

INTEGRATING QUIZLET INTO AVIATION ENGLISH COURSE

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The research aims to study and experimentally verify the effectiveness of the use of the Quizlet computer-based flashcard program for teaching future air traffic controllers (ATCs) profession-related vocabulary. In this research, we applied a mixed-method research design. The sample of the experiment participants was 57 first-year students majoring in “Aviation transport”. To evaluate the efficiency of Quizlet incorporation into aviation English learning, we used tests, speaking activities, observations, and questionnaires (the former two to assess passive and active vocabulary knowledge and the latter to evaluate the students’ engagement and motivation). The empirical data proved Quizlet to be an effective vocabulary learning tool that positively influences students’ proficiency in speaking skills and interest in learning aviation English. Based on the obtained findings, we claim vocabulary acquisition to be the basis for foreign language learners’ general language proficiency contributing to the development of voice communication skills. An important conclusion is made on the need to include in aviation English courses the intentional vocabulary learning component implying explicit vocabulary teaching, which then should be complemented with speaking practice and incidental vocabulary acquisition techniques. The research findings can be implied in aviation English and foreign language teaching presenting an experimental verification of computer-based flashcard program efficiency in the language learning process.

Keywords: aviation English; computer-based flashcard program Quizlet; vocabulary acquisition; speaking skills; foreign language proficiency.

Introduction

In the age of globalisation and internationalisation, English mastery is increasingly becoming one of the important skills a competent specialist should have. Therefore, in English teaching methodology, there is an ongoing search for effective approaches, techniques, methods, and learning aids to make English learners independent and proficient users of the target language. In this respect, communicative language teaching complemented with information and communication technology (ICT) tools is gaining popularity and is considered, by far, the most efficient language teaching strategy. At the same time, the use of ICT for intentional vocabulary learning to achieve English mastery as well as the expediency of technology-based activities in English course design remains open.

ICT tools are considered to be of great English teaching potential. Some researchers claim that technology should have a central position in learning English for specific purposes (ESP) (Constantinou & Sophocleous, 2020). Advantages brought to students and instructors by going digital are repeatedly addressed in publications (Mullamaa, 2010; Yunus et al., 2013; Yunus & Salehi, 2012; Azmi, 2017; Ilter, 2009). Information and communication technology (ICT) is seen as a means of increasing students’ motivation, boosting their engagement in classroom activities; as a way to foster learners’ autonomy opening up opportunities to choose individual learning strategies; as a tool to enhance multisensory perception and to create the atmosphere of immersion into language environment; as a means of making students’ progress easier to manage and monitor; as facilities creating favourable conditions for learners’ interaction and collaboration. According to the International Civil Aviation Organization (ICAO) (2009), computer-based training is particularly effective in developing such language skills as listening comprehension, vocabulary building, pronunciation and grammar application (p.6). All the above-listed advantages make ICT a valuable tool for the achievement of language proficiency. So, we assume that computer-based activities should definitely be used in aviation English classes. Taking into account the fact that in aviation English discourse, adequate profession-related vocabulary knowledge is central to two-way communication (understanding interlocutors’ words and the production of meaningful utterances), we will focus on computer-assisted vocabulary acquisition using computer-based flashcards.

Flashcards are a tool facilitating focused and intentional learning. Some scholars (Pyc & Rawson, 2007; Nakata, 2008; Barcroft, 2007; Fitzpatrick, Al-Qarni, & Meara, 2008; Alnajjar & Brick, 2019, etc.) consider it as a learning aid opening up vast language studying opportunities that result in better vocabulary retention contributing to improved language proficiency. Flashcards can be used in several ways – they are useful to study a definition, to remember collocations, synonyms, pronunciation, and the translations of words. Although the use of traditional “paper” flashcards in learning foreign languages is not new and is a common strategy, we totally agree with Gardner (2014), who claims computer-based flashcard programs have made them even more versatile and accessible. Since they are available not only for desktop computers and laptops but also for smartphones and tablets, students can always have a set of flashcards with them for studying.

