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Using Quizlet and Brain Quiz in ESP virtual classroom at technical university (CEFR level B2/C1)

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Importance. The use of game design features in educational activities, or gamification of learning, is a popular, albeit contentious, trend in the field of education right now. This research applies gamification as a strategy to enhance inner motivation and learner autonomy in acquiring L2 technical vocabulary of the second language by students at the B2/C1 level in a virtual classroom.
Research Methods. The case study uses a two-cycle action research design to assess the difference between learning terminology with and without Quizlet support throughout a spring semester 2022, observes the development of learner autonomy through a survey, and demonstrates the growth of inner motivation reflected by Brain Quiz team scores.
Results and Discussion. The paired-sample t-test findings showed a significant difference between the two vocabulary learning cycles. After utilising Quizlet, students' vocabulary scores on Moodle quizzes increased by 10 to 15 % on average across all grade levels. As part of the evaluation process, the online formative assessment "Brain Quiz" demonstrates that students with higher performance on Moodle quizzes are able to establish more productive teams.
Conclusion. The study can contribute to the English Language Teaching (ELT) literature regarding innovative and technological tools that can improve students' language skills in the 21st century.

Keywords: learners' motivation and engagement, gamification in education, second language learning, virtual classrooms, innovative education, educational quizzes and games, gamification, technical terminology, distance learning, learner autonomy

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Использование Quizlet и Brain Quiz в виртуальном классе ESP в техническом университете (уровень CEFR B2/C1)

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Актуальность. Использование элементов игрового дизайна в образовательной деятельности, или геймификация обучения, является популярным, хотя и спорным трендом в сфере образования в настоящее время. Геймификация применяется в качестве стратегии повышения внутренней мотивации и автономии обучающегося при освоении специальной лексики второго языка студентами технических специальностей уровня B2/C1 в условиях онлайн-обучения.
Методы исследования. Использован двухцикличный дизайн исследования действий, чтобы оценить разницу между изучением терминов с поддержкой и без поддержки Quizlet в течение весеннего семестра 2022 года, наблюдать за развитием автономии обучающегося с помощью опроса и продемонстрировать рост внутренней мотивации, отраженный в результатах командной викторины BrainQuiz.
Результаты исследования. Результаты парного выборочного *t*-теста показали значительную разницу между двумя циклами изучения лексики. После использования Quizlet результаты обучающихся по лексике в тестах Moodle увеличились в среднем на 10–15 % по всем уровням. Результаты викторины BrainQuiz показали, что обучающиеся с более высокими показателями по тестам Moodle смогли создать более продуктивные команды.
Выводы. Данное исследование может внести вклад в решение проблем преподавания английского языка посредством инновационных и технологических инструментов, которые могут улучшить языковые навыки студентов в XXI веке.

Ключевые слова: мотивация и вовлеченность обучающихся, геймификация учебного процесса, виртуальный класс, инновации в образовании, образовательные викторины и игры, геймификация учебного процесса, дистанционное обучение, развитие автономии обучающихся

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IMPORTANCE

Vocabulary has always been central to language learning. It is reported that in the last twelve years, 30 % of the research in L2 are reported to have investigated vocabulary learning in different contexts [1]. Strong connections between learners' receptive vocabulary size and four main communicative skills (listening, reading, speaking, writing) have been identified [2; 3]. Nonetheless, the success of mastering L2 vocabulary has always been based on the levels of learner autonomy in vocabulary learning [4; 5]. Learner autonomy is defined as "the learners' ability to self-direct their own learning process to attain learning goals, which eventual-

ly leads to the development of life-long learning skills" [6]. Learner autonomy and inner motivation cannot advance on their own, but strongly depend on support provided by teachers in encouraging students to study autonomously [7, p. 160]. Over recent years, the rise of learner autonomy in vocabulary learning can be supported by means of gamification.

