

## Effectiveness of Using Visual Vocabulary Application on Iranian EFL

### Learners' Vocabulary Knowledge

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#### **Abstract**

This study examined the effectiveness of using visual vocabulary application on Iranian EFL learners' vocabulary knowledge. To this end, 42 intermediated EFL learners were selected as the participants of the study and divided into two groups of 21- experimental and control. Then, the groups took a pre-test of vocabulary. After that, the experimental group received the treatment thorough visual vocabulary application. On the other hand, the control group participants were taught vocabulary items traditionally. After teaching all vocabulary items, a vocabulary post-test was administered to the participants of both groups to measure the effect of the treatment on their vocabulary development. The results of paired samples t-test and independent samples t-test indicated that that the experimental group outperformed the control group on the post-test. The results also indicated that there was a significant difference between the post-tests of both groups in favor of the experimental group. Finally, implications arising from the findings and suggestions for further research were explained.

**Keywords:** Mobile Learning, Visual Vocabulary Application, Vocabulary Knowledge

## **1. Introduction**

The usefulness of technology in education in general and in English as a Second Language (ESL) and English as Foreign Language (EFL) learning is undeniable. We frequently see that different types of technological devices including mobile phones, tablets, computers and many applications are used around the worlds to help EFL learners learn English language more efficiently. Mobile applications or multimedia aids are teaching tools based on computer technologies using sight or sound to deliver information. Films, videos, motion pictures, slide projectors, language tapes, multimedia games are some examples of multimedia aids (Rezaei, Mai, & Pesaranghader, 2015). Generally, the tools mentioned and applications are used for texting, browsing, playing games and socializing (Al Yafei & Osman, 2016).

In fact, mobile learning can provide new chances to follow educational materials, overcoming many limitations about times and places most suitable for learner access (Romero, Zarraonandia, Aedo, & Díaz, 2010). Mobiles, tables, and other technological devices are easily portable to other places, therefore, they can help students greatly to learn English language. Mobile learning has been confirmed to develop the learning and retention of L2 vocabulary. This is due to the characteristics of mobile devices that can permit students “to easily access learning materials at any time and place, overcoming many problems such as the limited language practice and the lack of language exposure” (Al Yafei & Osman, 2016, p. 288).

As interest in vocabulary acquisition is growing, today various kinds of tools are used to teach students; one of these tools is mobile applications. Still research in English language teaching and learning has often underestimated the vocabulary resources of the language. The effectiveness of mobile learning in education is still in its first stages of implementation and

concepts and instructional issues surrounding mobile learning are still evolving and require further research (Kukulka-Hulme, 2007; Namaziandost, Rezvani, & Polemikou, 2020). The significance of this studies comes from the feedback it provides on mobile applications and their effectiveness, where app developers can see how the selected applications are making difference on students' learning performance in real life and through the detailed questionnaire strength and weakness points are revealed. Not to mention how the proved influence of an application's effectiveness can help instructors to come up with new teaching methods that involve assigning applications as a homework and only do post-testing to make an evaluation. Multimedia aids are beneficial in different aspects of education, especially language acquisition. They lower student's stress and anxiety, especially students who cannot involve in classroom activities due to shyness or lack of confidence, what's more they motivate and encourage students by providing a fun platform through which the content is delivered as well as increasing communicative competence.

Using mobile applications may help EFL learners to increase their vocabulary repertoire. Learning new vocabulary items is an essential part of learning a new language. Moras and Carlos (2001) assert that vocabulary teaching should be a part of the syllabus and taught in a well-planned and regular basis. Some have claimed that to comprehend nontechnical English texts, students should know at least 5,000 lexical items (Laufer, 1998; Namaziandost, & Çakmak, 2020; Nation, 2006). Vocabulary learning can happen in two environments (i.e., technology-based and traditional environment) (Saleh Mahdi, 2018; Namaziandost, Hosseini, & Utomo, 2020). Technology-based environment refers to the use of new technologies for vocabulary learning such as television, computer, personal digital assistants, and mobile devices. The other environment is the traditional ways such as word cards, dictionaries, and

word lists. With the help of technology-based environments, vocabulary can be presented in different modes such as video captioning, subtitling, and annotations (Saleh Mahdi, 2018; Namaziandost, Sawalmeh, & Izadpanah Soltanabadi, 2020).

