WordTrek: A Digital Educational Material that Contributes to Vocabulary Learning in Higher Education

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Abstract—This study shows the result of research carried out at the Universidad de La Sabana, whose objective was to determine the contribution that the integration of the digital educational resource called WordTrek makes to the learning of vocabulary in English. A qualitative study with a descriptive scope was conducted through a case study. The main results indicated that the integration of the educational material to the training process in the classroom favors the motivation, the interest of the students for the vocabulary, as well as the appropriation of the lexicon by them. Likewise, it promotes collaborative work and the autonomy of students. However, it is concluded that the appropria-tion of the vocabulary of a second language cannot occur exclusively through the integration of digital educational material, since it also requires the integration of different teaching strategies by the teacher.

1   Introduction

One of the main challenges that students face when learning a foreign language is developing the confidence to communicate properly. To achieve this, they generally use their phonetic, phonological, grammatical, and lexical knowledge; however, as it has been well known for several decades, the mastery of the vocabulary of a language is more important than the accurate use of its grammar because "while without grammar very little can be conveyed, without vocabulary nothing can be conveyed" [1].

Although the learning of grammar and phonology has traditionally had priority in second language teaching programs [2], it is important to bear in mind that the acquisition of vocabulary is essential for communication and that is the main goal of learning a language. It is useless to know the grammar rules if you do not know the words to communicate what you want to say or to understand what you have been told. Because of this, as Schmitt [3] stated, language learners usually carry a dictionary in their pockets not a grammar book, since it is easier to convey meaning from knowing the appropriate words than from using accurate grammar but without knowing the right words.

Despite this, even at the university level, the teaching and learning of English as a second language have privileged the teaching of syntax and phonology, over the learning of vocabulary [4], and although in the first levels of training, there is a greater emphasis on the acquisition of the vocabulary [5], the time dedicated to it is much less than that dedicated to strengthening the accuracy of use grammar. Nevertheless, vocabulary teaching has benefited from the development of studies on the linguistics of the lexicon and psycholinguistics of the mental lexicon, the importance that the lexicon has in language acquisition, how the brain transfers vocabulary from the short-term memory to the long-term one, as well as its storage in the speaker's mind for immediate access and use [5,6]. Nonetheless, unlike learning grammar and developing communication skills, acquiring vocabulary involves not only memorizing a series of individual elements that are part of a word, but also its transfer from short-term memory to long-term, for later retrieval when the speaker needs it [7].

However, the more associations are established between the learned vocabulary and other information stored in the learner's long-term memory, the greater the chances of successful retrieval [7]. Therefore, the teaching of the lexicon requires that teachers prepare activities that allow their practice and provide enough opportunities for association [8], as well as promote students' motivation to learn it.

All this evidences the need to delve into the research on resources and learning strategies that contribute to students' vocabulary learning and acquisition. For this reason, this study aimed to identify the contributions that a digital educational material based on playful strategies makes to the learning of the lexicon in higher education students.

Below are shown, in the first instance the previous studies that exist regarding the teaching of vocabulary with technology, later the educational material developed and the reasons why it was designed in this way are described, then the methodological design and the results obtained, finally the main conclusions of the study are presented.

1.1   Previous studies

When reviewing the literature, it is possible to identify that there are two main approaches to teaching vocabulary, direct and indirect learning approach; the former is based on the fact that not all vocabulary can be learned naturally using context, and the latter on the belief that vocabulary is learned naturally using context [9]. In the direct approach, vocabulary teaching is explicit, and therefore, different activities are developed to learn it. In the indirect, there are no explicit activities or instruction, instead the vocabulary learned is part of other class activities such as reading exercises or listening comprehension [9].

Nevertheless, both approaches are necessary, and it is advised to use them according to the students' language learning level, in the initial levels the direct approach is more frequent, while in the advanced levels, the indirect approach is more appropriate [10]. However, Graves et al. [9] in the presence of a multifaceted proposal according to which the teacher must teach words individually and explicitly, teach vocabulary learning strategies and make the student aware of all aspects of learning a word involves.

