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# Which one? Technology or non-technology-assisted vocabulary learning: a probe into the state of academic buoyancy, creativity, and academic achievement

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## Abstract

Ignoring technology in teaching English language in EFL contexts persuaded the researchers to do this study. In fact, this research looked at how Saudi Arabian EFL learners' academic achievement (AA), creativity, and academic buoyancy (AB) were affected by vocabulary acquisition with and without the use of technology. Fifty intermediate EFL students were chosen based on the convenience sampling method to accomplish this goal, and they were split into two groups: control and experimental. Subsequently, the three questionnaires were given out to evaluate the participants' AB, AA, and creativity before the treatment. Next, utilizing the WhatsApp application to teach new words to the experimental group (EG) and the control group using the conventional technique, the research completed a 16-session treatment. At the end of the course, the post-tests for the AB, AA, and creativity for both groups were administered. The results of this research revealed that on three post-tests, the EG outperformed the control group. In other words, the technology-based treatment helped the EG to develop their AA, AB, and creativity. There are implications for English teachers, students, researchers, and other stakeholders from the current study. The implications of this research can encourage EFL teachers to incorporate technology into their English classes.

**Keywords:** Technology-assisted vocabulary learning, Academic buoyancy, Creativity, Academic achievement

## Introduction

One of the accomplishments of information technology in the humanities is language learning and education, which has its own theoretical underpinnings and principles (Huang et al., 2020). Due to study in the theoretical and practical principles, intermediate disciplines of computational linguistics and applied linguistics, as well as understanding of the best ways to apply technology, this multifaceted and multidisciplinary technology was developed (Hsu, 2017). Teachers may now convey their knowledge to pupils in a number of ways thanks to the quick development of technologies. It is

anticipated that technology and computer tools would be extensively utilized in classroom education. It is noteworthy in the field of research of language education that the use of computers and other technology aids in English language instruction is growing and changing (Barrett et al., 2023; Imlawi et al., 2015).

In the current day, digital technology is essential for language acquisition. Students can use digital technology to help with the learning process (Yang & Chen, 2007); this technology offers several affordable features, such as social media involvement and interpersonal connection. Furthermore, learners respond favorably to new technology, and they view it as an appropriately integrated and well-designed learning tool, according to Jones and Shao (2011). To assist students with resources whenever needed, mobile learning has emerged as a new trend in recent years (Lan & Sie, 2010; Tahounehchi, 2021). With the introduction of new technology, language learners now have efficient ways to improve their understanding of various sub-skills and abilities (Astika, 2015). Additionally, learners at the postsecondary level are considerably more prepared to use mobile devices both within and outside of language classrooms (Ibna Seraj et al., 2021). In this sense, learning vocabulary using mobile technology is one of the subjects that has attracted a lot of attention. Numerous smartphone apps are available to assist students in developing their vocabulary.

The widely utilized WhatsApp application throughout the globe is among these advantages. Furthermore, with over 1.2 billion monthly users using it for chatting and other reasons, WhatsApp is the most popular smartphone application worldwide (Bensalem, 2018). In addition to offering free messaging and calling, this app lets users exchange files including contacts, locations, videos, and music. Due to the widespread usage of these applications, a lot of language instructors are curious to find out how they may utilize WhatsApp to instruct students in certain areas of learning a second or foreign language. Enhancing vocabulary is one of the most crucial parts of learning a foreign language, and it is one area of language teaching where WhatsApp might be useful (Nazari & Xodabande, 2020). Bensalem (2018) states that “teachers can use WhatsApp to help students explicitly learn the terms and vocabulary they need (p. 71)”.

Digital tools like WhatsApp can support EFL students in achieving academic achievement. Any educational system's main goal is to help students succeed academically. Stated differently, the goal of all educators, including administrators and teachers, is to assist students in achieving high standards of academic success (Gajda et al., 2017). The result of learning is academic accomplishment, which is commonly evaluated by grades, evaluations, and outside achievement exams. Stated differently, academic accomplishment is the total quantity of information that students have gained in a given course (Winne & Nesbit, 2010). Within the field of language education, academic accomplishment refers to the total level of proficiency attained by students in a language course (Jin & Zhang, 2018).

Many academics have investigated the impacts of individual difference factors (i.e., emotional intelligence, self-concept, motivation, and self-esteem autonomy) in EFL students' AA, given that EFL students' individual distinctions can make a substantial difference in their AA levels (e.g., Li, 2020; Lin, 2021; Shao et al., 2013; Soodmand Afshar et al., 2014; Taheri et al., 2019; Wang, 2017). In contrast to other individual differences, not much research has been done on creativity and AB.

Zhang et al. (2020) noted that creative language pupils often use fresh and inventive techniques of learning that aid them learn a new language effectively, which helps to clarify the function of creativity in boosting EFL learners' academic accomplishment. Similar to this, Cassidy (2012) suggested that certain language learners get better academic achievements because of their inventiveness. According to him, learners' creativity and higher academic accomplishment are related since desired learning results call for diverse and reproductive capacity (Naderi et al., 2009).

As a great example of an individual difference variable, creativity often is referred to a person's capacity for creative production, regardless of whether they have created any work in the past (Glover et al., 2013). Within the field of education, learner creativity refers to the capacity of students to produce or bring into existence anything new and inventive, whether it a creative approach to a problem they are faced with in class or a fresh method of absorbing knowledge (Wang, 2018). Pishghadam et al. (2011) proposed the following theory on the value of creativity in education: creative learners are more likely to achieve desired learning outcomes. Part of the reason for this is that when learners lack creativity, they are compelled to use antiquated learning techniques that are useless for picking up new information (Sandri, 2013). It should be highlighted in this regard that creative students frequently use cutting-edge techniques to assist them acquire higher academic grades (Fang et al., 2016).

According to (Xu et al., 2021), the word "creativity" refers to the combination of aptitude, method, and environment that enables an individual or group to make a perceptual product that is both original and helpful. Based on Kapoor and Kaufman (2020), creativity is a multidimensional variable that consists of two main elements: originality and relevance. The birth of a fresh and inventive concept in the human mind is the first component, or novelty (López-Aymes et al., 2020). According to Hajilou et al. (2012), the second element, relevance, indicates that creativity always occurs in a specific context and that an act of creativity is a reaction to a circumstance that calls for an explanation or at the very least a solution. Creativity is defined as using imagination, inspiration, and original ideas to accomplish a goal. Applying this concept to the educational setting, Liu and Chang (2017) defined students' creativity as their use of original and creative ideas to comprehend the material covered in class.

AB is a psychological concept that is referred to learners' abilities to face daily problems and challenges on the road of learning (Yun et al., 2018). Despite their frequent interchangeability, AB and resilience are conceptually and operationally explained very differently (Jia & Cheng, 2022). In this regard, intellectual buoyancy and conventional resilience—concepts that illustrate day-to-day coping—are not synonymous, according to Martin and Marsh (2008). What we mean when we speak of academic resilience is the capacity to bounce back quickly from the fatigue and anxiety caused by both poor performance and academic failure. Conversely, AB describes the pupils' ability to stay motivated, self-assured, and engaged when faced with challenges. Jahedizadeh et al. (2019) found that while AB is necessary for academic resilience, it is insufficient on its own.

The research is important since education is developing alongside technology (Nawaila et al., 2018) and we need to be updated to gain the benefits of this development in our society and educational institutions. Technology integration in education aids in closing the knowledge transfer and educational system gaps. The intended goal of this research,

which is to encourage educational institutions that continue to use antiquated, conventional teaching methods—such as those in Saudi Arabia, where I teach—makes it significant. The findings and generalizations generated by this quantitative study design should encourage conventional educational institutions to use contemporary teaching methods. Concerning the importance of the research, we tried to examine the effects of TAVL on Saudi Arabian EFL learners' language learning AB, AA, and creativity.

## **Review of the literature**

### **Theoretical background**

#### ***Technology-assisted vocabulary learning***

Due to the application of various technologies, such as political, social, and industrial technology, quick expansions have caused dramatic changes in societies' economic and industrial structures (Gao et al., 2022; Wang, 2023; Wang et al., 2023). These changes have a significant impact on people's daily lives and occupations throughout the world, and they have seriously challenged traditional approaches to language teaching, learning, and education. The rapid growth of information and the evolution of new technologies in recent years have led to changes in many aspects of societies, including their educational system (Al-Obaydi et al., 2023).

Technology tools have become an integral part of teaching, and the range of teaching and learning tools is no longer limited to pens and boards (Chen & Hsu, 2020; Hafner & Ho, 2020). The use of technology tools in education has become very important and necessary in today's world (Teo et al., 2022). The advancement of communication technology and interaction in education programs has been an effective and sustainable step that has been able to create a qualitative change in goals, programs, and methods, and as a result, it leads to the effectiveness of education (Chen et al., 2023; Green et al., 2020). Using technology can help EFL learners develop their vocabulary knowledge.