Our focus will be laid on Quizlet, which is a famous example of such applications allowing deliberate vocabulary learning. It offers user-designed study sets comprised of terms and their definitions or descriptions. Students work with these modules in different learning modes, including flashcards, games and quizzes. Benefits that language learners can derive from utilizing Quizlet are widely discussed in publications. For instance, Sanosi (2018) experimentally investigates the actual efficiency of using Quizlet in vocabulary acquisition by Arabic students learning English as a second language in the academic environment. Following the test results, the researcher claims that the positive effect of using Quizlet in vocabulary acquisition “can safely be assumed” (p. 76). In Al-Malki’s study (2020), the author’s findings experimentally verify the improved performance in vocabulary with Quizlet, especially in the use of “ed/-ing/ adjectives and Hot verbs – take, get, do and make” (p. 337), revealing other merits such as the creation of an exciting, challenging, competitive and collaborative environment, enhanced motivation to learn English, and the boosted sense of autonomy. Özer & Koçoğlu (2017), investigating the efficiency of using Quizlet and a paper-based vocabulary notebook, conclude that such explicit vocabulary learning techniques result in better vocabulary acquisition as compared to the teaching strategy when no intentional vocabulary teaching tool is used, with Quizlet students being superior to the vocabulary notebook group in terms of vocabulary learning and recall. Bueno-Alastuey & Nemeth’s study (2020) investigates the positive effects Quizlet flashcards have on second language vocabulary acquisition when students generate podcasts and wordlists by themselves. Ulla, Perales, & Tarrayo (2020), studying the advantages of integrating information technology, in particular Quizlet, into the classroom for learning foreign languages, consider teachers’ attitude to mobile applications. From the instructors’ perspective, apart from lesson reinforcement, it can be an option enhancing convenience in teaching. It is especially true for marking students’ written assignments. Since in Quizlet, scores are generated automatically, “teachers can economize with their marking time” (p.373). Other publications address the perception of Quizlet by students. For instance, Kose, Cimen, & Mede (2016) interviewed and observed 42 students who used Quizlet to learn vocabulary for four weeks. The results revealed that most of the students treated Quizlet as an effective language learning tool, especially in recalling definitions, synonyms and pronunciation.

The present study follows the track of the previous literature in terms of investigating the effect of Quizlet podcasts and wordlists on vocabulary acquisition and learners’ motivation for the subject. However, our research aims to address a relatively uncovered issue of Quizlet’s influence on students’ speaking skills. To achieve this and to verify Quizlet’s efficacy, we use tests, speaking activities, observations, and questionnaires. So, the study aims to experimentally test the following hypothesis: the Quizlet online platform is characterised by efficiency in teaching future air traffic controllers (ATCs) profession-related vocabulary to boost their aviation English speaking skills and motivation.

Materials and methods

Research design

In this study, we apply a mixed-method research design utilizing quantitative (tests to identify the students’ English proficiency and vocabulary retention levels; the analysis of the participants’ questionnaire answers to examine their attitude to the use of Quizlet) and qualitative (the assessment of the learners’ speaking skills; class observations to evaluate the students’ motivation and engagement in the in-class activities) methods.

Participants

The study involved 57 first-year students majoring in “Aviation transport”. The experiment participants were divided into control and experimental groups. Two aviation English instructors participated in the experiment.

Materials and procedure

Before starting a new topic “Aircraft structure”, the students of the control and experimental groups took a diagnostic test to identify their English proficiency levels. We used a paper-based version of the test available at the Macmillan resource (2020).

The students of the control group studied the “Aircraft structure” topic and the topical vocabulary using traditional methods – the new vocabulary was first introduced in the text that they read at home. This activity was followed by reproductive exercises where instructions were formulated as follows: find the English equivalents in the text; give Ukrainian equivalents of the following words and phrases; match the words on the left with the definitions on the right; make up verb + noun collocations (there may be several variants); choose an appropriate word or phrase to complete the following sentences; fill in the gaps with appropriate prepositions or adverbs; combine two parts logically to make complete sentences; look through the text again and replace the words/phrases in italics with similar ones; translate the sentences from Ukrainian into English. Finally, the control group students were offered questions for discussion as an in-class activity.

In the experimental group, we replaced the above-described reproductive and productive exercises with the flashcards, games, and quizzes we created using Quizlet. In this study application, the students were first introduced to the vocabulary to memorise in the form of flashcards. Having gone through the introductory stage with flashcards, the students then proceed to the “learn” feature. It presented the material first as a multiple-choice test. If they were successful, the application considered that the terms were familiar to them. The vocabulary was then tested in another format – the students were required to understand and type in what word was described by an offered definition. The next task was to read the definition to type in the correct word. Through the spell function, the app said the term out loud and the students had to type in what they heard correctly. Finally, the students were required to take a test. The types of question included here were written questions (similar to the previous stages, the students had to write out the correct answers according to the offered definitions); matching tasks where the correct term and its definition were matched; multiple-choice questions where the task was to choose one correct option; true/ false questions. There were also two game options.