Gamification is a relatively young trend in game technology. According to Cheng et al., a game is an organised play with goals, rules, and challenges that is played for amusement [8]. First used in 2008, the term "gamification" has become more and more relevant since the 2010s [9; 10]. Gamification is distinguished from games by its deeper intent. Although definitions of gamification vary, they typically center on one of two things: the practice of gaming and game-like experiences in serious contexts, or game features and techniques. Gamification refers to the process of applying game mechanics and design elements to non-game contexts to increase user engagement [9]. It presupposes introduction of game-design methods into a non-game context (work, study or everyday life) and contributes to an increase in sales, customer and employee's loyalty and maximum involvement in the educational process [11]. Using person's instincts for competitions, collaboration, and focus on a common or individual result, gamification successfully motivates a person to achieve goals and increase productivity. Unlike a working or training routine, a game for an adult can become a vivid experience and help activate the process of memorizing.

F.A. Costa, M. Raleiras, J. Viana define 12 main principles of gamification that should be observed while planning a game-design element: motivation, individuality, intentionality, autonomy, interaction, collaboration, challenge, elaboration, relevance, feedback, inquiry, and assessment [12]. Game elements are, for example, levels, points, badges, leader boards, avatars, quests, social graphs, or certificates [13].

Since the 1970s, games have been created for instructional objectives. Games may be both appealing and effective when a learner's interest in them develops into engagement. According to Welbers et al., "gamification for learning" and "game-based learning" "share common ground on the idea that game elements can make learning experiences more engaging" when it comes to the alluring aspects of games with academics [14]. The notion that "application of gamification could significantly influence the efficiency of human work and the enjoyment of executing it" [15] was supported by findings from a number of studies [16–20].

The flow theory developed by M. Csikszentmihalui et al. is also connected with the popularity of games in educational settings [21]. Under the theory in question, the flow is a special mental state when a participant completely engages in the activity (game), "applies full concentration of the activity, becomes unaware of the passage of time, does not feel self-conscious" [22]. We find such deep and permanent engagement to be vital for efficient learning.

Amid the move to distance learning during the pandemic, the use of game-design methods is extremely important because information flows are significantly narrowed, which negatively affects the level of perception and assimilation of new information. The game as a means of stimulating students' activity can partly compensate for the lack of direct contact with the teacher.

Game-design methods are quite diverse: interactive tasks, quizzes, quests, online simulators and gameful features in the structure of the lesson. There are some trends towards the creation of virtual or role-playing games which contain a plot, puzzles, choice situations. There are simpler solutions related to obtaining a variety of rewards for routine educational activities and the possibility to convert these rewards into something pleasant and beneficial for a particular learner.

A plethora of online resources are available to assist educators in gamifying their lessons. For example, a number of programmes, including Quizalize, Kahoot, Quizlet, Blooket, PlayPosit, and Edpuzzle, are made to support education by utilising the concepts of game-based learning. They offer a user-friendly platform where students may have fun while creating,

competing, interacting, sharing, and helping one other to reach their full learning potential.

Quizlet is designed as a free website platform made up by Andrew Sutherland in 2005 which provides learning tools for students, such as flashcards, study and game modes. It comprises more than 50 million user-generated flashcard sets. The benefits of Quizlet in vocabulary learning have been highlighted in various experimental studies [23–25] and the perceptions of its users have been outlined [26–32; 24].

T.T. Phi, V.H. Tho, M.H. Thanh and P.T. Khanh carried out a survey to find out the effect of Quizlet on vocabulary learning of 210 students at The University of Economics Ho Chi Minh City [33]. The students' scores for vocabulary tests, the questionnaires and interviews were employed as the instruments of the research. The results showed a higher degree of motivation in learning English vocabulary through Quizlet and better vocabulary knowledge.

G. Dizon conducted a similar study on using Quizlet in EFL classroom with Japanese EFL university students [34]. The findings designated that the learners were capable of making statistically considerable gains. More importantly, the overview of the questionnaire arranged by the researcher proved students' positive perceptions of Quizlet to learn vocabulary.

In an empirical survey by A. Aksel, it was disclosed that the Quizlet users scored higher on tests in comparison to non-users [27]. In an experimental study on Quizlet, B. Lander emphasized that undergraduate students found using Quizlet in English courses effective and enjoyable [30]. According to the results the tests' score of Quizlet users were increased by 6 %, demonstrating the benefits of Quizlet on the students' lexical advancement.

