The Influence of Emotionally-Charged Images Generated with Artificial Intelligence on Vocabulary Learning among Teenage EFL Learners

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Abstract
This study examines whether emotionally-charged images created by Artificial Intelligence (AI) can improve vocabulary learning for teenage English as a Foreign Language (EFL) learners. Drawing on the Dual-Coding Theory and Multisensory Learning frameworks, the research explores how emotional stimuli influence vocabulary retention. A within-subjects experimental design was employed, involving 348 male students aged 12-16. Participants were exposed to vocabulary items paired with AI-generated images categorized by emotional valence (positive, negative, non-emotional) and tested on their retention through pretests and posttests. Results from a Repeated-Measures ANOVA revealed that both positive and negative emotional images significantly enhanced vocabulary retention compared to non-emotional images, with no significant difference between positive and negative stimuli. These findings suggest that emotional engagement, regardless of valence, plays a crucial role in enhancing memory and learning outcomes. The study underscores the potential of AI-generated emotionally charged visuals as a transformative tool in EFL education, offering educators innovative strategies to improve vocabulary retention. However, the study also highlights the need for further research to explore the interplay between emotional valence, cognitive load, and contextual learning environments. The findings advocate for the integration of emotionally resonant materials in language instruction to foster greater student engagement and optimize learning outcomes.

Keywords: AI-generated images, emotionally-charged stimuli, teenage EFL Learners, vocabulary retention

INTRODUCTION

The significance of vocabulary learning in the context of language learning is widely acknowledged as a critical factor in achieving linguistic competence. As Nation (2022) asserts, vocabulary constitutes a foundational element of language proficiency, playing a pivotal role in both comprehension and productive language use. Despite its importance, traditional approaches to vocabulary instruction often prove inadequate in engaging learners effectively, resulting in limited retention and recall. This issue is particularly pronounced among adolescent learners, who frequently perceive conventional methods as monotonous and lacking in motivational appeal (Schmitt, 2008). Drawing on the theoretical framework of Multisensory Learning and Dual-Coding Theory proposed by Paivio (1971), which posits that the integration

of visual stimuli—particularly those with emotional resonance—enhances vocabulary retention through the simultaneous activation of verbal and visual memory systems, the utilization of emotionally-charged images has emerged as a potentially transformative pedagogical tool. This innovative approach holds promise for addressing the limitations of traditional methods by leveraging the cognitive benefits of dual coding and emotional engagement to optimize vocabulary acquisition. Emotionally-charged images have been shown to significantly impact memory and learning. According to Kensinger and Corkin (2003), emotional content enhances the encoding and retrieval processes in the brain, leading to reduced load and better retention of information. This phenomenon is particularly relevant for teenage learners, who are at a developmental stage characterized by heightened emotional sensitivity and responsiveness (Steinberg, 2005). By leveraging Artificial Intelligence (AI) to generate images that evoke emotional responses, educators can create more engaging and effective vocabulary learning experiences. In recent years, the integration of AI into educational practices has revolutionized traditional teaching methodologies, particularly in the realm of language learning. One of the most intriguing developments in this field is the use of AI-generated emotionally-charged images to enhance vocabulary acquisition among English as a Foreign Language (EFL) learners.

AI-generated images offer several advantages over traditional visual aids. Firstly, they can be tailored to the specific needs and preferences of individual learners, thereby increasing personal relevance and engagement (Luckin et al., 2016). Secondly, AI can produce a vast array of images that depict a wide range of emotions, from joy and excitement to fear and sadness, providing a rich and varied emotional context for vocabulary learning (Goodfellow et al., 2016). This diversity can help learners form stronger and more nuanced associations between words and their meanings. Moreover, the use of AI in education aligns with the broader trend of digital transformation in learning environments. As Selwyn (2016) notes, digital technologies are increasingly being used to create more interactive and immersive learning experiences. AI-generated emotionally charged images can be integrated into digital platforms and applications, allowing for seamless incorporation into existing curricula and providing learners with opportunities for independent practice and reinforcement.

