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IN-CLASS USE OF WEB APPLICATIONS WITH ESP STUDENTS IN HIGHER EDUCATION

Abstract

Rapid advancement of technology has undeniably brought many changes to the traditional foreign language teaching and learning. Nowadays, numerous web- and mobile-friendly apps are being developed and used not only by individual learners, but also in interactive classrooms, since they are convenient and informal tools that may, if used appropriately, not only add a dash of playfulness and entertainment to the language learning and teaching process, but also contribute to its success.

This paper outlines the use of gamified web apps *Mentimeter, Kahoot!* and *Socrative* in an ESP course at a higher education institution and measures their contribution to students' specialized vocabulary development and their motivation to actively participate in classes using two instruments: an end-of semester vocabulary test and a questionnaire. The end-of-semester vocabulary test results were analyzed using the independent samples *t*-test to reveal that the experimental group students who used the apps scored higher than the control group students who did not use them. The questionnaire results were analyzed using descriptive statistics and the Pearson correlation coefficient, and proved that the students themselves believed that the applications contributed to their vocabulary development and increased their motivation to engage in class activities.

Keywords: gamification, gamified web applications, ESP, vocabulary development, learning achievement, MALL

1 Introduction

One of the central objectives of education is to promote learning by creating an engaging learning environment (Hanus & Fox, 2015). Making the learning experience [...] "fascinating", or at least "interesting" for all students (Campos et al., 2015) is a challenging task for contemporary teachers at all educational levels. Motivation is "central when learning a language" (Gamlo, 2019, p. 49), and "a pre-requisite [...] of student engagement in learning" (Saeed & Zyngier, 2012, p. 252), while engagement in a learning activity is dependent on students' motivation (Ainley, 2012). This is why motivated students and an engaging learning atmosphere eventually lead to better learning achievement. To provide conditions for better learning achievement, teachers need to question traditional teaching methods and current teaching practices, and constantly seek new and innovative teaching strategies that would increase the motivation and learning engagement of their students (Cilliers, 2017).

An innovative method of increasing student motivation, learning engagement and achievement is the integration of digital gamification strategies and elements with traditional teaching. Gamification for educational use is now present across disciplines, educational levels and in both online and traditional educational contexts, judging by the abundance of research papers on the topic (Deterding et al., 2011; Campos et al., 2015; Barata et al., 2017; Rachels & Rockinson-Szapkiw, 2017; Zainuddin et al., 2020, etc.). Game elements and strategies have a long-standing presence in language teaching and learning (see, for example, Palmer & Rogers, 1983), but with the introduction of the gamification concept and the emergence of gamified web and mobile-friendly apps they have gained new significance.

Despite the growing interest in the use of gamified mobile friendly apps in all educational contexts, the number of research papers exploring the benefits of gamified apps in the context of languages for specific purposes (LSP) at non-linguistic universities has been relatively scarce (e.g., Gamlo, 2019; Klimova, 2019). To the best of our knowledge, there have been no studies reporting on the use of Student Response Systems (SRSs), a subtype of mobile-friendly gamified apps, *Mentimeter* (www.mentimeter.com), *Kahoot!* (www.kahoot.com) and *Socrative* (www.socrative.com) in the context of vocabulary development in a tertiary ESP class. It is our belief, however, that these gamified and mobile-friendly apps offer many opportunities in this context, both in terms of learning achievement and in terms of student motivation and engagement. These apps seem particularly convenient for the current generation of university students – members of the so-called Generation Z, "born in the 1990's and raised in the 2000s" (Singh & Dangmei, 2016, p. 2). The generation of *digital natives* is highly engaged in technology and mobile devices, but has a short attention span (Csobanka, 2016), is inclined towards competition and autonomy in learning (Singh & Dangmei, 2016), and seems less responsive to traditional teaching practices and expository methods of teaching.