Regarding the effectiveness of using mobile applications on language learning, some experimental studies were conducted, for example, Rezaei, Mai, and Pesaranhader (2014) investigated the effectiveness of mobile applications on English vocabulary learning. This research studied intermediate-level English learners' performance before and after using mobile applications that were introduced to the study group as an intervention. It examined whether multimedia courseware can affect the vocabulary learning in the second language acquisition. The quantitative data revealed positive change in learners' performance and the questionnaire analysis indicated that using the applications helped enhance learning of vocabulary, confidence, class participation and that, students had a positive tendency toward the use of multimedia in education.

In another study, Gürkan (2018) examined students' views on the effects of a mobile assisted vocabulary learning (MAVL) application (VocaStyle). The data was gathered with semi-structured interview form. Ten participants were interviewed, five of which were aural learners and five of which were visual learners. The data was analyzed with thematic content analysis. The findings revealed that students found the MAVL application effective, motivating and useful. The findings also indicated that participants found video and graphic annotations more useful and their views changed depending on their learning styles.

Despite its importance in teaching and learning, technology has not yet received the attention it deserves. Besides, in Iranian EFL educational contexts, technological tools are used less in teaching and learning process, teachers are not fully familiar with new technological apparatuses and students do not have access to these tools since they are expensive. Because of the mentioned problems, many of Iranian EFL contexts are deprived of using new technological devices.

After reviewing the related literature, it is seen that no empirical studies have been done on the effectiveness of visual vocabulary application on Iranian EFL learners' vocabulary knowledge. Therefore, regarding the popularity and usefulness of technological devices and mobile applications in English language learning, this study intends to examine the effectiveness of visual vocabulary application on Iranian EFL learners' vocabulary knowledge. Accordingly, the following research question was posed.

**RQ.** Dose teaching through visual vocabulary application have any effect on Iranian EFL learners' vocabulary knowledge?

Based on the above-stated question, the following null hypothesis was formulated:

**HO.** Teaching through visual vocabulary application does not have any effect on Iranian EFL learners' vocabulary knowledge.

## **2. Method**

### **2.1 Participants**

In order to carry out this study, the Oxford Quick Placement Test (OQPT) was administered to 63 students at Parsian English Institute, Ahvaz, Khuzestan, Iran. Based on their performance in the mentioned test, 42 of them were at intermediate level and were selected as the

participants of the study. Then, the participants were divided into two groups of 21- experimental and control. The participants' age range was 16 to 18 years old and they had the same native language (Persian). The participants of this study were all male.

## **2.2 Instruments**

The first instrument which was used in the present research to homogenize the participants was the OQPT. This test has 60 multiple-choice items and based on it, the learners whose scores are 0 to 29 are considered as elementary; those learners whose scores are 30 to 39 are pre intermediate; the students whose scores are 40 to 47 are intermediate; the learners whose scores are 48 to 54 are considered as the advanced learners and those whose scores are 55 to 60 are very advanced learners.

The second instrument which was used in the current study was a researcher-made vocabulary pre-test. The pre-test included 40 multiple-choice items from the students' course book (Vocabulary for High School). The reliability and validity of the test were calculated. After making the test, it was checked by 3 English experts for its face and content validity. That is, for making sure about the Content Validity Index (CVI) of the test items, 3 English university instructors checked the test and offered some changes concerning the clarity, simplicity and the representativeness of items. As a result, the researchers modified some items of the test and then they piloted it on 10 students in another high school who were the same as the target groups regarding their course book and English proficiency level. Then, the researchers computed the reliability of the pretest through using KR-21 formula ( $r=0.821$ ). The allocated time for answering the test was 30 minutes.