This research aims to investigate the impact of AI-generated emotionally-charged images on vocabulary learning in teenage EFL learners, a demographic that is particularly receptive to visual and emotional stimuli. By examining the effectiveness of this approach, the study seeks to provide valuable insights for educators and policymakers. Ultimately, the goal is to enhance vocabulary retention through innovative and emotionally-engaging methods, thereby contributing to the broader field of language education. Thus, the research question is as follows:

Do images with different emotional valence (positive, negative, non-emotional) have differentiated effect on English vocabulary learning?

LITERATURE REVIEW

Vocabulary Learning Using Pictorial Stimuli

Vocabulary proficiency is widely recognized as a fundamental component of foreign language (FL) acquisition and serves as a key measure of successful FL development (Chen et al., 2019; Hu & Nassaji, 2016; Nation, 2022). Nevertheless, FL vocabulary acquisition tends to progress slowly, especially for EFL learners, as they often lack sufficient exposure and opportunities to practice vocabulary in natural settings (Solati-Dehkordi & Salehi, 2016; Tsai & Tsai, 2018). Additionally, conventional instructional approaches, such as rote memorization,

repetitive drills, and recitation, which remain prevalent in many FL classrooms, often lead to learner disengagement, boredom, or apathy toward vocabulary acquisition. Consequently, despite significant investments of time and effort, the outcomes of vocabulary learning frequently fall short of expectations (Teng, 2022).

However, According to Vasbieva (2023), the advancement of technology and digital media has opened up new possibilities for FL acquisition. Visual aids, in particular, are noted for their wide-ranging benefits in this area. From an emotional standpoint, these aids are known to increase learners' intrinsic motivation, interest, and curiosity (Silvia & Kashdan, 2009). Moreover, pictorial stimuli have been shown to enhance vocabulary retention and recall by leveraging the dual-coding theory, which posits that information is better retained when it is processed both verbally and visually (Paivio, 1990; Sadoski & Paivio, 2013). Research indicates that the use of images in vocabulary instruction facilitates deeper cognitive processing, as learners are able to associate new words with visual representations, thereby creating stronger mental connections (Alemi & Tayebi, 2011). For instance, a study by Boers et al. (2017) found that EFL learners who were exposed to pictorial cues during vocabulary instruction demonstrated significantly higher retention rates compared to those who relied solely on textual definitions. Similarly, Alemi and Tayebi (2011) reported that visual aids not only improved learners' ability to recall vocabulary but also enhanced their ability to use the words in appropriate contexts. These findings underscore the potential of pictorial stimuli as an effective tool for addressing the challenges associated with traditional vocabulary learning methods. In a related study, Zarei and Salimi (2012) conducted an investigation into the impact of three distinct vocabulary teaching methodologies—namely, the keyword method, the use of songs, and the application of visual imagery—on the recognition and production of FL vocabulary. Their findings revealed that the utilization of images emerged as the most efficacious technique among the three, significantly enhancing learners' ability to recognize and produce vocabulary in the target language. This underscores the potential advantages of incorporating visual aids in FL vocabulary instruction.

The Impact of Emotionally Engaging Visuals on Vocabulary Acquisition

Emotion plays a crucial role in the learning process, particularly in language acquisition, as it affects motivation, attention, and memory retention (Dörnyei, 2009). In educational contexts, emotionally-engaging materials can enhance cognitive processing, making learning more meaningful and effective (Immordino-Yang & Damasio, 2007). Students' favorable attitudes toward learning within multimedia settings indicate that engaging emotions were evoked through the thoughtful application of design principles, including visual aesthetics, layout, color schemes, and audio elements (Tractinsky et al., 2000). Visual stimuli, in particular, such as images in textbooks, have been found to elicit emotional responses that facilitate comprehension and retention of new vocabulary (Paivio, 1991).

The dual coding theory (Paivio, 1990) suggests that verbal and non-verbal systems process information differently but complementarily, meaning that images can enhance memory by providing an additional cognitive pathway for recall. When emotions are embedded within these visual stimuli, they further enhance engagement and retention (Mayer, 2020). Studies have shown that emotionally-charged images can increase learners' attention and motivation, leading to deeper processing of vocabulary (Schmidt, 1988). Additionally, research indicates that emotionally-stimulating visuals activate the amygdala, a brain region associated with memory consolidation, thereby making vocabulary learning more effective (Tyng et al., 2017).