In this paper, we investigate the use of three gamified mobile-friendly web applications *Mentimeter*, *Kahoot!* and *Socrative* for vocabulary development with English for Specific Purposes (ESP) students at university level. The two primary objectives of this study are:

1. to explore the possible benefits of using gamified mobile-friendly apps for developing and revising specialized vocabulary in a tertiary ESP class, and

2. to investigate the potential of gamified mobile-friendly apps to increase motivation to engage in class activities among university students of non-linguistic orientation.

The paper is structured as follows: after the introduction, we outline the concepts of Mobile-Assisted Language Learning (MALL), gamification and mobile-friendly gamified apps, and proceed to describe and compare the three apps used in our research. After a brief literature review on the role of gamification in promoting students' motivation to engage in class activities and in enhancing their learning achievement, we present the context, methodology and results of our study. The results are then discussed and compared to research that has reached similar of divergent conclusions. The paper ends by specifying research limitations and by considering implications for future research.

2 Literature review

2.1 Mobile-friendly gamified web apps in language learning

The first report about telephones in foreign language teaching used as a replacement for student-teacher face-to-face interaction, by Twarog and Pereszlenyi-Pinter, dates back to 1988 (Twarog & Pereszlenyi-Pinter, 1988). With the invention of mobile phones, however, numerous innovative language learning opportunities have emerged.

The term Mobile-Assisted Language Learning (MALL) was coined to explain the use of mobile phones in language learning (Mosavi Miangah & Nezarat, 2012). MALL is seen as a subgroup of *mobile learning,* or *m-learning* (Elaish et al., 2017), which refers to "a learning environment based on mobility of technology, mobility of learners and mobility of learning that augments the higher educational landscape" (El-Hussein & Cronje, 2010, p. 17). MALL is also seen as a part of Computer Assisted Language Learning (CALL) (Yang, 2013), i.e. "the full integration of technology into language learning" (Garrett, 2009, p. 719).

Mobile technologies of today have come to support different types of language learning – "personalized, authentic, situated, real-time, synchronous and asynchronous" (Traxler, 2007, p. 7) and have enabled the learning process to take place outside a conventional classroom as well as inside it (El-Hussein & Cronje, 2010): for in-class activities, self-study or a combination of the two. By offering face-to-face, distant or online interaction with students (Chinnery, 2006), mobile phones with Internet connection open many new opportunities for knowledge acquisition and revision. Modern smartphones with unrestricted Internet access have laid the ground for the disuse of regular features such as SMS and calls that were previously used in language courses, and given way to more modern ones, including gamified web and mobile applications suitable for the development of all four necessary language skills.

The concept of *gamification*, that is, "the use of game-design elements in non-game contexts" (Deterding et al., 2011, p. 10), was first coined in 2003 by the game designer Nick Pelling (Fuchs et al., 2014 in Nikolić, Anđelković & Abramović, 2020) and applied in the marketing context as a means of attracting new customers. Since then, the concept of gamification has been implemented in numerous other contexts, including education and language learning. There is no single classification of game elements that make up the concept of gamification. Barata et al. (2017) claim that the most common game elements include levels, points, badges,

leaderboards and avatars, while Rego (2015) also includes the aesthetics and mechanics of a game, game thinking, collaboration, reward and competition, feedback, progression in levels, the storytelling element, etc.

With the advancement of mobile technologies, *gamified* web applications, commonly defined as "the applications that incorporate elements of games" (Deterding et al., 2011, p. 11), have become increasingly popular. The most important feature of these apps is their learner-centeredness: they enable learners to be autonomous and motivated, and learning to be collaborative and flexible. In terms of language learning, there is a number of gamified apps specifically designed for language learning purposes, the most popular among them being *Duolingo,* a mobile-friendly language learning app intended for self-study. Other opportunities for employing game elements in language learning include numerous language learning websites, such as *Quizlet.com* (for creating vocabulary lists), *VisuWords.com* (modern online visual dictionary and thesaurus), *Quizbot* (a collaborative gamified quiz application), etc.

