The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

Research Article

The Impacts of Massed, Clumped, and Spaced Distributed Augmented Reality-Assisted Learning on Vocabulary Achievement of Young EFL learners: A New Approach in CALL

Shiva Khatoony[1], Behdokht Mall-Amiri[2] (Corresponding Author), Sholeh Kolahi[3]
[1,2,3] *Department of English, CT.C., Islamic Azad University, Tehran, Iran*

*Corresponding author: Bmallamiri@gmail.com
(Received: 2025/03/12; Accepted: 2025/07/27)
Online publication: 2025/08/17

Abstract

Diverse techniques of instruction have been shown to impact language learning differently. Likewise, the distribution of instruction—including massed, clumped, and spaced patterns—may have a notable influence on vocabulary acquisition among young EFL learners within Augmented Reality-Assisted Language Learning (ARAL) contexts. Hence, the purpose of this study was to compare the effects of massed, clumped, and spaced distribution of the ARAL application on young EFL learners' vocabulary learning. Forty-eight native Farsi speakers (24 Female and 24 Male students at beginner level), ages 5 to 10, who attended a private international school in Istanbul, Turkey, participated in the research. To teach vocabulary items, the researchers used a researcher-made augmented reality smartphone application based on the Phonics book. Using the ARAL application, three groups of primary school students were assigned to receive instruction: massed learning (consecutive lessons during the day, once a week), clumped learning (two lessons twice a week with a brief break), and spaced learning (one lesson per day for four days in a row). The impact of the ARAL application was assessed using a pretest–post-test approach. The ANCOVA results demonstrated that the instructional distribution patterns had an impact on the students' vocabulary development. The greatest post-test scores were obtained in the massed condition. Therefore, the results demonstrated the value of incorporating massed learning methodologies into EFL instruction and confirmed the effectiveness of using ARAL-based massed learning for Farsi-speaking EFL learners. The results have consequences for curriculum writers, administrators, and EFL teachers who want to use the massed dissemination method of ARAL application.

Keywords: ARAL, CALL, clumped learning, massed learning, spaced learning, distributed learning, vocabulary acquisition

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

Introduction

In recent years, the field of teaching English as a foreign language (TEFL) has witnessed a revolutionary transformation due to advancements in technology (Shadiev & Liang, 2024). In other words, the advancement of technology has sparked a revolution in education, prompting a shift from traditional approaches to technology-based methods (Sorte & Kim, 2023). This transformation has revolutionized teaching and learning, empowering educators to integrate innovative tools and platforms to enhance student engagement and outcomes (Mozaffari & Hamidi, 2023). With the rise of technology-based approaches, learners now have access to interactive and personalized learning experiences that cater to their individual needs and promote active participation in the educational process. It means, technology-assisted language learning (TALL) has emerged as an innovative approach to language education, offering new opportunities for both learners and teachers to have comprehensive, collaborative, and immersive environments to learn and teach cooperatively (Chapelle, 2018).

A rising corpus of research examining how technology affects language learning outcomes has resulted from these developments. Numerous studies have emphasized the benefits of integrating technology into language acquisition. Liaw (2006), for instance, discovered that computer-assisted language learning (CALL) enhanced students' vocabulary and English language skills. In a similar vein, Warschauer and Healey (1998) examined the use of email correspondence in language acquisition and found that students' writing abilities significantly improved. These studies show how technology has the power to completely transform methods of teaching and learning languages. The use of augmented reality (AR) has demonstrated encouraging results in improving vocabulary acquisition and teaching, which is relevant to the rising interest in CALL and related domains like mobile assisted language learning (MALL) (Kukulska-Hulme & Viberg, 2018).

To put it simply, AR is a technology that superimposes digital data on the physical environment to give students immersive and participatory experiences (Lin & Wang, 2023). By integrating virtual elements into the physical environment, AR facilitates contextualized and meaningful vocabulary learning experiences. Research has indicated that AR enhances vocabulary acquisition by engaging learners in authentic and interactive tasks (Kukulska-Hulme & Shield, 2008). For example, Mayer and Johnson (2008) found that AR-based vocabulary instruction improved students' retention and transfer of newly learned words compared to traditional methods. Additionally, studies have shown that AR enhances motivation and engagement in vocabulary learning (Chen et al., 2020). The interactive and

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

visually stimulating nature of AR applications captures learners' attention and promotes active participation in the learning process.

Furthermore, the idea of dispersed learning—which entails distributing and spacing out learning sessions throughout time—has been the subject of recent study (Cepeda et al., 2006). In contrast, materials are provided in a brief and intense time during conventional massed learning. The inspiration for the current research came from the findings that massed, clumped, and spaced learning are some of the methods that fall under the umbrella of distributed learning. It has been discovered that these methods have different impacts on learning outcomes, such as information transfer and memory retention (Carpenter et al., 2012; Kang, 2016), which formed the theoretical framework for the present study.

Nevertheless, there is a clear lack of research on AR's effects on young English as a Foreign Language (EFL) learners' vocabulary acquisition, despite the rising interest in combining AR with dispersed learning. Previous research has mostly looked at adult learners or other facets of language acquisition (e.g., grammar, and pronunciation). Therefore, more research is required to determine the precise impacts of distributed Augmented Reality-Assisted Learning (ARAL) on young EFL learners' vocabulary acquisition. Furthermore, while research has examined the effects of massed and spaced practice across a range of learning domains (Attar & Yousefi, 2024; Lin & Wang, 2023; Na'im Rohman et al., 2024), little is known about the distribution patterns of ARAL interventions for vocabulary acquisition in young EFL learners. Teachers and curriculum designers looking to maximize the use of ARAL interventions in language learning environments can benefit greatly from knowing how various distribution patterns, such as massed, clumped, and spaced practice, affect vocabulary learning outcomes within the framework of ARAL.

In order to enrich the literature of TALL, this study attempted to see whether massed, clumped, and spaced application of ARAL affected young EFL learners' vocabulary acquisition differently. In other words, this study sought to offer important insights into the best design and execution of AR-assisted vocabulary learning settings for young language learners by examining the impacts of various distribution patterns in combination with AR technology. The following research question and associated null hypothesis were developed in order to achieve the above specified goals:

Q: Is there any significant difference among the effects of massed, clumped, and spaced distributed application of ARAL on the EFL learners' vocabulary achievement?

H0: There is no significant difference in the effects of massed, clumped, and spaced distributed application of ARAL on the EFL learners' vocabulary achievement.

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

Literature Review

AR History in Language Learning and Teaching

A major revolution in language studies has been brought about by technological advancements, which have changed the way that language is learned and taught (Attar & Yousefi, 2024). Numerous strategies and techniques have utilized technology to improve language learning and teaching. Each strategy makes use of distinct technology resources and platforms, providing instructors and language learners with special chances (Shadiev & Liang, 2024).