In the context of EFL learning, images serve multiple functions, including contextualizing new words, reducing cognitive load, and fostering emotional connections with the material (Sadoski & Paivio, 2013). While traditional textbooks often rely on static, non-emotional visuals, research suggests that emotionally engaging imagery; such as expressive illustrations, dynamic photographs, or strategically used color and movement, can significantly enhance retention and comprehension of word items (Carpenter & Olson, 2012). Beyond improving memory, these visuals also bolster learner motivation and engagement. Moreover, color, facial expressions, and movement in images have been found to influence learners' emotional responses and, consequently, their ability to recall and use new vocabulary (Plass & Jones, 2005). For instance, a recent study by Chung (2023) demonstrated that the incorporation of visual aids in EFL vocabulary instruction resulted in statistically significant improvements in vocabulary acquisition. Specifically, learners exposed to visual aids exhibited superior comprehension, retention, and engagement compared to those who were not.

However, despite the growing body of evidence supporting the efficacy of visual aids in vocabulary learning, there remains a notable gap in the literature regarding the impact of emotionally-charged images—categorized by their emotional valence (positive, non-emotional, and negative)—on EFL vocabulary retention. This gap raises a critical question: Do emotionally-charged images yield differential effects on vocabulary retention among elementary-level EFL learners? Addressing this question is the primary focus of the present study, which seeks to explore the nuanced interplay between emotional imagery and vocabulary learning outcomes.

The Role of AI-Generated Images in Foreign Language Teaching and Learning

The emergence of generative AI technology has significantly transformed the educational landscape, particularly within the realm of language acquisition. By facilitating tailored learning experiences, generative AI enables educators to create customized content that aligns with individual student needs, enhancing their engagement and comprehension (Vashishth et al., 2024). As outlined in recent studies, tools like ChatGPT demonstrate potential in enriching language education by providing interactive environments that promote both vocal and written proficiency through instant feedback and adaptive learning pathways (Sulaeman et al., 2023). Recent advancements in AI-generated imagery have introduced new possibilities for integrating highly tailored, emotionally evocative visuals into teaching materials. Unlike conventional textbook images, AI-generated visuals can be customized to reflect cultural relevance, learner preferences, and specific emotional tones, potentially enhancing engagement and learning outcomes (Ironsi, 2024). The integration of AI-generated images in language learning offers significant advantages, enhancing both engagement and understanding among students. By leveraging visuals tailored to specific linguistic concepts, educators can create immersive experiences that cater to diverse learning styles (Nurjanah, et al., 2024). AI's capability to generate high-quality images instantaneously not only aids in illustrating vocabulary but also facilitates contextual learning, where students can grasp the nuanced meanings of words through visual representation. Moreover, as generative AI tools develop, they provide opportunities for individualized content that aligns with each learner's interests and proficiency levels, promoting a more personalized approach to education (Castro et al, 2024). Furthermore, visuals can simplify complex concepts and provide context that supports linguistic comprehension. A study involving an interactive vocabulary learning system, RetAssist, illustrates this advantage; it demonstrated that learners improved their fluency when using sentence-level images generated alongside stories, compared to a system devoid of such visuals (Chen et al., 2024). Moreover, the level of interactivity afforded by these visual aids can also play a critical role. Research in immersive virtual reality training revealed that high

interactivity increases cognitive load in a beneficial way, facilitating deeper learning experiences and engagement with the material (Lehikko & Nykänen, 2024). Consequently, employing generative AI to create tailored visual supports not only bolsters understanding but also promotes a more engaging and effective learning environment.