Other mobile-friendly gamified web apps, also known as Student Response Systems (SRSs) (Moorhouse & Kohnke, 2020) or Audience Response Systems (ARSs) (Mayhew et al., 2020), despite being originally intended for purposes other than in-class language learning, can be adapted and used in a language class as well. These include *Mentimeter*, promoted as software for creating interactive presentations and meetings for large audiences (www.mentimeter.com), *Kahoot!* (www.kahoot.com), and *Socrative* (www.socrative.com), which are primarily intended for learning in general, but they also provide interesting tools for businesses.

The three abovementioned web- and mobile-friendly apps demonstrate a diverse set of features depending on the version or the pricing plan. The available features according to the pricing plan are provided on the apps' respective websites. The features most important for our research belong to one of the following categories: (1) question types available, (2) number of questions, (3) game elements present in each app, and (4) number of participants. The features of the free versions of the apps that we used are presented in Table 1[1].

Table 1
Comparison of Mentimeter, Kahoot!, and Socrative (free versions)

	question types	***number of questions***	***game elements***	***number of participants***
Mentimeter	multiple choice (MC), word cloud, open ended, ranking, Q&A, etc.	only 5 quiz questions per presentation	time limit, leaderboard, competition, emojis	unlimited
Kahoot!	True/false (T/F) and MC	unlimited number of questions per quiz	leaderboard, music, time limit, competition	limited to 50 participants
Socrative	MC, T/F, and short answer (SA)	unlimited number of questions per quiz	monitoring students' progress and feedback	limited to 50 participants

1 The features presented here may differ from the ones on the apps' websites since they are regularly updated.

2.1 Role of gamification in promoting students' engagement, motivation and achievement

Even though the concept of gamification has not been used in the domain of education for a long time (Göksün & Gürsoy, 2019), a significant number of research papers on the implementation of gamification strategies, elements, and gamified web applications in this domain have been published over the several past years. Zainuddin et al. (2020) provide a systematic literature review and a summary of findings regarding the topic, and report on the use of gamified elements and apps across a number of disciplines, at all educational levels, both in traditional classrooms and in online contexts. These papers mostly present and compare different gaming platforms and apps, game mechanics and learning outcomes, or examine methodological approaches (Zainnudin et al., 2020). As Landers et al. (2015) observe, the theoretical foundations of gamification research in the educational context, however, are largely missing.

Zainnudin et al. (2020) report that most research papers on this topic, regardless of the discipline, explore the potential of gamification to improve learners' motivation, learning engagement, academic performance, social interaction and collaboration, and the overall learning experience. Authors have drawn attention to the importance of certain game elements, predominantly game mechanics (badges and leaderboards), for the creation of an engaging and motivating learning environment (Barata, 2017 in Zainnudin, 2020, p. 9).

Most authors believe that the motivation that comes from using gamified web apps in class is only extrinsic in nature (Buckley, 2017; Ding et al., 2017), that is, it does not lead to satisfaction with gaining new knowledge (Zainnudin et al. 2020), but just the satisfaction related to earning badges and rewards. Other authors, however, believe that the use of gamified apps also leads to intrinsic motivation of students, reflected in the fun and enjoyment students experience while using these apps (Kuo & Chuang, 2016). On the other hand, Zainnudin et al. (2020) maintain that both types of motivation are equally important in promoting student learning engagement. A number of studies, however, also claim that the use of extrinsic motivators, such as virtual trophies, badges and leaderboards does not guarantee better intrinsic motivation, increased student engagement, and more competence (Ding et al., 2017; Mekler et al., 2017; Kyewski & Kramer, 2018).

A number of studies on the educational use of gamification also focus on the means of enhancing learning achievement with the help of gamification elements, strategies and apps. This is mostly done by adapting gamified concepts to enhance students' positive learning outcomes (Sánchez-Martín et al., 2017), integrating gamification into the grading process by using gamified formative assessment systems (Çakırogluet et al., 2017; Sánchez-Martín et al., 2017; Göksün & Gürsoy, 2019), etc. These studies generally prove that the application of the concept and elements of gamification in learning and assessment has significantly improved student academic achievement compared with a non-gamified instructional classroom and conventional assessment, as reported by Zainuddin et al. (2020).