At the end of the experiment, both groups went through the testing of their vocabulary skills on the given topic. The exercise types in the final test were as follows: complete the gaps; match the words and the pictures; match the words with their definitions; multiple-choice questions; put the words into different groups; the odd one out; changing the form of a word from one part of speech to another; words that go together. There were 5 questions of each of the 8 above-described types – 40 questions in total. Each correct answer gave a student 1 point. The students’ test scores were calculated by the following formula (1):

$$\text{Test scores} = \frac{\text{student's correct answer scores}}{\text{the total number of questions}} \times 100 \quad (1)$$

The test results were reported using the following scoring scale (Table 1):

Table 1. Vocabulary test scoring scale

No.	Scores	Mastery level
1.	90-100	Excellent
2.	79-89	Very Good
3.	68-78	Good
4.	57-67	Satisfactory
5.	> 56	Poor

We also assessed the students’ speaking skills using a picture-cued task. They were given the following instructions “Look at the pictures. Compare these types of aircraft. What are their main differences?” The students expressed their ideas in a whole-class discussion. Their speaking skills were then evaluated according to the following criteria and four-level rating scale (Table 2) developed by the authors based on Brown and Abeywickrama (2010).

Table 2. Speaking rating scale

	Mastery level	Excellent	Good	Satisfactory	Poor
Criterion					
Vocabulary and its accuracy The body of topical vocabulary used in students' descriptions and its appropriateness					
Pronunciation Correct pronunciation of sounds and stress patterns					
Fluency A good speech rate with minor pauses, self-repetitions and self-corrections					
Task fulfilment A degree of description detail and its adequacy					

We also conducted class observations in both groups to assess the students' motivation according to how actively they engaged in the classroom activities. By this criterion, the students' participation was classified as disengagement, passive engagement, and active participation. Besides, among the students of the experimental group, we conducted a survey using a questionnaire developed by the authors where the learners were asked to comment on whether they liked using Quizlet for learning vocabulary and whether they found it useful, and how it influenced their motivation for taking the course as well as whether they wanted to use it further to study other material and topics.

Data analysis

To process and check the significance of the obtained findings and to confirm our hypothesis and prove Quizlet to be a more effective vocabulary learning tool as compared to traditional methods, we use the Student's t-test for independent samples (Allen, Titsworth, & Hunt, 2009). Analysing vocabulary test scores, it should be born in mind that possible positive experimental verification results should not be solely attributed to the effect of the experiment, since they are influenced not only by the experimental factor but also, for instance, by students' educational and extracurricular activities or a measured difference can be due to chance only. That is, it is to be identified whether the vocabulary test results are statistically equal in the control and experimental groups. Our hypothesis, which is referred to as the alternative one, assumes that the control and experimental groups' test scores are not equal. Consequently, the opposing statement, known as the null hypothesis, assumes that statistically, there is no significant difference between the two groups indicating the absence of statistically significant relationships and interdependencies, showing that all findings are accidental, and the alternative hypothesis is false. A mathematically substantiated answer to the question of the alternative hypothesis validity can be obtained using the Student's t-test for independent samples. In other words, this mathematical statistics technique enables us to identify if there is a significant difference between the effectiveness of traditional and experimental learning with Quizlet.

To calculate the test statistic, "t", for independent samples, we use the following three descriptive statistics indicators: the sample mean (\bar{x}) that is the arithmetic mean of the students' test scores in the control and experimental groups; standard deviation (SD) that is the generalised mean deviation of each student's scores from the sample mean (\bar{x}) – it shows how widely the values are dispersed (spread) concerning the mean (\bar{x}); the standard error of the difference (m_r), which is the ratio of the standard deviation and sample size – it indicates sample generalizability. To put it differently, the standard error shows the extent to which sample observation results are different from the results that would have been obtained by examining the general population – all students who study using traditional methods and Quizlet. Having calculated all the indicated values, we can perform the Student's t-test for independent samples. Its formula is quite simple (2) – the numerator finds the magnitude of the difference between the two means; the denominator has a formula with a square root of the sum of squared standard errors in the two groups:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{m_1^2 + m_2^2}} \quad (2)$$