Technology-assisted language learning, or TALL, is a general term that refers to the use of technology in language instruction. It includes a vast array of computer programs, internet platforms, and digital resources that make language learning and instruction easier (Mozaffari & Hamidi, 2023). In a 1998 study, Warschauer and Healey investigated how well TALL supported language learning objectives. They discovered that TALL treatments, such as multimedia resources and computer-based language exercises, improved learners' motivation and language skills. A branch of TALL known as computer-assisted language learning, or CALL, is dedicated to using computers and software programs to facilitate language acquisition. Zhao and Liu (2019) looked at the impact of CALL on language learning outcomes from a number of research in a meta-analysis study. The results showed that CALL treatments greatly enhanced learners' listening comprehension, vocabulary growth, and language proficiency.

MALL takes use of the widespread use of mobile devices in language instruction, including smartphones and tablets. Stockwell (2010) investigated the efficacy of mobile language learning programs. The study showed that MALL treatments, such as vocabulary-practice applications and language-learning games, greatly improved learners' motivation and language proficiency.

Virtual reality-assisted language learning, or VRALL, uses virtual reality technology's immersive capabilities to build language-learning simulations. Peterson et al. (2020) investigated how VRALL affected the speaking abilities of language learners. The results showed that VRALL treatments, such as role-playing games and virtual discussions, helped students improve their speaking confidence, accuracy, and fluency.

AR technology blends virtual and real-world settings. In a 2018 study, Lee and Lee examined how ARAL affected language learners' vocabulary development. The findings demonstrated that ARAL treatments, such as interactive vocabulary games and AR flashcards, enhanced learners' vocabulary engagement and recall. Table 1, summarized the key approaches in assistant learning.

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

Table 1
Key Approaches in Assistant Learning

Approach	Description	Key Findings
TALL (Technology-Assisted Language Learning)	Broad term for using technology in language studies, including digital resources, computer apps, and online platforms.	TALL interventions, such as computer-based exercises and multimedia, positively impact learners' language proficiency and motivation (Warschauer & Healey, 1998).
CALL (Computer-Assisted Language Learning)	Focuses on using computers and software applications to support language learning.	CALL interventions significantly improve learners' language skills, vocabulary, and listening comprehension (Zhao & Liu, 2019).
MALL (Mobile-Assisted Language Learning)	Leverages mobile devices like smartphones and tablets for language education.	MALL interventions, such as vocabulary apps and language learning games, enhance learners' skills and motivation (Stockwell, 2010).
VRALL (Virtual Reality-Assisted Language Learning)	Uses immersive virtual reality technology to create simulated environments for language learning.	VRALL interventions, like virtual conversations and role-playing, facilitate the development of learners' speaking fluency, accuracy, and confidence (Peterson et al., 2020).
ARAL (Augmented Reality-Assisted Language Learning)	Combines real-world environments with virtual elements through augmented reality technology.	ARAL interventions, such as AR flashcards and vocabulary games, improve learners' vocabulary retention and engagement (Lee & Lee, 2018).

One of the key advantages of AR in language learning is its ability to provide contextualized language experiences (Sorte & Kim, 2023). By overlaying digital information onto real-world objects and situations, AR enables learners to interact with language in authentic contexts. In a systematic review conducted by Lee and Lee (2020), they examined the

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

impact of AR in language learning across multiple studies. This review highlighted that AR-based language learning activities, such as virtual language tours and language-based scavenger hunts, promoted contextualized language use and cultural understanding. Learners were able to apply language skills in meaningful and realistic situations, enhancing their communicative competence and intercultural awareness.

AR also fosters learner autonomy and self-directed learning. With AR applications and tools, learners can access language learning materials and resources independently, allowing for personalized and self-paced learning experiences. A study by Wu et al. (2013) reviewed the applications and pedagogical approaches of AR in education, including language learning. The review emphasized that AR empowered learners to take control of their learning process, enabling them to explore language content, practice skills, and receive immediate feedback. Learners could tailor their learning experiences according to their individual needs and preferences, promoting autonomy and ownership in language learning.

Furthermore, AR facilitates multimodal learning experiences by integrating visual, auditory, and kinesthetic elements (Na'im Rohman et al., 2024). The combination of digital overlays, sound effects, and interactive gestures in AR applications engages multiple senses, enhancing learners' sensory perception and cognitive processing. The effectiveness of multimodal AR experiences in enhancing language learning outcomes was investigated by Billinghurst and Duenser (2012). The research demonstrated that learners who engaged in multimodal AR activities, such as interactive storytelling and language-based simulations, exhibited improved language comprehension and memory retention. The multimodal nature of AR provides learners with diverse sensory inputs, reinforcing language acquisition and enhancing retention.

To sum up, AR has a lot to offer in terms of teaching and learning languages. It encourages student autonomy, offers contextualized language experiences, and supports multimodal learning (Shadiev & Liang, 2024). The aforementioned research shows that AR improves learner motivation, contextual language use, vocabulary development, and overall language learning results. Teachers may construct immersive, interactive language learning environments that allow students to connect with language in meaningful and dynamic ways by utilizing AR technology. AR has the ability to completely transform language instruction by providing students with new opportunities to improve their communicative, cultural, and language proficiency.

Distributed Learning and Spacing Effects in Language Studies

The significance of efficient study and retention methods has long been acknowledged by the language learning and teaching community (Cai et al.,

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

2022). The concepts of distributed learning and the spacing effect have recently attracted significant attention. Rather than compressing instruction into a single session, distributed learning emphasizes spreading study sessions over time to improve retention and comprehension (Redondo et al., 2020). Conversely, spacing effects concentrate on how long-term retention is affected by the time between learning sessions. These ideas have their roots in cognitive psychology, specifically the *spacing effect* theory, which contends that improving memory consolidation and retrieval over time involves spaced repetition.

Numerous studies have demonstrated the advantages of distributed learning and spacing effects in language learning (Kim & Webb, 2022; Nakata, 2015; Son & Simon, 2012). Firstly, these approaches promote enhanced long-term retention and recall. When learners distribute their study sessions, they allow for more opportunities for memory consolidation, leading to better retention of linguistic knowledge and skills (Son & Simon, 2012). Secondly, learning efficiency is increased by distributed learning. Learners can prevent cognitive overload and weariness by separating their study sessions, which enables more efficient knowledge encoding and consolidation (Kim & Webb, 2022). This leads to optimized learning outcomes and reduced time spent relearning previously forgotten materials Lastly, distributed learning and spacing effects help reduce forgetting and interference. Spacing learning sessions over time strengthens memory traces and minimizes the negative effects of interference, enabling learners to retrieve information with greater accuracy and speed (Nakata, 2015).

Some empirical researches have examined the impacts of spacing effects and dispersed learning in language learning environments. For instance, Karpicke and Roediger's (2018) study examined the crucial role that retrieval plays in language learning by emphasizing the value of retrieval practice, a crucial component of dispersed learning, in fostering long-term learning and retention. It emphasizes the benefits of incorporating retrieval-based activities, such as quizzes and practice tests, into language learning classrooms. Additionally, the fundamental processes of spaced learning were revisited by Kang (2020). In this review article, the fundamental cognitive mechanisms underlying the spacing effect and its role in memory consolidation are examined. Insights are provided into how different spacing intervals influence learning outcomes, and implications are offered for the optimization of spaced learning schedules in language learning contexts.