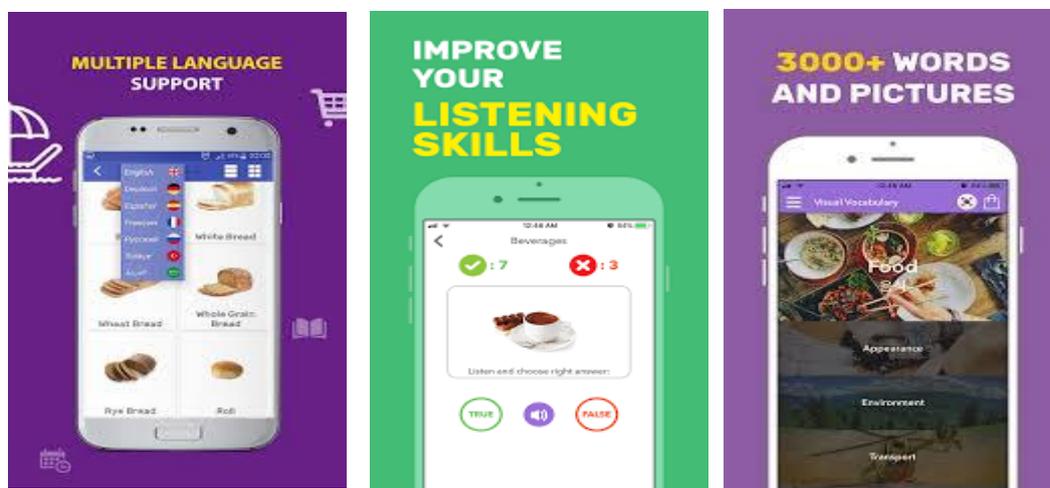
The third instrument utilized in this study was a vocabulary post-test. The modified version of the pre-test was used as the post-test of the study. All characteristics of the posttest were the same as those of the pre-test in terms of type and the number of items. The only difference of this test to the pre-test was that the order of questions and alternatives were changed to avoid the probable recall of the pre-test answers. It was administered to help the researchers measure the effectiveness of the treatment on the students' vocabulary learning improvement. Since the post-test was the same as the pre-test, it was regarded both valid and reliable (the reliability and validity of the pre-test were reported above).

### 2.2.1 Visual Vocabulary Application

English Visual Vocabulary is an Android application which provides the learners with an amusing learning environment. This app delivers its materials using a picture-mediated leaning design. With more than 3000 words accompanied with pictures and pronunciations, VVA can cover 14 main topics that are divided into 75+ subtopics. The application supports Flashcard for each topic and also offers listening tasks.

**Figure 1.**

*Snapshots of Visual Vocabulary Application*



### **2.3 Materials**

The participants' degree of familiarity with the target items was realized through a vocabulary list. In other words, a list of 100 words was prepared by the researchers and it was given to the students to determine their familiarity with the words. If a word was known to the majority of the participants, then it was excluded from the study. After answering this list, it was revealed that about 70 words were unfamiliar and unknown for the students and they were regarded as the target words.

### **2.4 Procedures**

To do this study, first of all, 42 intermediated participants were selected and divided into two groups of 21- experimental and control. Then, both groups were pretested by a vocabulary test. After that, the experimental group received the treatment thorough Visual Vocabulary Application- an awesome tool consists of 3000 words with pictures and examples. It should be noted that the participants of the experimental group were required to install the mentioned Application on their mobile phones. The participants of the experimental group were taught 10 words in each session through using the aforementioned Application. On the other hand, the vocabulary items were taught to the participants of the control group traditionally. The words were delivered to the students on a pamphlet and in each session 10 of them were taught to the participants. After teaching all vocabulary items to the both groups, a vocabulary post-test was administered to the participants to determine the effectiveness of the treatment on their vocabulary development.