Even though the studies focusing on the educational use of gamification appear to be plentiful, the use of gamification strategies and gamified web apps for language learning and teaching has been, to our knowledge, discussed by very few authors in higher education

(Klimova, 2017; Tayan, 2017; Jin & Yan, 2018; Klimova et al., 2018; Gamlo, 2019; Klimova, 2019) and even fewer in lower education (Rachels & Rockinson-Szapkiw, 2017). After providing a detailed literature review on the topic (Klimova, 2017), Klimova (2019) introduces a newly made smartphone app *Angličtina (English) TODAY* to her students of Management in Tourism in the Czech Republic and conducts an evaluation survey which proves the app's effectiveness in studying and revising vocabulary, provided that teacher facilitation and observation of students' needs are constantly present. The research findings of Gamlo (2019) also favor the use of game-based mobile apps for increasing Saudi female beginner level students' motivation to learn English and reveal that the apps contribute only to the rise in the level of instrumental motivation. In research conducted in an elementary school context, Rachels & Rockinson-Szapkiw (2017) report on the use of *Duolingo* as a replacement for traditional face-to-face Spanish language instruction, indicating that that this type of instruction may be equally efficient as the traditional one.

3 Methodology

Despite the ever-growing presence of gamified apps in all aspects of education, the number of studies focusing on the use of SRSs, a subtype of mobile-friendly gamified apps, *Mentimeter* (www.mentimeter.com), *Kahoot!* (www.kahoot.com) and *Socrative* (www.socrative.com) in the context of vocabulary development in a tertiary ESP context is largely missing. Considering their potential benefits for learning achievement, motivation and engagement of our students, and based on the research objectives stated above, we have formulated the following research questions:

RQ1: Does the regular use of *Mentimeter*, *Kahoot*! and *Socrative* for in-class vocabulary revision enhance students' vocabulary development?

RQ2: Do students believe that these apps motivate them to actively engage in class activities?

RQ3: Do students find these apps useful for achievement in the course?

3.1 Setting

The research presented in this paper was carried out in the context of a tertiary ESP course at a non-linguistic university. More precisely, the course in question is English for Specific Purposes 2 (ESP2), mandatory for second-year undergraduate students at the Faculty of Organizational Sciences, University of Belgrade. The course is mandatory for both undergraduate study programs – Management and Organization, and Information Systems and Technologies, so the course syllabus is intended to cater for the needs of both groups of students.

The ESP 2 course builds on the mandatory English for Specific Purposes 1 (ESP 1), taught to the first-year undergraduate students of both study programs, which focuses mainly on grammar revision and the introduction into English for Specific Purposes. ESP 2, on the other hand, puts emphasis on vocabulary and terminology development, reading and writing skills, and mostly relies on traditional teaching methods. The two-semester course is divided into

two sections – the teaching of language structures and terminology specific for the field of Information Systems and Technologies in the fall semester, and the ones specific for the field of Management and Organization in the spring semester. Students need to pass two major tests to complete the course – the mid-term exam (40% of the final grade), which tests the IT-related teaching materials covered in the fall semester, and the end-of-year exam (50% of the grade), which focuses on the management-related spring semester course material. The remaining 10% of the grade is awarded to students for active participation in classes and several *ad-hoc* tests (5 points, i.e., 5% of the grade per semester).

The ESP 2 classes are mixed ability in several aspects, depending on a number of factors, including but not limited to the students' educational background, previously attended language courses, frequency of language use, etc. The average number of students who opt for this course is approximately 800 per school year, and they are divided into 11 groups, with approximately 70 students in each group. Even though the course is mandatory, attendance is not, so the average number of students who actually attend ESP 2 classes is around 30 per group. In addition, the attendance rate tends to fluctuate and gradually drop towards the end of each semester.