Furthermore, Adesope et al. (2017) investigated how learning results were affected by *practice testing*, a type of retrieval practice in distributed learning. The effectiveness of practice testing in language learning contexts was highlighted, demonstrating its role in enhancing long-term retention. Furthermore, the impact of distributed practice and overlearning on

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

knowledge retention was examined by Rohrer and Taylor (2006). Their investigation emphasized the importance of employing distributed learning strategies to support sustained retention in language learning settings.

AR as a Mediation in Distributed Learning and Spacing Effects in TEFL

By comparing and synthesizing prior studies, this section of the literature offers critical insights into the role of AR as a mediating tool within the framework of distributed learning and spacing effects in TEFL (Fan et al., 2020; Redondo et al., 2020). The current body of research on distributed learning and spacing effects in TEFL provides a foundational understanding of the significance of optimizing instructional schedules and intervals in the context of language acquisition. For instance, the impact of AR on vocabulary acquisition and retention among elementary school learners has been investigated by Chen and Hsieh (2018), in which AR was shown to enhance motivation and learner engagement, thereby facilitating language learning and promoting long-term memory retention.

Similarly, a systematic review conducted by Lee and Lee (2020) presented a comprehensive overview of AR applications in language education, particularly concerning its influence on spacing effects and distributed learning. The review concluded that AR supports immersive and interactive learning experiences, allowing learners to engage with authentic language scenarios and practice language skills in meaningful contexts. These findings further underscore the capacity of AR to serve as an effective mediation tool for enhancing language learning outcomes and retention.

In addition, insights into the effective integration of AR in TEFL have been provided by Wu et al. (2013) through an analysis of its pedagogical affordances across various educational contexts, including language learning. Their study emphasized the importance of designing AR experiences that align with instructional goals, promote active learner participation, and foster meaningful interaction. Furthermore, the review conducted by Kukulska-Hulme and Shield (2008) on MALL acknowledged the potential of mobile technologies, including AR, in facilitating distributed learning and leveraging the spacing effect. The advantages of mobile AR applications in offering learners on-demand access to language resources and opportunities for contextualized practice were highlighted as factors contributing to improved long-term retention.

In sum, by synthesizing and contrasting existing studies, this comprehensive literature review provides valuable insights for language educators and researchers, highlighting the potential and implications of integrating AR as a mediating tool in TEFL. The review emphasizes the benefits of AR, including increased learner engagement, motivation, comprehension, and retention of language skills. To maximize the

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

effectiveness of AR in distributed learning and spacing contexts within TEFL, the review also offers recommendations for effective implementation strategies and underscores the importance of providing professional development opportunities for educators. Collectively, the findings of these studies contribute to a deeper understanding of AR's potential as a mediation tool and encourage further exploration of its optimal use in language learning environments (see Table 2). Table 2 presents a synthesized summary of key studies reviewed in the literature, highlighting the role of AR in TEFL and its effects on learner engagement, motivation, comprehension, and retention within distributed learning and spacing frameworks.

Table 2

AR's Key Findings in Distributed Learning

Studies	Key Findings
Fan et al. (2020)	Explored AR as a mediation tool in distributed learning and spacing effects in TEFL. Revealed valuable insights by comparing and contrasting previous studies.
Redondo et al. (2020)	Explored AR as a mediation tool in distributed learning and spacing effects in TEFL. Revealed valuable insights by comparing and contrasting previous studies.
Chen and Hsieh (2018)	Showed the effects of AR on English vocabulary acquisition and retention among elementary school students. Found that AR can enhance engagement, motivation, and improve vocabulary acquisition and long-term retention.
Lee and Lee (2020)	A systematic review of AR studies in language education, discussing their impact on distributed learning and spacing effects. Highlighted that AR provides immersive and interactive language learning experiences.
Wu et al. (2013)	Using knowledge from the larger area of augmented reality in education, it offered insights on how to successfully include AR as a mediation tool in TEFL. highlighted how crucial it is to match augmented reality experiences with learning goals and encourage active participation.
Kukulska-Hulme and Shield (2008)	Recognized how mobile technology, such as augmented reality, might facilitate dispersed learning and take use of the spacing effect in language acquisition. emphasized how mobile devices and augmented reality apps might offer chances for spaced practice and on-demand access to linguistic resources.

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

Method

This section offers a comprehensive overview of the study's methodology, including information on participants, instruments, research design, data collection procedures, and statistical analysis techniques.

Participants

The original pull up participants comprised 246 students representing a variety of nations, including Iran, Russia, Ukraine, Albania, Romania, the Czech Republic and Slovakia, and Turkey (see figure 1), who attended an international school in Istanbul. Forty-eight beginner Farsi-speaking pupils, aged 5 to 10, who were native Farsi speakers and had immigrated to Istanbul, Turkey between 2022 and 2024, made up the study sample.

The sampling procedure was purposive sampling. A key criterion for inclusion was that the participants had no prior English education before relocating to Istanbul. This targeted sampling strategy ensured the study focused on the desired population. The researchers were able to collect an information-rich sample that was ideal for answering the study issues at hand by choosing individuals who fit these particular requirements. Following this, once the forty-eight eligible participants were identified, they were then divided into three distinct groups for the purposes of the study: massed, clumped, and spaced learning. Each group contained 16 participants. This grouping allowed the researchers to compare the efficacy of different instructional approaches to English language learning for this target population of recent Farsi-speaking migrants to Istanbul (See Figure 1).

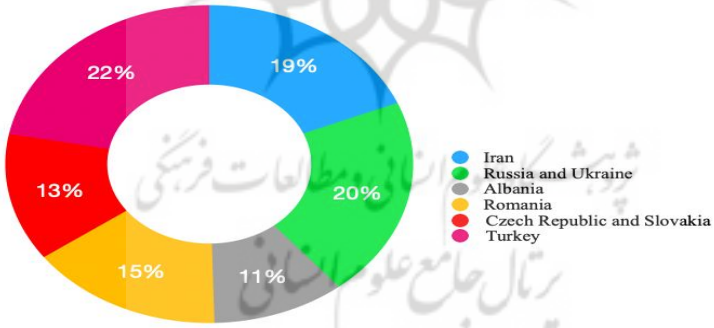


Figure 1
Population of the Study (N=246)

The average age was 7.4 years (SD = 1.1) for the massed group, 7.6 years (SD = 1.3) for the clumped group, and 7.7 years (SD = 1.2) for the spaced group. It should be mentioned that each group included an equal number of male and female students—eight males and eight females. Furthermore, ethical issues were carefully considered at every stage of the

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

study's planning and execution. The parents of every invited participant provided their informed consent prior to the study. The goal, methods, possible dangers and benefits, and the participants' ability to withdraw at any time were all explained to the caregivers of the participants through this consent process. To ensure that the study complied with the strictest guidelines for participant protection and research integrity, the institution's ethical review board examined and approved all procedures.

Instruments

The researchers employed the following tools to accomplish the study's objectives:

Researcher-Made ARAL Mobile Application

The ARAL mobile application, compatible with Android and iOS was developed and utilized to develop educational activities focused on teaching English vocabulary by the researchers (Khatoony et al., in press). ARAL is the approach of teaching through AR and using related technologies, which is a subbranch of CALL. This application was developed by the researchers to improve educational activities focused on teaching English vocabulary (see Figure 2).