### 2.5 Data Analysis

In order to answer the research question, data analysis was carried out by using Statistical Package for Social Science (SPSS) software version 22. Firstly, Kolmogorov- Smirnov (K-S) test was used in order to check the normality of the data. Secondly, descriptive statistics including means and standard deviation were calculated. Finally, to examine the impacts of the treatment on Iranian EFL learners' vocabulary knowledge, a paired samples t-test and an independent samples t-test were run.

### 3. Results

In order to analyze the gathered data, the SPSS software, version 22 software was used. The results of paired samples t-test and an independent samples t-test indicate that the treatment had positive effects on the participants' vocabulary knowledge development. Table 1 shows that the statistics of scores is normal as the results obtained from using SPSS 22. In this case, the parametric statistics like independent samples t-test and paired samples t-test can be used to get the final results.

**Table 1**  
*One-Sample Kolmogorov-Smirnov Test (Groups' Pre and Post-tests)*

		One-Sample Kolmogorov-Smirnov Test			
		CG. Post	CG. Pre	EG. Post	EG. Pre
N		21	21	21	21
Normal Parameters <sup>a,b</sup>	Mean	15.61	15.04	18.42	15.28
	Std. Deviation	3.00	2.9	1.69	2.90
Most Extreme Differences	Absolute	.14	.23	.30	.21
	Positive	.14	.23	.17	.21
	Negative	-.11	-.15	-.30	-.13
Kolmogorov-Smirnov Z		.64	1.06	1.37	.97
Asymp. Sig. (2-tailed)		.79	.20	.14	.29
a. Test distribution is Normal.					
b. Calculated from data.					

In table 2, the pre-test descriptive statistics of both groups is presented. The control group's mean score is 15.04 and the experimental group's mean score is 15.28. The mean scores of both groups seem equal on the pre-test.

**Table 2**  
*Pre-test Descriptive Statistics of Both Groups*

	N	Mean	Std. Deviation	Std. Error Mean
CG	21	15.04	2.90	.63
EG	21	15.28	2.95	.64

In Table 3, an independent samples t-test was used to show the significant difference between the pre-test of both groups. Based on this table, Sig (.794) is greater than 0.05, so the difference between the groups is not significant at ( $p < 0.05$ ). In fact, they performed the same on the pre-test.

**Table 3**  
*Independent Samples t-test (Pre-test of Both Groups)*

	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	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	.01	.91	.26	40	.794	.23	.90	-1.58	2.06
Equal variances not assumed			.26	39.98	.794	.23	.90	-1.58	2.06

Table 4 presents the descriptive statistics of both groups on the post-test. The means of the groups are different. The control group's mean score is 15.61 and the experimental group's mean score is 18.42. It seems that the experimental group outperformed the control group on the post-test.

**Table 4**

*Post-test Descriptive Statistics of Both Groups*

	N	Mean	Std. Deviation	Std. Error Mean
CG	21	15.61	3.00	.65
EG	21	18.42	1.69	.36

Table 5 indicates that Sig (.001) is less than 0.05, so the difference between the groups is significant at ( $p < 0.05$ ). In fact, the experimental group outperformed the control group on the post-test.

**Table 5**

*Independent Samples t-test (the Post-test of Both Groups)*

	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	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	12.73	.001	-3.73	40	.001	-2.80	.75	-4.33	-1.28
Equal variances not assumed			-3.73	31.48	.001	-2.80	.75	-4.34	-1.27

In table 6, a paired samples t-test is used to compare the pre and post-tests of each group. As seen in this table, the difference between the pre-test and post-test of the control group is not significant since Sig (.168) is greater than 0.05. On the other hand, the difference between the pre-test and post-test of the experimental group is significant since Sig (.000) is less than 0.05. We can say that the treatment - visual vocabulary application - had a significant effect on vocabulary learning of Iranian EFL learners.

