irrelevant content. Research also suggests that multitasking on phones or other digital devices can impede our memory and ability to understand concepts. A particular study indicated that people who have the habit of completing different tasks at once, often found it difficult to concentrate on one and ended up losing focus since multi-tasking needs split attention (Asuako et al., 2025; Ophir et al., 2009; Mancone et al., 2024; Fischer & Plessow, 2015). This is often the most critical challenge faced by language learners as they try to remember newly learned lexis and understand structures. According to Sandua (2024), a decline in productivity and increased cognitive load are often experienced by learners who regularly check notifications and spend time scrolling down on social media. This can be a matter of grave concern for language learners, as their functional memory may be too occupied by multi-tasking thereby obstructing the process of transferring newly acquired words from short-term to long-term memory (Sweller et al., 2011). Thus, while digital tools can be of great assistance in learning languages, they might also actively interfere with our ability to remember and store information in the long run. Therefore, sharing the concept of adopting a minimalistic approach to life (Newport, 2019), which emphasizes the importance of reducing problematic technology use and overuse of digital devices--- digital minimalism in language learning and vocabulary acquisition raises the question of whether minimalistic use of digital devices and learning platforms can contribute to better learning and acquisition.

1.1 The Foundation Program in Oman

The concern regarding overuse of digital devices and possible effects they might have on the linguistic growth of language learners is of great relevance in the context of Oman's pre-university bridge course, which is often referred to as the General Foundation Program. The course is considered a bridge that provides students with the necessary linguistic, mathematical, and technical skills required to complete

their university degrees. Students undergo a year of intensive English language training with a strong emphasis on developing both the receptive and productive skills, and the development of vocabulary is essential for students to improve these skills (Alenezi, 2021). As is the case with Generation Z in every part of the world, students here frequently engage with their phones primarily because of social reasons and less for educational purposes, although it is at times used as a digital tool for learning (Chen, 2023). The increasing desire to check their phones, coupled with the never-ending notifications, not only lowers their ability to focus (Erfani & Abedin, 2018) but also diminishes their cognitive functioning. Students in the foundation program often use technology to aid their studies—such as online dictionaries, grammar apps, and language-learning platforms. However, the temptation to switch between educational tools and entertainment is strong. Research suggests that every time a student checks a notification or switches between apps, their brain must refocus, which interrupts the learning process and weakens their ability to store new vocabulary effectively (Sweller et al., 2011). As a result, students may experience a slower language development and lower overall proficiency. This recurring phenomenon can indicate lower retention and reduced language proficiency in the long run. As a matter of fact, deep vocabulary learning helps learners retain information longer than they do when involved in multiscreen, distracted activities (Laufer & Hulstijn, 2001; Liu, 2024). It is commonly believed that making use of digital minimalism offers a consistent way to regulate technology use in the classroom. Digital minimalism helps people in determining when and how often to use technology, instead of completely banning its use. Students can maximize the benefits obtained from technology while avoiding unnecessary interruptions. According to Newport (2019), Students need to schedule specific study time blocks during which they block incoming phone calls and use physical books instead of screens to ensure their learning sessions are uninterrupted. Studies reveal that lowering the amount of digital distraction can aid in focusing and remembering things better.

1.2 Research Gap

While extensive research has explored the impact of digital tools on language learning (Yu & Trainin, 2021), limited studies have directly compared the vocabulary retention of students using digital tools versus those practicing digital minimalism. Most research has either studied the many benefits of technology-based learning (Xodabande & Hashemi, 2022; Laufer & Hulstijn, 2001) or the drawbacks of digital multitasking (Ophir et al., 2009). However, there are not many evidence-based studies that demonstrate whether avoiding digital diversions leads to improved retention of vocabulary over a long period. This study investigates the level of retention in both approaches, to discover if digital minimalism leads to improved memory of the learnt vocabulary. It provides us with information about the ways in which adopting digital minimalism can impact our students' ability to retain newly learned vocabulary. The research attempts to provide language teachers with proven strategies to enhance focus and retention in language classes, by conducting a comparative analysis between students using digital resources and those practicing digital minimalism. The findings of the study may help in the creation of better-informed policies on the use of digital resources in language learning to improve learning outcomes.