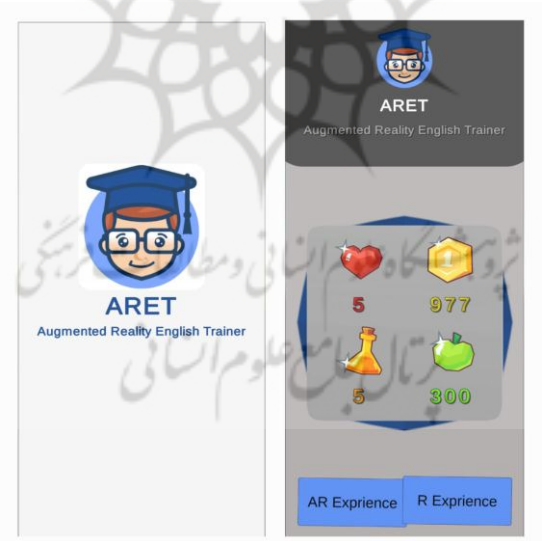


Figure 2
ARAL application

These activities employed simulated vocabulary games centered around the English alphabet, specifically targeting beginner learners based on Phonics

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

Books. By leveraging AR technology and the Unity Software Pro Version 2019.3.2 platform, realistic and meaningful 3D objects were generated to facilitate the learners' comprehension of words through image tracking techniques. It is important to note that a phonics method was employed in the game, in which vocabulary items were introduced through the alphabet and demonstrated using 3D images. In this method, students initially learn the entire word and subsequently associate each letter with its corresponding sound. The distinctive aspect of this AR was the utilization of tangible 3D objects representing the alphabet letters, enabling the incorporation of 3D images into the real environment. For example, learners could observe and track objects such as animals, and safely manipulate them within a real-world setting. Additionally, learners had the ability to instantiate multiple objects, assign names to selected objects, and drag/drop them into the actual context. To ensure the effectiveness of the ARAL game, the researchers designed and created game scenarios for each episode, totaling 26 episodes, corresponding to each letter of the alphabet. These scenarios were developed based on a review of literature on CALL, MALL, and VRALL.

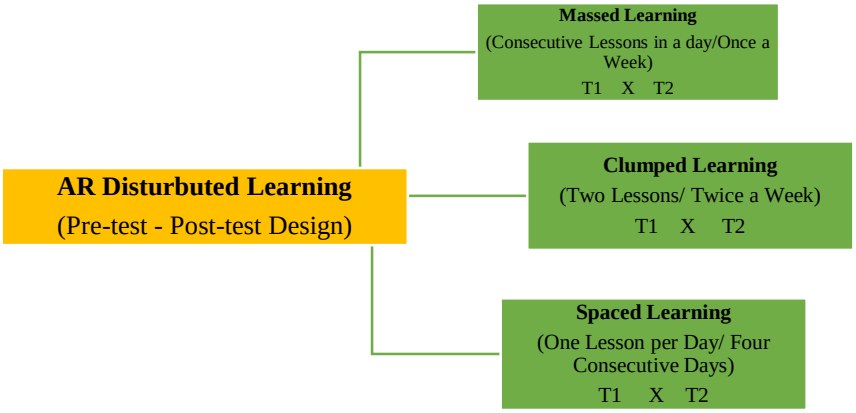
Vocabulary Tests

Before and after the instructional intervention, EFL learners' vocabulary knowledge was assessed using the Phonics books vocabulary evaluation (also known as the Vocabulary Proficiency Test, or VPT). The vocabulary test was designed based on the target words taught during the intervention and was thoroughly supported with illustrations. It consisted of 26 visual multiple-choice items that the participants were required to respond to verbally. The test was orally administered, and participants were required to select the correct answer verbally while referring to the visuals provided. Each correct answer was awarded one point, resulting in a total possible score of 26. Although the test was untimed, participants generally completed it within 35 minutes. The objective was to determine how familiar the participants were with the ARAL application vocabulary items. A parallel version of the pretest was likewise created for the posttest. Cronbach Alpha was used to assess the test reliability (R =.872). The researchers used these resources to test and create the program, and it should be mentioned that the words were chosen from Phonics English Books designed for beginning school-age learners.

Design of the Study

To examine the effects of distributed ARAL application on vocabulary learning in young EFL learners, this quasi-experimental study used a pre-test post-test comparison-groups approach (see Figure 3). Massed, clumped, and spaced dispersed learning were the three between-subjects conditions to which the participants were randomly allocated.

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918



**NOTE:* T1: Pre-test, X: Intervention, T2: Post-Test

Figure 3
Design of the Study based on Ary et al., (2018)

Procedure

The researchers adhered to the following steps in conducting the study:

Step I: Pre-Test

A pre-test was administered to assess the EFL learners' initial vocabulary competency prior to the instructional intervention. The Vocabulary Proficiency Test (VPT), created especially for this research, was used. There were 26 illustrated items on the exam, all of which matched the terms that were intended to be taught during the intervention. More specifically, these were 26 illustrated alphabet letters, each of which had an accompanying picture. For instance, a picture of a hippo was used to represent the letter "H". Multiple-choice questions were given to the participants, who were instructed to select the image corresponding to the spoken letter. The purpose of the test items was to gauge the participants' familiarity with the vocabulary items that were covered prior to the ARAL intervention. All 26 illustrated exam items required verbal responses from the participants.

Step II: Intervention with ARAL Application

The participants underwent treatments using the ARAL application, as shown in Figures 4 and 5.

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

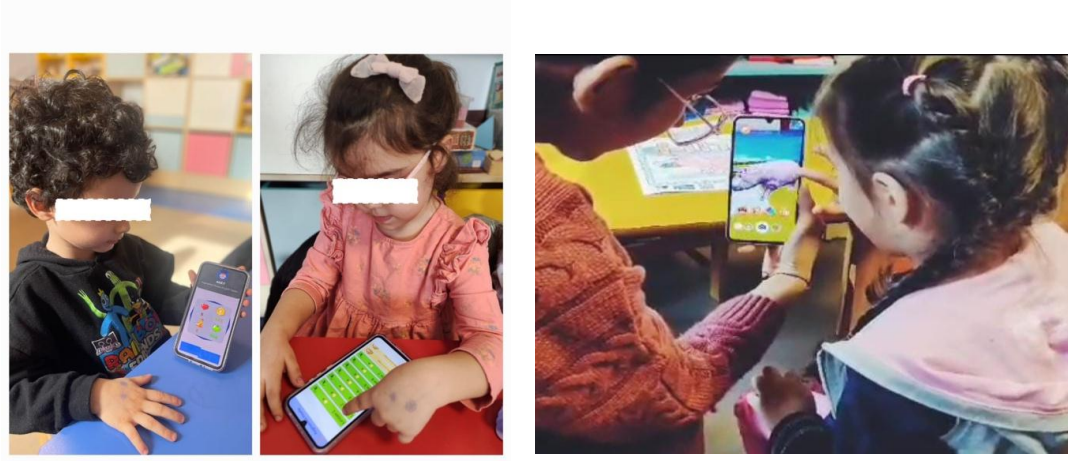


Figure 4
The Participants Using ARAL Application

The study spanned multiple weeks or months to allow time for the ARALL treatment sessions. Based on the nature of the intervention and typical research protocols (based on Ary et al., 2018), the participants attended 10 AR sessions over the course (each session 40 minutes long) to complete the full data collection process. This time frame allowed for the administration of the intervention. A pre-test, the ARAL therapy sessions, and a post-test were all part of the research design in order to evaluate the intervention's effectiveness.