According to Schmidt (2014), a learner's vocabulary can be either productive—related to the word's use in speaking or writing—or receptive, which is related to the word's comprehension when heard or read. According to Ardasheva et al. (2019), the two mastery kinds are frequently seen as being on a developmental continuum, with knowledge changing over time from receptive to productive mastery. Learning vocabulary can either be accidental or purposeful. The term "intentional vocabulary learning" describes learning exercises specifically designed to help one acquire new vocabulary. Examples of these exercises include employing word lists to study specific target terms (Nation, 2001).

On the other hand, incidental vocabulary learning describes learning activities that are not specifically intended to promote vocabulary learning. For example, learners may pick up new vocabulary just by watching L2 videos or playing online games without any particular intention of doing so (Basal et al., 2016). The question of how technology can support incidental vocabulary learning has been central to a significant number of TAVL studies (Franciosi, 2017; Taj et al., 2017), with a number of studies taking into consideration the meaningful influences on productive versus receptive vocabulary learning (Tsai & Tsai, 2018). This is because vocabulary is important for SL learning and there is a limited amount of time in class.

However, as several studies have shown, conventional learning and teaching approaches produced better L2 vocabulary learning results than did technology-based approaches (Taghizadeh & Porkar, 2018), suggesting that the state-of-the-art nature of technology does not guarantee useful learning processes or desired learning outcomes. The constant changes in technology may be the cause of these discrepancies between individual studies as well as differences in effect sizes between meta-analyses trying to reconcile the discrepancies between individual studies. This necessitates periodic systematic reviews and meta-analyses of the majority of current literature, paying close attention to important details of individual studies. TAVL, which falls under the broader category of computer-oriented language learning, focuses on topics including the efficacy of technology-based tactics, including gadgets and delivery methods (Yousefi & Biria, 2018).

Research on individual variations, environmental conditions, and intervention features that may affect how successful technology-assisted techniques are is also important. Therefore, we first provide an overview of the significant results on the present body of research about the efficacy of TAVL, highlighting important variables along which treatments differ, and then we highlight important moderators of L2 vocabulary interventions (Lin & Lin, 2019).

The dual-coding theory, whose central tenet is that students receive information through two mental codes, namely, nonverbal and verbal, underpins our study (Clark & Paivio, 1991). The nonverbal code processes nonlinguistic information, whereas the vocal code processes and represents language (Moody et al., 2018). The two codes are linked and independent at the same time. Put another way, even if the two codes are functionally separate, learning may benefit from what Paivio (2006) refers to as "a dual verbal-nonverbal memory trace" (p. 4). The creation and expansion of cognitive schemas, which are built by activating past information and elaboration, may benefit greatly from such dual verbal/nonverbal memory traces.

Particular to vocabulary acquisition, verbal-only linkages might lead to learners' inadequate attempts to concretize the abstract, which could result in superficial understandings (Moody et al., 2018). For this reason, vocabulary education must emphasize the imageability (concreteness) of words. Since TAVL offers audio-visual (and, as we'll see below, interactive) input, it has enormous potential to improve these processes. This is crucial since a lot of teachers believe that their pupils will automatically make the connection between words and images (Metros, 2008). According to Moody et al. (2018), teachers who comprehend DCT know that in order for all children to comprehend and internalize new terms, education must involve a deliberate focus on contextual referents.

The learning theory known as connectivism, developed by Stephen Downs and George Siemens, explains how technology and the internet have opened up new avenues for learners to study and share educational materials both locally and globally. This theory informs the current research. According to Lepp et al. (2014), networks serve as a platform for the sharing of information and creative ideas from academia that will ultimately result in economic and social and cultural growth. According to this view, technology today plays a significant role in the advancement of human society. In order to make teaching and learning easier, technology is essential. To advance

their knowledge and abilities, second-language learners of English must often listen, talk, read, and write in the language (Ybarra & Green, 2003).

### ***Academic buoyancy***

Positive psychology, which emphasizes the importance of emotions in education, is where buoyancy first emerged. The academic experiences that pupils have provide them the chance to develop more flexibility. Nonetheless, there is additional pressure placed on students by the tests they must prepare for, the homework they must do, the possibility of receiving low marks, and the deadlines they must meet (Martin et al., 2013). Hence, buoyancy might be seen as a solution to a pressing problem that has to be taken into account. Students are more driven to pursue their passions with ardor when they feel cheerful. Yun et al. (2018) suggest that buoyancy may be seen as a means of addressing the daily obstacles encountered when acquiring a new language as well as negotiating the apogees and perigees of language acquisition.

Based on Martin and Marsh (2008), academic buoyancy is not the same as the conventional construct known as resilience. According to the research that follow, resilience is focused with horrible circumstances that people could experience in life, such impairments, whereas buoyancy is more concerned with day-to-day conflicts, stresses, and failures. Additionally, buoyancy tends to take a proactive rather than a reactive stance toward these events, in contrast to resilience. Put another way, buoyant people strive to improve their welfare over time rather than merely reacting to unfavorable circumstances, which allows for psychological growth. Similar to buoyancy, immunity is thought to allow defensive mechanisms to be employed in order to limit difficulties, disturbances, and damages (Hiver, 2017).

Hardiness is another synonym for, a personality quality that helps people to lessen the impacts of stress while accomplishing something, is another name for buoyancy (Hiver & Dörnyei, 2017). Similarly, coping is another phrase that may be used interchangeably with buoyancy to describe strategies that are used to reduce stressors or alter how people perceive them (Ulfa & Bania, 2019). Subsequent to the literacy on the buoyancy of EFL learners, it was also identified that buoyant students possess the ability to track their experiences that set them apart from the rest of society, resulting in a sense of independence, determination, and self-assurance (Martin et al., 2013). The idea that academic buoyancy affects psychological and educational results is well supported by the available data. The former is typified by how much a student can enjoy the class; the latter is exemplified by educational outcomes, self-efficacy, and self-esteem.

Another research by Yun et al. (2018) assessed the grade point average (GPA), L2 accomplishments, and academic buoyancy of 787 language learners enrolled in South Korean colleges by giving them questionnaires. The findings showed that buoyancy was a basic predictor of both GPA and L2 achievement. In an investigation by Jahedizadeh et al. (2019), a newly developed questionnaire was used to examine the association between the buoyancy of EFL learners and three factors: GPA, gender, and instructional levels. The aforementioned questionnaire consisted of 27 items that measured four aspects of buoyancy: sustainability, regularity conformity, positive personal competency, and positively accepting academic life. The items measured the capability to tolerate in a fairly ongoing way across numerous areas of life. Putwain et al. (2015) also said that



concern has a bad impact on academic buoyancy. To put it plainly, pupils who are cheerful and have a strong sense of self-worth tend to be highly motivated. Additionally, it was shown that academic buoyancy predicts students' academic success. Research pertaining to buoyancy makes it abundantly clear that academic learning and buoyancy are closely related (Yun et al., 2018).

### ***Creativity***

Morar et al. (2020) defined creativity as the capacity to synthesize existent elements to produce original and useful ideas. The creation of new ideas is hence the primary distinction between creativity and innovation, but innovation also demands the application of changes based on those ideas. According to Simintonon (2012), creativity is the capability to come up with original ideas, thoughtful solutions, and well-thought-out strategies in response to a given challenge.

The study of creativity appears to be of great interest. Almost every well-known scientist shares his or her interpretation of this event. Most likely, Guilford's (1966) differentiation between divergent and convergent thinking has had the biggest impact on how we have evolved in understanding creativity. Divergent or creative thinking entails coming up with several original answers and solutions, whereas convergent thinking brings one to the right, conventional option. According to Torrance (1990), creativity is the ability to make assumptions, formulate hypotheses, assess and test theories, communicate findings, and be sensitive to issues, flaws, and information gaps.

The ability or capacity to create, to bring into existence, to invest with a new shape, to generate via inventive talent, to manufacture or bring something new into life are characteristics that define creativity. Language is undoubtedly one of the most significant ways that creativity expresses itself (Berg et al., 2020). After early infancy, language use—both understanding and generating it—is a highly mechanized skill. Because of the very nature of language, most things that are spoken or heard are being said for the first time. The majority of what we hear and say is produced, not something we can remember from memory. Knowledge of speech sounds, word patterns, and construction and word-stringing principles make up the storage of language. After acquiring these automatic abilities and knowledge, language usage becomes nearly totally creative and subconscious (Arnout & Almoied, 2020).

Language has a creative component, claims Labrague (2021): learning a language entails being able to both create and comprehend new phrases that have never been heard or spoken before. Every person who speaks a language has the ability to construct new phrases every time they speak and can also comprehend new sentences that others have generated. Accepting that everyone possesses creative abilities and that creativity is an intrinsic part of personality makes us realize that we should value creativity more and make a conscious effort to include it into our everyday instruction. Thankfully, creativity is a skill that can be developed just like most other abilities. Additionally, creativity gives working teachers innovative and useful ideas that can help students enjoy language learning and modify language to deal with unforeseen circumstances (Thomas & Zolko-ski, 2020).