In an attempt to upgrade the course syllabus and increase student learning motivation and engagement, the course teaching staff decided to incorporate mobile apps to a portion of the classes. Mobile-friendly web apps *Mentimeter, Kahoot!* and *Socrative* were introduced to six out of 11 groups of students in ESP 2 class in the academic year 2019/20 and were used throughout the fall semester a way to motivate students to engage more in classroom activities and potentially contribute to their vocabulary development. The groups accessed the apps through their smartphones to complete quizzes consisting of up to 10 multiple choice, open-ended, or true/false questions. There were 9 quizzes in total and each quiz focused on vocabulary taught during the preceding class and was used as revision.

3.2 Instruments and data collection procedures

At the end of fall semester 2019/20, we administered an end-of-semester paper-based vocabulary test to measure how much the use of apps contributed to the development of specialized vocabulary, and a questionnaire to identify how students perceived the effects of the apps on their motivation to engage in class activities and their overall achievement in the course.

The end-of-semester vocabulary test was administered in classrooms during the last week in the semester. The paper-based test comprised 59 multiple-choice, open-ended and true/false questions, all of which had been presented to students through applications during in-class vocabulary revisions throughout the semester. The questions tested students' knowledge of common collocations (e.g., *empty* the recycle bin), terms and their definitions (e.g., *markup language, Trojan Horse, broadband connection*, etc.), prepositions (e.g., upload files *to* the Internet), acronyms (e.g., *RAM, ICT, PAN*, etc.), as well as word formation (e.g., *encrypt – encryption*).

The questionnaire was administered through *Google Forms* and included six questions in total. The first three were demographic questions focusing on the respondents' study program (Q1), gender (Q2) and mid-term exam grade (Q3). A five-point Likert scale was provided in

question four (Q4) to collect information on the students' perceived influence of the apps on their motivation to engage in class activities, as well as on their achievement in the mid-term exam. The next question (Q5) asked students to mark the app they considered the best among the three, including the option "None". The last question (Q6) asked students to elaborate their answer to the previous question (Q5).

3.3 Participants

In order to measure the effectiveness of the applications through the end-of-semester vocabulary test, the students were divided into the control group and the experimental group. The experimental group comprised students who used apps for in-class vocabulary development, while the control group used no apps at all. The experimental and the control group attended classes on different days and in different time periods. Additionally, a yes/no question was inserted at the top of the test asking students whether they had been using the apps in classes or not. In the end, a total of 108 students completed the test – 45 from the experimental and 63 from the control group. The responses were anonymous since our intention was to compare the achievement of the two student groups collectively.

The questionnaire (see Appendix) was completed by the experimental group students only, as it focuses on their perception of the apps' benefits. There was a total of 48 respondents, out of which 29 (60%) were provided by students of Information Systems and Technologies, while 19 respondents (40%) were Management students (Q1); 33 respondents (69%) were female, and 15 (31%) male students (Q2).

3.4 Data analysis

The independent samples *t*-test was used to analyze the data obtained through the end-of-semester vocabulary test, since it is the most convenient method for small sample sizes divided into two different groups that need to be compared in terms of achieved results (Robby & Gitsaki, 2015). The *t*-test was performed using the statistical software *Minitab*.

4 Results

The data analysis provided answers to the research questions, but also offered insight into some other aspects of the analyzed apps' use.

4.1 Does the regular use of Mentimeter, Kahoot! and Socrative for in-class vocabulary revision enhance students' vocabulary development?

The results of the end-of-semester vocabulary test provide an affirmative answer to RQ1: they reveal that the regular use of the apps in question contributes to students' vocabulary development.

The data gathered from the vocabulary test scores served as the basis for the *t*-test. The hypotheses were formulated as follows:

H_0: There is no significant difference in the test scores between the experimental and the control group. $\mu_1 - \mu_2 = 0$

H_a: The experimental group test scores are higher than the control group test scores. $\mu_1 - \mu_2 > 0$