Similarly, Restrepo Ramos [11] indicates that, although the knowledge of a word implies its form, meaning, and use when learning it, the student can only focus on

one aspect at a time; so, it is necessary to conduct diverse and varied activities for its complete acquisition [12]. Likewise, given the fact that the lexicon is one of the most difficult aspects of learning a language [13], it is necessary to develop various strategies for its acquisition, such as the use of images, the organization in categories or semantic maps, the association of new words with the previously learned words through synonyms and antonyms, among others [8,12,14].

Additionally, for more than a decade, the Information and Communication Technology (ICT) has played an important role in learning a second language because it enables the creation of learning environments where the learning process becomes more playful [15], making the acquisition of vocabulary no longer a complex and tedious process. Furthermore, various researchers agree that ICT allows the development of an individualized and personalized learning process [15], promotes autonomy [16], inquiry, and vocabulary retention [17].

In the same way, various technologies have been used to contribute to the acquisition of vocabulary in a second language, ranging from the integration of web pages and digital tools to the use of mobile devices. Among the main findings brought into being by researchers are that the use of images and videos helps improve vocabulary retention [16,17]. Similarly, Şahin Kızıl and Savran [18] studied how the use of vocabulary learning strategies in conjunction with different ICTs contributes to vocabulary acquisition. Alternatively, Matsubara and Yoshida [19] found that ICTs not only made students more autonomous but also improved their motivation and vocabulary. Likewise, studies conducted by [17], Wang [20], and Chen et al. [21] found that the use of mobile devices favors and promotes autonomy, increases motivation and interest in acquiring vocabulary, improves its acquisition and retention and, owing to its ubiquity, allows the development of learning strategies that encourage study habits.

Besides, another strategy used to promote the acquisition of vocabulary is the integration of videogames and serious games because they not only help motivate students but also allow them to advance at their own pace and according to their skills [22]. Furthermore, the proactive role that the student plays in the game helps the processing of all aspects related to learning a word, which has a positive impact on vocabulary learning and memory. Additionally, the game dynamics help reduce students' shyness and insecurity, promoting spontaneous communication among them [23]. However, to achieve greater success, video games that, in addition to teaching, are entertaining and challenging should be used [22,24], thus accomplishing a more pleasant learning process and significantly reducing the stress and pressure that this process entails [25].

1.2 Description of the digital educational material

This study aimed to design a digital educational material -WordTrek-, which contributes to the appropriation of vocabulary by higher education students, through the development of playful activities in an interactive game. WordTrek has specific learning and entertainment objectives. The entertainment objective was to get the students to actively participate in the game. The educational objective was to strengthen the learning of and use of the lexicon, since this is one of the greatest difficulties faced by higher education students in Colombia.
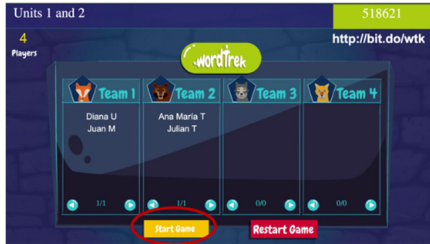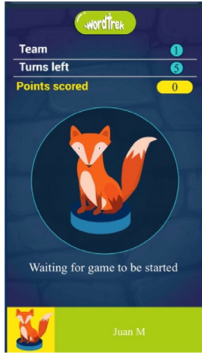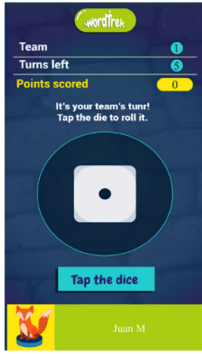
For its elaboration the methodology of software instructional design called ADDIE was used, which has five phases: Analysis, Design, Development, Implementation, and evaluation. The procedure followed in each phase is indicated below.

Analysis Phase. In this phase, the student's English language learning needs at the Universidad de La Sabana were analyzed, and it was identified that students' acquisition of new vocabulary is one of the greatest difficulties they have in that learning process.

Design Phase. In this phase, the goals of the digital educational material were set, bearing in mind that it had to support and promote the acquisition of vocabulary interactively in the classroom and through the active participation of the students in teams. The board games Pictionary and Cranium were taken as a starting point, as well as the real-time interaction that occurs in games like Kahoot and Quizizz. Based on this, the pedagogical and technical scripts of the educational material were prepared, and their development proceeded.

