

# Exploring Perspectives of Students on Using Mobile Apps to Improve English Vocabulary Through Youtube Videos: A Comparative Study

Otto Parra<sup>a</sup>, Edisson Reinozo and María Fernanda Granda<sup>b</sup>  
*Department of Computer Science, University of Cuenca, Cuenca, Ecuador*

**Keywords:** The English Vocabulary, Youtube Videos, Spaced-Learning, Multi-Criteria Decision Making.

**Abstract:** Currently, in countries where the mother tongue is not English language, globalization brings a very important requirement related with level of English since it facilitates communication in any area, be it, business, education, tourism, and so on. People need to have a good mastery of the English language, however, if the mother tongue is different from English, dominating the English language can become a very serious problem. Under these circumstances, in countries where the mother tongue is not English, educational institutions have included meaningful learning of English as a second language in their curriculum for many years. Vocabulary is one of the essential components of any language and it is required get a good level in order to have success in the process of teaching/learning of the English. Spaced repetition has been widely implemented and examined in mobile-assisted vocabulary learning as an important learning strategy. In this context, the purpose of this comparative study was to investigate and compare university students' perspectives utilizing two mobile apps to improve English vocabulary in the Language Department at University of Cuenca (Ecuador): the first application is Slango and the second was chosen applying multi-criteria decision making of a set of mobile apps with similar features than Slango. Therefore, we did a comparative evaluation of the two mobile apps in order to evaluate usability by using SUS questionnaire and desirability by using Microsoft Desirability Test. Results show that Slango has similar features as ReadLang (the second app to compare) when it is used to improve student English vocabulary using YouTube videos.


## 1 INTRODUCTION


In countries where the mother tongue is not English language, it is presented as a mandatory requirement in many areas of the society (education, tourism, business, among others.) to achieve its internationalization (Vallejo Jiménez et al., 2023), also, it is even conceived as a differentiation characteristic to achieve competitiveness. For this reason, in some sectors of the population there is a great interest in achieving a mastery of the English language, to the point that it is the mandatory language of the curricula of the countries of the region. However, according to (Cronquist & Fiszbein, 2017) despite the importance of the English language, educational systems have low English domain levels.

The rapid development of the technology related to education (Web 2.0 and mobile-assisted learning) has allowed the emergence of a set of applications

that try to help users learn/practice the English language (Chen et al., 2020). Along with mobile technology and applications that allow users to practice English vocabulary, a well-known methodology in the educational field called spaced repetition has been used (Zhang et al., 2022), it is a learning technique that distributes vocabulary learning and practice into multiple sessions over a period of time to optimize learning outcomes, is one of the most important learning strategies that have been widely integrated into mobile-assisted vocabulary learning (Settles & Meeder, 2016).

Some authors claimed that vocabulary learning might support the skills required to the communication: listening, speaking, reading, and writing (e.g. (Yunus & Saifudin Muhammad, 2019), (A/P Prabha & Abdul Aziz, 2020)). The result showed that most students claimed that vocabulary learning strategies such as media, movies, internet materials,

<sup>a</sup>  <https://orcid.org/0000-0003-3004-1025>

<sup>b</sup>  <https://orcid.org/0000-0002-5125-8234>

note-taking, and concept mapping were very useful in their learning process (Schimanke et al., 2013).

Currently, there are some mobile apps and websites to learn English vocabulary or practice known vocabulary, using spaced repetition (Martínez-Valencia et al., 2021). In our research work, we are interested in mobile apps because the mobile devices have become useful instruments that support the teaching and learning process due to their ubiquity, multi-functionality and Internet connectivity (Cabrera-Solano et al., 2020).

Then, the mobile apps of interest for our research work are those that use YouTube videos to help users improve their English vocabulary by using the spaced repetition system (SRS) method. The use of YouTube, social media and other Web 2.0 technologies in education has been proposed as a tool to engage new generation students (Sakkir et al., 2020). In this context, we need two mobile apps to compare university students' perspectives utilizing them to improve English vocabulary. The first mobile app is Slango, a non-commercial application, it was developed as part of our research work based on requirements obtained with university students in Cuenca (Ecuador). In order to obtain the second mobile app, we consider five mobile (Table 1) to select the second mobile app using multi-criteria decision making (MCDM) method (Soniya et al., 2021).