2. Literature Review

In today's technology-driven world, the use of electronics in the classrooms has raised serious concerns among educators. With the increasing sense of connectivity and the developing features of personal devices, students find it very difficult to concentrate on a task and contemplate deeply on a subject discussed in the classroom. Some studies indicate the negative impact of digital distraction among college students using their digital personal devices. They reported it usually takes 20-30 minutes for a student to regain focus after each digital distraction (e.g., a notification, an email, or an internal message) (Gazzaley & Rosen, 2016; Chen et al., 2020). According to Brand (2010), students have developed a habit and have been totally adjusted to extensive use of technology, making it an unavoidable routine. Early generations of digital devices were mainly designed to be used at home or at the workplace, while the new generation has provided the users with portable and tiny user-friendly gadgets to ensure constant connectivity. As a matter of fact, after the COVID-19 outbreak, the higher education institutions witnessed a drastic change while shifting to online classes and canceling all the on-campus lectures (Smalley, 2020). Despite the negative impression about the overuse of digital devices, some educators claim that the use of smartphones and laptops can assist students in accessing affordable learning platforms that are adjusted to students' demands (Wood & Zivcakova, 2015). Some believe that educational platforms like Kahoot, Quizlet, and Quizizz gamify learning through interesting challenge games and improve academic performance (Guillén-Yparrea & Ramírez-Montoya, 2023). Likewise, some scholars hold the opinion that using electronic devices in a classroom environment makes learning entertaining and effective in a meaningful way. If these activities are integrated in the curriculum properly, the students will find it engaging rather than distracting (Pérez-Juárez et al., 2023). Additionally, some believe that depriving students of using laptops and digital devices could be a disadvantage that could spoil academic performance (Elliot-Dorans, 2018). Careful studies need to be conducted to understand the advantages and disadvantages of using digital devices in classroom environment. Meanwhile, the educators need to enhance their knowledge on how and when to use technology to augment academic performance.

2.1 Digital Minimalism

Following the excessive use of the internet and reliance on digital devices, online activities have become an inevitable part of our lives, and this has raised a huge concern among the intellectuals. Newport (2019) developed the term "digital minimalism" to refer to a healthy lifestyle which utilizes technology as an efficient tool and not a distraction. Newport (2016) highlighted the detrimental effects of technology overuse and advocated "digital minimalism" as a strategy to reduce dependence on devices and promote intentional technology use. This strategy is in alignment with Zimmerman's cyclical model of self-regulated learning (Panadero, 2017) which states there are three important stages in which individuals should engage in namely, the forethought stage in which they set purposeful goals

and plans of technology use, followed by the performance phase which involves monitoring personal digital use and finally, the self-reflection stage. The final stage requires an individual's reflection on their use of technology and adjusting their habits (Zimmerman, 2002). By applying the self-regulation strategy, individuals can withstand the use of technology and nurture their abilities to manage time more effectively (Sarnou, 2021).

2.2 Digital Distractions and Their Effects on Learning

According to May and Elder (2018), students struggle to recall or focus during lectures due to media multitasking. Numerous studies confirm that the distraction of text messages and constant notifications impair students' ability to retain lecture materials over time (Glass & Kang, 2018; Kuznekoff et al., 2015). Digital multitasking avoidance enables students to establish better cognitive control which leads to better memory retention (Ophir et al., 2009). Brooks and Pomerantz (2017) conducted a survey with 35,760 college students as the participants. While some students believed that digital devices facilitated notetaking and finding new information sources, they still struggled to control the distractions caused by media and found it difficult to stay focused. More research (Sarnou, 2021; Attia et al., 2017; McCoy, 2020; Shanmugasundaram & Tamilarasu, 2023) reported the same results. Further studies comparing printed material and online activities on learning indicated that many students across the world are more comfortable with printed material as they can read with more confidence, interact with the text easily, and experience less fatigue in comparison to reading online texts from a device screen (Kong et al., 2018; Mizrachi et al. 2021; Jeong & Gweon, 2021). Moreover, students experience uninterrupted focus due to the absence of notifications along with social media temptations and this creates an optimal condition for learning (Bakla, 2024).