The development phase. In this phase, it was decided that the material, like Kahoot, would have one interface and screen for the players and another one for the teacher. That way, the students could interact individually using their own devices, but all their decisions would be visible to the user, their classmates, and the teacher through the teacher's screen, as shown in Table 1.

Table 1. WordTrek user interface

Teacher Interface	Students Interface

However, since during the course the students must learn 100 different words divided into 6 learning units, the game was designed so that the words with which it will be played can be modified by the teacher, with this not only It does not ensure that students can use the game throughout the course, but the teacher has the autonomy to decide which set of words they want to work on each week of the course.

Also, to achieve the goal of entertainment, the scoring system, difficulty levels, menus, sound effects, and game interface were established. Before moving to the implementation phase, a test board was created and used twice with two different groups of students. The results of the tests were used to make the last adjustments and corrections before starting to use it, as well as to define the types of activities that were used in the game and the dynamics of student participation, as can be seen in Table 2.

Table 2. WordTrek activity types

Type of Activity	Description
Talented Spider	In this activity, a team representative comes forward and draws on the board the word that any player from the other teams will show her/him from their mobile device. The representative's team members must guess the correct word at the allotted time according to the level of difficulty chosen.
Acting Dragonfly	In this activity, a team representative comes forward and acts out the word that any player from the other teams shows her/him without speaking. The representative's team members must guess the correct word at the allotted time according to the level of difficulty chosen.
Word Bee	In this activity, a sentence with a missing word and 4 answer choices are displayed on the devices of the playing team members. The team must decide which word from the 4 choices is correct to complete the sentence and say it out loud in the allotted time according to the level of difficulty chosen.
Memory Ant	In this activity, the definition of a word is displayed on the devices of the playing team members. They must decide what the word that corresponds to that definition is and say it out loud in the allotted time according to the level of difficulty

Finally, it is important to mention that it was decided to develop a digital game in real time, available for mobile devices, due to the closeness that students have with video games, mobile devices, social networks, and interactive series. Likewise, as previously indicated, the dynamics used in the interaction were taken from the suggestions given by the students of the two test groups.

2   Method

This research aimed to determine the contribution of the WordTrek digital educational material, in the appropriation of vocabulary by higher education students at the La Sabana University. A qualitative approach with a descriptive scope was used. Also, a case study design was used because it allows to see a learning environment in all its aspects, as well as to understand the practices and conceptions of the actors, their relationships, tensions and transformations.

2.1 Participants

This research involved a group of 21 undergraduate students of English who were in level 3. This level corresponds to level A2 of the Common European Framework of Reference for Languages (CEFR). The group was made up of 9 men and 12 women. The participants were aged from 16 to 18 and were studying different majors at the University. This level and this group were chosen because the vocabulary they are expected to learn was better suited for the activities in WordTrek digital educational material. Additionally, it is important to indicate that the course had an intensity of 4 h of face-to-face classes per week for 4 months.

2.2 Techniques and instruments for data collection

Data collection occurred over a period of 16 weeks through a Pre- and Post-baseline, regular class observations (mainly when the material was used) surveys, data collected by the educational material, quizzes, a field diary, and a group focal. The data collected were coded to guarantee the anonymity of the study participants. Subsequently, to respond to the objective of the research, the information was processed using Qualitive Data Analysis (QDA) Miner software and analyzed based on the following categories: Vocabulary learning, Effects of digital educational material, influence on the acquisition of vocabulary, and influence of the integration strategy.

2.3 Implementation strategy

WordTrek was used in 7 class sessions during the semester as follows: at the end of the first two units, at the beginning and end of units 3 and 4, at the end of the last two units, and the last day of class. The vocabulary of the first game played corresponded to the one that had been studied up to that point in the course. For the following games, the same set of words was played twice, before having studied that vocabulary in class and after studying it. The last game included all the vocabulary studied throughout the course. Additionally, a record was kept of the points obtained by each student in each game, the accumulated score was included in the evaluation of the course.

3 Results and discussion

Next, the results obtained in the study are shown on the basis of the findings brought into being in the categories of analysis and a discussion of them is carried out against the state of the object of study in the literature.