Table 2
Descriptive sample statistics and t-test results

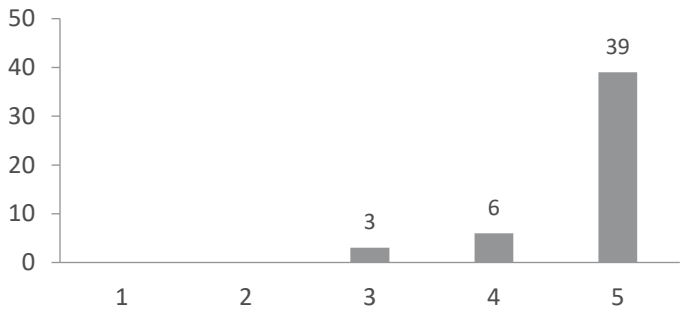
Descriptive Sample Statistics					t-test results		
Sample	**N**	**Mean**	**St. dev.**	**SE Mean**	**t-value**	**df**	p-value
Experimental	45	**40.33**	9.66	1.4	**2.15**	85	**0.017**
Control	63	**36.51**	8.32	1.0			

The results of the independent samples *t*-test show that the H_0 is rejected in favor of the H_a, since $\mu_1 - \mu_2 > 0$. More precisely, the experimental group test scores are statistically significantly higher than the control group test scores, which supports the conclusion that the regular use of *Mentimeter*, *Kahoot!* and *Socrative* for in-class vocabulary revision does, indeed, enhance our students' vocabulary development.

4.2 Do students believe that these apps motivate them to actively engage in class activities?

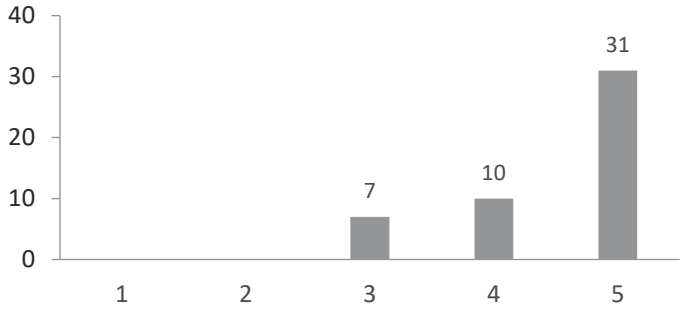
The answer to RQ2 can be inferred from students' responses to Q4 from the questionnaire, where they were asked to mark 5 statements referring to their perception of the apps' usefulness on a 5-point Likert scale. To begin with, a great majority of the respondents, 39 of them (81%), completely agreed with the second statement that the use of apps made classes more interesting (Figure 1).

Figure 1
The use of apps made our classes more interesting



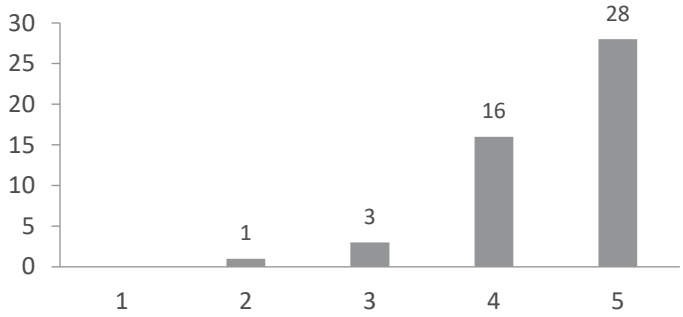
The responses for the third statement follow a similar trend. 31 respondents (65%) completely agreed that the web apps motivated them to take a more active part in classes (Figure 2).

Figure 2
The apps motivated me to actively engage in classes



Twenty-eight respondents (58%) completely agreed, and 16 (33%) agreed with the fourth statement – *I would like to use these applications more often in our English classes* (Figure 3).