While the integration of AI-generated materials into educational contexts presents exciting possibilities, it is crucial to approach these innovations with a discerning perspective. Concerns regarding the authenticity and accuracy of AI-crafted content remain significant, as they can influence the learning experience and outcomes. Therefore, finding a balance between leveraging the advantages of AI-generated images and addressing their potential shortcomings is vital for maximizing their effectiveness in foreign language instruction (Sulaeman et al., 2023; Creely, 2024). Although AI-generated images hold considerable promise for enhancing pedagogical practices, there is a pressing need for further research to assess their actual impact on language acquisition, particularly among teenage learners of EFL. The existing literature lacks comprehensive studies that explore the nuanced effects of these tools on various aspects of language learning, including vocabulary acquisition and retention.

In response to these identified gaps, this study aims to investigate the influence of AI-generated images, categorized according to their positive, negative, and neutral emotional effects, on the acquisition of English vocabulary among young adult learners. By systematically examining these relationships, the research seeks to contribute valuable insights to the academic discourse surrounding the use of AI in language education. Ultimately, this study aspires to inform educators and researchers about the potential benefits and challenges of incorporating AI-generated imagery into curriculum design, thereby enhancing the overall effectiveness of language instruction.

METHOD

Participants

The research initially recruited a sample of 392 male students aged 12 to 16 from three junior high schools in Hamadan, Iran. Participants were drawn from 12 classes, with formal approval obtained from all relevant school authorities prior to data collection. After excluding individuals who did not attend testing sessions, the final sample comprised 348 EFL learners.

As shown in Table 1, the participants' demographic details reveal that 51% were monolingual (with Persian as their mother tongue), while the remaining 49% were bilingual, speaking Turkish, Kurdish, or Luri as their second language (see Table 2). According to school administrators, none of the participants had diagnosed learning disabilities, and all were confirmed to have normal visual acuity.

Table 1. Participants' demographic data

N	age	Gender	EFL Learning experience
348	12-16	Male	1-3

Table 2. Participants' mother tongue

Persian Monolinguals	Bilinguals			
177 (51%)	171 (49%)			
	Turkish - Persian	Kurdish - Persian	Luri - Persian	Other languages
	105 61%	32 19%	19 11%	15 9%

Research Design

This research employed a within-subjects experimental design, as the same participants were exposed to identical sets of vocabulary items. Participants were required to complete a pretest, followed by an instructional session, and then an immediate posttest. To minimize the potential influence of the pretest, a time interval of one week was introduced between the pretest and the posttest. During the instructional session, participants were introduced to individual vocabulary items accompanied by AI-generated images and their corresponding Persian (L1) translations. The researchers verbally articulated each vocabulary term to ensure that participants fully understood the meanings. The order of item presentation was counterbalanced across different classes to control for potential order effects. The study's primary focus was to evaluate the impact of emotionally-charged images on the retention of explicit vocabulary knowledge, which was assessed through meaning recall in the posttest. It is important to note that participants completed all tests independently, without the opportunity to consult peers, and were restricted from using smartphones, dictionaries, or any external resources. To optimize participant engagement while maintaining experimental rigor, students were advised that their active participation would positively influence their English course evaluation, with explicit assurance that study outcomes would not adversely affect their academic standing.

Instructional Intervention

The participants underwent an engaging instructional intervention that involved interacting with slides displaying images generated with AI, each crafted to elicit a distinct emotional reaction. These visually-stimulating images were paired with English vocabulary items and their Persian equivalents (see Appendix), which the instructor articulated aloud to enrich the learning process and facilitate a stronger connection with the content. The stimulus set comprised 36 slides, equally distributed across three emotional valence conditions (positive, negative, and non-emotional), with 12 slides presented for each category at a fixed duration of 60 seconds per slide. To mitigate bias and ensure the robustness of our findings, we implemented two key controls. First, the presentation order of emotion-inducing slides was randomized. So, a positive image would be followed by either a negative or non-emotional image which would be further followed by a positive or negative/non-emotional image. Second, participants from different classes received the vocabulary learning items in varying sequences, which helped control for potential order effects on vocabulary acquisition. To promote lexical variety, each emotional category included four nouns, four adjectives, and four verbs. We carefully chose the target vocabulary from learning materials designed for the learners' upcoming years of study. To ensure novelty, we deliberately excluded words they had already encountered in previous EFL instruction. Our initial pool of 73 potentially suitable words was narrowed down to 36 based on a meaning-recall test with similar participants and feedback on the accompanying images from their peers.