In another survey on the effects of Quizlet on vocabulary acquisition, Sanosi used experimental research with a pre-test and post-test control group design [31]. Having compared the test scores of the groups, it was found out that Quizlet helped enhance the vocabulary knowledge of the students in the experimental group.

In classroom action research carried out by A.G. Anjaniputra and V.A. Salsabila, the use of Quizlet in classrooms for vocabulary acquisition was considered beneficial. The outcome of the study revealed that Quizlet created enjoyable learning atmosphere for the participants, and boosted their attention, as well as engagement in vocabulary learning process [26].

The increasing demand for highly skilled professionals in technical fields necessitates specialized linguistic knowledge to be used in the professional development process such as educational training, career development, scientific communication, etc. Due to the complex nature of ESP acquisition and the lack of solid research addressing this issue, this study intends to present a new approach to language skill development that incorporates digital tools and gamification elements. The relevance of the research is explained by the necessity to study the effects of Quizlet on mastering technical vocabulary at high school.

This survey aims to prove the efficacy of Quizlet in the vocabulary tests, and to investigate students' perception of the instrument. In addition to Quizlet, the study explores further practice of technical terms in context (MOODLE exercises) that is supported by gamification (Brain Quiz) in a classroom action research design. The authors have opted for these tools since vocabulary quizzes and MOODLE exercises are assumed to promote learner autonomy, whereas gamification through the use of Brain Quiz facilitates learner vocabulary consolidation and assessment in the classroom. By employing a classroom action research design where learners acquire new vocabulary both with and without gamification tools, the researchers expect to get empirical evidence of how gamification influences vocabulary learning outcomes, promotes learner autonomy, assess vocabulary consolidation and growth of inner motivation through Brain Quiz.

RESEARCH METHODS

Research is based on the action research design, which provides a structured process for customizing survey findings, giving teachers the opportunities to address certain questions, con-

cerns, or problems within their own classrooms, schools, or districts. The main focus was on the exploration of the efficacy of using Quizlet for increasing vocabulary learning outcomes, assessed through Brain Quiz, and enhancing learner autonomy. Reviewing Kurt Lewin‘s work (the originator of action research), G. Adelman highlighted the positive effect of action research on improving practice. In education process, action research is employed when educators make several changes to their teaching practices to address problems in the classroom [35]. This led to the creation of a two-cycle action research design, wherein during the first four weeks of the study, all students participated without any gamification support; during the second eight-week cycle, participants were split equally into two groups (Group 1 and Group 2), with the second group receiving gamification support during their studies (Fig. 1).

The entire study was conducted over 12 weeks, with formative assessment through exercises on Moodle every fourth week, and a final test at the end of the second cycle. The concluding assessment (summative assessment) took the form of a Brain Quiz after week 12, followed by a questionnaire to elicit students' views on their experience of using Quizlet in vocabulary learning. This method provided the definite advantage of having a built-in control group, since the same students were used for both cycles. Thus, proof of validity of the concept was increased.

Context and Participants. The study was conducted for 12 weeks in the spring academic term of 2021–2022 at Moscow Institute of Physics and Technology (MIPT). The selected course was named ”Language for Specific Purposes” and aimed at advancing students ‘English knowledge and skills for both academic and professional communication. The group of subjects contained 110 third-year students (73 % male, 27 % female) who majored in Fundamental and Applied Physics, Aerospace Technology, Electronics, Photonics and Molecular Physics, Applied Mathematics and Informatics, Biological and Medical Physics. Ranging from 19 to 20 years old of age, the students’proficiency was at the level of Upper-Intermediate users (B2/C1) in the Common European Framework of Reference for Languages (CEFR). All the participants were informed of the research and agreed to participate as long as it did not affect their course grades.

Data. There were 3 types of data utilized in this study. The first data were students’end of month online Moodle exercises (vocabulary tests), the scores were included into a student’s general rating. The second data were obtained as a result of the end of course Brain Quiz. The third data came from a survey questionnaire, which was distributed after week 12. Each of the data are elaborated on in the next section.