Once we have our t-value, which is referred to as an empirical t (t_{emp}), we go to the table of probabilities for the t-distribution (Heckert et al., 2002), and look up our critical (or tabular) t (t_{crit}) for the appropriate degree of freedom (ν). In our case, the latter is calculated by subtracting 2 from the general sample size. The

next step is comparing our data to critical value from the table – we need to identify whether t_{emp} is bigger than t_{crit} . If t_{emp} is bigger, it allows us to conclude that there is enough evidence from the experiment to declare that a significant difference does exist between the two groups. Subsequently, if t_{emp} is smaller, then this is indicative of the fact that there is not enough evidence to conclude that there exists a significant difference between the control and experimental groups.

It should be noted that the results of statistical tests and, in general, their interpretation do not give us an unequivocal "yes" or "no" answer on hypothesis validity. It is always a matter of a certain percentage of probability – the probability of making a wrong decision when stating a positive result. In practical statistics, the error probability is denoted by the letter "p" and is expressed as a percentage. By convention, the error probability at which it is reasonable to reject the null hypothesis and accept the alternative one in studies is 5% (0.05) – it is a cut-off point for declaring statistical significance. Statements with the error probability $p \leq 0.05$ are called significant; statements with the error probability $p \leq 0.01$ are more significant, and statements with the error probability of $p \leq 0.001$ are statistically highly significant (Greenland et al., 2016), indicating less than one in a thousand chance of a researcher being wrong.

If there is a significant difference between the control and experimental groups (i.e., t_{emp} is bigger than t_{crit} , then the p-value is < 0.05 – identified variations are unlikely to be due to chance); if we do not find a significant difference between our two groups (i.e., t_{emp} is lower than t_{crit}), then the p-value is > 0.05 (i.e., there is a high probability that obtained findings are simply a result of chance). Thus, based on our p-value, we will be able to reasonably reject the null hypothesis in favour of the alternative one and declare Quizlet's efficiency in vocabulary acquisition as compared to traditional methods.

To double-check not making arithmetic errors in calculations done by hand and to get a precise p-value that does not imply the use of "<" or ">" symbols (the table of probabilities for the t-distribution allows determining the error probability in such approximate terms only), we use the SPSS statistical modelling program. Consequently, it should be noted that this program significantly speeds up the processing of obtained results.

Taking into account a large number of participants simultaneously performing the communication task, for evaluating the students' speaking performance as well as their motivation, we stick to the qualitative method, not implying the use of any numerical indicators and based on the parameters that are descriptive in nature. Following the in-class discussion, the instructors choose a level corresponding to speaking skills and engagement rate demonstrated by the students.

To process the obtained questionnaire results and to analyse the responses of the experimental group, we use a quantitative analysis method according to the following algorithm. The quantitative indicator of experimental group students (28 learners) is taken as 100%. The next step is to calculate the students' positive answers to each of the proposed questions about the benefits of implementing Quizlet in the learning process. The third stage involved compiling a proportion where the percentage corresponding to the number of students who believe Quizlet to be effective is an unknown variable calculated as the product of the number of experiment participants who are in favour of learning with Quizlet and 100% divided by the total number of the experimental group students.

Ethical issues

In our study, we are committed to the ethical principles of the students' voluntary participation, their informed consent (all the students are informed about the procedure of the experiment and give their consent to participation in the experiment) and confidentiality.

Results

In the present experimental study on Quizlet's efficiency in vocabulary acquisition conducted in the 2019-2020 academic year at National Aviation University among first-semester freshmen-future ATCs using tests, engaging the students in speaking activities, making observations, and asking them to complete questionnaires, we obtained the following results. The diagnostic test revealed that the students in both groups had approximately the same level of English – the majority of the students were intermediate English learners. The vocabulary testing results on the topic "Aircraft structure" in the control and experimental groups are summarised in Table 3.