3.1 Vocabulary learning

When reviewing the results obtained in the pre- and post-test used to assess the level of students' vocabulary knowledge, it was possible to identify, as shown in Figure 1, that 48% of the students improved their level of vocabulary acquisition. While 24% of them remained the same and 19% of them presented a lower vocabulary knowledge level.

When analyzing the reasons why this occurred, it was possible to find a relationship between the level of participation of the students in the sessions with WordTrek and the level of acquisition reached by them in the post-test.
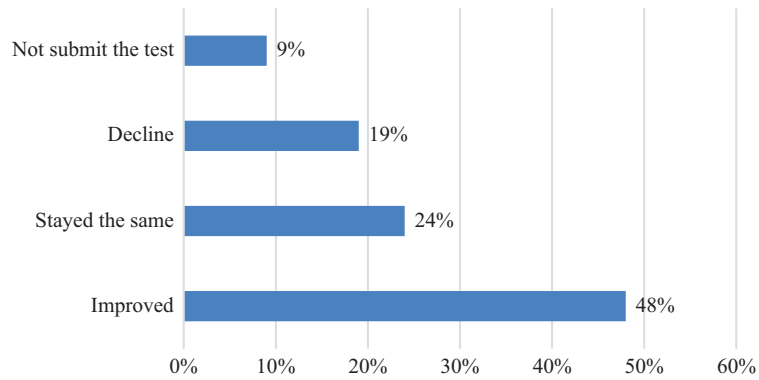

Fig. 1. Comparison of results obtained in the pre- and post-vocabulary knowledge test

However, these results differ a little from the scores obtained in the two quizzes applied during the development of the intervention since, as indicated in Figure 2, when comparing the level of acquisition of each student's vocabulary, it was observed that the 62% of them did not present any variation in their level of acquisition, while the remaining 38% showed an improvement in it. These results are due to the structure and length of the tests applied the one hand, the knowledge test evaluated the entire lexicon that the students had to learn in the course, a corpus made up of 40 different words, while on the other, each quiz only evaluated the vocabulary studied in the previous two units and it only had 5 words.
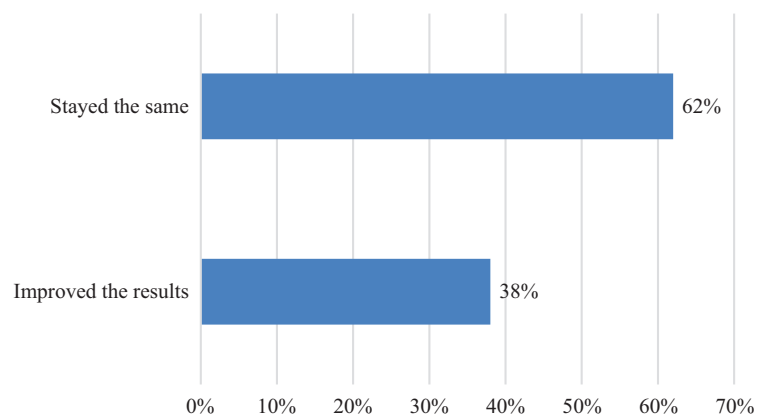

Fig. 2. Comparative level of the lexicon in the tests carried out during the intervention

Additionally, it is important to indicate that the pre- and post-vocabulary knowledge test was divided into two parts, in the first, the student had to match the word with the corresponding definition and in the second he had to choose the correct word, from four

options, to complete a sentence. Each part had 20 words. In contrast, each quiz included only one type of exercise. In the first quiz, you had to complete the sentence with the correct word and in the second, you had to match the word with the definition.