2.3 The Importance of Digital Minimalism in L2 Learning and Vocabulary Retention

The widespread adoption of online educational platforms has transformed traditional language instruction. However, both students and teachers continue to hold differing views when it comes to paper-based vs. computer-based assignments. Many students struggle with distractions associated with screen-based tasks (Tang et al., 2021). Among EFL learners in higher education, opinions are divided regarding the impact of digital tools versus traditional methods in English learning (Agung et al., 2020; Hazaymeh, 2021)

While some appreciate the flexibility it brings with itself, some feel that these activities lack social interaction and communication that are necessary to enhance speaking skills (Klimova et al., 2021; Nenakhova, 2021). As a matter of fact, learning language vocabulary requires successful retention and recall of new words to make progress in any language education. However, digital distractions interfere and hinder this process significantly. Liu et al. (2019) argue that printed materials offer benefits that digital sources cannot fully replicate. A comparative study to analyze the effects of printed books and e-texts on secondary learners, conducted by Pfost et al. (2013) revealed that traditional reading practices resulted in stronger literacy skills, while digital formats had a negative effect on both vocabulary retention and reading comprehension. In a similar study, Chiu and Liu (2013) investigated the impact of printed and online dictionaries on English vocabulary retention among high school students. Although online dictionaries looked highly attractive momentarily, the vocabulary retention level of students who used printed dictionaries indicated better results.

2.4 Research Questions

1. Does practicing digital minimalism improve EFL learners' vocabulary retention compared to digital tool-assisted learning?

2. What effects do digital minimalism, and the use of digital tools have on learners' focus and distraction levels during vocabulary study?

3.What differences in student engagement and participation are observed between the two learning approaches?

4. How do students perceive the effectiveness of their assigned learning method for vocabulary retention?

3. Methodology

3.1 Participants

A total of 87 English as a Foreign Language (EFL) students of the English foundation program of a business and science college in the Sultanate of Oman joined the study (M ≈ 18–19 years). During the study 43 students were assigned to the Digital Tools group and 44 remained a part of the Digital Minimalism intervention. Both groups shared comparable educational backgrounds and approximately equal gender representation (around 50% female). All participants demonstrated similar intermediate-level English proficiency levels and showed minor prior knowledge of the experimental vocabulary before the study. Before the intervention, the two groups exhibited equivalent vocabulary test results according to pre-intervention assessment (Digital Tools group M = 10.2, SD = 3.8; Digital Minimalism group M = 13.0, SD = 6.3, out of 30; $t(85) = -1.60$, $p > .11$) with no statistically significant difference in the baseline vocabulary test.

3.2 Instruments

The main instrument used in the study was the researcher-made vocabulary test which was administered before and after the interventional classes. Consisting of 50 target English words, selected from the students' curriculum, it assessed students' both receptive and productive knowledge using multiple-choice and sentence completion questions. The same instrument was administered in both the pre-learning period and post-learning period, yet its sequence was randomized on the post-test to reduce subjects' recall abilities. Similar test items were used in both the pre- and the post-test to examine students' long-term retention of the learnt words. Two experienced EFL instructors evaluated the test for content validity and to verify that its items sufficiently matched the proficiency level and learning objectives. The test demonstrated high internal consistency (pre-test Cronbach's $\alpha = 0.88$).

3.3 Intervention Materials

Over the period of four weeks, the intervention materials used included the exact same list of 50 lexical items with definitions and examples for both groups. The participants in the Digital Tools group were allowed to use a range of digital tools and also received instructions and training to use four digital resources:

- Digital flashcards on Quizlet.
- Platforms for Vocabulary Games (Kahoot and Quizzes)
- Cambridge online dictionary app for meaning and pronunciation
- Activities for practicing vocabulary on the Institution's learning and management system (EduOasis)

Tasks were assigned to these participants on these platforms regularly, and they also completed a set of class activities on a weekly basis. One benefit reaped from the use of these platforms included getting immediate performance feedback. On the other hand, students in the Digital Minimalism group used a 'low-tech' approach by using digital minimalist techniques. These students made use of index cards to make paper flashcards and also received a printed booklet with vocabulary exercises. Additionally, they were also required to maintain a separate vocabulary notebook. These students were given specific training on ways to control digital distraction. These strategies included arranging for phone-free study blocks, disabling notifications and minimizing their time on social media throughout their study sessions. Their use of devices was only for minimal needs, and they entirely depended on paper-based materials along with intensive focused study. The two experimental groups received the same vocabulary items but adopted distinct study strategies. At the end of the intervention, participants were required to respond to an open-ended questionnaire (Qualitative Feedback Instrument). The questionnaire included prompts that focused on the students' learning experience, obstacles faced and perceived effectiveness of the approach followed. The responses were examined thematically to enrich the interpretation of these findings.