Language and creativity are closely related human capacities. It was said that there is a fundamental pattern shared by all creative endeavors, including artistic originality,

scientific discovery, language inventiveness, and more (Chapman et al., 2020). On the other hand, a lot of language specialists affirm that language is creative and that it has an innate creative quality. According to Zhang et al. (2020), language proficiency allows speakers to put words together to make phrases, phrases to form sentences, and sentences to build paragraphs.

Creativity may be shown in every conceivable field and in every talent. Writing is the most appropriate language in terms of language for several reasons (Chen et al., 2018). First of all, creativity is a productive skill, and creativity requires participation in all endeavors, including the learning process. Second, because writing is a process that takes time, students may work generally at their own pace while brainstorming ideas, drafting and revising, sharing, structuring, evaluating, and reviewing. All of this might be seen as a framework that allows creativity to flourish more easily (Gowda & Gautam, 2022).

### Experimental studies

Ozkan and Selcuk (2015) investigated how students' comprehension of buoyant force was affected by technologically enhanced conceptual change texts. One CG and one EG, together with a pre-test/post-test quasi-experimental design, were exploited. While the control group received regular teaching, EG received technology-enhanced conceptual transformation texts. Five open-ended buoyancy-related questions were used to gather data. EG's conceptual knowledge was determined to be greater than that of the conventional instruction group when the study's results were analyzed in relation to the conceptual understanding gained in the two groups. These works on "buoyant force" are thought to be excellent teaching resources that might help students gain valuable knowledge.

Furthermore, Aysu (2020) sought to determine how students' desire for learning foreign languages in language courses was impacted by their usage of technology. Students in the program for tourism and hotel management were divided into two groups. Twenty of them were in the EG, while twenty were in the CG. Both groups received the identical questionnaire—which the researcher had created—as a pre- and post-test. The findings showed that, despite no discernible differences between the two groups on the pre-test, students in the experimental group (EG) had a high level of motivation following a four-week intervention. However, there was no discernible change in the CG students' motivation levels.

In addition, Hasan et al. (2022) investigated the effects of WhatsApp, a mobile aided language program, on the vocabulary acquisition of Bangladeshi EFL tertiary level students. Sixty-four EFL students with intermediate English proficiency were involved in the study; they were selected at random. Following the completion of a vocabulary examination or test to determine the learners' homogeneity, the participants were divided into two groups, EG and CG, and their vocabulary knowledge was evaluated. The study had a 14-session treatment plan, wherein the EG taught new phrases via WhatsApp and the CG used the conventional approach. Following the conclusion of the course, a vocabulary post-test was given for both classes. The results of this investigation indicate that the EG outperformed the CG.



Recently, Boroughani et al.'s (2023) goal was to find out how digital flashcards and mobile-assisted vocabulary acquisition supported university students' improvement of their self-regulatory skills and academic vocabulary. 54 Iranian university students who were available for the study were chosen as participants. An EG and a CG were allocated to the participants. Both before and after the treatments, the participants' vocabulary knowledge and ability to self-regulate for vocabulary learning were assessed. The results showed that after four months, all groups had increased their vocabulary and ability to self-regulate, but the experimental group did better on both measures, with extremely high effect sizes separating them from the control group. As a result, the study offered empirical support for the superiority of mobile-assisted vocabulary acquisition over conventional resources in the advancement of academic literacy. The results also showed that university students' ability to engage in self-regulated vocabulary learning was enhanced when they used digital flashcards for vocabulary acquisition.

As one of the indicators of twenty-first century learning, Arabloo et al. (2021) set out to investigate whether integrating technology and project-based learning into traditional English teaching classes aids in the development of language competence and self-regulation. A quasi-experimental design was used to achieve this goal, and two entire classes—68 Iranian English language learners—were split into an EG and a CG. In addition to receiving language education focused on many skills and textbooks, the participants in the EG managed various little and large-scale TAVL projects. In contrast, the CG's participants did not get any technology-assisted projects; instead, they got multi-skill textbook-oriented language teaching. Before and after the training, each participant's level of English proficiency and self-control were assessed. The study's technology-assisted project-based education raised participants' levels of language competence and self-regulation, according to comparison data.

Moreover, a study conducted by Genanew Asratie et al. (2023) investigated the impact of utilizing educational speaking technology tools, namely FORVO, YouGlish, and OALD, on improving students' speaking abilities. A two-group pretest–post-test quasi-experimental design was employed. Data were collected from 82 first-year Information and Technology (IT) students chosen through thorough sampling using tests, questionnaires, interviews, and instructor logs. While the control group of students learnt using traditional methods, the experimental group's pupils acquired speaking abilities utilizing educational speaking technology tools. Thematic analysis was used to examine the qualitative data after the quantitative data were examined using the independent samples T-test. The study's conclusions showed that the speaking abilities of the students in the experimental and control groups differed statistically. As a result, when compared to students who used traditional methods, those who utilized educational speaking technology had improved speaking abilities. The majority of students who acquired speaking skills using instructional technology spoke with greater fluency, coherence, and accuracy; they also possessed a large vocabulary, employed a wide range of grammatical constructions, and had improved pronunciation. Additionally, the students view the use of educational speaking technology tools well. As a result, this research suggests that scholars, educators, and learners utilize educational technology and adhere to current best practices.

It is clear from reading the literature review that using technology to teach and study English is unavoidable. More assistance and training programs are also needed for EFL and SEL instructors on how to use technology into language instruction. The findings also showed that instructors and students may benefit greatly from the responsible use of technology. Furthermore, a review of earlier research revealed that technologies are important and critical to language acquisition since they motivate students to acquire language abilities. The literature evaluation indicates that when using technology, students experience freedom, curiosity, motivation, and enjoyment. They can learn both inside and outside of classrooms thanks to technology. It has the ability to provide access to an infinite number of sources and information. In conclusion, educational technologies facilitate communication between instructors and students both within and outside of the classroom, offer real-world input and output, and support language skill development for students utilizing a variety of educational technologies.

The influences of technology usage on the states of AB, creativity, and AA of Saudi Arabian EFL learners have not been investigated, despite the fact that there are numerous researches in general education or in other fields with different levels of learners. Thus, the purpose of this study was to determine how vocabulary acquisition supported by technology affected the AB, AA, and originality of Saudi Arabian EFL students. The following research questions were looked at within this scope.

1. Does using TAVL affect Saudi Arabian EFL learners' language learning AB positively?
2. Does using TAVL affect Saudi Arabian EFL learners' language learning creativity positively?
3. Does using TAVL affect Saudi Arabian EFL learners' language learning AA positively?

Based on the questions, three hypotheses were formulated:

1. Using TAVL does not affect Saudi Arabian EFL learners' language learning AB positively.
2. Using TAVL does not affect Saudi Arabian EFL learners' language learning creativity positively.
3. Using TAVL does not affect Saudi Arabian EFL learners' language learning AA positively.

## **Method**

### **Design of the study**

A quasi-experimental design was used in this work, which has both a CG and an EG. Three questionnaires measuring creativity, AB, and AA were employed as pre- and post-tests in the current study. For a period of eight weeks, the CG received vocabulary instruction using a conventional method, whereas the EG was exposed to TAVL. Finally, both groups received the post-tests for inventiveness, AB, and AA.

### Participants

Fifty intermediate Saudi Arabian EFL students were selected for the survey based on the convenience sampling, which took accessibility into account. We selected the intermediate level learners since their number was more than the elementary and advanced students. The researchers explained the objectives of the research to the participants and their parents beforehand, and they were given the assurances of anonymity and confidentiality. The age range of the participants was 16 to 25 and all of them were male because we had an easy access to the male students. The chosen participants were split up into two groups, EG ( $n = 25$ ) and CG ( $n = 25$ ).

### Instruments

To standardize the participants' English language competence, the Oxford University Press Quick Placement Test, version 1, was utilized. This multiple-choice exam consists of two sections, each with eight items totaling sixty. Participants are given forty-five minutes to complete the examination. Through the estimation of Cronbach's alpha, the degree to which the test utilized was standard with regard to reliability index was determined. Reliability was found at 0.91.

Yun et al. (2018) developed the Academic Buoyancy Scale to assess students' AB in EFL learning. There are twenty items on the scale, like Q14: I persevere on a challenging assignment in English class long after the others have given up. A 6-point Likert scale, with 1 denoting total disagreement and 6 denoting complete agreement, was utilized to score the items. The dependability of the current study was deemed adequate, as indicated by the Cronbach's alpha of 0.92.

The creativity of each person was evaluated using the Torrance Test of Creative Thinking (TTCT) (Torrance, 1990). The exam consisted of sixty items, each of which had three possible answers that the participants were asked to choose from. Based on the test's own scoring scale, the overall scores are categorized as "low = up to 75; mid = 76–85; high = 86–120." Creative levels were coded as follows: 0 for low, 1 for medium, and 2 for high. The test was supposed to last for thirty minutes. Cronbach Alpha ( $r = 0.83$ ) was used to evaluate the survey's reliability, and a committee of English experts confirmed it.