To generate images with varying emotional valences, the study employed Playground, a generative AI system developed by OpenAI. This deep learning-based image synthesis tool converts textual prompts into high-resolution visual outputs. The platform facilitates the creation, modification, and refinement of images through customizable parameters, enabling precise control over stylistic elements, compositional features, and perceptual details. Table 3 presents exemplars of the AI-generated images for a target lexical item, illustrating the differential emotional loads (positive, negative, and non-emotional) under investigation.

Table 3. Examples of AI-generated images for the word "carpenter"

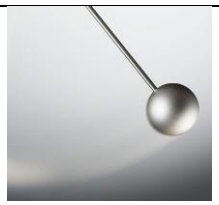
Positive valence	**Non-emotional valence**	**Negative valence**
		

To systematically control the emotional valence of each image, we incorporated affectively coded instructions into the AI's text prompts. This method draws upon well-established techniques in affective picture research (Lang et al., 2008; Bradley & Lang, 2007), where emotional valence (positive, negative, or non-emotional) is systematically managed through controlled stimulus design. We specifically guided the AI's output by including directives related to color palettes (e.g., warm colors to evoke positivity, cool colors for negativity) and atmospheric descriptors (e.g., "serene" for calmness, "tense" for agitation). These parameters were chosen based on research showing their influence on how we perceive emotions (Palmer et al., 2013), ensuring that the generated images consistently communicated the desired emotional feeling.

For instance, to have a negative emotional impact while illustrating the word "carpenter", we asked the AI to create an image with a sense of melancholy and despair, using a palette of muted, blackish colors. This imagery was intended to evoke a sense of unease and discomfort in participants. In contrast, to elicit positive feelings, we instructed the AI to create images with a colorful and joyful theme. To design non-emotional images, we carefully crafted prompts that avoided extreme lighting or colors associated with strong emotions. Examples of the prompts given to the AI to illustrate emotionally-charged or non-emotional images are available in Table 4.

Table 4. Examples of prompts provided for image generator AI

word	**prompt**	
Carpenter (negative emotion)	Create a somber and emotionally charged image of a carpenter in his workshop. The scene should evoke a sense of melancholy and despair. The carpenter is a middle-aged man with weathered hands and a tired and angry expression. The workshop is dimly lit, with shadows casting long, eerie shapes across the room. The overall atmosphere should be heavy and oppressive, with muted, desaturated colors emphasizing the negative emotion.	

Huge (positive emotion)	Create a vibrant and joyful image of a grand, multi-tiered wedding cake, beautifully decorated with intricate floral designs, soft pastel colors, and delicate gold accents. The cake should be the centerpiece of a warm, celebratory atmosphere, with soft, glowing lighting that highlights its elegance. Surround the cake with subtle elements of celebration, such as flowers.	
Swing (non-emotional)	Generate a minimalist and balanced image of a pendulum in motion, swinging smoothly from side to side. The pendulum should have a sleek, metallic finish, reflecting subtle light to emphasize its movement. The background should be a solid color, such as light gray or beige, to create a calm and undistracted atmosphere. The overall composition should evoke a sense of simplicity and neutrality, with no emotional undertones.	

To ensure valid emotional representations, we employed a multi-stage validation process. First, the AI image generator was instructed to produce three visual representations for each target word. These AI-generated images were then evaluated by a panel of eight raters (four adolescent non-participants and four qualified teachers) who independently categorized each image according to its emotional valence (positive, negative, or non-emotional). To maximize classification reliability, we selected only those images that achieved the highest inter-rater consensus regarding their emotional categorization.

Testing Instruments

The study implemented a comprehensive methodology to evaluate vocabulary learning, carefully considering participants' prior knowledge to uphold the credibility of the findings. Initially, a pretest was conducted to assess participants' familiarity with the target vocabulary, which comprised all 36 words intended for the instructional session along with 4 additional distractor words (40 items total). Both the pretest and posttest utilized a Persian adaptation of Paribakht and Wesche's (1997) Vocabulary Knowledge Scale (VKS), a tool designed to measure the extent of participants' word knowledge by merging self-assessed familiarity with actual performance.