Table 1: Mobile app selected.

Mobile App name	URL
Memrise	<a href="https://www.memrise.com/app">https://www.memrise.com/app</a>
Quizlet	<a href="https://quizlet.com/">https://quizlet.com/</a>
Duolingo	<a href="https://en.duolingo.com">https://en.duolingo.com</a>
rosetta Stone	<a href="https://www.rosettastone.com/">https://www.rosettastone.com/</a>
readLang	<a href="https://readlang.com/">https://readlang.com/</a>

Under this perspective, our work is justified from different aspects, thus from a social perspective, the Slango application represents a contribution to English language teaching strategies, since it is based on the SRS method, which is conceived as an evidence-based learning technique, where new vocabulary is learned and gives the possibility of reviewing several times, thereby guaranteeing learning (Seibert Hanson & Brown, 2019). The comparative evaluation is detailed in the next sections and it is based on the university students' perspective when the usability evaluation and the desirability test according to Microsoft Desirability Test (Perez-Medina et al., 2021) are applied.

Therefore, the contribution of this paper is twofold: (1) Slango, a non-commercial mobile app for the Android platform, and (2) the comparison of two mobile apps for learning English Vocabulary through YouTube videos.

## 2 BACKGROUND

In this section, we include some concepts obtained from the related literature with our research work.

According to (Tinsley & Board, 2014), the Spanish language is one of the most widely spoken language in the world with approximately 400 million native speakers, however, following globalization, there are more and more people who learn to speak English as second language, due to the importance it has at the academic and professional levels as it is considered as part of the curriculum from the primary level to the university.

(García et al., 2016) refer that the teaching of the English language is going through several transformations that are awarded to the constant modification of educational systems, which seek to innovate, and improve the teaching-learning process, because to learn a foreign language, it is not enough to limit yourself to understanding or writing texts, it is also necessary for the student to develop auditory and oral expression skills, with this the approach to teaching includes the use of methods to develop them.

Advances related to the scientific field in understanding the functioning of human memory favours the development of models and systems that allow the application of learning strategies in computer programs. The curve of oblivion (or Ebbinghaus Curve of Forgetting) (Dandan, 2020) and the spacing effect became the two principles of cognitive science that are key to the design of spaced repetition algorithms that are commonly used by several applications. This curve refers to the ease with which you can forget the more time passes, if this applied to education implies that, from the data received by a student, there is less probability than remember in a larger time period, which is why it must be reinforced by repetitions over time, which is called spaced learning or effect (Palomares, 2022).

(Wozniak, 2018) points out that the concept of spaced repetition is an intuitive tradition with a greater probability of remembering information when a content review is carried out during a longer period of time and in increasingly spaced intervals in time.

On the other hand, if it is necessary to select a product/service from a set of alternatives based on a set of characteristics that can be established and that will help in the selection process, it is possible to use the method called MCDM. It is the process of determining the best solution to problems that are criteria that commonly arise in everyday life (Soniya et al., 2021). MCDM is the selective process of finding a decision, gathering information, and evaluating alternative outcomes. In MCDM, there are

some main methods: TOPSIS, AHP, PRAGMA, SMART, etc. (Taherdoost & Madanchian, 2023). In our research work, we are focused on TOPSIS. The main idea of this technique, the preferred alternative is the one with the closest to the positive ideal solution and the further to the negative ideal solution (Chakraborty, 2022).

Slango is a mobile app implemented in our research work using Domain Driven Design (DDD) approach (Evans, 2003) because it allows the development of a mobile app that is extensible and maintainable. DDD is nothing more than a collection of principles and design patterns that allow the development of complex systems. The mobile app was developed to allow users to learn vocabulary in English through YouTube videos. In the design process, we consider the user-centred design and define the user PERSONA with the aim of being able to create representations of the users that the app will have. The objective of these representations is to generalize and identify the types of users of Slango.

Regarding ReadLang, is a multi-platform web application designed with mobiles and tablets in mind that helps students in understanding the reading text of a foreign language. Each language consists of several chapters and each chapter also has many options which help to learn in a fun way. Reading the text accompanied by the available translations of words and phrases. This platform also has exercises in the form of flash cards that can help learners in remembering vocabulary lists in reading text. The use of the Readlang is quite simple and easy to use and can be accessed anywhere with an adequate internet connection, either through smartphones or laptops (Magfirah et al., 2022).