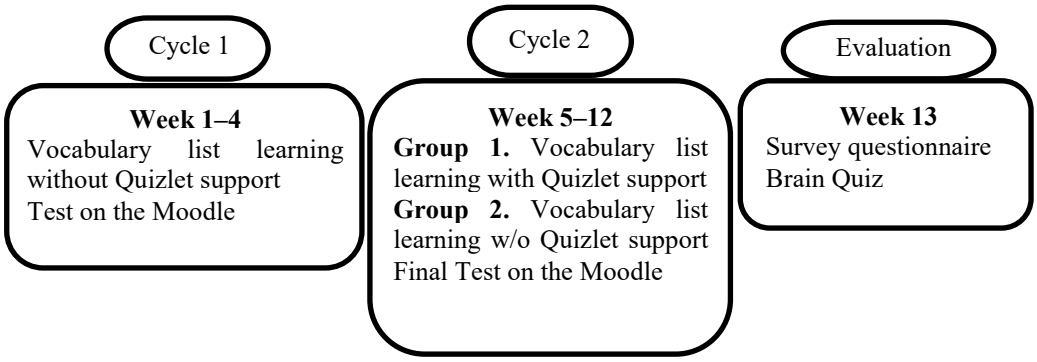


Fig. 1. Scheme of action research
Рис. 1. Схема практического исследования

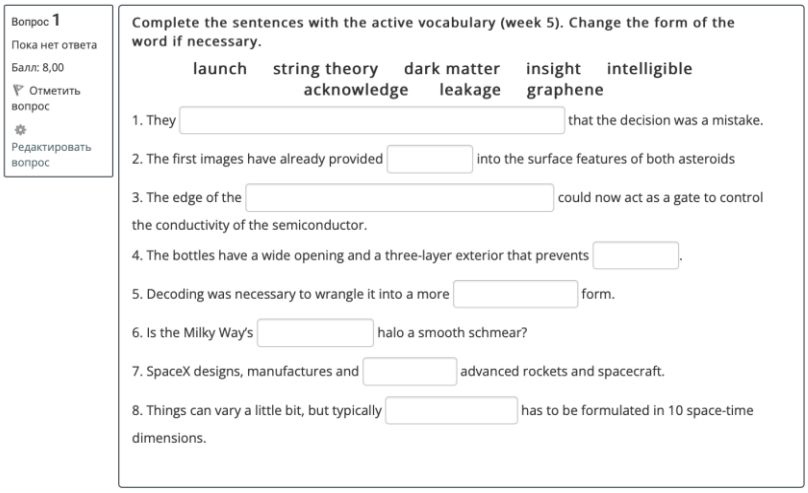


Fig. 2. Example of the vocabulary test on the Moodle
Рис. 2. Пример словарного теста на Moodle

Vocabulary scores. The students had 3 vocabulary tests on the Moodle platform (online) at the end of each month (February, March, April) and a final vocabulary test at the end of the second cycle. The tests were meant to assess the outcomes of the students' autonomous vocabulary learning for each vocabulary list. There were 100 sentence completion questions, aimed at using the terms in context. The tests were conducted at home as a part of home preparation for the lessons. The students took the test by going to www.moodle.phystech.edu using their laptops or tablets (Fig. 2).

The teacher could monitor students' progress as soon as the tasks were completed. The maximum score for the vocabulary test was 10 and the minimum score – 6.

The target vocabulary underlying the vocabulary tests consisted of 300 academic English words at B2/C1 levels in the CEFR: 200 words were taken from Vocabulary-minimum, 100 terms – from scientific papers (https://phys.org/). The words were divided into 3 lists of vocabulary, where one list consisted of 100 words (Table 1). By using the dictionary at home, the students had to find definitions in English as well as examples to illustrate each meaning of the word. Through this process, it was expected that the students would develop their autonomous vocabulary learning.

Brain Quiz scores. Since Brain Quiz contains 63 tasks, the maximum number of points students could receive was 63. All responses were collected via Google Forms followed by manual verification to eliminate scoring bias and allow for additional points for comprehensive answers. This approach allowed Brain Quiz instructors to make the assessment process more transparent and reliable.