3.4 Data Collection

The given study used a quasi-experimental design to study the effects of the practice of digital minimalism and use of digital technology tools in a higher educational setting. The study included two experimental groups which were named Digital Minimalism group and Digital Tools group. All subjects received the same vocabulary tests on two occasions - before and after their four-week intervention period. The study uses a mixed-method approach, where the type of learning (digital minimalism or digital tool-assisted learning) is the independent variable, and the vocabulary retention measured by the tests before and after is the dependent variable. To complement this, a quantitative part was included to understand the participants' experience in each of these learning conditions. Both groups followed the same testing schedule and equal exposure to the target vocabulary was provided. The only notable difference was the method of study and some of the rules followed in class:

The Digital Minimalism group was isolated from digital tools such as Kahoot, Quizlet, Quizzes and other on-screen tools which aid in vocabulary learning in the modern EFL classroom. Their exposure to power point presentations and videos related to the vocabulary topic was also limited. Classroom rules ensured limited digital distractions in the form of notifications as students were asked to keep their phones on the airplane mode during the class. Teachers also encouraged students to limit their digital use while revising the taught vocabulary at home.

The Digital Tools group had access to all digital tools. Various interactive platforms along with on-screen tools were used to help with vocabulary learning. Also, teachers used PowerPoint presentations, videos and games to engage students. In addition to this, weekly homework was also set on Quizzes for extra practice. Taking occasional phone breaks during class was another common practice amongst students of this group.

3.5 Procedure

Pre-test- At the start of Week 1, the participants took a 30-minute vocabulary exam (pre-test) as the first step to measure their initial knowledge under testing conditions. The assessment covered 30 vocabulary items directly from the curriculum. Question types included were sentence completion and multiple-choice questions. The results demonstrated that there were no statistically relevant discrepancies in the pre-testing phase between Digital Tools and Digital Minimalism students ($t(85) = -1.60$, $p > .11$).

Intervention- After the pre-test, an orientation session was conducted for all students concerning their study strategy. The teachers provided some hands-on instructions and set certain rules informing the students in the Digital Tools group about how the applications shall be used. The participants were given instructions to practice 15–20 minutes of daily activities with these digital tools. On the other hand, the Digital Minimalism group were instructed to keep a class notebook where they could list the words studied. They were also given a folder with some stationery that were to be used during the course. This group utilized printed materials but also incorporated distraction-reduction techniques through phone-free study blocks along, while using journaling as an additional support.

To maintain the unity of the intervention, the vocabulary list was the only instructional material provided to both groups outside the classroom. The study duration for independent learning activities extended to four weeks. Weekly check-ins with the teachers promoted consistency and helped recognize any challenges that the students were facing. The teachers in Digital Tools group planned lessons that included a lot of Kahoot, Quizzes games and used Quizlet flashcards during their study. Learners were trained to check the meaning of words on the Cambridge online dictionary, along with the parts of speech, the primary and secondary stress and their usage in a sentence.

Teachers encouraged them to listen to the pronunciation of new words too. For their after-class study, researchers analyzed exercise completion data on Edu Oasis, the platform on which students were assigned review activities.

By contrast, participants in the Digital Minimalism group used paper logs to demonstrate their engagement with the study. They were instructed to maintain a vocabulary log which included the meaning, usage, parts of speech and stress in the word. Students were trained to use the paper dictionaries in class, and they also created paper flashcards. Worksheets with the learnt vocabulary were given for homework and later checked in class by the teachers. Class feedback and monitoring of the online homework assignments showed that 90% or more students practiced as needed. Teachers conducted the post-test after the intervention in which they used standard test procedures which was similar to the pre-test. Students participated in a qualitative feedback assessment soon after the experiment to share their experience-related thoughts. Each participant received a score gained through the comparison between post-test and pre-test results.

3.6 Reliability and Validity Measures

To ensure methodological rigor, multiple strategies were utilized for this study (content, research and construct validity). To account for content validity, two experienced EFL instructors validated the pre- and post- test and aligned it with the specific learning objectives. Research reliability was established through Cronbach's α value of 0.88 which measured the pre-test internal consistency. All students received the same materials for the test and the testing environment was similar in both cases (construct validity). Each classroom consisted of 20 students during the test which was proctored by two teachers. Four classrooms were used in total. Both the pre- and the post-test were piloted before the tests were administered to the whole group. The pilot group consisted of 15 students (students who were of the same language proficiency level but not a part of the study), and this was done to refine the vocabulary items, ensure clarity of instructions, and confirm the feasibility of the digital and minimalist approaches. Finally, a mixed-methods approach strengthened the validity of interpretations (triangulation). Quantitative vocabulary test results were cross-analyzed with qualitative feedback from student reflections and questionnaire data, to provide a comprehensive understanding of learner experiences and outcomes.