### 3 APPLYING TOPSIS TO SELECT THE SECOND MOBILE APP

By means of a focus group session, the researchers involved in the research work decided the features to consider when someone requires to select a mobile app to learn English vocabulary by using YouTube videos. The list of mobile app features (Table 2) can be summarized as follows:

- i. Cost: we consider two options: (a) it specifies how much cost the license of the app, and (b) there is a free version of the app.
- ii. Vocabulary manager: a component of the app which permits that the user can manage the vocabulary revised.

- iii. Integration with YouTube: it is important because in our research work, we consider YouTube as required to practice vocabulary.
- iv. Easy to use: students and teachers should use the software without help and independently. Error message must be clear and the system should recover after failure.
- v. Use spaced repetition: the software uses this method to learn the English vocabulary.
- vi. Usable and portable: the software should run on any mobile device using any web browser.

In order to apply TOPSIS, we consider the aforementioned five mobile app which use YouTube videos to practice English vocabulary (Table 1). The selection of the mobile apps and their features was carried out through Web searches (Table 2).

In order to apply TOPSIS, in the process, we need the following data:

- a) decision matrix (Zaini et al., 2015), a  $n \times m$  numeric matrix ( $m$  alternatives - the number of mobile apps - and  $n$  criterions) (Table 3).
- b) the weights vector, a numeric vector with length equal to number of columns in decision matrix for weights of criterions (Table 4).
- c) A character vector of "+" and "-" signs for the way that each criterion influences on the alternatives.

The weights assigned to each feature were determined in the aforementioned focus group where each of the researchers who participating in a focus group assigned a value to each feature included. The weights assigned to each feature are included in the Table 4, according to the importance of each feature in the selection of a mobile app. Then, TOPSIS is applied using R Studio obtaining the second mobile app. The results obtained are:

1. readLang
2. Memrise,
3. Duolingo,
4. Quizlet
5. Rosetta stone

The results shows that ReadLang is the app selected to use in the comparative evaluation.

### 4 PROBLEM STATEMENT

English language is presented as a mandatory requirement in many areas of the society to reach its internationalization and it is a differentiation characteristic to achieve competitiveness.

Table 2: Mobile app with their features.

Feature/app	Cost of license	Vocabulary manager	Integration with YouTube	Easy to use	Use spaced repetition	Usability and portability
Memrise	V	V	V	V	V	V
Quizlet	V	V	X	V	X	V
Duolingo	V	V	X	V	V	V
Rosetta Stone	V	X	X	V	V	V
readLang	V	V	V	V	V	V

Table 3: Decision matrix.

Feature/app	Cost of license	Vocabulary manager	Integration with YouTube	Easy to use	Use spaced repetition	Usability and portability
memrise	20	20	20	20	20	20
quizlet	10	10	0	10	0	10
duolingo	10	10	0	10	10	10
Rosetta stone	10	0	0	10	10	10
readLang	20	20	20	20	20	20

Table 4: Weights assigned to each feature.

Feature	Weight
Cost	0.05
Vocabulary manager	0.25
Integration with YouTube	0.25
Easy to use	0.05
Use spaced repetition	0.20
Usability and portability	0.20
<b>Total</b>	<b>1.00</b>

Under this perspective, the teaching of English seeks to be constantly evolving to establish new strategies based on innovative resources such as new technologies that contribute to meaningful learning and in the acquisition of communication competencies in English. In this regard, (Acosta et al., 2018) refer to the need to generate new pedagogical methodologies for the teaching of English, which must be generated from the culture of Latin America countries to obtain better results in the process.

In this regard, Ecuador is no stranger to the reality of the Latin American region, according to (Cruz Rizo et al., 2021) there is a generalized problem in the teaching of the English language that deals with the lack of linguistic - methodological interaction, to the communicative didactic. Also, (Fernandez et al., 2018) refer that in higher education institutions it is important that teachers' skills be improved, especially in the use of new technologies such as teaching tools, as well as the constant search to improve the professional profile of students, such as, for example,

by means of international certifications through integration with other educational centres.