**Table 6***Paired Samples T-test (Pre and Post-tests of Each Group)*

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	CG. Post – CG. Pre	.57	1.83	.39	-.26	1.40	1.42	20	.168
Pair 2	EG. Post – EG. Pre	3.14	1.74	.37	2.35	3.93	8.27	20	.000

#### 4. Discussion

In this part, the research question “*Dose teaching through visual vocabulary application have any significant effect on Iranian EFL learners’ vocabulary knowledge?*” is answered. Based on the results reported above, those participants who received the treatment through visual vocabulary application outperformed the control group who received a traditional vocabulary instruction. Therefore, the null hypothesis of the study “*Teaching through visual vocabulary application does not have any significant effect on Iranian EFL learners’ vocabulary knowledge*” is rejected.

The improvement of the experimental participants can be attributed to the effectiveness and novelty of visual vocabulary application as a kind of new and useful technological device. We can say that visual vocabulary application is more attractive for the students and this application may help them to recall the English words better and improve their retentive memory as well. Mobile devices include features of connectivity, social interactivity, context sensitivity, portability and individuality which personal computers may not do (Klopfer, Sheldon, Perry & Chen, 2012). The findings of this study are in line with the previous studies (e.g., Rezaei et. al,

2014; Gürkan, 2018) which indicated that mobile devices were useful tools for language learning. On the other hand, this study is in contrast to some studies (e.g., Alemi, Sarab, & Lari, 2012; Stockwell, 2010; Tosuna, 2015) which showed that there was no statistically significant difference in the effect of using mobile devices on vocabulary learning. The reason of the contrast between the results of the current study to the results of the previous studies may be due to the fact that nowadays students are more familiar with the mobile applications, they use mobile applications most of the time (both in and out of the classroom), therefore, we can say that the frequent use of mobile applications can help EFL learners to develop their English learning.

Convenience and availability of applications can pave the way for EFL learners to learn English language more successfully. In fact, applications are available both in and out of the classrooms and this availability provides opportunity for the students to learn English language beyond classroom borders. In other words, instructional activities are not limited to a specific place and time, but can be carried out in any place at any time and students can engage, often asynchronously, with teachers, learning resources and other learners (Bornman, 2012). Therefore, we can conclude that instructors can enhance students' knowledge of vocabulary through using multimedia aids.

The findings of the study support the idea that using mobile applications helps vocabulary acquisition. Particularly it can be concluded from the results that an effective way to improve the learning of English vocabulary based on Mayer's (1997) principle is to present the contents through graphics to show the meaning of words to help students remember. When mobile

application was used, the students showed more motivation to learn vocabulary since it helped visualize the definitions in a meaningful manner.

The result of this research reinforces that of Yousefzadeh (2012) who have investigated the supremacy of learning mobile-based collocation words compared with learning classical paper-based collocation words. The outcome indicated mobile community dominance over paper dependent group.

The results are compatible with Chen 's observations (2008), which examined the usage of cell phones to distribute vocabulary resources to Taiwanese English learners. The findings revealed that learners from the EFL favored utilizing cell phones because of their convenient exposure to resources and their willingness to train anytime and wherever.

The results in this research about the usefulness of the vocabulary application are in line with Stockwell (2007) who concluded that the future usage of smartphone phones was excellent and that the learners ' vocabulary awareness was improved by utilizing the web-based smart vocabulary program.

The findings of this study are supported by Hashemifardnia, Namaziandost, and Rahimi Esfahani (2018) who investigated the effects of using WhatsApp on Iranian EFL learners' vocabulary learning. They concluded that concluded that using WhatsApp helped the experimental group to improve their vocabulary knowledge.

Most research projects conducted on vocabulary acquisition and multimedia-assisted language learning, focus on the effects of multimedia glosses. According to Baker (1995) studies on computer-assisted methods of teaching prove them to be more attractive to learners for three main reasons. First, these kinds of interventions need less direct teacher participation than teacher-led instructions. Next is the ability to customize the instructions and make the techniques and vocabulary goals easy, and last, the potential to systematically repair essential instructional design features within the change framework which includes instructional scaffolding and integration across academic areas (Magogwe & Oliver, 2007).