As seen from Table 3, the number of students who demonstrated excellent skills learning and practising the vocabulary using Quizlet was considerably higher than it was the case with the students using traditional methods – the difference between the figures was 22.4%. Basically, in the control group, this percentage difference of learners was distributed among lower vocabulary mastery levels – in the control group, more students showed very good and good results totalling 19.2 %. Moreover, in the group where traditional

methods were used, one student was showing unsatisfactory results (3.4 % out of all the students in the group), while in the experimental group, no students were demonstrating poor vocabulary mastery levels. In both groups, there was almost an identical percentage of students whose results were at a satisfactory level. So, overall, vocabulary test results in the experimental group studying with Quizlet were higher than the results among the control group students taught using traditional methods.

Table 3. Vocabulary testing results in the control and experimental groups

Mastery levels	Control group		Experimental group		Difference, %
	Students	%	Students	%	
Excellent	8	27.6	14	50	+ 22.4
Very Good	6	20.7	4	14.3	- 6.4
Good	12	41.4	8	28.6	-12.8
Satisfactory	2	6.9	2	7.1	+0.2
Poor	1	3.4	-	-	-3.4
Total	29	100	28	100	

We verified the above-mentioned results and proved the differences between the control and experimental groups to be significant using the Student's t-test. The students' results and values used to calculate the t-scores and p-value are given in Table 4.

Table 4. Data values in the Student's t-test calculations

Control group students			Experimental group students		
No.	Scores	Standard deviation	No.	Scores	Standard deviation
1.	90	201.64	1.	94	98.01
2.	80	17.64	2.	91	47.61
3.	70	33.64	3.	94	98.01
4.	79	10.24	4.	75	82.81
5.	90	201.64	5.	90	34.81
6.	68	60.84	6.	94	98.01
7.	80	17.84	7.	82	4.41
8.	90	201.64	8.	78	37.21
9.	70	33.64	9.	90	34.81
10.	90	201.64	10.	75	82.81
11.	71	23.04	11.	88	15.21
12.	68	60.84	12.	78	37.21
13.	91	231.04	13.	94	98.01
14.	69	46.24	14.	70	198.81
15.	80	17.64	15.	76	65.61
16.	68	60.84	16.	65	364.81
17.	79	10.24	17.	92	62.41
18.	70	33.64	18.	90	34.81
19.	44	1011.24	19.	65	364.81
20.	90	201.64	20.	88	15.21
21.	57	353.44	21.	92	62.41
22.	70	33.64	22.	70	198.81
23.	91	231.04	23.	90	34.81
24.	58	316.84	24.	85	0.81
25.	82	38.44	25.	95	118.81
26.	71	23.04	26.	90	34.81
27.	70	33.64	27.	70	198.81
28.	91	231.04	28.	94	98.01
29.	72	14.44			

Sample mean	75.8		Sample mean	84.1	
Sample standard deviation		11.88	Sample standard deviation		9.85
Standard error of the difference	2.20		Standard error of the difference	1.86	
t-value	2.858				
p-value	0.006				

Since the empirical value $t_{emp} = 2.858$ obtained in the experiment exceeds the tabular value $t_{crit} = 2.688$ (for the degree of freedom $v = 28 + 29 - 2 = 55$), therefore the significance level (p-value) is less than 0.01 – more precisely it is equal to 0.006. Suppose the significance level is less than 0.05, in that case, we can reasonably conclude that there is a statistically significant difference between the groups, in our case, in the level of “Aircraft structure” vocabulary proficiency. It gives us grounds to argue in favour of experimental learning with Quizlet.

Following the in-class discussion of the issues encouraging the students to use the learned vocabulary on “Aircraft structure”, we identified that the experimental group demonstrated excellent results according to vocabulary and its accuracy, task fulfilment and fluency criteria. In the control group, according to the same criteria, the students’ performance was evaluated as good. The students of the experimental group were using aviation English more easily and more accurately than the control group; in many cases, their speech rate was higher since they needed less conscious concentration when speaking (to remember how to refer to a particular aircraft part or what verbs go together with a given noun like, for instance, to retract/extend with the noun “landing gear”); the experimental group students asked their instructors fewer questions to help to translate a particular word or an idea into English and were generally more skilled in language use. According to the pronunciation criteria, the students of both groups demonstrated an excellent level – in general, there were no serious pronunciation mistakes or difficulties with stress patterns in topical vocabulary use.

The class observation results clearly indicated that in the experimental group, the students were more interested in classroom activities and were characterised by a higher engagement rate – the overwhelming majority of students took part in the group discussion. There were fewer cases of disengagement among them when participating in the discussion, while in the control a little less than a half of students were just passive listeners of others and had nothing to add or didn’t want to speak on the topic.