In this way, the use of new information technologies is preponderant in the improvement of English learning capacities. According to (Chumaña et al., 2018), in Ecuador there are few initiatives that integrate the technological part as means for teaching, in most cases they are considered established applications, without individualizing the educational needs of the students.

The biggest challenge for teachers is to determine how and with what they can improve the linguistic and communicative skills of their students. The lack of development of tools that correspond to Ecuador's educational reality means that the only alternative is already established tools. In order to solve this situation, we develop a mobile app that using spaced repetition method and YouTube videos become a tool to that university students can improve their English vocabulary.

#### 4.1 Research Question

This paper attempts to answer the following research questions (RQ): *Regarding the English vocabulary learning process, is there any significant difference between the usability of SLANGO and ReadLang?*

#### 4.2 Research Hypothesis

The null hypothesis tested to address this research question is: H0: *“There is no difference between the usability of SLANGO and ReadLang in the English vocabulary learning process”.*



## 5 METHODOLOGY

This section describes the methodology used in this research work which contains seven steps (Gorscheck et al., 2006) (Figure 1).

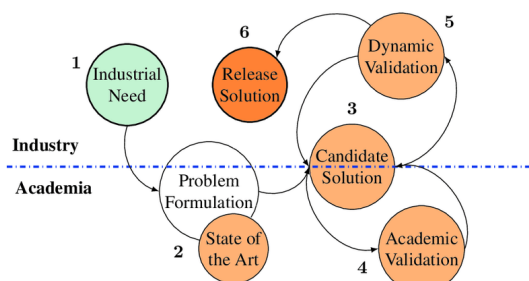


Figure 1: Overview of research approach and technology transfer model.

### 5.1 Population and Research Sample

The subjects who participated in the evaluation were students of English courses from two departments: Language Department and Computer Science Engineering of the University of Cuenca (Ecuador). The students belong to the English courses of levels A1 and B2. The sample size was 50 students for the evaluation of usability and desirability.

### 5.2 Instrumentation

For the execution of the evaluation, 4 instruments were developed for the collection of information. All the material required to support the experiment was developed beforehand, including the preparation of the experimental object, instruments and task description documents (TDD) for data collection used during the experiment. The instruments are described here:

- Sociodemographic information: general data about the participants.
- TDD: It describes the tasks to be performed in the experiment using the SLANGO and ReadLang. This document contains guidelines to guide the participants throughout the experiment.
- Microsoft Desirability: questionnaire that measures the attitude of users towards the proposed interface through a controlled vocabulary test, in total several qualities were presented where participants had to select the 5 characteristics according to the perception the application describes.

- Systems Usability Scale Score (SUS): measures satisfaction in terms of usability using a 10-item questionnaire. The participants were expected to rank their perspectives on a 5-point Likert scale (1: completely disagree, 5: completely agree).

In order to collect the information, the researchers socialized basic notions such as the definition and installation of Slango and ReadLang applications to the study participants.

### 5.3 Validity of the Instruments

Regarding the validity of the instruments, the sociodemographic questionnaire was assessed by two members of the research group to ensure its construct and content validity before its application to the participants. The desirability questionnaire and the SUS questionnaire are very known questionnaires in the field of the human-computer interaction.

### 5.4 Data Collection

Before carrying out the data collection process, pilot test was carried out in order to refine the process of questions and tasks. Its main objective was to ensure that there are no errors in the instruments and that the time for doing the tasks and filling out the form does not exceed the time delivered.

During the data collection related with the activities proposed to the users in the comparative evaluation, some vocabulary repetition tasks were established, which consisted of user registration, watching a video, adding vocabulary and the respective review. Once these activities are completed, the researcher conducts a brief orientation on the proposed questionnaires.

The entire process lasted approximately 70 minutes, where phase 1 took 10 minutes, phase two took 40 minutes and phase 3 about 20 minutes

Data were collected by means of Google Forms containing the questions included in each aforementioned instrument. The link was given to the users by means of WhatsApp messages during the session prepared to evaluate the mobile apps.

## 6 RESULTS AND DISCUSSION

This study compared university students' perspectives on using two mobile app to improve vocabulary learning. Descriptive and inferential statistics were used to answer the research questions. The results

obtained from the evaluation of the developed application are detailed, so that the results reflect information of usability and desirability evaluation.