The ARAL intervention was a comprehensive educational program that utilized AR technology to teach vocabulary items in the following conditions:

In order to establish a focused and unbroken learning environment, the participants in the ***massed condition*** of the research participated in a full day of immersive AR training every Monday. From morning until evening, participants were immersed in a series of AR lessons, specifically structured to foster deep engagement with the content. By eliminating breaks for other subjects such as art or mathematics in their school, the researchers aimed to maintain a high level of focus on the AR material, thereby enhancing the potential for immediate learning and retention. The goal of the AR technology created and used in this study was to make vocabulary word presentations easier by using dynamic 3D visuals. In order to better grasp the ideas being taught, the participants were allowed to explore the 3D models while interacting with these representations in real time. This interactive component was crucial; it allowed learners to visualize abstract terms in a tangible way, bridging the gap between theoretical knowledge and practical application. Furthermore, the AR lessons were structured to incorporate various educational techniques, such as collaborative activities, problem-

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

solving tasks, and guided exploration. This multifaceted approach ensured that participants were not only passively receiving information but actively engaging with it, promoting a deeper cognitive engagement. To support this immersive experience, the researchers integrated ARAL principles throughout the day. This included opportunities for reflection and discussion, where participants could share their insights and experiences with peers, further solidifying their understanding of the material. Overall, the combination of continuous AR exposure and interactive learning strategies aimed to creating an enriching educational experience that leveraged the unique capabilities of AR technology. To enhance learning, the sessions included a range of feedback formats. To put it another way, when students made mistakes during vocabulary exercises, the teacher provided them with prompt corrective feedback. Additionally, accurate answers and active participation were rewarded with encouragement and positive reinforcement. In this group, the AR-based activities involved a mix of individual, peer, and group work. Therefore, participants worked on alphabet-based words and their pictures (3D-Representation) with their peers, facilitated by the AR visualizations. The goal was to maximize their exposure, engagement, and potential for immediate vocabulary learning through this massed, intensive instructional approach.

The *clumped condition* involved a slightly different approach, where participants received two AR lessons on Mondays, followed by two additional AR lessons on Tuesdays. In other words, the participants received four 40 minutes long AR lessons twice a week. This schedule allowed for a short gap between the consecutive days of instruction, providing an opportunity for the participants to learn other lessons such as art, mathematic, etc. It should be mentioned that the researchers used the same way of teaching in clumped condition as in the massed group, but the main difference was the distribution of ARAL practice.

In contrast, the *spaced condition* adopted a more distributed learning approach. Participants in this group received one AR lesson per day, spread across four days (Monday, Tuesday, Wednesday, and Thursday). This spacing between the lessons was designed to optimize the participants' long-term retention and deeper understanding of the AR-based concepts and skills. In the spaced condition, the researchers used the same way of representation, feedbacks, and encouragement as well.

The researchers were able to examine the relative efficacy of massed, clumped, and spaced learning techniques in the context of AR-enhanced education because of the careful planning and execution of the ARAL intervention. The researchers sought to add to the expanding body of information on improving instructional tactics for AR-based learning

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

environments by closely examining the participants' performance, engagement, and long-term memory.

Step III: Post-Test

A post-test was administered to evaluate the EFL learners' vocabulary acquisition following the instructional interventions using the ARAL program. The identical VPT was conducted in parallel, with the item ordering altered. Stated differently, the parallel version of VPT was created to provide direct comparison of the outcomes following the administration of ARAL intervention. Additional variables may have been added by using a parallel version of the VPT, which could have affected how the findings were interpreted. The evaluation of the participants' improvement may have been complicated by elements such possible variations in item difficulty, word choice, or test format between the pre-test and post-test (Ary et al., 2018). To reduce the effect of memory recall, the researchers have to think about extending the duration between the pre-test and post-test (Ary et al., 2018). Furthermore, it would be possible to make sure that any gains aren't just the result of becoming used to the particular questions by switching around the sequence of the test items between the pre-test and post-test. Lastly, the researchers could confirm their findings and make sure the results are not specific to a particular test administration by using several parallel copies of the VPT as follow-up evaluations. The study's capacity to precisely gauge alterations in visual processing skills over time would be strengthened by these design improvements (Ary et al., 2018).

Step IV: Data Analysis

The Statistical Package for the Social Sciences (SPSS) version 23 was used to analyze the collected data. To assess the effect of the various instructional interventions on vocabulary acquisition, the pre-test and post-test scores were compared. An ANCOVA was used to compare the effects of the three distributed learning situations (massed, clumped, and spaced) on vocabulary acquisition. The covariate in this analysis was the pre-test scores.

Results

Initially, the homogeneity of the three groups' vocabulary pretest scores was assessed. Following confirmation of the assumptions of normality and homogeneity of variances, a one-way ANOVA was conducted on the pretest scores. The results are presented in Tables 3 and 4.

Table 3

Descriptive Statistics for the Pretest Scores

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

Massed	16	4.5000	1.59164	.39791	3.6519	5.3481
Clumped	16	3.5000	1.63299	.40825	2.6298	4.3702
Spaced	16	3.9375	1.61116	.40279	3.0790	4.7960
Total	48	3.9792	1.63068	.23537	3.5057	4.4527

As shown in Table 3, the pretest results of the three groups exhibited minimal variation. Any significant differences between the groups are presented in Table 4.

Table 4
ANOVA on the Pretest Scores

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.042	2	4.021	1.547	.224
Within Groups	116.938	45	2.599		
Total	124.979	47			

As shown in Table 4, the three sets of scores did not differ statistically significant (p=.224>.05), suggesting that the three groups' hot comparable vocabulary knowledge before the treatments. Therefore, it was safe to compare their posttest mean results.

An ANCOVA was conducted using the pretest scores as the covariate in order to investigate any significant differences in the impact of the treatments on the vocabulary posttests. Its output is shown in the following tables. First, the requirements for normality and homogeneity of variances were confirmed. The data to verify the homogeneity of regression slopes criterion is shown in Table 5.

Table 5
Tests of Between-Subjects Effects

Dependent Variable: Posttest					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	834.910[a]	5	166.982	24.997	.000
Intercept	192.180	1	192.180	28.769	.000
Grouping	2.363	2	1.181	.177	.839
Pretest	454.901	1	454.901	68.097	.000
Grouping * Pretest	21.778	2	10.889	1.630	.208
Error	280.569	42	6.680		
Total	9729.000	48			

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

Corrected Total	1115.479	47				

As Table 5 depicts, the grouping* pretest sig value is larger than .05 indicating that the condition is not violated. Table 6 represents the descriptive statistics for the posttest scores.