3.7 Ethical Considerations

The study proposal was thoroughly reviewed and approved by the research committee of the given higher educational institution. Participants consented to the study and had the freedom to withdraw at any point. Ultimately, all 87 participants successfully finished the pre-test and follow-up assessments; only a few students missed the pre-test, and they were not included in the paired comparisons (these cases were balanced across groups and did not affect overall group sample size for final analysis).

4. Results

4.1 Quantitative Results

Descriptive Statistics: All the participants demonstrated better vocabulary retention after completion of both testing periods. The Digital Tools group obtained an average post-test score of M = 23.1 (SD ≈ 3.4) following their initial pre-test score of M = 10.2 (SD ≈ 3.8), out of a maximum of 30 points. The participants in the Digital Minimalism group demonstrated an increase in mean scores from M = 13.0 (SD ≈ 6.3) to M = 21.3 (SD ≈ 6.8) during the study period. The Digital Tools group began with a slightly lower score at the beginning but reached a score that was marginally higher than the minimalism group at the end. Both groups recorded substantial vocabulary development, demonstrating successful vocabulary learning in each condition. The Digital Tools group began with a lower pre-test score but eventually showed a greater overall gain, ultimately achieving a slightly higher average post-test score than the Digital Minimalism group. By the end of the intervention, both groups achieved high scores, suggesting strong overall retention of the target vocabulary, though the nature and extent of their improvement differed between the two approaches.

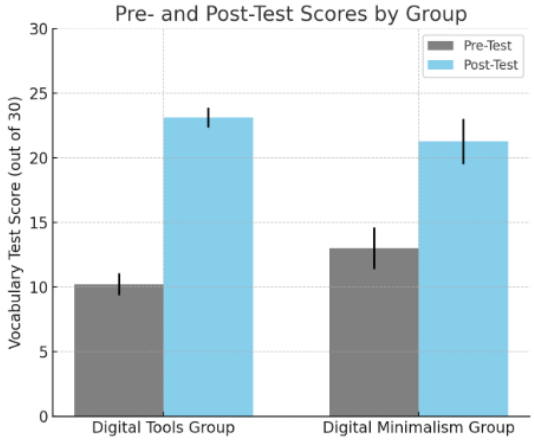

Figure 1. Mean pre-test and post-test vocabulary scores (with standard error bars) for the Digital Tools and Digital Minimalism groups

T-tests were used to assess within-group vocabulary improvements. Students in the Digital Tools group demonstrated a marked improvement of +12.9 points (~43%) between pre-test and post-test, reflecting a large effect size (*t*(42) ≈ 12.90, *p* < .001). Participants

in the Digital Minimalism group also demonstrated significant gains, with an average increase of +7.6 points and a strong effect size, $t(43) = 4.01$, $p = .001$.

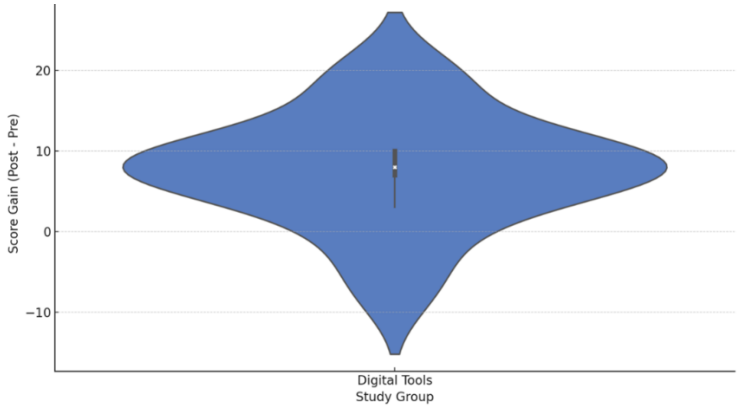

Figure 2. The plot shows the distribution and density of vocabulary score gains (post-test minus pre-test) for both groups

The Digital Minimalism group began the intervention with a slightly higher initial score but demonstrated a restricted potential for improvement. In contrast, participants in the Digital Tools group achieved higher post-test outcomes, likely due to the interactive and repetitive learning features provided by the digital tools. Prior research supports the view that interactive digital tools enhance vocabulary acquisition. While both experimental approaches delivered effective results, the digital tools condition provided more opportunities for learners to achieve maximum success (Stockwell, 2022).