### 6.1 Sociodemographic Results

Of the total number of participants in the execution of the experiment, 62% identify with the male gender, while women are represented by 36%.

Questions about the level of English proficiency of the participants were included, where 50% acknowledge having an intermediate B1 level. In second place, with 28% of the study sample, it is located in A2 (Basic level), in lower percentages (6%) are those who have an intermediate B2 level.

In accordance with the purposes of the application to use multimedia content, the frequency of use of the YouTube platform was determined. 46% of the participants, state that they rarely use these types of resources, 22% state that they are useful with some frequency, followed by 16% who admit to using them many times. With this, the possibility of incorporating an application that through the viewing of videos strengthens the learning capacity in terms of vocabulary in English is valid.

In relation to the intention of people to learn other languages through YouTube, 36% consider that they watch this type of video a few times a week, in contrast, 22% admit that they use said platform most days in the week, even 18% do this type of activity every day. Thus, the incorporation of the application that contributes to the learning of a language other than Spanish encourages self-learning in a young population segment that is interested in activities of this nature.

Regarding to the perception of the participants in using applications to learn English, the 38% of the participants give a qualification of "good" because the criteria are acceptable to the learning mechanisms, followed by 26% who consider that the previous experience is "very good", while 14% points an "excellent" rating. Consequently, most participants prove to have a pleasant experience around applications that encourage language learning.

### 6.2 Desirability Results

The results of the Microsoft Desirability questionnaire that was applied to the research participants, are shown in the following two figures in which the words that mentioned when describing the two applications are compared, the first shows the positive aspects and the second the negatives. Figure

2 shows regarding ReadLang app a greater number of participants mentioned that it is attractive, creative, friendly and fast, however, there is little difference between the useful and easy-to-use option. With this it is evident that from the user's perspective the Readlang app has greater positive characteristics than Slango.

Regarding the negative characteristics, it is evident that ReadLang is mostly qualified in these aspects, the majority refers that it is complex, it requires a lot of time, it is rigid, it is not a refined app and it is little attractive. For its part, Slango is attributed the same negative aspects, in quantity users who characterize it from this perspective are lower (Figure 3).

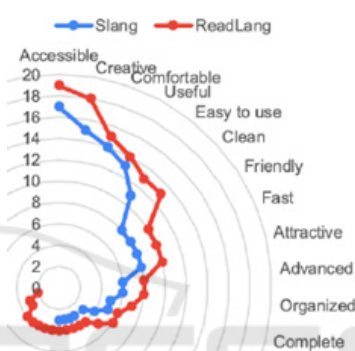


Figure 2: Positive adjectives given to the applications.



Figure 3: Negative adjectives used to qualify both apps.

### 6.3 Usability Results

The results obtained in the evaluation of the usability by means the SUS questionnaire are: 80 points to Readlang and 78 points to Slango. When identifying in the SUS scale, it is observed that Readlang is considered as the best imaginable, while that Slango as excellent.

The user experience evaluation is included in the following paragraphs. Table 5 and Table 6 show that the applications have similar values on average, where the difference is not shown as significant; ReadLang presents greater values in attractiveness, perspicuity, efficiency, and dependability; while Slango presents a value of stimulation greater than ReadLang. Finally, Slango and ReadLang presents the same value about Novelty (1.58).

Next, the statistical analysis of the average value is presented to identify whether there are significant differences applying t-Student. Table 7 shows that there are no statistically significant differences in the dimensions that the UEQ evaluates, in consideration, that the two obtained results above the average, it is considered that the two represent a good experience for the users.

Table 5: UEQ Results of SLANGO.

Scale	Mean	Comparison to benchmark
Attractiveness	1.95	Excellent
Perspicuity	1.99	Good
Efficiency	1.51	Good
Dependability	1.44	Above average
Stimulation	1.48	Good
Novelty	1.58	Good

Table 6: UEQ Results of ReadLang.

Scale	Mean	Comparison to benchmark
Attractiveness	1.98	Excellent
Perspicuity	2.09	Excellent
Efficiency	1.60	Good
Dependability	1.51	Good
Stimulation	1.35	Above average
Novelty	1.58	Good

Table 7: Results of t-Student.