Survey questionnaire. A set of questions (Google Forms) was created to find out students' perceptions of their experience in using Quizlet in vocabulary learning. The surveys were distributed in week 12. Two aspects were measured: students' perceptions of the use of Quizlet as a place for learner vocabulary training and the Influence of Quizlet on the development of autonomy. The former consisted of 6 items, such as "Quizlet from teacher really helped me learn the vocabulary sets more and better.", "Quizlet from the teacher really facilitated my vocabulary learning through practices.", and "Quizlet from the teacher enabled me to practice on vocabulary exercises more." The items were developed based on Cunningham [36]. Meanwhile, the latter part involved 4 items, such as" Quizlet helped me study the vocabulary sets

Table 1

The First 30 of 270 Words that the Students Learned in 12 Weeks

Таблица 1

Первые 30 из 270 слов, которые студенты выучили за 12 недель

insert (v)	invent (v)	string theory
insight (n)	involve (v)	dark matter
instantaneous (adj)	irrespective of (prep)	bifurcation point
integral (n)	justify (v)	quantum teleportation
intelligible (adj)	knowledge (n)	Large Hadron Collider
intend (v)	acknowledge (v)	the Hirsch Index
intermediate (adj)	lag (v)	artificial neural network
interpret (v)	last (v)	graphene (n)
intersect (v)	launch (v)	sequencing (n)
introduce (v)	leakage (n)	entropy (n)

Note. v = verb; n = noun; a = adverb; adj = adjective; prep = preposition
Примечание. v = глагол; n = существительное; a = наречие; adj = прилагательное; prep = предлог

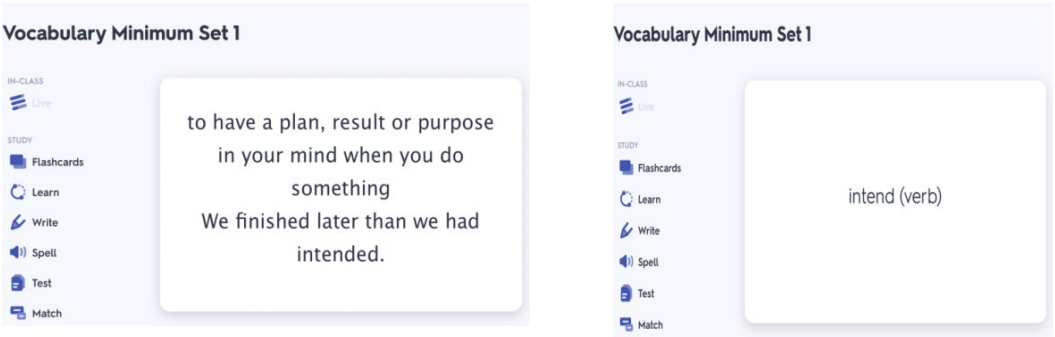


Fig. 3. Sample of word layout on Quizlet platform
Рис. 3. Пример оформления слов на платформе Quizlet

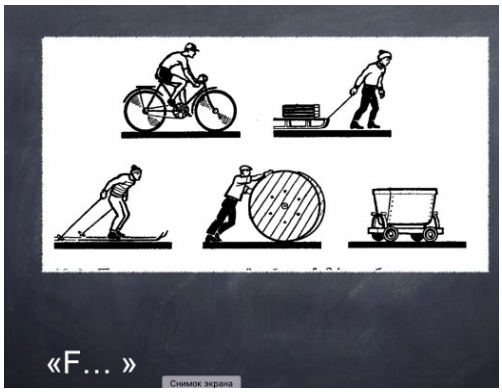
independently", "I could learn vocabulary autonomously on Quizlet." The items were created by referring to Agustín-Lach and Alonso[1]. These two aspects had the responses ranging from 1 to 5, where "1" was strongly disagree and "5" strongly agree. Three scales were used to interpret the mean value, including Low level (1–2.4), Moderate level (2.5–3.4), and High level (3.5–5).

Procedure. Stage 1 – Preparation. Prior to the start of the term, the 300 target words and 3 vocabulary lists were prepared. Then, the words in the vocabulary lists for week 4–12 were computed into Quizlet (Fig. 3).