4.2 Qualitative Results

The researchers employed thematic analysis to acquire qualitative feedback from 87 participants via reflection questionnaires: 43 students from the Digital Tools group and 44 students from the Digital Minimalism group. The comparative thematic analysis explored three main areas: 1.) how well students managed their focus and distractions, 2.) their participation in class or group activities, and 3.) how they felt about remembering vocabulary. Student experiences regarding focus and distraction varied between groups. 15 students in the Digital Tools group rated their focus as "very focused" while 29 students rated it as "somewhat focused." Most participants acknowledged the task-focused design of the digital tools; some reported the presence of external distractions. Participant D3 reported that *"Sometimes, I opened social media after studying in the app. It's easy to get off track."*

On the other hand, in the Digital Minimalism group, several people said that using paper improved their ability to concentrate, while 16 people disagreed with this statement and 13 remained neutral about their results. The respondents who indicated positive responses mentioned they experienced a calm study environment.

"Every night during my studies, I used paper flashcards. No phone meant no distractions. I could focus deeply." (Participant M5)

However, some other participants in this group reported feeling bored and lacking motivation. One participant reported that the absence of digital prompts affected their consistency:

"Paper exercises became repetitive during the seventh day. I missed the app notifications for reminders." (Participant M18)

Overall, while digital minimalism served to minimize distractions for several students, yet its success depended on an individual level of self-discipline and motivation. As for participation in class or group activities, 24 students in the Digital Tools group reported being more engaged in class. Many said that their increased engagement was due to the interactive and competitive nature of the digital activities:

"I enjoyed competing on the Quizzes app with classmates. It made me want to study more before class." (Participant D9)

Similarly, 25 students in the Digital Minimalism group also reported being more engaged in group work and also appreciated peer-led sessions, discussions and hands-on materials.

"Writing words on the board and explaining them in pairs helped me understand more." (Participant M21)

The results indicate that both the approaches supported learner engagement in various ways including gamification and digital interaction in the Digital Tools group whereas collaborative learning in the form of discussions and group work were fostered in the Digital Minimalism group. The ways students viewed their academic progress in regard with perceived vocabulary retention varied between the two groups. 28 participants in the Digital Tools group reported that these tools and activities were extremely helpful, while 12 participants expressed moderate helpfulness.

"I kept reviewing words in the app. The repetition really helped me remember them in class." (Participant D4)

On the contrary, participants in the Minimalism group had mixed opinions. While 21 participants reported that using traditional materials improved retention, 9 disagreed and 13 expressed uncertainties. One wrote:

"Writing words by hand helped me think about their meaning more clearly." (Participant M10)

Another offered a contrasting view:

"I sometimes forgot the words without the app to remind me." (Participant M33)

The findings align with previous research conducted by Stockwell (2022) and Carrier et al. (2015), which suggested that vocabulary learning benefits from mobile-based repetition and limiting digital distractions can help in better vocabulary retention and focus.

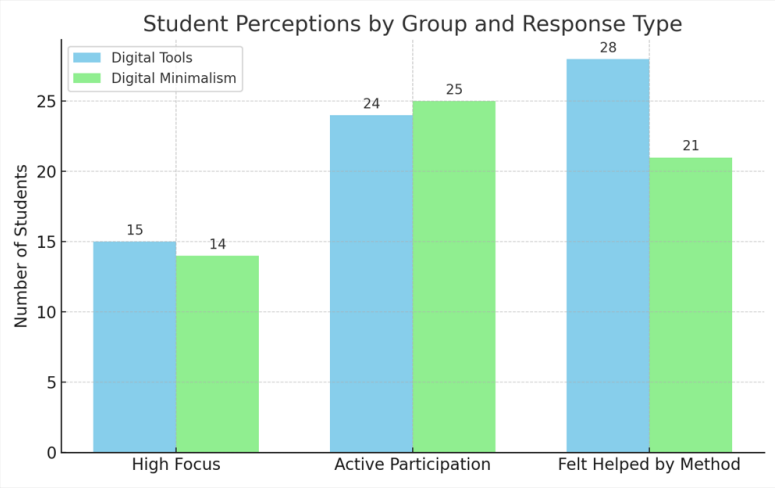

Figure 3. The bar chart summarizes key qualitative themes: focus, class participation, and perceived vocabulary retention