Variable	t-value	Significance
Attractiveness	0.9112	No significant difference
Perspicuity	0.6906	No significant difference
Efficiency	0.7251	No significant difference
Dependability	0.7254	No significant difference
Stimulation	0.6512	No significant difference
Novelty	0.9897	No significant difference

## 7 CONCLUSIONS AND FUTURE WORK

Without a doubt, in the learning process of a language, the vocabulary plays an important role

since based on the acquired vocabulary, a person can express their ideas or communicate with other people. Therefore, if a person can have applications that help to practice the vocabulary learned, especially if the vocabulary is included in videos in the English language which will help in the process of getting to dominate the language under study.

In comparison with ReadLang, a commercial product, results have been obtained that shows that Slango is an application that has a future in the field of using YouTube videos to practice vocabulary, and in general, the English language.

As future work, it is important that the system is considered to be customized to the level of knowledge of the English language of the user. This may be reflected presenting videos based on the student's level of knowledge or at a deeper level. It is very interesting to explore with a system that accompanies the user in the new vocabulary selection flow while observing a video and recommends words and phrases that can be useful, can learn and ignore phrases outside their level of knowledge.

Another important consideration is to incorporate a collective virtual learning environment that allows users to learn in a group of friends, family or colleagues, where vocabulary can be shared and learn significantly.

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## REFERENCES

- Acosta, R., García, M., & Carcedo, R. (2018, diciembre). La enseñanza de lenguas extranjeras desde el contexto latinoamericano. *Mendive*, 16(4), 11.
- A/P Prabha, T., & Abdul Aziz, A. (2020). Effectiveness of Using Poly Category Mind Map for Vocabulary Development. *Arab World English Journal*, 11(2), 214-231. <https://doi.org/10.24093/awej/vol11no2.15>
- Cabrera-Solano, P., Quinonez-Beltran, A., Gonzalez-Torres, P., Ochoa-Cueva, C., & Castillo-Cuesta, L. (2020). Enhancing EFL Students' Active Learning by Using 'Formative' on Mobile Devices. *International Journal of Emerging Technologies in Learning (iJET)*, 15(13), 252. <https://doi.org/10.3991/ijet.v15i13.13975>
- Chakraborty, S. (2022). TOPSIS and Modified TOPSIS: A comparative analysis. *Decision Analytics Journal*, 2, 100021. <https://doi.org/10.1016/j.dajour.2021.100021>