The analysis of the questionnaire answers revealed that most students in the experimental group (75.2%) found Quizlet a useful learning aid and took much interest in working with the application as compared to traditional exercises. The majority of students (73.7%) indicated that the use of Quizlet is seen by them as a factor increasing motivation for taking aviation English classes since they help to improve their knowledge and skills. 72.5 % of students found the use of the Quizlet platform to study more new topics while taking the course useful and appealing to them. So, having assessed the use of Quizlet as a learning aid at the levels of knowledge acquisition, ability to apply what is learned in a speech to fulfil a communication purpose, the students’ engagement in learning activities, and motivation to learn aviation English, we may conclude that Quizlet incorporation into aviation English classes is proved to be effective.

Discussion

Our study is a contribution to the discussion of the efficiency of Quizlet for language learning as compared to traditional intentional vocabulary learning methods, not implying the use of ICT. According to the ICAO circular (2009), “aviation English training must adopt an essentially communicative approach to language learning with the main focus on speaking, listening, and interactive skills” (p.2), with the primary objective being voice-only communication. However, in the same document, it is mentioned that vocabulary together with grammar, syntax, and reading underlie oral communications” (ICAO, 2009, p.2). Although our research is focused on teaching vocabulary using ICT, in particular, the Quizlet application, the essential component of the experiment is speaking – a discussion through which the students practice using vocabulary, thinking in English as well as pronunciation and listening skills. So, apart from taking a

vocabulary test, Quizlet's effectiveness as a learning tool is ultimately assessed based on the students' ability to use the topical vocabulary in a speech to produce a meaningful utterance. Thus, the conducted educational experiment is consistent with the ICAO aviation English training priorities and communicative approach principles. Besides, we also evaluated the students' engagement in speaking activities after the use of Quizlet and their attitude to this program.

As expected, our research revealed that mastering vocabulary with Quizlet results in better learning outcomes. These findings are congruent with the results of the previous research on Quizlet as a vocabulary learning tool (Sanosi, 2018; Al-Malki, 2020; Özer & Zeynep, 2017; Bueno-Alastuey & Nemeth, 2020; Ulla, Perales, & Tarrayo, 2020; Kose, Cimen, & Mede, 2016). In these publications, the authors advocate for Quizlet's potential in creating a favourable learning environment for vocabulary performance enhancement. However, although the experimental group students' vocabulary test results were 8.3 points higher than those in the control group, it is a noteworthy detail that both techniques were helpful and assisted the learners in vocabulary acquisition. This fact can serve as an argument supporting intentional vocabulary learning (proved to be effective, for instance, in publications by Schmitt (2008), Laufer (2005) and Smith (2004)) with a priority given to digital flashcards over conventional vocabulary learning techniques.

We believe that the students studying with Quizlet outperformed those who studied with traditional vocabulary learning techniques since working with flashcards involves repetition and retrieving of the target vocabulary, which is an indispensable component of vocabulary acquisition. To remember a lexical unit, students need to encounter a vocabulary item from 6 to 20 times (Webb, 2007, p.49). Nevertheless, mere repetition is not enough for a vocabulary unit to become a part of the long-term memory. Retrieving vocabulary should be the next step. Instead of simple repetition and encountering words, again and again, retrieving the term by its definition or vice versa results in higher chances for the target vocabulary to be still remembered later on because it will require greater efforts similar to what is needed during normal use (Barcroft, 2007).

We also favour the idea that the feature of adding pictures as a visual aid to help students memorise vocabulary also contributes to better vocabulary acquisition. We find this function effective like the authors of some publications (Phillips, 2016). We support the idea that when a student knows a word in their native language, pictures allow connecting the new word to their background knowledge, creating and reinforcing word associations that will help the word to become a part of the long-term memory (Laufer, Meara, & Nation, 2005). Pictures help us memorise and recall vocabulary better since more neural connections are established between different parts of the human brain.

One of the most useful functions as a learning tool to enhance vocabulary acquisition and pronunciation is speech synthesis. We agree with the idea that this artificial intelligence feature has a teaching potential, as it has been proven in some publications (Kristein, 2006; Proctor, Dalton, & Grisham, 2007). This feature helps students memorise a vocabulary unit as well as its correct pronunciation (where the stress falls, how to pronounce English sounds, especially diphthongs). Although there were no significant differences according to the pronunciation criterion registered in the control and experimental group, we consider a speech synthesis as a factor activating an additional perception channel. It results in improved vocabulary learning.