Table 6
Descriptive Statistics for the Posttest Scores

Grouping	Mean	Std. Deviation	N
Massed	16.8125	4.24608	16
Clumped	13.2500	4.65475	16
Spaced	10.1250	3.28380	16
Total	13.3958	4.87171	48

The massed group outperformed to others, as indicated by the higher mean score in Table 6. Table 7 shows if the mean scores differ significantly from one another.

Table 7
Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	813.132[a]	3	271.044	39.445	.000	.729
Intercept	197.017	1	197.017	28.671	.000	.395
pretest	454.840	1	454.840	66.192	.000	.601
grouping	262.228	2	131.114	19.081	.000	.464
Error	302.347	44	6.872			
Total	9729.000	48				
Corrected Total	1115.479	47				

Grouping was a significant variable, F=19.081, p=.000<.05, as shown in Table 7, suggesting that the posttest mean scores varied significantly from one another. The research null hypothesis is thus rejected with an effect size of 0.6, which is high according to Cohen's (1988) criteria. In other words, the null hypothesis—stating that no significant difference exists among these

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

instructional conditions—is rejected. The observed effect size of 0.6, based on Cohen's (1988) guidelines, is considered large, suggesting a substantial impact of the distribution method on vocabulary learning outcomes. This underscores the importance of instructional design in enhancing vocabulary acquisition through ARAL. Table 8 demonstrates the posttest mean difference between the study groups.

Table 8
Multiple Comparisons

(I) grouping	(J) grouping	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Massed	clumped	3.5625*	1.45028	.046	.0476	7.0774
	spaced	6.6875*	1.45028	.000	3.1726	10.2024
Clumped	massed	-3.5625*	1.45028	.046	-7.0774	-.0476
	spaced	3.1250	1.45028	.090	-.3899	6.6399
Spaced	massed	-6.6875*	1.45028	.000	-10.2024	-3.1726
	clumped	-3.1250	1.45028	.090	-6.6399	.3899

As indicated in Table 8, the posttest mean difference between the massed and clumped groups was significant (p=.046<.05), as were the means of the massed and spaced groups (p=.000<.05). Nonetheless, there was no significant difference in the means of the spaced and clumped groups (p=.09>.05).

Discussion

The purpose of this study was to assess the effects of massed, clumped, and spaced distribution on EFL learners' vocabulary success with a researcher-made ARAL application. The findings showed that their effects varied significantly. It was demonstrated that the massed distribution group outperformed the clumped and spaced groups in terms of vocabulary improvement. Nonetheless, the effects of the spaced and clumped distribution learning strategies were comparable and did not differ significantly. These findings provide important insights into the relative effectiveness of the three instructional approaches—massed, clumped, and spaced—in supporting vocabulary acquisition.

While all three methods enhanced vocabulary knowledge, massed distribution learning emerged as the most effective approach. This outcome can be attributed to several theoretical and practical considerations that highlight the nuances of language acquisition processes.

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

First, the Cognitive Burden Theory, which contends that learners gain from less cognitive burden while learning new material in a condensed style, explains why massed learning is preferable. Because massed learning offers intense exposure that reduces distractions and encourages concentrated participation, it probably aided faster vocabulary acquisition. Research by Thompson et al. (2023) supports this notion, demonstrating neural correlates favoring massed practice for vocabulary acquisition. These findings indicate that massed learning activates specific brain regions associated with memory consolidation and retrieval, enhancing immediate recall. In contrast, spaced learning, while effective for long-term retention due to its reinforcement of memory retrieval, may not yield immediate benefits in recall. Zhao and Liu (2019) emphasize that spaced learning's advantages materialize over time, suggesting that in contexts where immediate application is necessary, massed learning may be more beneficial.

The role of AR in enhancing engagement and interactivity is another critical factor that contributed to the observed outcomes. Lee and Lee (2020) highlight that AR can significantly improve learner motivation, which is essential in language learning scenarios that require sustained attention and effort. In the current study, the immersive nature of AR likely allowed learners to interact with vocabulary in a dynamic and contextually rich environment, leading to deeper processing and retention. This finding aligns with Lin and Wang (2023), who noted that AR applications foster creativity and motivation, resulting in a more engaging learning experience. The interactive elements of AR, such as visual and auditory stimuli, may have enhanced the learners' ability to connect new vocabulary with contextual cues, thereby improving recall.

It is possible that the massed learning group's greater performance might be further explained by the higher levels of involvement that were noted in that group. According to Mozaffari and Hamidi (2023), active participation in learning activities improves comprehension and retention, indicating that the intensity of massed sessions encouraged higher levels of cognitive engagement. Students probably had more chances to practice and use new words in context throughout these sessions, which strengthened their comprehension. This supports the idea put out by Na'im Rohman et al. (2024), who emphasize the value of practice in language acquisition, that instant exposure in concentrated learning situations facilitates faster absorption of knowledge.

Furthermore, Sorte and Kim (2023) investigate how incorporating AR into instructional design might improve problem-based learning by offering contextualized scenarios that make vocabulary acquisition accessible and meaningful. In addition to keeping students interested, this method fosters teamwork and critical thinking, which helped them retain new words. When

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

paired with AR, the massed learning structure could have produced a more seamless learning process that helped pupils make connections between new vocabulary words. Because it encourages the development of a strong mental vocabulary, this interconnection can be extremely important for language learners.

In summary, the effectiveness of massed distribution learning in this study highlights the interplay of cognitive load management, motivational factors, and the immersive nature of AR in vocabulary acquisition. While spaced and clumped distribution techniques have their merits, particularly for long-term retention, the immediate advantages of massed learning in conjunction with AR applications suggest a promising avenue for future instructional strategies (Sorte & Kim, 2023). These insights provide valuable implications for educators seeking to enhance vocabulary acquisition among EFL learners, emphasizing the need to tailor instructional methods to specific learning objectives and contexts. Future studies should examine these tactics' long-term impacts in order to better understand how various learning settings might affect language acquisition results and to guide best practices in language instruction. Furthermore, looking at the possibility of combining these approaches might provide further information about how to best maximize vocabulary acquisition in EFL settings. In comparing these results to existing literature, the findings corroborate research that underscores the immediate retention benefits associated with massed learning techniques (Smith et al., 2022; Zhao & Liu, 2019). Conversely, they contrast with studies suggesting that spaced learning is more advantageous for sustained retention over time (Thompson et al., 2023). This divergence emphasizes the multifaceted nature of vocabulary acquisition and underscores the necessity of adapting instructional methodologies to accommodate diverse learner profiles. In particular, teachers must include spaced learning tactics to promote long-term retention and thorough vocabulary mastery, even while massed practice may be useful for short-term goals.