Now, when reviewing the results obtained by the students in detail in each part of the pre- and post-knowledge test, it was possible to determine that, of all things that are part of learning a word, the accurate use of a word in a sentence was more difficult than matching its form with its meaning. The aforementioned can be seen in Figure 3, in which in both, the pre- and post-test results, the part with the lowest number of correct answers is the one that evaluates the use of the word to give meaning to a sentence. This coincides with the findings in [26] who, when consulting EFL teachers, identified that, according to this, one of the most common mistakes made by students when writing their texts is related to their difficulty in using words in their proper context.
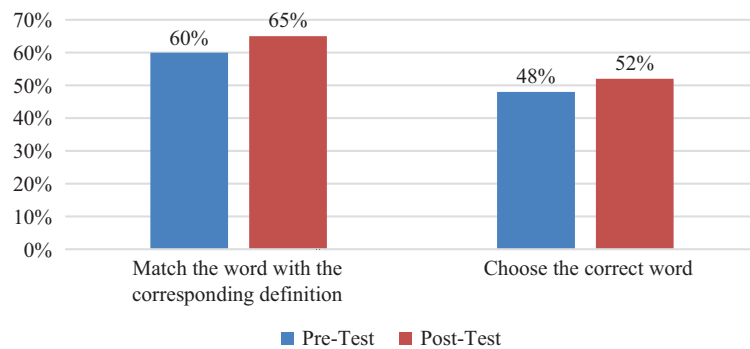

Fig. 3. Percentage of correct answers in each part of the knowledge test

Regarding the data collected in the focus group and the surveys applied to the students, notably all the students agreed that WordTrek digital educational material had helped them to practice and learn vocabulary. However, as seen in Figure 4, only 28% acquired more than 25 words, 24% between 20 and 25 words, 29% between 15 and 20 words, 14% between 10 and 15 words and 5% between 5 and 10 words. It is concluded that WordTrek can be a tool that contributes to the acquisition of vocabulary by students.
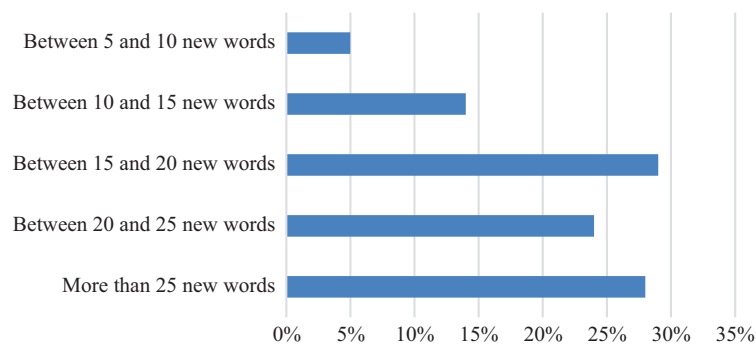

Fig. 4. Vocabulary learned using WordTrek according to students

3.2 Influence of the material on the vocabulary learning process

The analysis of the data collected made it possible to identify the influence that WordTrek digital educational material had on the students' vocabulary learning processes, as well as the reasons why this occurred.

All the students in the focus group indicated that most of the words they remembered were those that they had to draw or act out during the game, either because they had to do it when playing the game, someone in their group did it, or they saw how much someone in the other group struggled to do it. These findings coincide with those in [27] who identified that the use of images contributes to improving retention and recall of vocabulary. Nevertheless, the activities Talented Spider (drawing) and Acting Dragonfly (acting) were the most difficult in the game, especially the former, since it registered the lowest rate of success in the game with only 36%, while the latter registered 49% success. Despite this, it was the students' favorite activity.

Regarding the level of difficulty of the game in general, 63% of students stated that it was adequate, however, the participants in the focus group agreed that the level of difficulty should increase as the game progresses. In this regard, it was observed that the participants chose the easiest level of difficulty, the one that gave them more time to complete the activity, for the drawing and acting challenges, while they preferred the highest level of difficulty, the one that gave them less time, for the activities of completing the sentence and saying the word that corresponds to the definition.

During the work sessions with the educational material, it was reiterative to observe the interest of the students in inquiring about the meaning of all words that appeared in the game, even though they were not going to receive additional points. Also, camaraderie was observed among them to discover the use of vocabulary in certain contexts, identify synonyms and/or new meanings. The students stated that WordTrek had motivated them to study the vocabulary outside the classroom and even to prepare for the sessions in which it will be used. Some of them used the mnemonic strategy [8] for their individual studies in preparation for the game.

Both in the surveys and in the focus group, all students mentioned that the competitiveness of the game and desire to win and accumulate more points to be among the top five scores at the end of the course had motivated them to study more; this became evident in the students' interest to know about other resources to learn or practice vocabulary outside the class. What was observed is consistent with the findings of the studies carried in [22,28,29] which it is concluded that games motivate and increase interest in learning vocabulary.