The Digital Tools group gave positive feedback on the interactive and accessible features of the platforms used because they enhanced student engagement and maintained temporary vocabulary retention. In contrast, students in the Digital Minimalism group processed information more reflectively but reported facing certain challenges because of the need for greater self-discipline and intrinsic motivation. The strategies demonstrated successful results, but their effects depended on how learners preferred their study environment to be. Eventually, both groups reported significant vocabulary gains, suggesting that instructions tailored to the needs of the learners indicate beneficial pedagogical implications. Ultimately, both groups showed significant vocabulary gains, suggesting that both the approaches offer meaningful pedagogical advantages.

5. Discussion

5.1 Influence on Vocabulary Retention

The quantitative findings indicated that both the Digital Minimalism and Digital Tools groups showed statistically significant developments after 4 weeks of interventional classes. Although the Digital Tools group scored a lower average pre-test score ($M = 10.2$), it outperformed the Digital Minimalism group in the post-test ($M = 23.1$ vs. $M = 21.3$), reflecting an overall better performance. The findings suggest using digital devices in a structured way can affect vocabulary retention positively. The larger effect size observed in the Digital Tools group ($t(42) \approx 12.90$, $p < .001$) underscores the role of interactivity and immediate feedback given by online platforms like Kahoot and Quizzes, which appear to support vocabulary consolidation. On the other hand, the Digital Minimalism group also produced notable results ($t(43) \approx 4.01$, $p = .001$), with an average improvement of +7.6 points. This finding acknowledges the fact that reducing cognitive overload by minimizing digital distraction results in more sustainable vocabulary acquisition. The result is distinctly aligned with cognitive load theory (Sweller et al., 2011), which highlights minimizing the irrelevant cognitive load to enhance meaningful learning. Despite the students' daily use of digital devices and applications, many reported that screen-based learning can lead to a shift towards non-academic digital activities. This observation supports prior research done by Gazzaley and Rosen (2016), Chen et al. (2020), and McCoy (2020), who have documented the inevitable temptations students face with digital multi-tasking during academic tasks. The present study highlights the importance of digital minimalism in managing these distractions and boosting vocabulary acquisition. By minimizing the participants' exposure to notifications and multimedia data, the students were able to focus more during the lesson, which ultimately led to improved academic performance. Furthermore, this research provides important insights into the general foundation program in Oman, where the educators are actively trying to bridge the gap between secondary and tertiary education. As students in this context are greatly dependent on their digital devices, especially mobile phones, for non-academic purposes, motivating students to adopt digital minimalism could enhance their productivity and lead to better cognitive engagement.

5.2 Focus and Cognitive Load Management

The thematic analysis of both quantitative and qualitative data suggested that maintaining focus and managing distraction were some of the challenges faced by the Digital Tools group. The participants valued the usefulness of the interactive games; however, they found it difficult to ignore the temptation of social media and constant notifications they receive on their phones. This dualism highlights the role of self-regulation strategies while using digital devices effectively. On the other hand, the Digital Minimalism group reported feeling "peace of

mind" and more focused when they left their phones aside. Many participants stressed how paper-based worksheets and group discussions deepened their vocabulary learning and long-term retention. However, some others missed the fun of interactive games, and they believed this could have stimulated the learning process by adding more excitement to the process. The findings suggest that while elimination of digital devices could boost concentration, stronger intrinsic motivation would assist in keeping the students engaged throughout the learning process.

5.3 Student Engagement and Learning Preferences

Another additional theme that emerged from the participants' feedback was about classroom engagement. Participants of the Digital Tools group frequently expressed their interest in the online challenge games which influenced competition against their peers. Gamification played a crucial role in encouraging competition and forming a community, which ensured better learning outcomes. Meanwhile, participants of the Digital Minimalism group valued the traditional methods such as paper games, group discussion, and peer-learning as they created more interpersonal and collaborative dynamics. When reflecting on vocabulary retention, those in the Digital Tools group found that digital devices helped them learn vocabulary quickly because they got immediate feedback, could practice repeatedly, and had tools for pronunciation. In contrast, the Digital Minimalism group had mixed experiences; some missed the reminders from the online games, while others found writing by hand very helpful. These findings inform individual differences in study habits, learning preferences and student's self-regulated behavior which has an impact on the effectiveness of these approaches.