The VKS features five categories, each representing a different level of vocabulary proficiency. Given the study's focus on receptive vocabulary knowledge, only the first four categories were employed. The first two categories required simple responses: category 1 indicated, *"I've never encountered this word previously,"* while category 2 stated, *"I recognize this word, but I'm unsure of its meaning."* Categories 3 and 4 demanded active demonstration of knowledge: participants were asked to provide a synonym or Persian translation—category 3 based on the prompt *"As far as I know, this word means..."* and category 4 on *"I am familiar with this word, which means..."*

Scoring was designed to ensure accuracy. Selecting category 1 or 2 yielded 1 or 2 points, respectively. However, if a participant chose category 3 or 4 but failed to provide the correct synonym or translation, they were assigned only 2 points, preventing inflated self-assessments. After the instructional intervention, an immediate posttest (also 40 items) was administered to gauge vocabulary improvement. To quantify learning gains, the pretest results were compared to the posttest performance, tracking how many words advanced from lower to

higher categories (e.g., moving from category 1/2 to 3/4). This approach provided a clear measure of vocabulary growth while maintaining methodological rigor.

To ensure that the assessment focused exclusively on newly-learned vocabulary, learning ratios were calculated based only on words that were unfamiliar to participants prior to the treatment. In line with the methodology proposed by Suárez et al. (2021), vocabulary items that participants already knew were excluded from the analysis. This approach allowed for a more precise evaluation of the instructional treatment's effectiveness in teaching new vocabulary, as participants' performance was assessed solely on their ability to recognize or recall previously unfamiliar words.

Data Analysis

To address the aim of the study, we first calculated the descriptive statistics for the vocabulary test. In our vocabulary test, we aimed to reduce the impact of prior knowledge on vocabulary assessment. Learning ratios were calculated based on the number of newly-learned items after accounting for prior knowledge. Therefore, a student already familiar with two words from a category (meaning they knew 2 out of 12 beforehand) and then demonstrated knowledge of eight out of the remaining ten words on the posttest, would have a learning ratio of 80% (8 out of 10) rather than 66% (8 out of 12). Following this approach, each participant had four sets of ratio scores in percentages: one total ratio for overall vocabulary gains and three additional ratios for each emotionally-charged category (positive, negative, and non-emotional). Before conducting the analysis, we began by verifying key assumptions regarding homogeneity of variances and covariances. We employed Levene's test and Mauchly's test of sphericity for this purpose. Levene's test indicated that the assumption of homogeneity of variances was satisfied ($p > .05$). However, Mauchly's test revealed that the sphericity assumption was violated ($p < .05$). Consequently, we applied the Huynh-Feldt correction method for the analysis. To investigate how the emotional load of images affects vocabulary learning, we conducted a Repeated-Measures ANOVA, complemented by a Bonferroni post-hoc test for deeper insights. Our analysis utilized participants' overall ratio scores to assess this impact. SPSS version 23 was used for all analyses.

RESULTS AND DISCUSSION

Results

The descriptive outcomes, which outline the participants' performance on the vocabulary pretest and posttest, categorized by the presentation style of vocabulary items—negative, positive, and non-emotional—are presented in Table 5. This analysis highlights the proportion of words that participants successfully acquired compared to those they potentially could have learned.

Table 5. Descriptive Results of the Vocabulary Scores

Test	N	Min	Max	Mean	SD
Ratio* positive	348	0	100	45.50	28.07
Ratio negative	348	0	100	45.01	28.13
Ratio non-emotional	348	0	100	42.68	28.28
Ratio total	348	0	100	44.40	25.56