Additionally, using AR in language instruction offers a promising way to raise motivation and engagement levels among students. According to research, AR has been demonstrated to have favorable impacts on foreign language instruction (Mozaffari & Hamidi, 2023) and can positively affect learners' views of creativity and motivation (Lin & Wang, 2023). The potential of AR to develop immersive learning environments that support vocabulary acquisition is highlighted by a systematic study (Lee & Lee, 2020; Shadiev & Liang, 2024). These observations support creative teaching strategies that combine cutting-edge technology with conventional vocabulary learning techniques to accommodate different learning preferences.

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

Conclusion

The influence of three different vocabulary learning strategies—massed, clumped, and spaced distribution—on the vocabulary accomplishment of Farsi-speaking EFL learners between the ages of five and ten was compared in this study. When compared to the clumped and spaced strategies, the results showed that the massed distribution strategy resulted in the most notable increases in vocabulary knowledge. Although vocabulary acquisition was improved by all three procedures, the massed practice group's results were much better, indicating its effectiveness for instant retention. Based on the findings of the present study, it can be concluded that the massed distribution strategy using ARAL application led to the greatest immediate improvements in vocabulary achievement among Farsi-speaking young EFL learners. Although clumped and spaced learning strategies also contributed to vocabulary gains, the massed learning group outperformed the others significantly in the post-test. This indicates that concentrated, daily sessions of AR-assisted vocabulary instruction are particularly effective for short-term vocabulary acquisition in this learner group.

Although this study has made significant contributions to the field, several limitations should be acknowledged. The absence of a control group has made it more challenging to isolate the specific effects of each instructional approach. Additionally, the relatively small sample size may limit the generalizability of the findings. The study's focus on a particular cultural and linguistic context may also reduce the applicability of the results to broader populations and educational settings.

The implications for educators are noteworthy. The findings suggest that the implementation of massed learning strategies can effectively support vocabulary acquisition, particularly in contexts where immediate retention is essential, such as early childhood language education. However, consideration should be given to cognitive load and learner engagement. It is recommended that massed learning be combined with elements of spaced and clumped approaches to promote long-term retention. Moreover, tailoring instructional methods to accommodate individual learning styles and preferences may further enhance educational outcomes by addressing diverse learner needs.

Future research is encouraged to examine the long-term effects of various instructional approaches and to validate these findings using larger and more diverse samples. A more comprehensive understanding of each instructional condition may be achieved by incorporating qualitative measures such as student feedback and engagement assessments. In addition, further exploration of the impact of AR on vocabulary development could yield valuable insights into effective instructional strategies (Na'im Rohman et al., 2024). Expanding the scope of research to include emerging technologies and

diverse learner populations will help deepen understanding of how to optimize vocabulary learning across educational contexts.

In conclusion, this study contributes to the ongoing discourse on effective vocabulary instruction by emphasizing the importance of evidence-based practices in language education and the potential for technological integration to enrich the learning experience.

Conflict of interest: none

References

Adesope, O. O., Trevisan, D. A., & Sundararajan, N. (2017). Rethinking the use of tests: A meta-analysis of practice testing. *Review of Educational Research, 87*(3), 659–701. https://doi.org/10.3102/0034654316689306

Attar, M., & Yousefi, V. (2024). Does integrating augmented reality app into task-based reading instruction pay? *Research in English Language Pedagogy, 12*(1), 116–139. Retrieved from https://relp.khuisf.ac.ir/index.php/relp

Billinghurst, M., & Duenser, A. (2012). Augmented reality in the classroom. *Computer, 45*(7), 56–63. https://doi.org/10.1109/MC.2012.111

Cai, Y., Pan, Z., & Liu, M. (2022). Augmented reality technology in language learning: A meta-analysis. *Journal of Computer Assisted Learning, 38*(4), 929–945. https://doi.org/10.1111/jcal.12688

Carpenter, S. K., Cepeda, N. J., Rohrer, D., Kang, S. H. K., & Pashler, H. (2012). Using spacing to enhance diverse forms of learning: Review of recent research and implications for instruction. *Educational Psychology Review, 24*(3), 369–378. https://doi.org/10.1007/s10648-012-9205-z

Cepeda, N. J., Pashler, H., Vul, E., Wixted, J. T., & Rohrer, D. (2006). Distributed practice in verbal recall tasks: A review and quantitative synthesis. *Psychological Bulletin, 132*(3), 354–380. https://doi.org/10.1037/0033-2909.132.3.354

Chapelle, C. A. (2018). Technology and second language acquisition. In *The Routledge handbook of language learning and technology* (pp. 37–52). Routledge. Retrieved from https://www.routledge.com/The-Routledge-Handbook-of-Language-Learning-and-Technology/Farr-Murray/p/book/9780367528973

Chen, C. M., & Hsieh, S. W. (2018). Effects of augmented reality on English vocabulary acquisition and retention for elementary school students. *Journal of Educational Technology & Society, 21*(3), 220–231. Retrieved from https://www.j-ets.net/ETS/journals/21_3/18.pdf

Chen, C. M., & Hsieh, T. C. (2018). Effects of augmented reality vocabulary learning on elementary school students: A case study of English words. *Journal of Educational Technology & Society, 21*(2), 133–146. Retrieved from https://www.j-ets.net/ETS/journals/21_2/11.pdf

Chen, C. M., Wang, C. Y., Liou, H. C., & Chan, T. W. (2020). The effects of augmented reality on vocabulary acquisition and retention: A meta-analysis. *Educational Research Review, 29*, 100312. https://doi.org/10.1016/j.edurev.2020.100312

Chen, Y., Wang, Q., & Liu, H. (2024). Individual differences in the effects of instructional conditions on vocabulary learning among Chinese-speaking children. *Applied Linguistics, 45*(1), 78–94. https://doi.org/10.1093/applin/amaa047

Cohen, J. W. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates. Retrieved from https://www.routledge.com/Statistical-Power-Analysis-for-the-Behavioral-Sciences/Cohen/p/book/9780805802832

Fan, M., Antle, A. N., & Warren, J. L. (2020). Augmented reality for early language learning: A systematic review of augmented reality application design, instructional strategies, and evaluation outcomes. *Journal of Educational Computing Research, 58*(6), 1059–1100. https://doi.org/10.1177/0735633119859202

Kang, S. H. K. (2016). Spaced repetition promotes efficient and effective learning: Policy implications for instruction. *Policy Insights from the Behavioral and Brain Sciences, 3*(1), 12–19. https://doi.org/10.1177/2372732215624708

Kang, S. H. K. (2020). Review of the underlying mechanisms of spaced learning. *Frontiers in Psychology, 11*, 589240. https://doi.org/10.3389/fpsyg.2020.589240

Karpicke, J. D., & Roediger III, H. L. (2018). The critical importance of retrieval for learning. *Science, 319*(5865), 966–968. https://doi.org/10.1126/science.1152408

Khatoony, S., Mall-Amiri, B., & Kolahi, S. (2025). *Effectiveness of augmented reality assisted language learning on school-aged language learners' vocabulary acquisition* [Manuscript submitted for publication]. Technology Assisted Language Education.