6. Conclusion

The study examined the effectiveness of digital minimalism versus digital tool-assisted learning regarding vocabulary retention for EFL students. The research shows that both groups of students improved their vocabulary significantly over the four weeks, but those using digital tools performed slightly better on the final tests. Subject to qualitative evaluation, the Digital Minimalism group indicated better attention and fewer interruptions when studying, which demonstrates the intellectual value of digital minimalism practices. This study presents technology-enhanced learning tools boost student participation and study repetition, yet the potential screen distractions might impede learners from engaging in deep processing activities. selecting a minimalistic approach helps students sustain their focus throughout their studies, yet they need stronger discipline and motivational skills to follow this method. Therefore, whether or not to use or restrict the use of digital tools in language requires a comprehensive understanding of the learning style, context, and cognitive load of a particular task. This research encourages sustainable learning practices connected to sustainable development goals through teaching students to use technology wisely, which benefits their education as well as their mental health and environmental responsibilities. Teachers should select adaptable teaching methods that combine online educational tools together with strategies that encourage concentration within their learning environments. Educational institutions must teach students effective digital-distraction management techniques to achieve maximum benefits from their digital involvement and in-depth work practices.

6.1 Pedagogical Implications

These findings underline the significance of differentiated instruction when educators face learner diversity. Digital devices promote learner's autonomy and can enhance engagement through gamification. Digital devices carry pedagogical value when they are used purposefully rather than passively, which helps minimize digital overload. However, learners who easily become distracted and tempted by social media and apps notifications can benefit from digital minimalism. Structured activities such as paper games and hand-drawn flashcards help deepen metacognitive understanding and enhance concentration. This approach, particularly benefits learners who are interested in focused low-distraction engagement and less involvement with technology. Therefore, such an approach will only be feasible if the learner is disciplined and motivated enough. A balanced pedagogical model could be a combination of the two, wherein digital technologies are used to engage and get participation in the classroom, and more traditional reflective tasks that are based on paper are used to ensure that the task focus is maintained. The teacher can tailor some activities based on the learners' learning styles while staying focused on the content and objectives of the study. This study contributes to broader educational sustainability aims. As Newport (2019) claims, digital minimalism is not about reducing the use of technology but about using it effectively and in a structured, meaningful way, which is only possible by minimizing the nonessential digital usage (Bharaty & Das, 2023). Students who practiced digital minimalism reported greater mental clarity and less fatigue, as noted by Kong et al. (2018) and Mizrachi et al. (2021), who emphasized that students experience greater concentration and comprehension when engaging with print-based materials.

6.2 Limitations and Directions for Future Research

Despite all the careful considerations when designing this study, the researchers faced some limitations. First, is the duration of the intervention (four weeks) which may not reflect long-term retention of vocabulary knowledge. Further longitudinal studies could reveal the effect of each method on vocabulary acquisition over a longer period. Furthermore, conducting the study among the adult learners, considering the sample size, the result cannot be generalized across various age groups, cultural contexts and proficiency levels. Besides, while the mixed-method approach provided a more comprehensive study, the learner's self-reflection can always be biased by internal and external factors. Teachers' observational data provided more objective perception and transparency into learner's behavior and involvement. Finally, future studies might consider a thorough study on student's self-regulated behavior and how it mediates the effectiveness of both digital minimalism and using digital devices. While this study emphasized different performances among students with different learning preferences and study habits, it did not directly study the self-regulated behaviors and metacognitive reflections.

Additional research should further develop these findings by conducting studies on extended vocabulary retention times and creating research models that merge digital minimalism strategies with appropriate technology implementation. In doing so, educational institutions need to establish better support frameworks that enable students to build linguistic abilities and cognitive mental strength needed to succeed in the digital age.

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Authors' contributions

- Shreya Basu: Drafting the study framework, study design, data collection, results, revision
- Soodeh Hamzehlou-Moghadam: Literature review, data collection, data analysis, references, revision

Both authors contributed equally to this work and are considered co-first authors.

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