Finally, the 63-question Brain Quiz was created in a Keynote PowerPoint presentation format. All tasks were based on the target vocabulary studied during the 12 weeks (Fig. 4).

Stage 2 – Implementation. Students learned the weekly vocabulary lists without the Quizlet support from week 1 to 4, and students in Group 2 with the Quizlet support from week 5 through week 12. In Quizlet, learners could study the provided words through *Flashcards*, *Write* (involving word meaning), *Spell* (involving listening, pronunciation and spelling), and

[1] *Чепурная И.Н.* Словарь-минимум для перевода научных статей. М.: Моск. физ.-техн. ин-т, 2011. 53 с.



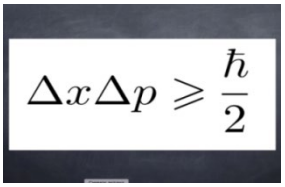


Fig. 4. Samples of the Brain Quiz tasks
Рис. 4. Примеры заданий викторины “BrainQuiz”

Test (involving word meaning, matching questions and true/false questions). They could do various vocabulary exercises repeatedly and autonomously anywhere and anytime using their smartphone and/or computer.

After week 12 Brain Quiz was introduced to check students’ ability to use technical vocabulary in context. Brain Quiz is an online quiz based on the Vocabulary-minimum, a dictionary for translation of scientific and technical literature, which is studied by the third-year Upper-Intermediate students at MIPT [37]. Vocabulary-minimum includes 501 terminological units with their translation into Russian and examples of usage. This textbook is supposed to help students overcome difficulties in reading scientific papers. The use of the dictionary facilitates the process of preparing students for oral presentations on selected scientific and technical topics.

The quiz includes 8 rounds and 63 tasks based on technical terminology and scientific facts. The total duration of the quiz is 2 academic hours. Every question is going to take from 30 seconds to 1 minute to answer, depending on the conditions of a certain round. The Brain quiz can be held online on Zoom or Google-meet platforms for 100 or more students at a time.

The instructor assigns students to breakout rooms in advance, thus ensuring that the assignment is discussed strictly in a certain group. The instructor explains terms and conditions of each round and proceeds to demonstration of tasks (power point/keynote presentation slides). Within the available time, teams discuss options and fill in answer forms. To simplify the process of transferring answers and introduce automatic evaluation of each task Google-forms are used. This allows the instructor to assign a certain number of points for a correct answer, to give feedback on the result of the round to the participants, as well as to monitor the results and statistics of answers. In the final round of the game the teacher announces three winners, namely, the teams that have scored the maximum number of points based on the results of 8 rounds. The winners receive an encouragement in the form of additional points to the final rating.

Stage 3 – Evaluation – data analysis. The evaluation involved three sets of data: students’ vocabulary test scores, Brain quiz scores and survey results. To answer the first research question, this study conducted a paired sample t-test with the scores of Group 1 and Group 2 students. The results of the Brain Quiz were then interpreted and compared, and finally, the survey data were analyzed using frequency and descriptive statistics.

RESULTS AND DISCUSSION

The results of the paired-sample t-test indicated a significant difference between two groups of learners (Table 2). After using Quizlet in Cycle 2 the students showed better performance in

Table 2

Paired sample t-test results after Cycle 2

Таблица 2

Результаты проведенного по парным выборкам Т-теста после цикла 2

Score	Number of students from Group 1 after Cycle 2	Number of students from Group 2 after Cycle 2	Difference
10 / >95 % correct answers	5 (9 %)	11 (20 %)	6 (+11 %)
9 / >90 % correct answers	10 (18 %)	15 (28 %)	5 (+10 %)
8 / >80 % correct answers	18 (33 %)	25 (45 %)	7 (+12 %)
7 / >70 % correct answers	15 (27 %)	4 (7 %)	9 (–20 %)
6 / >60 % correct answers	5 (7 %)	0	–
Failed / >60 % correct answers	2 (4 %)	0	–

completing vocabulary exercises on the Moodle. On average, the students' vocabulary scores in final vocabulary test (summative assessment) after using Quizlet were from 10 to 12 % higher in the top ratings (10/9/8) and the number of failed attempts dropped to zero.