What is more in an article about the relationship between multimedia annotations and vocabulary acquisition, Chun and Plass (1996) talk about the positive results of three studies on students in second year of German who used Cyber bunch, a multimedia application which provides many annotations (pictures, texts, videos) (Chun & Plass, 1996). The results driven from this study as well supported the driven conclusion from the past studies on the effects of various types of annotation, that found out that visual imagery helps learning and remembering new foreign words Chanier and Selva (1998) as well emphasized on the benefits of multimedia in learning L2/FL vocabulary and they introduced Alexia, a French vocabulary learning environment in vocabulary acquisition process (Chanier & Selva, 1998).

## **5. Conclusion**

This study confirmed the positive effects of using visual mobile application on developing Iranian EFL learners' vocabulary knowledge. We come to the conclusion that using technological based instruction is effective for learning and teaching English language. It can be more appealing and

motivating for the students and it can provide more chances for the students to improve their English language even when they are not present in the educational environment. However, as Kukulska-Hulme (2009) stated this can also be disadvantageous since learning that happens outside the classroom is beyond the control of the teacher, therefore, careful planning need to be made to establish a strong connection between “what is best learnt in the classroom, and what should be learnt outside the classroom” (p. 164).

Multimedia can be used as a great asset to help vocabulary development. As it provides features which are not accessible by any other conventional instructional tools, such as offering variety of example, i.e. videos, sound, pictures, animation, and accessibility what’s more, researchers have studied the effectiveness of these features that can enhance incidental vocabulary learning through the use of multimedia (Al-Seghayer, 2005).

## **6. Limitations and Suggestions of the Research**

This study has some limitations; one limitation is that the study included only participants that were 16 to 18 years old. So, the results cannot be generalized to the other age groups. The population was limited to 42 people. Therefore, this cannot be generalized either. Furthermore, this study was one month long so it may not bring about everlasting effects. Finally, this study was conducted on male students and the females were not included.

This study offers some recommendations for the next studies; it is suggested that the next researchers examine the effects of visual vocabulary application on more vocabulary items to get more valid and reliable results. Also, this study suggests the next researchers to include more

participants to increase the generalizability of their studies. Moreover, next studies are offered to use a triangulation method to examine the effects of visual vocabulary application on EFL learners' vocabulary learning.

## **References**

- Al Yafei, O., & Osman, M. (2016). Mobile phone apps: an emerging e-platform for vocabulary learning and retention. *Journal of Applied Linguistics and Language Research*, 3(7), 286-308.
- Alemi, M., Sarab, M. R. A., & Lari, Z. (2012). Successful learning of academic word list via MALL: Mobile assisted language learning. *International Education Studies*, 5(6), 99–109.
- Al-Seghayer, K. (2005). The effect of multimedia annotation modes on L2 vocabulary acquisition. *Research in Technology and Second Language Education: Developments and Directions*, 3, 133-151.
- Baker, S. K. (1995). *Vocabulary acquisition: Synthesis of the research*: National Center to Improve the Tools of Educators, College of Education, University of Oregon.
- Bornman, E. (2012). The mobile phone in Africa: has it become a highway to the information society or not? *Contemporary Educational Technology*, 3(4), 278-292.
- Chanier, T., & Selva, T. (1998). The ALEXIA system: the use of visual representations to enhance vocabulary learning. *Computer Assisted Language Learning*, 11(5), 489-521.
- Chen, C. H. (2008). Why do teachers not practice what they believe regarding technology integration? *Journal of Educational Research*, 102, 65-75.
- Chun, D. M., & Plass, J. L. (1996). Effects of multimedia annotations on vocabulary acquisition. *The modern language journal*, 80(2), 183-198.
- Gürkan, S. (2018). The effects of a mobile assisted vocabulary learning application on vocabulary learning. *Computer Assisted Language Learning*, 237(3), 17-29.
- Hashemifardnia, A., Namaziandost, E., & Rahimi Esfahani, F. (2018). The effect of using WhatsApp on Iranian EFL learners' vocabulary learning. *Journal of Applied Linguistics and Language Research*, 5(3), 256-267.