The last tool was a research-made English proficiency exam that was made using the participants' course books and had forty objective questions that measured each participant's proficiency in vocabulary, grammar, and reading comprehension. The test's validity was approved by a group of English language specialists, and its reliability was calculated using the KR-21 formula ( $r = 0.81$ ). A pilot test was conducted on a different group that was similar to the target group to see if the test could be given to them. The validity of all instruments was confirmed by two English experts in applied linguistics. It is significant to say that the two aforementioned questionnaires and the AA test were administered both before and after the intervention, acting as the study's pre- and post-tests.

### Procedures and analysis

In order to conduct this study, 50 Saudi Arabian EFL learners were initially chosen and split into an EG and a CG. Next, AB, AA, and creativity pretests were given to both

groups. Following that, the EG participants were given therapy using TAVL; this group was instructed 120 new terms utilizing the WhatsApp application. The new words were taught to the EG using digital flashcards. The contents and materials were given to the EG at a specific time, and the researcher used the WhatsApp app to go over them with the participants. The goal was for the participants to practice and learn the content collaboratively, asking the teacher only the difficult or confusing sections that they couldn't understand. When the students requested for assistance, the teacher always gave them constructive criticism. Conversely, the CG students received traditional instruction without the use of digital flashcards. They took an in-person lesson, where the instructor gave them a traditional introduction to the new vocabulary. During the most recent session, three questionnaires were given to each group's members to assess how the therapy was affecting their AA, AB, and inventiveness. Finally, the data were analyzed using paired and independent sample t-tests.

## Results

Table 1 displays the results of the AB pre-test's descriptive statistics. The table's results indicate that there was no significant difference between the two groups' mean scores on the AB pre-test.

Table 2 presents the t-test findings under the premise that the variances are homogeneous. The conclusion is that there was no initial significant difference between the mean scores of the two groups because the sig value is bigger than 0.05. Therefore, the researchers could be confident that, before the therapy, there was no discernible difference in the AB of the EG and CG.

The examination of the descriptive statistics for the posttest of the AB test is shown in Table 3. It is evident that the EG's mean score of 85.56 is greater than the CG's score of 56.36. Given that the KS test results for both groups showed a normal distribution of scores, an independent samples t-test was performed on the aforementioned means to assess whether or not there was a substantial difference.

**Table 1** Pre-test of AB (Descriptive Statistics)

Groups	N	Means	Std. deviations	Std. error means
CG	25	51.88	6.48	1.29
EG	25	52.56	6.23	1.24

**Table 2** Independent sample T-test of AB pre-test

	Levene's test for equality of variances		t-test for equality of means				
	F	Sig.	t	Df	Sig. (2-tailed)	Mean difference	Std. error difference
Equal variances assumed							
Equal variances not assumed			-.37	47.93	.70	-.68	1.79

**Table 3** AB post-test (Descriptive Statistics)

Groups	N	Means	Std. deviations	Std. error means
CG	25	56.36	14.33	2.86
EG	25	85.56	6.85	1.37

**Table 4** Independent sample T-test of AB post-test

	Levene's test for equality of variances		t-test for equality of means				
	F	Sig.	t	Df	Sig. (2-tailed)	Mean difference	Std. error difference
Equal variances assumed							
Equal variances not assumed			− 9.18	47.43	.00	− 29.20	3.17

**Table 5** Paired Sample T-test of AB

	Mean	Std. deviation	Std. error mean	t	df	Sig. (2-tailed)
CG pre—CG post	− 4.48	10.57	2.11	− 2.11	24	.04
EG pre—EG post	− 33.00	6.13	1.22	− 26.91	24	.00

**Table 6** Creativity Pre-test (Descriptive Statistics)

Groups	N	Means	Std. deviations	Std. error means
CG	25	83.28	13.20	2.64
EG	25	82.04	21.16	4.23

There was a statistically significant difference ( $P < 0.05$ ) between the groups, as Table 4 shows. Since the EG outperformed the CG on the post-test, it may be argued that this difference may be the effect of employing technology to teach vocabulary.

The paired sample t-test findings, which were used to examine the performance of the CG and EG independently on the AB pretest and post-test, are shown in Table 5. This table shows that the mean scores on the CG's AB pretest and post-test differed significantly. Furthermore, a noteworthy distinction was seen between the average results on the AB pretest and the EG post-test. These findings showed that following therapy, the AB of individuals in both groups increased.

The mean scores of the two groups are nearly identical, as the Table 6 illustrates. On the pre-test for creativity, their results were nearly identical. The independent samples t-test is used in the following Table 7 to verify this assertion.

To see if there were any notable variations between the creativity pre-tests of the two groups, an independent samples t-test was performed on the above table. Given

**Table 7** Independent Sample T-test of Creativity Pre-test

	Levene's test for equality of variances		t-test for equality of means				
	F	Sig	T	Df	Sig. (2-tailed)	Mean difference	Std. error difference
Equal variances assumed	1.32	.25	.24	48	.80	1.24	4.98
Equal variances not assumed			.24	46.22	.80	1.24	4.98

**Table 8** Creativity Post-test (Descriptive Statistics)

Groups	N	Mean	Std. deviation	Std. error mean
CG	25	87.68	18.20	3.64
EG	25	102.00	14.21	2.84

**Table 9** Independent Sample T-test of Creativity Post-tests

	Levene's test for equality of variances		t-test for equality of means				
	F	Sig	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	4.32	.04	− 3.09	48	.00	− 14.32	4.62
Equal variances not assumed			− 3.09	45.33	.00	− 14.32	4.62

**Table 10** Paired Sample T-test of Creativity

	Mean	Std. deviation	Std. error mean	t	df	Sig. (2-tailed)
CG pre—CG post	− 4.40	8.96	1.79	− 2.45	24	.02
EG pre—EG post	− 19.96	28.66	5.73	− 3.48	24	.00

that Sig.80 is more than 0.05, it may be concluded that there were no appreciable variations amongst the two groups' creativity pre-test results.

Table 8 makes it clear that students who received technology-based education outstripped the CG group in terms of creative post-test scores. The CG has a mean score of 87.68, whereas the EG has a mean score of 102.00.

Given that the sig value is less than 0.05, as Table 9 demonstrates, there was a substantial difference between the groups. One may conclude that there was a statistically meaningful difference amongst the groups as a result of the TAVL.

As can be seen from Table 10, which presents the results of a paired sample t-test used to compare the performance of the CG and EG separately on the creativity pretest and post-test, there was a meaningful difference between the CG's mean scores on the creativity pretest and post-test and between the EG's mean scores on the same test. These findings demonstrated that participants in both groups' creativity increased following the instruction.



**Table 11** AA Pre-test (Descriptive Statistics)

Groups	N	Means	Std. deviations	Std. error means
CG	25	13.44	2.12	.42
EG	25	12.88	2.04	.40

**Table 12** Independent Sample T-test of AA Pre-test

	Levene's test for equality of variances		t-test for equality of means				
	F	Sig.	t	Df	Sig. (2-tailed)	Mean difference	Std. error difference
Equal variances assumed	.07	.78	.94	48	.34	.56	.58
Equal variances not assumed			.94	47.93	.34	.56	.58

**Table 13** AA Post-test (Descriptive Statistics)

Groups	N	Means	Std. deviations	Std. error means
CG	25	14.44	2.02	.40
EG	25	16.04	2.31	.46

**Table 14** Independent Sample T-test of AA Post-test

		Levene's test for equality of variances		t-test for Equality of Means				
		F	Sig.	T	Df	Sig. (2-tailed)	Mean difference	Std. error difference
Scores	Equal variances assumed	.34	.56	− 2.60	48	.01	− 1.60	.61
	Equal variances not assumed			− 2.60	47.13	.01	− 1.60	.61

According to Table 11, the mean score for the CG is 13.44, while the mean score for the EG is 12.88. This suggests that the two groups' AA was the same at the commencement of the instruction.

To show the AA pre-test differences between the two groups, an independent samples t-test was run on Table 12. The results show that the Sig value (0.34) is greater than 0.05, indicating that the group differences are not significant. In fact, they performed identically on the AA pretest.

The accompanying table (Table 13) shows that the EG (Mean = 16.04) received greater points than the CG (Mean = 14.44). Having confidence in the data's normality, the following data were subjected to an independent samples t-test (Table 14).

**Table 15** Paired Sample T-test of AA

	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
CG pre—CG post	− 1.00	1.97	.39	− 2.52	24	.01
EG pre—EG post	− 3.16	2.30	.46	− 6.85	24	.00

According to Table 14, the EG outperformed the CG on the AA post-test, based on the results of the independent sample t-test. This indicates that the EG developed their AA considerably better than the CG thanks to the use of TAVL.

Table 15 compares each group's pre- and post-test results using a paired samples t-test. Sig (0.1) is less than 0.05, indicating a difference between CG's pre- and post-treatment performances; similarly, Sig (0.00) is less than 0.05, indicating significant variations between EG's pre- and post-test results.