A unique aspect of the current study is Quizlet's potential in speaking skills development. We advocate for the fact that better speaking skills demonstrated by the Quizlet-taught students result from the fact that there is a strong relationship between vocabulary knowledge and speaking proficiency. Consequently, a greater Quizlet's contribution to vocabulary acquisition implicates the experimental group students' comparatively higher speaking performance. It is in line with Uchihara and Clenton's (2018) suggestions that "vocabulary size should be associated with lexical use in production because larger L2 lexicons allow for the selection and retrieval of conceptually and contextually appropriate words in communication" (p.4). A similar correlation is empirically proven by Koizumi and In'nami (2013) concluding that students with "greater vocabulary knowledge in terms of size, depth, and speed, are likely to have higher speaking proficiency, enabling them to produce more rapid, accurate, and syntactically complex oral performance" (p. 910).

In our study, we paid much attention to motivation and engagement in classroom activities as factors determining students' success. Basically, our findings echo the brief review results of some studies done by Altiner (2011) – since computer-based flashcard programs can offer numerous ways for the presentation of new vocabulary using multimedia, it can increase learners' motivation and autonomy. Based on our research findings, we recommend Quizlet's integration into aviation English and ESP classes to make language learning more effective and appealing to students. The use of such a computer flashcard program should be accompanied by the thorough planning of such classes and their role in the foreign language course design.

However, we can't but agree with Nakata's (2008) valid concern that using this tool for self-study and vocabulary practice, learners should be aware of effective flashcard use strategies, such as planning their

review schedule and monitoring learning progress. If there are no such skills, flashcard learning can even result in inefficient learning. A Quizlet app can assist students in these organisational issues due to scheduling ability.

Limitations

Although the empirical data demonstrated Quizlet's efficiency in boosting vocabulary retention, speaking skills and the students' motivation, the research findings are subjects to some limitations such as small sample size and the fact that class observations were made by the instructors who delivered practical classes in the groups for several months and, therefore, had some expectations as for the students' engagement rate – some kind of bias might have taken place. Besides, students' motivation for and engagement in in-class activities can be attributed to external factors (participants' psycho-emotional state, background knowledge on a topic proposed for discussion, etc.) rather than learners' language skills. Thus, the authors' conclusions on a higher engagement rate learning with Quizlet should be carefully generalised. To improve the generalisability of the obtained results, it can be reasonable to expand the sample composition and size, to invite independent instructors to interact with participants and to apply psychological techniques specifically targeting motivation research.

Conclusions

The results of our experiment demonstrated that the use of a Quizlet flashcard program has a positive influence on the learners' aviation English skills. We found this learning application especially useful for gaining many vocabulary units over a relatively short time. In this study, we evaluated the Quizlet platform efficiency in terms of its contribution to the students' aviation English competency and their values and motivation. The students' knowledge was measured at two levels – first, at the level of reception and reproduction using a vocabulary test and, secondly, at the level of production activities – the students' skills were evaluated according to their ability to use the target vocabulary in speech. At both levels, the students' learning outcomes were better than the results shown by the learners studying the same vocabulary with the use of traditional exercises and tasks. The motivation and engagement rate was also higher.

Based on these findings, we strongly support the idea that vocabulary knowledge underlies foreign language learners' general language proficiency. So, aviation English classes should not entirely rely on incidental vocabulary acquisition techniques as it is commonly done following the principles of communicative language teaching. It is more effective to include an intentional vocabulary learning component implying explicit vocabulary teaching, which then should be complemented with speaking practice encouraging students to use the target vocabulary.

We would like to point out that Quizlet is only one of a great number of electronic flashcard programs that can be used as a learning aid. There are also such electronic tools as SuperMemo, Anki, StudyProf, Teachmaster, etc. We believe that further research can be centred on measuring the effect the above-listed computer-based flashcard programs have on students' writing and reading skills, pronunciation and speaking. We also believe that methods, techniques, and learning aids boosting future ATCs' aviation English skills are one of the means to manage the human factor in aviation since statistics show that many incidents and accidents could have been avoided if pilots and ATCs were more skilful users of aviation English.

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Received: December, 5, 2020

Accepted: April, 24, 2021