Regarding the design of the material, the students stated that although they liked the dynamics of the game very much, they would like that it have more activities, background music, all the minor technical failures and glitches that occurred during implementation corrected and a reduced or more controlled game time (each game session lasted approximately 45 min).

3.3 Influence of the integration strategy on the acquisition of vocabulary

To play a game of WordTrek, 4 teams of approximately 5 people each were formed randomly. In this regard, the students suggested that, for a future implementation, teams

be formed with a smaller number of participants, ideally 3 per group, to avoid the lack of commitment of some group members when working collaboratively. Regarding the number of teams, the students mentioned that 4 is an appropriate number, considering that it is important to control the waiting time between turns and avoid losing interest in the game.

Regarding the frequency of use of the material, despite the students' liking of the game due to the dynamics that it generated in the development of the classes and the way it helped them improve their vocabulary learning, it was observed that in two of the last three sessions that the game was played, the level of interest was not the same and about 50% students were distracted and not paying attention to the game while waiting for their turn. For this reason, in the last session, the game dynamics changed, and double points were assigned. These changes once again increased the engagement in the activity. It is important to highlight that, if you want to use the educational material in several class sessions without losing students' interest and motivation, it is necessary to introduce changes to the game dynamics, strategy of use, and interaction of the teams.

However, given the competitiveness that occurs in games like WordTrek, repeated failure can affect students' interest in it. In this regard, as stated in [25] recommend taking advantage of educational games to create learning environments where mistakes can be made without affecting the student's motivation or generating stress. In the case of this project, it was necessary to take breaks in some of the game sessions to reduce the level of stress generated by repeated failures. Students were told to review the vocabulary previously studied for a minute before resuming the game. Nonetheless, the teacher is aware of this situation because instead of contributing to the learning of vocabulary, if this situation is repetitive, it can generate the opposite effect and hinder students' vocabulary learning process.

4   Conclusions

The study confirmed that WordTrek digital educational material contributes to the vocabulary learning of students at the Universidad de La Sabana because the dynamics proposed within it allow students to have greater exposure to vocabulary through activities that promote their active participation in the learning process. Likewise, the competitive component of WordTrek arouses interest, dedication, and involvement in the participating teams.

However, the findings found in this research allow us to conclude that it is necessary to change how the educational material is used in the classroom because after several game sessions, the students lost interest in it. In the case of this study, this could be solved by changing the strategy of use and integration of the material within the class.

Besides, an aspect that greatly contributed to achieving the results obtained in this study was breaking the paradigm that students have that vocabulary learning is a complex and tedious process [15]. That was possible thanks to the fact that WordTrek allows the practice of vocabulary pleasantly and entertainingly, as well as its repetition and use. Likewise, as reported by the students, WordTrek managed to motivate them to study the vocabulary independently since they wanted to have a better performance in the game and in the quizzes held during the course.

However, one of the greatest accomplishments achieved by integrating the material was to generate a space for spontaneous and natural interaction, typical of the interactions that are generated in the contexts where the language being learned is spoken, which, not only allows its practice and the development of communication skills, but also gives students the security and confidence they need to practice it without the fear of feeling embarrassed when making mistakes.

WordTrek was designed as a digital board game to be used in face-to-face classes and adaptable to any vocabulary. Although the activities are unoriginal, their combination in this didactic material is. A big difference concerning other materials is the group work and the interaction that it generates in its participants. Additionally, being under the control of the teacher, new rules can be created for the benefit of learning, such as that a dictionary can or cannot be used during the game or that a word answered is invalid if the pronunciation is not correct.

Finally, although some of the contributions of this material to vocabulary learning were identified, there are still some questions to be answered. It is impossible to specify to what extent the use of the material affects the retention and recall of vocabulary, how it would be affected if a different implementation strategy is used, for example, a lower frequency of use, how this material influences casual vocabulary learning and what difference it would make, in terms of the contributions described here, if the activities included in WordTrek are done independently as separated class activities. All these questions could be addressed in future research for which an improved version of this material could be used considering the learning from this study.

5   Acknowledgment

6   References

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