Briefly speaking, the EG or technology group outperformed the CG on the three post-tests of AB, AA, and creativity. The results show that the EG got better scores than the CG on the three post-tests. In fact, using technology in the class of EG helped EFL learners enhance their AB, AA, and creativity.

## Discussion

The results exhibited that the technology group did better on the post-tests measuring academic accomplishment, AB, and creativity than the non-technology group. This is consistent with research by Ozkan and Selcuk (2015), who found that technology-enhanced conceptual change texts improve primary school pupils' comprehension of buoyant force. Additionally, the results corroborate those of Aysu (2020), which demonstrated the effects of technology use on students' motivation levels in foreign language courses. Furthermore, our findings concur with those of Hasan et al. (2022), who confirmed the effects of TAVL on the vocabulary acquisition of Bangladeshi university level EFL learners.

Furthermore, the obtained results align with the outcomes of Boroughani et al. (2023), who validated the efficacy of digital flashcards in conjunction with mobile assistance for vocabulary learning in scaffolding academic vocabulary acquisition and the development of self-regulatory ability in university students. Furthermore, our results align with the findings of Arabloo et al. (2021), who stated that technology might positively contribute to the improvement of linguistic competence and self-regulation in EFL learners. The results are consistent with previous research that found similar things, including Xodabande and Atai (2022) and Xodabande et al. (2022).

Learning theory grounded on social constructivism lends credence to our findings. Long (1996) asserts that social contact improves meaning negotiation and, hence, the comprehensibility of the L2 input, which is a crucial part of L2 acquisition. Since language is primarily used for communication, social connection is very important for language learners. Learning is more likely to be effective when students can dynamically interact with other individuals. Meaningful engagement in particular can improve learners' L2 learning by helping them recognize and use new terms in conversation.

TAVL settings can facilitate social interaction in two ways: directly, through interactive environments that allow learners to collaborate and exchange information with others wherever they are, thanks to technology portability (such as email and SMS), or indirectly, through audio-visual input that helps learners pay close attention to words that need to be learned and interact with them on computer screens (Mohsen, 2016). Stated differently, the interaction hypothesis posits that the use of technology in conjunction with aided vocabulary learning can facilitate learners' direct and organic experience of a second language through meaning negotiation with other users or the interactive technology itself.

The following factors may help to explain the relative efficacy of TAVL. Initially, the participants were given a more efficient method for acquiring language thanks to digital flashcards. More precisely, the spaced repetition function allowed students to interact with the target words several times, and this exposure to form-meaning relationships aided in the acquisition of academic vocabulary (Nation, 2022). Second, in comparison to the control group, learning with digital flashcards required higher retrieval work from the EG participants. Such processes have a major role in improving learning outcomes, as demonstrated by prior research (Li & Hafner, 2022). Third, because of the intrinsic motivating potential of employing technology, it has been noted that incorporating digital tools into language teaching leads in greater motivation and student engagement. Therefore, this element may have contributed to the users' enhanced performance while using digital flashcards, considering the decisive role that motivation plays in language learning success (Hashemifardnia et al., 2021).

Fourth, using digital flashcards to acquire academic vocabulary aided in the development of several fundamental self-regulation abilities, including goal-setting that is reasonable, time management, resource management, and choosing the most effective course of action (Lei et al., 2022). Fifth, using digital flashcards instead of wordlists had a greater influence on participants' ability to control their commitment, which made it easier to manage more positive expectations by memorizing words in sets (Burston & Giannakou, 2021). Sixth, as was already said, using digital flashcards to acquire language has intrinsic motivating benefits. It has been suggested that more motivation increases positive emotionality and reduces the effects of negative emotions, taking into account the function of emotion management in the self-regulatory ability for vocabulary learning (Ziegler, 2015). (MacIntyre et al., 2019). Lastly, it's possible that the participants' greater metacognitive control over vocabulary learning as a result of using digital flashcards is what caused the observed improvements in their growth (Teng & Zhang, 2020). The participants' ability for self-regulated learning increased as a result of the affordances that mobile-assisted learning gave them to track their progress and assess their performance.

Students in the technology group performed better than those in the conventional group. The use of technology in EFL instruction is becoming more prevalent for numerous reasons. First off, it is undeniably true that students are enthusiastically involved in the learning process when using current technology, which makes the entire process fascinating and student-centered. Second, if connectivity is available, technology group learners may make the most of their free time to study a wide range of online resources and advance their English language skills. Thus, stable connectivity is essential

to securing the advancement of EFL students and enhancing their language proficiency and output.

The findings have some ramifications for English instruction and acquisition in EFL settings. First, EFL teachers should be stimulated to use various digital tools in their lessons, as the study showed that utilizing digital flashcards successfully led to a large growth in EFL learners' academic buoyancy, originality, and academic accomplishment (Coxhead, 2019). Second, using digital flashcards to study vocabulary appears to be a workable way to continue learning outside of the classroom. For this reason, EFL teachers and students should take particular heed of the different affordances offered by mobile tools for relocating the learning activities to anytime and anywhere (Xodabande & Atai, 2022). Additionally, mobile-assisted academic vocabulary study gives teachers additional opportunities to maintain and promote EFL students' involvement in the learning content, as leveraging innovations and technology for language learning is naturally stimulating (Stockwell, 2013). When taken as a whole, these implications draw attention to the advantages of TAVL, which is one of the newest trends in educational technologies. Students' achievement and the development of their professional identities are enhanced when this technology is customized to meet the learning demands of EFL students through the expansion of their academic vocabulary.

Some suggestions for pedagogy are made in light of the study's findings. Technology integration into curriculum can extend and broaden students' access to course information at any time and anywhere, even outside of the classroom, as a result of the quick improvement of new technologies and the necessity of hosting online and virtual classes. It is also believed that technology tools are accessible and affordable for the younger generation. Therefore, in order to use technological tools and platforms for language instruction, instructors must become digitally literate. Applying technology to language learning may also improve it, since it allows language learners to write phrases, record their voices, listen to audios, see videos, and negotiate meanings. As was previously said, students' positive psychology should be nurtured while they are in school. In this sense, it is essential for both educators and pupils to comprehend the self-help conceptions and how they relate to their overall wellbeing. It is recommended that academic topics receive direct or indirect training in relevant methodologies. It is advised that curriculum designers and materials producers alter educational resources and take these findings into account in addition to other academic disciplines. In this sense, teachers must also undergo pre-service and in-service training courses. To ensure students' academic success and, more crucially, the well-being of society, curriculum designers, policy makers, materials producers, and teachers are advised to include TAVL and teaching self-help practices.

The learning process may be focused and language learners' progress can be made by utilizing technology-related tools. As stated by Alavi et al. (2022) and Jensen and Konradsen (2018), teachers have the power to enhance their students' knowledge and skills while making the learning process more efficient and interesting. This is made possible by the use of educational technology tools in the classroom and the presence of qualified teachers and instructors in the subjects being taught. Teachers and students must be computer literate due to the variety of technological tools available and the advantages of utilizing computers in the classroom (Kashada et al., 2018).

In short, the results of the research indicate that using technology developed Saudi Arabian EFL learners' AB, creativity, and AA. We might infer that the roles of teacher and student have evolved as a result of technology. In order to be successful in the classroom, students must actively participate in problem solving, communication, teamwork, knowledge generation, and knowledge management. They need to become self-sufficient learners and take charge of their own time rather than depending only on their lecturers for everything. By utilizing reliable online resources like email, YouTube, Twitter, WhatsApp, discussion forums, iPods Skype, and tablets, they are expected to enhance their skills. Because they may utilize these technology tools anytime, anyplace to enhance their interactive reading experience, EFL learners can benefit from real communication chances outside of the classroom. This interactive reading can introduce a variety of syntactical patterns to EFL students and broaden their vocabulary. EFL students must utilize YouTube, basic audio resources, and audiobooks to the fullest in order to enhance their listening abilities. As a matter of truth, increasing speaking and listening comprehension require a great deal of listening. Enhancing listening comprehension and accentual patterns of English words can be achieved by simultaneously reading material and listening to English native speakers on the internet. Podcasts are a valuable resource for enhancing listening abilities.

The idea that instructors may be replaced by contemporary technology gadgets and that children no longer need them is a common misperception. The current technology-led pedagogical setting really presents greater challenges for teachers than it did in the past. Modern EFL teachers are required to support students and include them in the entire learning process in addition to captivating EFL learners with their lecture skills. Their whole attention should be directed toward improving the efficacy of learning. With the advent of contemporary technology, education has taken on a whole new meaning. To keep up with the newest technology, EFL teachers nowadays must adapt their methods of instruction. They must be proficient in the use of Skype, WhatsApp, Twitter, email, discussion forums, and other platforms that give them real-world communication possibilities. They must adjust to the so-called paradigm shift from the teacher-centered, traditional learning style to learner-oriented learning, which places the student at the center of the learning process.