*Ratio = ratio of potentially learnable to actually learned meaning of words

This research aimed to explore the varying impacts of images with positive, negative, or non-emotional content on EFL vocabulary retention among teenage learners. A preliminary analysis revealed no significant order effects ($p > .05$), confirming that counterbalancing effectively controlled for this potential confound. To assess the effect of emotional content, a Repeated-Measures ANOVA was employed to analyze the influence of emotional valence on the vocabulary retention of EFL learners. Since Mauchly's test revealed a violation of the sphericity assumption (χ^2 (2) = 8.33, $p = .16$), the degrees of freedom were adjusted using the Huynh-Feldt correction ($\varepsilon = .982$). The analysis, incorporating this correction, demonstrated a statistically significant difference in the mean effects of the three emotional conditions on participants' vocabulary retention, $F(1.964, 91675.55) = 5.981$, $p = .003$, partial $\eta^2 = .017$. These findings suggest that the emotional valence of the accompanying images influenced participants' ability to recall vocabulary, leading to the rejection of the null hypothesis, which posited that the emotional charges of images have no effect on word recall among EFL learners.

Post-hoc pairwise comparisons, adjusted using the Bonferroni method, revealed that participants recalled words more effectively when they were paired with emotionally positive or negative images compared to those paired with non-emotional images. Specifically, learners achieved significantly higher scores with positively-charged images ($M = 45.50$, $SD = 28.07$) than with non-emotional ones ($M = 42.68$, $SD = 28.28$), $p = .002$. Similarly, words paired with negatively-charged images ($M = 45.01$, $SD = 28.13$) were recalled more effectively than those with non-emotional images, $p = .025$. However, no significant difference was observed between the positively- and negatively-charged images on vocabulary retention, $p = 1.000$. Although the effect sizes indicated a marginally greater impact for positive emotional content (Mean Difference = 2.821) compared to negative content (Mean Difference = 2.329) relative to non-emotional images, this difference was not statistically significant. These results highlight the role of emotional valence in enhancing vocabulary retention, with both positive and negative emotional stimuli proving more effective than non-emotional ones.

Discussion

This study aims to examine the effect of visuals with different emotional valence on vocabulary retention among EFL learners. We explored whether positive, negative, or non-emotional images accompanying new vocabulary words influenced learning outcomes. Thirty-six slides, each presenting a vocabulary item paired with a corresponding image, were shown to participants in varying sequences. Our goal was to determine if and how different emotional valences generated through AI tools affect foreign vocabulary acquisition. This research builds upon existing studies of multimedia presentations by incorporating the emotional dimension within the context of FL vocabulary learning.

The findings highlight the significant impact of emotions on vocabulary retention among teenage EFL learners. The research reveals that emotionally-charged images, whether positive or negative, considerably enhance vocabulary retention when compared to non-emotional images. This observation aligns with the principles of Dual-Coding Theory and Multisensory Learning frameworks proposed by Paivio (1971), which suggest that emotional stimuli enhance memory encoding by engaging both verbal and visual cognitive pathways. These results further support previous studies indicating that emotional content promotes deeper cognitive processing and better retention (Pishghadam et al., 2021). Interestingly, the lack of a significant difference between the effects of positive and negative emotional stimuli indicates that emotional arousal, rather than the specific nature of the emotion, is the primary factor driving improved vocabulary acquisition.

Interestingly, the findings contrast with certain prior research on the effects of visual aids on vocabulary learning. While studies by Chung and Cheon (2020) suggested that negative emotional stimuli hinder learning, our results indicated that learners achieved greater vocabulary gains when exposed to negative images compared to non-emotional ones. This suggests that negative emotions may persist in learners' memory, thereby enhancing their learning experience. The study's findings may be attributed to the novelty of the teaching method within the Iranian educational system, specifically in Hamadan. Traditional vocabulary instruction in Iranian state schools rarely integrates technology or visuals beyond standard textbooks. The emotionally-charged images used in this study proved significantly more engaging than their non-emotional counterparts, likely contributing to a more enriching learning experience. This aligns with a prominent theory emphasizing the interaction between emotion and cognition, which suggests that a learner's emotional engagement enhances the learning process (Dörnyei & Ryan, 2015). Effective learning arises from the synergy between cognitive and emotional elements (Lewis, 2005). Emotionally engaged learners are more likely to dedicate focus and effort, thus improving learning outcomes. Furthermore, this research supports the established theory, initially proposed by Um et al. (2012), that positive emotional design, as implemented in this study, has a more direct and immediate impact on learning compared to emotions elicited by external factors.