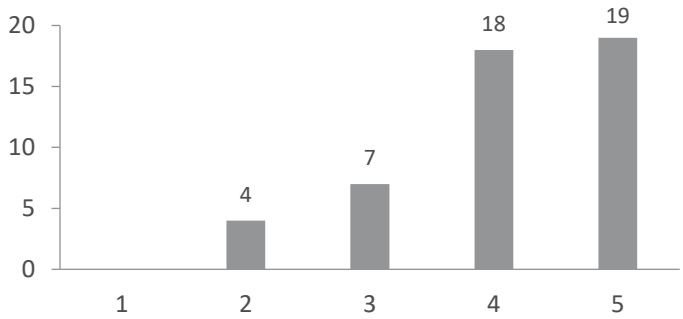
Figure 3
I would like to use these apps more often in our English classes



4.3. Do students find these apps useful for achievement in the course?

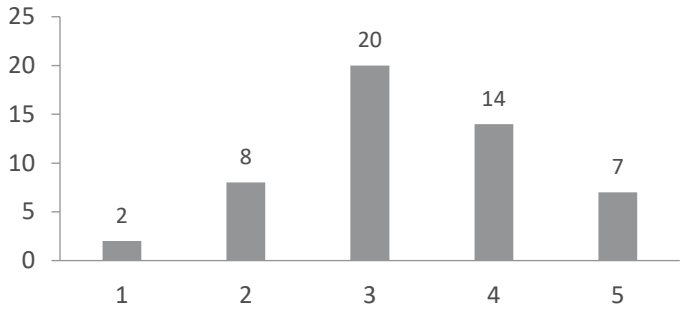
The questionnaire responses produce favorable results regarding the contribution of apps to the students' learning achievement in the course. Nineteen respondents (40%) completely agreed, while 18 (37%) agreed with the first statement *The exercises done through web apps helped me master the course material better*.

Figure 4
The exercises done through web apps helped me master the course material better



In contrast to the previous answer, only 7 (15%) respondents completely agreed that the vocabulary exercises done in the applications helped them perform better, i.e. gain a better mark in the mid-term exam, while 20 of them (42%) neither agreed nor disagreed with this statement. The distribution of answers to this question was more diverse (Figure 5) in comparison to the other questions in which the greatest majority of respondents selected one option.

Figure 5
I got a better mark thanks to the exercises done in apps



When asked to mark the app they considered the best, the majority of respondents, 31 or 65% of them opted for *Kahoot!*, followed by *Mentimeter* (preferred by 12, or 25% of the respondents), while the least preferred one was *Socrative* (only one respondent chose this option). Four respondents (8%) chose none of the three options.

When asked to elaborate their choice (Q6), the respondents who opted for *Kahoot!* mostly said that this application was the most interesting, interactive and user-friendly of the three, with the best interface design. Two of the respondents even argued that they did not remember using any other web applications, which may lead us to the conclusion that *Kahoot!* left the greatest impression on them. Those who opted for *Mentimeter* also mentioned its design, user-friendliness and interactivity as the main reasons for their choice, in addition to competition, speed and accuracy. A respondent also claimed that he/she chose *Mentimeter* because the answers were anonymous and they allowed shy students to take part without fear of being publicly exposed if their answers were incorrect. The one respondent who opted for *Socrative*, claimed that the user experience is somewhat better, while those who chose none of the apps either stated that they could not remember the difference or could not decide which one they preferred.

4 Discussion

Similar to Klimova's (2019) findings, the results of our research also indicate that the control group performed worse in the end-of-semester vocabulary test than the experimental group. However, unlike her research that included only one personalized smartphone app, our study revolved around three mobile-friendly gamified applications. Despite this, both her and our students claimed that the use of the app/apps helped them master the studied vocabulary better. As for the influence of apps on students' motivation, although we did not make a distinction between intrinsic and extrinsic motivation like Gamlo (2019), the questionnaire displayed that 92% of the respondents believed that the use of apps motivated them to actively engage in class activities.

Contrary to the first two positive findings, the one concerning the students' opinions about the apps' usefulness in their achievement is unforeseen as they were mostly indecisive about the contribution of the vocabulary exercises done through the applications to gaining better marks in the course. Thus, a definite conclusion about their perception of the usefulness of apps in their mid-term test achievement could not be reached. Nonetheless, our students, just like Klimova's (2019), expressed a great interest in using the apps more often in our English classes, since they believe the apps contributed to making classes more interesting, which further resulted in creating an encouraging learning environment. Lastly, contrary to our belief that the students would find *Kahoot!* the least sophisticated to be used in classes, it was regarded the best among the three apps.