In order for students to be autonomous learners and not only be seen as empty vessels or passive receptors who blindly rely on teachers as the ultimate authority, EFL instructors must support their students' full capacity to engage with real online resources. The participatory technique, which allows students to actively participate in the blended learning process, should be introduced by EFL teachers. They must enable students to approach learning challenges in accordance with their aptitudes by utilizing contemporary technology tools that may enhance the educational experience of EFL learners and provide them with an extensive array of integrated language competencies. In order to help students complete challenging language learning tasks, they must prepare useful summative assessment policies, incorporate technology into EFL classrooms, and customize teaching materials. They are also expected to play the roles of instructional designers, trainers, facilitators, mentors, and assessment specialists. In the current educational environment, collaborative teaching—which emphasizes informal exchange of teaching experiences with colleagues and

team teaching—is becoming increasingly popular. In order to improve the efficiency and informational value of the entire learning process, instructors are expected to share with their colleagues the creative and useful educational experiences they have had. Teaching and learning will be more successful as a result of the new responsibilities that contemporary EFL teachers and students will play.

In the current digital era, parents and teachers face significant challenges. They need to consider how to motivate students to get the most out of their electronic devices. According to some studies, things get worse when pupils develop a smart-phone addiction. When students are told not to use their phones in class, they experience nomophobia, which is the dread of being cut off from mobile connectivity. Actually, students' obsessive attachment to cellphones interferes with their ability to focus and participate in the learning process. If educators and parents handle kids with sensitivity, they can eliminate the negative impacts of cellphones on students.

As with all empirical studies, some limits should be used while analyzing the study's results. Just two groups participated in the sampling methods for this quasi-experimental study design. It is advised that future studies use other approaches to supplement the current study's conclusions. Furthermore, there were just a small number of students in EG and CG, which might have an impact on how broadly applicable the results are. In the future, greater research with a larger sample size is advised. Next studies can address these variables and examine whether they influence AB, creativity, and AA of the EFL students. The investigation did not examine the potential impacts of the participants' demographic information and social-cultural variation. The study's emphasis on intermediate-level learners' language competency was likewise constrained. To determine if TAVL affects elementary, upper-intermediate, and advanced learners, future study may take other language skill levels into account.

English As A Foreign Language (EFL).

#### **Abbreviations**

AA	Academic achievement
AB	Academic buoyancy
EG	Experimental group
CG	Control group
TAVL	Technology-assisted vocabulary learning
GPA	Grade point average

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#### **Availability of data and materials**

The data that support the findings of this study are available from the corresponding author upon reasonable request.

#### **Declarations**

##### **Ethics approval and consent to participate**

The study involving human participants did not require ethical review and approval, as it complied with local legislation and university requirements of Saudi Arabia. Written informed consent was obtained from all participants prior to their participation in the study.

##### **Consent for publication**

Not applicable.



**Competing interests**

On behalf of all authors, the corresponding author states that there is no competing interests.

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**References**

- Alavi, S. M., Dashtestani, R., & Mellati, M. (2022). Crisis and changes in learning behaviours: Technology-enhanced assessment in language learning contexts. *Journal of Further and Higher Education*, 46(4), 461–474. <https://doi.org/10.1080/0309877X.2021.1985977>
- Al-Obaydi, L. H., Pikhart, M., & Shakki, F. (2023). Digital gaming as a panacea for incidental L2 acquisition in an EFL context. *Applied Research on English Language*, 12(1), 73–94. <https://doi.org/10.22108/are.2022.135344.2001>
- Arabloo, P., Hemmati, F., Rouhi, A., & Khodabandeh, F. (2021). The effect of technology-aided project-based learning on EFL learners' language proficiency and self-regulation. *Foreign Language Research Journal*, 11(2), 121–143. <https://doi.org/10.22059/jflr.2021.316780.798>
- Ardasheva, Y., Hao, T., & Zhang, X. (2019). Pedagogical implications of current SLA research for vocabulary skills. In N. Polat, P. MacIntyre, & T. Gregersen (Eds.), *Research-driven pedagogy: Implications of L2A theory and research for the teaching of language skills* (pp. 125–144). Routledge.
- Arnout, B., & Almoied, A. (2020). A structural model relating gratitude, resilience, psychological well-being and creativity among psychological counsellors. *Counselling and Psychotherapy Research*. <https://doi.org/10.1002/capr.12316>
- Astika, G. (2015). Teaching english vocabulary: What international language educators tell us. *English Teacher*, 44(2), 84–95.
- Aysu, S. (2020). The use of technology and its effects on language learning motivation. *Journal of Language Research (JLR)*, 4(1), 86–100.
- Barrett, A., Pack, A., Guo, Y., & Wang, N. (2023). Technology acceptance model and multi-user virtual reality learning environments for Chinese language education. *Interactive Learning Environments*, 31(3), 1665–1682. <https://doi.org/10.1080/10494820.2020.1855209>
- Basal, A., Yilmaz, S., Tanriverdi, A., & Sari, L. (2016). Effectiveness of mobile applications in vocabulary teaching. *Contemporary Educational Technology*, 7(1), 47–59. <https://doi.org/10.30935/cedtech/6162>
- Bensalem, E. (2018). The impact of WhatsApp on EFL students' vocabulary learning. *Arab World English Journal*, 9(1), 1–16.
- Berg, J., Vestena, C., & Costa-Lobo, C. (2020). Creativity in Brazilian education: Review of a decade of literature. *Creative Education*, 11, 420–433. <https://doi.org/10.4236/ce.2020.113030>
- Boroughani, T., Behshad, N., & Xodabande, I. (2023). Mobile-assisted academic vocabulary learning with digital flashcards: Exploring the impacts on university students' self-regulatory capacity. *Frontier in Psychology*, 14, 1112429. <https://doi.org/10.3389/fpsyg.2023.1112429>
- Burston, J., & Giannakou, K. (2021). MALL language learning outcomes: A comprehensive meta-analysis 1994–2019. *ReCALL*, 34, 147–168. <https://doi.org/10.1017/S0958344021000240>
- Cassidy, S. (2012). Exploring individual differences as determining factors in student academic achievement in higher education. *Studies in Higher Education*, 37, 793–810. <https://doi.org/10.1080/03075079.2010.545948>
- Chapman, M. T., Lines, R. L. J., Crane, M., Ducker, K. J., Ntoumanis, N., & Peeling, P. (2020). Team resilience: A scoping review of conceptual and empirical work. *Work and Stress*, 34, 57–81. <https://doi.org/10.1080/02678373.2018.1529064>
- Chen, R., Sim, B., & Paramasivam, S. (2023). Toward the implications of technology-based education and EFL learners' anxiety for instructions. *Language Related Research*, 14(3), 265–287.
- Chen, X. J., Cheung, H. Y., Fan, X. T., & Wu, J. (2018). Factors related to resilience of academically gifted students in the Chinese cultural and educational environment. *Psychol. Schools*, 55, 107–119.
- Chen, Y. L., & Hsu, C. C. (2020). Self-regulated mobile game-based English learning in a virtual reality environment. *Computers an Education*, 154, 103910. <https://doi.org/10.1016/j.compedu.2020.103910>
- Clark, J. M., & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review*, 3(3), 149–210. <https://doi.org/10.1007/BF013200>
- Coxhead, A. (2019). Academic vocabulary. In S. Webb (Ed.), *The Routledge Handbook of vocabulary studies* (pp. 97–110). England: Routledge.
- Fang, Z., Xu, X., Grant, L. W., Stronge, J. H., & Ward, T. J. (2016). National culture, creativity, and productivity: What's the relationship with student achievement? *Creativity Research Journal*, 28, 395–406. <https://doi.org/10.1080/10400419.2016.1229976>
- Franciosi, S. J. (2017). The effect of computer game-based learning on FL vocabulary transferability. *Educational Technology and Society*, 20(1), 123–133.
- Gajda, A., Karwowski, M., & Beghetto, R. A. (2017). Creativity and academic achievement: A meta-analysis. *Journal of Educational Psychology*, 109, 269–299. <https://doi.org/10.1037/edu0000133>
- Gao, Y., Zeng, G., Wang, Y., Klan, A., & Wang, X. (2022). Exploring educational planning, teacher beliefs, and teacher practices during the pandemic: A study of science and technology-based universities in China. *Frontiers in Psychology*, 13, 903244. <https://doi.org/10.3389/fpsyg.2022.903244>
- Genanew Asratie, M., Derseh Wale, B., & Tadele Aylet, Y. (2023). Effects of using educational technology tools to enhance EFL students' speaking performance. *Education and Information Technologies*, 28, 10032–10051. <https://doi.org/10.1007/s10639-022-11562-y>
- Glover, J. A., Ronning, R. R., & Reynolds, C. R. (2013). *Handbook of creativity*. Springer.
- Gowda, M., & Gautam, R. (2022). Application of resilience practice on creativity and emotional regulation in education setting: A Review study. *Journal of Positive School Psychology*, 6(11), 32.