Furthermore, research in psycholinguistics highlights the rapid processing of emotional words. These words appear to receive preferential treatment in early perceptual processing within the brain, likely due to their motivational significance (Citron et al., 2013). This accelerated processing stems from the way attention is drawn to stimuli with emotional valence (Lang et al., 1998; Sabatinelli et al., 2005). Although this study intentionally avoided emotionally-charged words, the findings suggest that even emotional images benefit from faster processing times, potentially enhancing the retention of associated words.

The effectiveness of AI-generated emotionally-charged images in this study also supports recent advancements in educational technology. AI can now tailor visual stimuli to evoke specific emotional responses (Luckin et al., 2016), providing a scalable and adaptable tool for language instruction. This is particularly relevant for adolescent learners, who exhibit heightened emotional sensitivity (Steinberg, 2005) and may benefit from emotionally resonant materials. Recent studies have similarly highlighted the role of AI in personalizing learning experiences, with emotionally adaptive systems showing promise in improving engagement and outcomes (Wang et al., 2023). Moreover, design principles aim to create engaging experiences by maximizing the sensory and aesthetic impact of each element (Lidwell et al., 2003; Norman, 2004). While this requires a strong artistic sensibility from the designer, AI generative tools, as employed in this study, can support and enhance this nuanced and critical aspect of design. These tools enable designers to achieve the discretion and artistic subtlety necessary for effective visual and emotional engagement, thus advancing the potential of aesthetically compelling educational materials.

This study has also raised questions about the interplay between emotional stimuli and cognitive load. Recent work by Sweller (2022) suggests that excessive emotional arousal may compete for cognitive resources, impairing learning efficiency. Balancing emotional engagement with cognitive load management could optimize instructional design. The findings, however, demonstrated the opposite. Images with positive and negative valence improved vocabulary retention, meaning the cognitive load was reduced. While still under question, this conclusion runs against the hypothesis that emotional load might overload cognition and hinder learning (Seibert & Ellis, 1991). Although emotional images enhanced

retention in the present study, their potential to overwhelm learners with high emotional intensity warrants investigation.

Pedagogically, these findings advocate for the intrinsic integration of emotionally-charged visuals in EFL curricula. Educators should leverage AI tools to create diverse emotional contexts for vocabulary instruction, catering to learners' affective needs. Moreover, the study underscores the importance of individual differences in emotional responsiveness (Dewaele, 2023). Adaptive systems that adjust emotional content based on learner profiles could further enhance outcomes.

CONCLUSION AND IMPLICATIONS

The findings of this study highlight the importance of considering the emotional valence of images paired with vocabulary items. Both positive and negative images were found to have a significant impact on vocabulary acquisition among EFL learners compared to non-emotional images. However, the study is not without limitations, which should be addressed in future research. First, although this study provides valuable insights, its exclusive focus on decontextualized vocabulary presentation necessitates a cautious interpretation of its generalizability. While this method allowed for rigorous control of extraneous variables, it potentially diminishes the ecological validity of the findings by excluding the contextual cues known to facilitate the consolidation of semantic networks and appropriate language use (Nation, 2022). Future research should integrate emotionally-charged images into contextualized tasks, such as sentence construction or narrative-based activities, to evaluate their impact on productive vocabulary use. Additionally, the exclusive reliance on meaning recall tests neglects other dimensions of vocabulary knowledge, such as collocational competence and active usage (Schmitt, 2019). Future studies should aim to evaluate all facets of vocabulary knowledge to provide a more holistic understanding of the learning process.

Despite these limitations, the study offers valuable pedagogical insights for educators and material developers. It emphasizes the need to carefully select the emotional valence of visual media accompanying vocabulary or text, as non-emotional images often lack the engagement necessary to captivate elementary-level learners. Additionally, the findings underscore the importance of recognizing and addressing individual cognitive and emotional differences in both material design and teaching strategies. By doing so, educators can create more effective and inclusive learning environments that cater to the diverse needs of students.

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APPENDIX

Positive Pictures

Negative Pictures

Non-emotional Pictures