- Chen, Z., Chen, W., Jia, J., & An, H. (2020). The effects of using mobile devices on language learning: A meta-analysis. *Educational Technology Research and Development*, 68(4), 1769-1789. <https://doi.org/10.1007/s11423-020-09801-5>
- Chumaña, J., Castillo, D., Santacruz, E., & Risueño, P. (2018, junio). Teaching-learning of english in health training: Variables of interest. *Revista Cubana de Educación Médica Superior*, 32(2), 1-10.
- Cronquist, K., & Fiszbein, A. (2017). *El aprendizaje del inglés en América Latina* (Liderazgo para las Américas, p. 88). <https://www.thedialogue.org/>
- Cruz Rizo, L., Matos Hernández, E., & Marriot Toledo, H. (2021, junio). La metaenseñanza-aprendizaje del idioma inglés con fines didácticos. *Dilemas contemporáneos: educación, política y valores*, 8(3), 20.
- Dandan, Z. (2020). *Programming of English Word Review Planning Time Based on Ebinhaus Forgetting Curve*. 2, 901-904. <https://doi.org/10.1109/ICITBS49701.2020>
- Evans, E. (2003). *Domain-Driven Design: Tackling Complexity in the Heart of Software* (1st edition). Addison-Wesley Professional.
- Fernandez, A., Armijos, L., Cárdenas, F., & Calero, S. (2018, marzo). Key aspects for improving english teaching in the University of the Armed Forces ESPE. *Educación Médica Superior*, 32(1), 94-105.
- García, K., Llanio, G., & Arenas, R. (2016, agosto). English Teaching as a Foreign Language: Its Insertion in the Formation of Registered Nurses in Cuba. *Revista Cubana de Educación Superior*, 35(2), 59-71.
- Gorscheck, T., Wohlin, C., Garre, P., & Larsson, S. (2006, diciembre). A model for technology transfer in practice. *IEEE Software*, 23(6), 88-95.
- Magfirah, T., Roy, A., & Arridha, R. (2022, julio). Improving Students' Technical English Vocabulary Using Readlang Platform at State Polytechnic of Fakfak. *CEBONG Journal*, 1(3), 75-79.
- Martínez-Valencia, R. F., Montero-Valverde, J. A., Martínez-Arroyo, M., & Hernández-Bravo, J. M. (2021). App design for teaching academic English vocabulary using spaced repetition method. *Revista de Tecnologías Computacionales*, 11-20. <https://doi.org/10.35429/10.35429/JOCT.2021.15.5.11.20>
- Palomares, M. (2022). *El español como lengua extranjera en aplicaciones adaptativas y multimedia: El caso de Duolingo* [Universidad de Murcia]. <https://digitum.um.es/digitum/handle/10201/115763>
- Perez-Medina, J.-L., Zalakeviciute, R., Rybarczyk, I., & González, M. (2021). *Evaluation of the Usability of a Mobile Application for Public Air Quality Information*. International Conference on Applied Human Factors and Ergonomics. [https://doi.org/10.1007/978-3-030-20040-4\\_41](https://doi.org/10.1007/978-3-030-20040-4_41)
- Sakkir, G., Dollah, S., & Ahmad, J. (2020). Students' Perceptions toward Using YouTube in EFL Classrooms. *Journal of Applied Science, Engineering, Technology, and Education*, 2(1), 1-10. <https://doi.org/10.35877/454RI.asci2125>
- Schimanke, F., Mertens, R., Vornberger, O., & Vollmer, S. (2013). Multi Category Content Selection in Spaced Repetition Based Mobile Learning Games. *2013 IEEE International Symposium on Multimedia*, 468-473. <https://doi.org/10.1109/ISM.2013.90>
- Seibert Hanson, A., & Brown, C. (2019, febrero). Enhancing L2 learning through a mobile assisted spaced-repetition tool: An effective but bitter pill? *Computer Assisted Language Learning*, 33(1-2), 133-155.
- Settles, B., & Meeder, B. (2016). A Trainable Spaced Repetition Model for Language Learning. *Proceedings of the 54th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, 1848-1858. <https://doi.org/10.18653/v1/P16-1174>
- Soniya, S., Ramachandran, M., Sathiyaraj, C., & Mathivanan, G. (2021). A Review on Multi-Criteria Decision-Making and Its Application. *REST Journal on Emerging Trends in Modelling and Manufacturing*, 7(4), 101-107. <https://doi.org/10.46632/7/4/1>
- Taherdoost, H., & Madanchian, M. (2023). Multi-Criteria Decision Making (MCDM) Methods and Concepts. *Encyclopedia*, 3(1), 77-87. <https://doi.org/10.3390/encyclopedia3010006>
- Tinsley, T., & Board, K. (2014). *Languages for the future* (Report 1; p. 48). British Council.
- Vallejo Jiménez, B., Peláez Carmona, R. M., Amador Fierros, G., Sánchez Cesar, M. L., & León De La Rosa, R. I. (2023). *English as a Teaching Tool to Non-native Undergraduate Students* (1.ª ed.). Universidad de Colima. <https://doi.org/10.53897/LI.2023.0027.UCOL>
- Wozniak, P. (2018, junio). Exponential adoption of spaced repetition. *History of Spaced Repetition*. [https://supermemo.guru/wiki/Exponential\\_adoption\\_of\\_spaced\\_repetition](https://supermemo.guru/wiki/Exponential_adoption_of_spaced_repetition)
- Yunus, K., & Saifudin Muhamad. (2019). Vocabulary Learning Strategies among English as second language learners. *Journal of Qualitative Social Sciences*, 1(1), 12-19.
- Zaini, R., Quqandi, E., & Guezuguez, W. (2015). A Multi-criteria Decision Making Model for Software Selection to Build E-Portfolio. *2015 Fifth International Conference on E-Learning (Econf)*, 131-134. <https://doi.org/10.1109/ECONF.2015.89>
- Zhang, R., Zou, D., & Xie, H. (2022). Spaced repetition for authentic mobile-assisted word learning: Nature, learner perceptions, and factors leading to positive perceptions. *Computer Assisted Language Learning*, 35(9), 2593-2626. <https://doi.org/10.1080/09588221.2021.1888752>