- Green, J. K., Burrow, M. S., & Carvalho, L. (2020). Designing for transition: Supporting teachers and students cope with emergency remote education. *Postdigital Science and Education*, 2(3), 906–922. <https://doi.org/10.1007/s42438-020-00185-6>
- Guilford, J. (1966). Measurement and creativity. *Theory into Practice*, 5, 185–189. <https://doi.org/10.1080/00405846609542023>
- Hafner, C. A., & Ho, W. Y. J. (2020). Assessing digital multimodal composing in second language writing: Towards a process-based model. *Journal of Second Language Writing*, 47, 100710.
- Hajilou, Y., Yazdani, H., & Shokrpour, N. (2012). The relationship between Iranian EFL learners' creativity and their lexical reception and production knowledge. *English Language Teaching*, 5, 131–146. <https://doi.org/10.5539/elt.v5n3p131>
- Hasan, K., Fakihi, A., Ibna Seraj, P. M., & Hasmirati, K. (2022). The effect of technology-assisted language programme on vocabulary learning among EFL students at the tertiary level. *Heliyon*, 2, 1–6.
- Hashemifardnia, A., Shafiee, S., Rahimi Esfahani, F., & Sepehri, M. (2021). Effects of flipped instruction on Iranian intermediate EFL learners' speaking complexity, accuracy, and fluency. *Cogent Education*. <https://doi.org/10.1080/2331186X.2021.1987375>
- Hiver, P. (2017). Tracing the signature dynamics of language teacher immunity: A retrodictive qualitative modeling study. *The Modern Language Journal*, 101, 669–690. <https://doi.org/10.1111/modl.12433>
- Hiver, P., & Dörnyei, Z. (2017). Language teacher immunity: A double-edged sword. *Applied Linguistics*, 38, 24–39. <https://doi.org/10.1093/applin/amv034>
- Hsu, T. C. (2017). Learning English with augmented reality: Do learning styles matter? *Computers and Education*, 106, 137–149. <https://doi.org/10.1016/j.compedu.2016.12.007>
- Huang, C. L., Luo, Y. F., Yang, S. C., Lu, C. M., & Chen, A.-S. (2020). Influence of students' learning style, sense of presence, and cognitive load on learning outcomes in an Immersive Virtual Reality Learning Environment. *Journal of Educational Computing Research*, 58(3), 596–615.
- Ibna Seraj, P. M., Klimova, B., & Habil, H. (2021). Use of mobile phones in teaching English in Bangladesh: A systematic review (2010–2020). *Sustainability*, 13(10), 1–13.
- Imlawi, J., Gregg, D., & Karimi, J. (2015). Student engagement in course-based social networks: The impact of instructor credibility and use of communication. *Computers and Education*, 88, 84.
- Jahedizadeh, S., Ghonsooly, B., & Ghanizadeh, A. (2019). Academic buoyancy in higher education. *Journal of Applied Research in Higher Education*, 11, 162–177. <https://doi.org/10.1108/JARHE-04-2018-0067>
- Jensen, L., & Konradsen, F. (2018). A review of the use of virtual reality head-mounted displays in education and training. *Education and Information Technologies*, 23(4), 1515–1529. <https://doi.org/10.1007/s10639-017-9676-7>
- Jia, L. Y., & Cheng, P. (2022). The role of academic buoyancy and social support on English as a Foreign Language learners' motivation in higher education. *Frontiers in Psychology*, 13, 89260. <https://doi.org/10.3389/fpsyg.2022.892603>
- Jin, Y., & Zhang, L. J. (2018). The dimensions of foreign language classroom enjoyment and their effect on foreign language achievement. *International Journal of Bilingual Education and Bilingualism*, 24, 948–962. <https://doi.org/10.1080/13670050.2018.1526253>
- Jones, C., & Shao, B. (2011). *The net generation and digital natives: Implications for higher education*. Higher Education Academy, York. Retrieved from: [http://oro.open.ac.uk/30014/1/Jones\\_and\\_Shao-Final.pdf](http://oro.open.ac.uk/30014/1/Jones_and_Shao-Final.pdf).
- Kapoor, H., & Kaufman, J. C. (2020). Meaning-making through creativity during COVID-19. *Frontiers in Psychology*, 11, 595990. <https://doi.org/10.3389/fpsyg.2020.595990>
- Kashada, A., Li, H., & Koshadah, O. (2018). Analysis approach to identify factors influencing digital learning technology adoption and utilization in developing countries. *International Journal of Emerging Technologies in Learning*, 13(02), 48–59. <https://doi.org/10.3991/ijet.v13i02.7399>
- Labrague, L. J. (2021). Psychological resilience, coping behaviors and social support among health care workers during the COVID-19 pandemic: A systematic review of quantitative studies. *Journal of Nursing Management*, 29(7), 1893–1905. <https://doi.org/10.1111/jonm.13336>
- Lan, Y. F., & Sie, Y. S. (2010). Using RSS to support mobile learning based on media richness theory. *Journal of Computers in Education*, 55(2), 723–732.
- Lei, X., Fathi, J., Noorbakhsh, S., & Rahimi, M. (2022). The impact of Mobile-assisted language learning on English as a foreign language learners' vocabulary learning attitudes and self-regulatory capacity. *Frontiers in Psychology*, 13, 1–14. <https://doi.org/10.3389/fpsyg.2022.872922>
- Lepp, A., Barkley, J. E., & Karpinski, A. C. (2014). The relationship between cell phone use, academic performance, anxiety and satisfaction with life in college students. *Computer in Human Behavior*, 31, 343–350.
- Li, C. (2020). A positive psychology perspective on Chinese EFL students' trait emotional intelligence, foreign language enjoyment and EFL learning achievement. *Journal of Multilingual and Multicultural Development*, 41, 246–263. <https://doi.org/10.1080/01434632.2019.1614187>
- Li, Y., & Hafner, C. A. (2022). Mobile-assisted vocabulary learning: Investigating receptive and productive vocabulary knowledge of Chinese EFL learners. *ReCALL*, 34, 66–80. <https://doi.org/10.1017/S0958344021000161>
- Lin, Y. (2021). *A correlational study of grade 9 students' motivation for learning English as a foreign language and their attitudes toward the learning situation with English as a foreign language academic achievement at a private school in China*. Master Thesis. Thailand: Assumption University.
- Lin, J. J., & Lin, H. (2019). Mobile-assisted ESL/EFL vocabulary learning: A systematic review and meta-analysis. *Computer Assisted Language Learning*, 32(8), 878–919. <https://doi.org/10.1080/09588221.2018.1541359>
- Liu, H., & Chang, C. (2017). Effectiveness of 4Ps creativity teaching for college students: A systematic review and meta-analysis. *Create Education*, 8, 857–869. <https://doi.org/10.4236/ce.2017.86062>
- Long, M. H. (1996). The role of linguistic environment in second language acquisition. In W. C. Ritchie & T. K. Bhatia (Eds.), *Handbook of second language acquisition* (pp. 413–468). Academic Press.
- López-Ayres, G., Acuña, S. R., & Ordaz Villegas, G. (2020). Resilience and creativity in teenagers with high intellectual abilities: A middle school enrichment experience in vulnerable contexts. *Sustainability*, 12, 7670.