5 Conclusion

The results of the end-of-semester vocabulary test revealed that the use of gamified web applications *Kahoot!, Mentimeter* and *Socrative* during our undergraduate ESP 2 course enhanced students' vocabulary development. Moreover, the questionnaire responses showed that the majority of students believed that the use of these apps helped them master the course material better *and* increased their motivation to engage in class activities. Conversely, the students reported to be indecisive about the apps benefit for their achievement in the mid-term exam.

There are, however, several research limitations to be considered. Firstly, the relatively limited number of students who participated in the research and the convenience sampling technique used may be the most conspicuous ones, as these prevent us from making any generalizations or performing a more detailed data analysis. Secondly, the effects of the use of apps on students' progress in vocabulary development and the overall achievement in the course have not been sufficiently explored. Namely, measuring how much students in the control and the experimental group developed their vocabulary using the end-of semester vocabulary test did not provide information on the effects the apps had had on the progress of individual students, or the progress of students pertaining to their study program, English language proficiency level, learning style, and other variables. Thirdly, the achievement in the test was not measured against the overall achievement in the course, as the outbreak of COVID-19 and the consequent disruption of in-class teaching prevented us from continuing with the apps use during the spring semester.

We believe that the limitations above can be overcome by making several adjustments to the research design and implementation. For more detailed analysis of the effects the apps had on students' achievement, students' vocabulary level should be measured both at the beginning and at the end of the course by administering an entrance test in addition to the end-of-semester test. Additionally, a random nickname should be assigned to all students taking both tests in order to appropriately track and compare the progress of each student, and potentially compare test results to the overall achievement in the mid-term and the final exam.

In current research, the vocabulary content tested through the use of *Kahoot!, Mentimeter* and *Socrative* was entirely teacher-generated, while the students were not involved in task design whatsoever. Future research may focus on the active involvement of students in generating

content to be tested through web apps, and measuring the effects of such active involvement on students' motivation, achievement, and increased autonomy in learning. Additionally, new research may focus on investigating social interaction and collaboration among students in both generating content and completing vocabulary tests; if so, other collaborative gamified apps may potentially be used.

The research presented in this paper was performed in traditional classrooms and interrupted by the COVID-19 outbreak and the switch to online teaching and learning. While the use of web apps under these changed circumstances and in an online environment may seem unnatural, especially during online classes via MS Teams, we believe that certain adjustments can be made to enhance the apps' usefulness for our students. The adjustments may include using these apps in flipped classroom, engaging students in generating learning content and thus increasing their autonomy, involving students of IT in designing customized mobile-friendly vocabulary development apps, etc.

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Appendix: End-of-semester questionnaire

Web applications in the teaching of foreign languages

Dear colleagues,

This short questionnaire surveys the use of applications Kahoot!, Mentimenter and Socrative on student achievement, motivation and engagement in the course English for Specific Purposes 2 during the past academic year.

If you have used these apps in class, please spare a few minutes of your time and share your thoughts and observations about them. The results of the survey will be used to improve our teaching.

1. Study program
   a) Information Systems and Technologies
   b) Management
2. Gender
   a) Male
   b) Female
3. My score on the mid-term test in English for Specific Purposes out of the maximum 40 points:
   a) 21-30 points
   b) 31-35 points
   c) 36-40 points
   d) I still haven't passed the mid-term test
4. Mark the following claims on a scale from 1 to 5 (1 - I completely disagree, 5 - I completely agree).
   a) The exercises done through web apps helped me master the course material better
   b) The use of apps made our classes more interesting
   c) The apps motivated me to actively engage in classes
   d) I would like to use these apps more often in our English classes
   e) I got a better mark thanks to the exercises done in apps
5. Mark one of the apps used in class that you think is the best:
   a) Kahoot
   b) Mentimeter
   c) Socrative
   d) None
6. Please elaborate your answer to the previous question: _____