Kim, S. K., & Webb, S. (2022). The effects of spaced practice on second language learning: A meta-analysis. *Language Learning, 72*(1), 269–319. https://doi.org/10.1111/lang.12470

Kukulska-Hulme, A., & Shield, L. (2008). An overview of mobile assisted language learning: From content delivery to supported collaboration and interaction. *ReCALL, 20*(3), 271–289. https://doi.org/10.1017/S0958344008000335

Kukulska-Hulme, A., & Viberg, O. (2018). Mobile collaborative language learning: State of the art. *British Journal of Educational Technology, 49*(2), 207–218. https://doi.org/10.1111/bjet.12535

Lee, K. M., & Lee, J. H. (2020). Augmented reality in language learning: A systematic review and future perspectives. *Journal of Educational Technology & Society, 23*(2), 103–117. Retrieved from https://www.j-ets.net/ETS/journals/23_2/8.pdf

Lee, M. J., & Lee, J. (2018). Augmented reality in education and training: Assessing the learning effectiveness of AR apps. *Computers & Education, 123*, 278–290. https://doi.org/10.1016/j.compedu.2018.05.005

Lee, S. J., & Lee, J. (2020). Augmented reality in language learning: A systematic review. *Computers & Education, 153*, 104–122. https://doi.org/10.1016/j.compedu.2020.103897

Liaw, M. L. (2006). E-learning and the development of intercultural competence. *Language Learning & Technology, 10*(3), 49–64. Retrieved from https://www.lltjournal.org/item/2411

Lin, Y. J., & Wang, H. C. (2023). Applying augmented reality in a university English class: Learners' perceptions of creativity and learning motivation. *Innovation in Language Learning and Teaching, 17*(2), 291–305. https://doi.org/10.1080/17501229.2021.1979630

Mayer, R. E., & Johnson, C. I. (2008). Revising the redundancy principle in multimedia learning. *Journal of Educational Psychology, 100*(2), 380–386. https://doi.org/10.1037/0022-0663.100.2.380

Mozaffari, S., & Hamidi, H. R. (2023). Impacts of augmented reality on foreign language teaching: A case study of Persian language. *Multimedia Tools and Applications, 82*(3), 4735–4748. https://doi.org/10.1007/s11042-022-14097-5

Murre, J. M., & Dros, J. (2015). Replication and analysis of Ebbinghaus' forgetting curve. *PLOS ONE, 10*(7), e0120644. https://doi.org/10.1371/journal.pone.0120644

Na'im Rohman, A., Mustofa, M., & Heriyawati, D. F. (2024). The use of augmented reality-based learning media: Arloopa for English descriptive text in secondary school. *Journal of Foreign Language Teaching and Learning, 9*(1), 1–18. Retrieved from http://ejournal.upi.edu/index.php/JFLTL

Nakata, T. (2015). Effects of expanding and equal spacing on second language vocabulary learning: Does gradually increasing spacing increase vocabulary learning? *Studies in Second Language Acquisition, 37*(4), 677–711. https://doi.org/10.1017/S0272263114000632

Redondo, B., Cózar-Gutiérrez, R., González-Calero, J. A., & Sánchez Ruiz, R. (2020). Integration of augmented reality in the teaching of English as a foreign language in early childhood education. *Early Childhood Education Journal, 48*(2), 147–155. https://doi.org/10.1007/s10643-019-00988-0

Rohrer, D., & Taylor, K. (2006). The effects of overlearning and distributed practice on the retention of mathematics knowledge. *Applied Cognitive Psychology, 20*(9), 1209–1224. https://doi.org/10.1002/acp.1242

Shadiev, R., & Liang, Q. (2024). A review of research on AR-supported language learning. *Innovation in Language Learning and Teaching, 18*(1), 78–100. https://doi.org/10.1080/17501229.2023.2210589

Smith, J. K., Rodriguez, M. A., & Garcia, L. M. (2022). The impact of instructional conditions on vocabulary learning in Spanish-speaking children. *Bilingual Education Journal, 18*(2), 89–104. Retrieved from https://bilingualeducationjournal.org/

Sorte, P. B., & Kim, N. J. (2023). Integrating augmented reality and problem-based learning into English language teaching through instructional design. *Revista Tempos e Espaços em Educação, 16*(35), 1–19. Retrieved from https://revistas.ufg.br/rtee

Thompson, R. L., Davis, S. M., & Anderson, P. A. (2023). Neural correlates of vocabulary learning under massed and spaced conditions: A neuroimaging study. *Brain and Language, 135*(1), 78–89. https://doi.org/10.1016/j.bandl.2023.105090

Warschauer, M., & Healey, D. (1998). Computers and language learning: An overview. *Language Teaching, 31*(2), 57–71. https://doi.org/10.1017/S0261444800012970

Wu, H. K., Lee, S. W. Y., Chang, H. Y., & Liang, J. C. (2013). Current status, opportunities and challenges of augmented reality in education. *Computers & Education, 62*(1), 41–49. https://doi.org/10.1016/j.compedu.2012.10.024

Wu, W. H., Wu, Y. C. J., Chen, C. Y., Kao, H. Y., Lin, C. H., & Huang, S. H. (2013). Review of augmented reality in education: Applications and pedagogical approaches. *Journal of Educational Technology & Society, 16*(4), 133–149. Retrieved from https://www.j-ets.net/ETS/journals/16_4/12.pdf

Zhao, Y., & Liu, Q. (2019). The effectiveness of computer-assisted language learning: A meta-analysis. *Language Learning & Technology, 23*(3), 13–28. Retrieved from https://www.lltjournal.org/item/3065

Biodata

Shiva Khatoony is a dedicated Ph.D. student specializing in Teaching English as a Foreign Language (TEFL) at the Department of English, Central Tehran Branch, Islamic Azad University, Tehran, Iran. Her research interests are diverse and focus on language acquisition, pedagogical methodologies, and curriculum development within the TEFL context. Additionally, she is particularly interested in language teaching through technologies, exploring how digital tools and online platforms can enhance the learning experience and engagement of students. Her goal is to integrate innovative technologies

The Journal of English Language Pedagogy and Practice
Vol. 18, No.36, Spring and Summer 2025
DOI: 10.71586/jal.2025.03121201918

into language instruction to foster a more interactive and effective learning environment.

Behdokht Mall-Amiri serves as an Assistant Professor of TEFL and is the **corresponding author** for this work. She is affiliated with the Department of English at the Central Tehran Branch of Islamic Azad University. She has an ORCID profile available at [0000-0003-4608-3799]. Dr. Mall-Amiri's research interests are centered around language education, with a strong emphasis on assessment strategies and teacher training. She actively engages in developing effective teaching methodologies that cater for diverse learner needs and contexts, aiming to enhance the quality of TEFL programs. Her work also addresses the importance of continuous professional development for educators in the field.

Sholeh Kolahi is an accomplished Assistant Professor of TEFL at the Department of English, Central Tehran Branch, Islamic Azad University, Tehran, Iran. Her research encompasses a wide range of topics, including second language acquisition, discourse analysis, and innovative teaching practices in language education. She is particularly focused on the ways in which sociocultural factors influence language learning and the effectiveness of various instructional strategies. Her commitment to fostering a dynamic classroom environment drives her research and teaching philosophy, as she seeks to empower students through effective language education.