- Klopfer, E., Sheldon, J., Perry, J., & Chen, V. H. H. (2012). Ubiquitous games for learning (UbiqGames): Weatherlings, a worked example. *Journal of Computer Assisted Learning*, 28, 465-476.
- Kukulka-Hulme, A. (2009). Will mobile learning change language learning? *ReCALL*, 21(2), 157-165.
- Laufer, B. (1998). The Development of passive and active vocabulary in a second language: Same or different? *Applied Linguistics*, 19(2), 255-271.
- Magogwe, J. M., & Oliver, R. (2007). The relationship between language learning strategies, proficiency, age and self-efficacy beliefs: A study of language learners in Botswana. *System*, 35(3), 338-352.
- Mayer, R. E. (1997). Multimedia learning: Are we asking the right questions? *Educational psychologist*, 32(1), 1-19.
- Moras, S., & Carlos, S. (2001). *Teaching vocabulary to advanced students: a lexical approach. Karen's linguistics issues.* Sao Carlos, Brazil. Available <http://www3.telus.net/linguisticissues/teachingvocabulary.html>
- Namaziandost, E., & Çakmak, F. (2020). An account of EFL learners' self-efficacy and gender in the Flipped Classroom Model. *Education and Information Technologies*, 25(2). <https://doi.org/10.1007/s10639-020-10167-7>
- Namaziandost, E., Hosseini, E., & Utomo, D.W. (2020). A comparative effect of high involvement load versus lack of involvement load on vocabulary learning among Iranian sophomore EFL learners. *Cogent Arts and Humanities*, 7(1). <https://doi.org/10.1080/23311983.2020.1715525>.
- Namaziandost, E., Rezvani, E., & Polemikou, A. (2020). The impacts of visual input enhancement, semantic input enhancement, and input flooding on L2 vocabulary among Iranian intermediate EFL learners. *Cogent Education*, 7(1). DOI: [10.1080/2331186X.2020.1726606](https://doi.org/10.1080/2331186X.2020.1726606)
- Namaziandost, E., Sawalmeh, M. H. M., & Izadpanah Soltanabadi, M. (2020). The effects of spaced versus massed distribution instruction on EFL learners' vocabulary recall and retention. *Cogent Education*, 7(1). DOI: [10.1080/2331186X.2020.1792261](https://doi.org/10.1080/2331186X.2020.1792261)
- Nation, I. S P. (2006). How large a vocabulary is needed for reading and listening? *The Canadian Modern Language review*, 63(1), 59-82.

- Rezaei, A., Mai, N., & Pesaranghader, A. (2015). Effectiveness of using English vocabulary mobile applications on ESL's Learning performance. *Journal Teknologi (Sciences & Engineering)*, 68(2), 73–83.
- Romero, R., Zarraonandia, T., Aedo, I., & Díaz, P. (2010). Designing usable educational material for English courses supported by mobile devices. *Lecture Notes in Computer Science*, 63, 373-383.
- Saleh Mahdi, H. (2018). Effectiveness of mobile devices on vocabulary learning: A meta-analysis. *Journal of Educational Computing Research*, 56(1), 134–154
- Stockwell, G. (2007). A review of technology choice for teaching language skills and areas in the CALL literature. *ReCALL*, 19(2), 105-120.
- Stockwell, G. (2010). Using mobile phones for vocabulary activities: Examining the effect of the platform. *Language Learning and Technology*, 14(2), 95–110.
- Tosuna, S. (2015). The effects of blended learning on EFL students' vocabulary. *Procedia Social and Behavioral Sciences*, 199, 641–647.
- Yousefzadeh, M. (2012). Mobile- based learning vs. paper-based learning and collocation words learning. *Journal of Educational and Instructional Studies*, 2(3), 216-220.