- MacIntyre, P. D., Ross, J., & Clément, R. (2019). Emotions are motivating. In M. Lamb, K. Csizér, A. Henry, & S. Ryan (Eds.), *The Palgrave handbook of motivation for language learning* (pp. 183–202). Springer International Publishing.
- Martin, A. J. (2013). Academic buoyancy and academic resilience: Exploring 'everyday' and 'classic' resilience in the face of academic adversity. *School Psychology International*, 34, 488–500. <https://doi.org/10.1177/0143034312472759>
- Martin, A. J., Ginns, P., Brackett, M. A., Malmberg, L. E., & Hall, J. (2013). Academic buoyancy and psychological risk: Exploring reciprocal relationships. *Learning and Individual Differences*, 27, 128–133. <https://doi.org/10.1016/j.lindif.2013.06.006>
- Martin, A. J., & Marsh, H. W. (2008). Workplace and academic buoyancy: Psychometric assessment and construct validity amongst school personnel and students. *Journal of Psychoeducational Assessment*, 26, 168–184.
- Metros, S. E. (2008). The educator's role in preparing visually literate learners. *Theory into Practice*, 47(2), 102–109. <https://doi.org/10.1080/00405840801992264>
- Mohsen, M. A. (2016). Effects of help options in a multimedia listening environment on L2 vocabulary acquisition. *Computer Assisted Language Learning*, 29(7), 1220–1237. <https://doi.org/10.1080/09588221.2016.1210645>
- Moody, S., Hu, X., Kuo, L. J., Jouhar, M., Xu, Z., & Lee, S. (2018). Vocabulary instruction: A critical analysis of theories, research, and practice. *Education Sciences*, 8(4), 180–122. <https://doi.org/10.3390/educsci8040180>
- Morar, L., Bratu, S., & Negoescu, A. (2020). The importance of creativity in foreign language acquisition. *Land Forces Academy Review*, 3, 217–222. <https://doi.org/10.2478/raft-2020-0026>
- Naderi, H., Abdullah, R., Aizan, H. T., Sharir, J., & Kumar, V. (2009). Creativity, age and gender as predictors of academic achievement among undergraduate students. *The Journal of American Science*, 5, 101–112.
- Nation, I. S. P. (2001). *Learning vocabulary in another language*. Cambridge University Press.
- Nation, I. S. P. (2022). *Learning Vocabulary in another Language* (3rd ed.). Cambridge University Press.
- Nawaila, M. B., Kanbul, S., & Uzunboylu, H. (2018). Toward making social media effective in our classrooms: A 9- point method. *International Journal of Interactive Mobile Technologies*, 12(4), 54–67.
- Nazari, M., & Xodabande, I. (2020). L2 Teachers' mobile-related beliefs and practices: Contributions of a professional development initiative. *Computer Assisted Language Learning*, 5, 1–30.
- Ozkan, G., & Selcuk, G. (2015). Effect of technology enhanced conceptual change texts on students' understanding of buoyant force. *Universal Journal of Educational Research*, 3(12), 981–988. <https://doi.org/10.13189/ujer.2015.031205>
- Paivio, A. (2006). *Dual coding theory and education* [Paper presentation]. Pathways to Literacy Achievement for High Poverty Children Conference, University of Michigan
- Pishghadam, R., Khodadady, E., & Zabihi, R. (2011). Learner creativity in foreign language achievement. *European Journal of Education*, 3, 465–472.
- Putwain, D. W., Daly, A. L., Chamberlain, S., & Sadreddini, S. (2015). Academically buoyant students are less anxious about and perform better in high-stakes examinations. *British Journal of Educational Psychology*, 85, 247–263. <https://doi.org/10.1111/bjep.12068>
- Sandri, O. J. (2013). Exploring the role and value of creativity in education for sustainability. *Environmental Education Research*, 19, 765–778. <https://doi.org/10.1080/13504622.2012.749978>
- Schmitt, N. (2014). Size and depth of vocabulary knowledge: What the research shows. *Language Learning*, 64(4), 913–951. <https://doi.org/10.1111/lang.12077>
- Shao, K., Yu, W., & Ji, Z. (2013). The relationship between EFL students' emotional intelligence and writing achievement. *Innovation in Language Learning and Teaching*, 7, 107–124. <https://doi.org/10.1080/17501229.2012.725730>
- Simonton, D. K. (2012). Teaching creativity: Current findings, trends, and controversies in the psychology of creativity. *Teaching of Psychology*, 39(3), 217–222. <https://doi.org/10.1177/0098628312450444>
- Soodmand Afshar, H., Rahimi, A., & Rahimi, M. (2014). Instrumental motivation, critical thinking, autonomy and academic achievement of Iranian EFL learners. *Issues in Educational Research*, 24, 281–298.
- Stockwell, G. (2013). Technology and motivation in English-language teaching and learning. In E. Ushioda (Ed.), *International perspectives on motivation* (pp. 156–175). Palgrave Macmillan.
- Taghizadeh, M., & Porkar, P. (2018). Tablet, flashcard and SMS and their effects on EFL learners' attitudes and vocabulary Knowledge. *International Journal of English Language and Translation Studies*, 6(1), 105–118.
- Taheri, H., Sadighi, F., Bagheri, M. S., & Bavali, M. (2019). EFL learners' L2 achievement and its relationship with cognitive intelligence, emotional intelligence, learning styles, and language learning strategies. *Cogent Education*, 6, 1655882. <https://doi.org/10.1080/2331186X.2019.1655882>
- Tahounchchi, S. (2021). The impact of mobile technology on vocabulary learning of L2 learners: The case of WhatsApp application. *The Journal of Asia TEFL*, 18(1), 223–234.
- Taj, I., Ali, F., Sipra, M., & Ahmad, W. (2017). Effect of technology enhanced language learning on EFL reading comprehension at tertiary level. *Arab World English Journal*, 8(1), 108–129. <https://doi.org/10.24093/awej/vol8no1.9>
- Teng, L. S., & Zhang, L. J. (2020). Empowering learners in the second/foreign language classroom: Can self-regulated learning strategies-based writing instruction make a difference? *Journal of Second Language Writing*, 48, 100701. <https://doi.org/10.1016/j.jslw.2019.100701>
- Teo, T., Khazaie, S., & Derakhshan, A. (2022). Exploring teacher immediacy-(non)dependency in the tutored augmented reality game-assisted flipped classrooms of English for medical purposes comprehension among the Asian students. *Computers & Education*, 179, 104406. <https://doi.org/10.1016/j.compedu.2021.104406>
- Thomas, C., & Zolkoski, S. (2020). Preventing Stress among Undergraduate Learners: The Importance of Emotional Intelligence, Resilience, and Emotion Regulation. *Frontiers in Education*, 5, 94. <https://doi.org/10.3389/feduc.2020.00094>
- Torrance, E. P. (1990). *The Torrance tests of creative thinking norms—technical Manual figural (streamlined) forms A & B*. Scholastic Testing Service Inc.
- Tsai, Y. L., & Tsai, C. C. (2018). Digital game-based second-language vocabulary learning and conditions of research designs: A meta-analysis study. *Computers and Education*, 125, 345–357. <https://doi.org/10.1016/j.compedu.2018.06.0208>
- Ulfa, M., & Bania, A. S. (2019). EFL student's motivation in learning English in Langsa, Aceh. *Studies in English Language and Education*, 6, 163–170. <https://doi.org/10.24815/siele.v6i1.12860>

- Wang, H. C. (2018). Fostering learner creativity in the English L2 classroom: Application of the creative problem-solving model. *Thinking Skills and Creativity*, 31, 58–69. <https://doi.org/10.1016/j.tsc.2018.11.005>
- Wang, Y. L. (2017). Construction elements and path of practical education model in universities. *Eurasia Journal of Mathematics, Science and Technology*, 13, 6775–6782. <https://doi.org/10.12973/ejmste/78525>
- Wang, Y. L. (2023). Probing into the boredom of online instruction among Chinese English language teachers during the Covid-19 pandemic. *Current Psychology*, 43(1), 1–15. <https://doi.org/10.1007/s12144-022-04223-3>
- Wang, Y. L., Pan, Z. W., & Wang, M. Z. (2023). The moderating effect of participation in online learning on EFL teachers' teaching ability. *Heliyon*, 9(3), e13890. <https://doi.org/10.1016/j.heliyon.2023.e13890>
- Winne, P. H., & Nesbit, J. C. (2010). The psychology of academic achievement. *The Annual Review of Psychology*, 61, 653–678. <https://doi.org/10.1146/annurev.psych.093008.100348>
- Xodabande, I., & Atai, M. R. (2022). Using mobile applications for self-directed learning of academic vocabulary among university students. *Open Learn*, 37, 330–347. <https://doi.org/10.1080/02680513.2020.1847061>
- Xodabande, I., Iravi, Y., Mansouri, B., & Matinparsa, H. (2022). Teaching academic words with digital flashcards: Investigating the effectiveness of Mobile-assisted vocabulary learning for university students. *Frontiers in Psychology*, 13, 1–11. <https://doi.org/10.3389/fpsyg.2022.893821>
- Xu, Y., Shao, J., Zeng, W., Wu, X., Huang, D., & Zeng, Y. (2021). Depression and creativity during COVID-19: Psychological resilience as a mediator and deliberate rumination as a moderator. *Frontiers in Psychology*, 12, 665961. <https://doi.org/10.3389/fpsyg.2021.665961>
- Yang, S. C., & Chen, Y. J. (2007). Technology-enhanced language learning: A case study. *Computers in Human Behavior*, 23(1), 860–879.
- Ybarra, R., & Green, T. (2003). Using technology to help ESL/EFL students develop language skills. *The Internet TESL Journal*, 9(3). Retrieved from <http://iteslj.org/Articles/Ybarra-Technology>.
- Yousefi, M. H., & Biria, R. (2018). The effectiveness of L2 vocabulary instruction: A meta-analysis. *Asian-Pacific Journal of Second and Foreign Language Education*, 3(1), 21. <https://doi.org/10.1186/s40862-018-0062-2>
- Yun, S., Hiver, P., & Al-Hoorie, A. H. (2018). Academic buoyancy: Exploring learners' everyday resilience in the language classroom. *Studies in Second Language Acquisition*, 40, 805–830.
- Zhang, W., Ren, P., & Deng, L. (2020). Gender differences in the creativity–academic achievement relationship: A study from China. *The Journal of Creative Behavior*, 54, 725–732. <https://doi.org/10.1002/jocb.387>
- Ziegler, N. (2015). The predictive value of the self-regulating capacity in vocabulary learning scale. *Applied Linguistics*, 36, 21–23. <https://doi.org/10.1093/applin/amv020>

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