The online game "Brain Quiz" (formative assessment) arranged as part of evaluation revealed that those students who showed better results in Moodle quizzes formed more effective teams. BQ results show higher scores for teams with Quizlet support learning (from 45 to 63 correct answers) and clearly prove its positive impact on technical vocabulary acquisition (Table 3).

Table 3

Range of correct answers in BQ

Таблица 3

Диапазон правильных ответов в BQ

TeamType	Students of Group 1 (with Quizlet support)	Students of Group 2 (without Quizlet support)
Correct answers	45–63	39–51

Moreover, the employment of online technologies such as online Brain Quiz allowed to achieve the following results: to check the studied material, to consolidate knowledge of technical vocabulary, to practice the contextual use of lexical units, to involve the maximum number of students into team work, to introduce a competitive element into the learning process, to create a positive atmosphere.

The survey results showed that students' perceptions on the use of Quizlet for enhancing their autonomy were at Moderate level in general (Table 4). The students perceived that the Quizlet helped them learn more vocabulary words and learn them better, increased their vocabulary learning through practices, and helped them to practice on vocabulary exercises more. The majority of the students also stated that they used the Quizlet more than once for vocabulary practice every week and they liked the exercises provided in Quizlet. Considering learner autonomy, the students supposed that Quizlet helped them study the vocabulary lists independently and felt that they had become more independent in vocabulary learning since using Quizlet. They stated their enjoyment in learning autonomously on Quizlet. However, learners' perceptions in these two aspects were not considerably correlated.

The present study intends to investigate the process of active vocabulary acquisition through gamification, as well as to increase independence and practicing vocabulary by means of Brain Quiz. The paired-sample t-test analysis revealed a significant difference in students' scores between Cycle 1 (before introducing Quizlet) and Cycle 2 (after introducing Quizlet). The Brain Quiz had a positive impact on students' acquisition of vocabulary lists. Our findings are in good agreement with earlier studies on the use of Quizlet in learning new vocabulary conducted by Japanese researchers Dizon and

Wright claiming that Quizlet is an effective means to facilitate learning an academic vocabulary [34; 38].

We also support the idea expressed by Cunningham stating that in terms of limited time in class, it is possible to learn vocabulary independently on Quizlet website [36]. The above-mentioned research works do not take into account contextual vocabulary learning, nor do they examine using ESP in speech production, which is achieved in our experiment through Moodle exercises and Brain Quiz respectively.

The first finding of this study follows and sustains the positive suggestions from previous ones. Students' reports on their experiences of using Quizlet for twelve weeks in vocabulary reflected moderate levels on both the potential of Quizlet for enhancing autonomy and facilitating vocabulary training. In the studies on autonomy in vocabulary learning, learners' reflections revealed the need for teacher guidance through vocabulary instructions and the second finding of the present study suggests the inclusion of Quizlet in vocabulary learning instruction. Learning through vocabulary lists can be one alternative solution to help students acquire target words within limited class-hours and this approach offers similar results to other approaches [39; 40]. As effective vocabulary learning and acquisition happens when learners are engaged in various tasks and activities involving the exploitation of linguistic resources, the support of Quizlet can be very helpful.

Student accounts of their experiences using Quizlet over twelve weeks in vocabulary learning reflect a moderate level of both Quizlet's potential for increasing autonomy and facilitating vocabulary learning. In research on autonomy in acquisition occurs when students engage in a variety of tasks and activities involving language resources, Quizlet support can be very helpful [41].

CONCLUSION

The findings contribute to the current study of the impact of gamification for better learning process in higher education, specifically in courses for students of technical specialties, through the following aspects: **(a)** a game design process aimed to accompany the course, based on a causal model with specific desired actions, vocabulary learning, student reflection has shown the need for teacher guidance in vocabulary instruction [7], and the second finding of this study suggests the incorporation of Quizlet into vocabulary instruction. Vocabulary list instruction can be an alternative solution to help

Table 4

Descriptive statistics

Таблица 4

Описательная статистика

Item	Mean	SD	Level
Students' perceptions of Quizlet as a place for learner vocabulary training			
Quizlet from teacher really helped me learn the vocabulary sets more and better	3.70	0.95	High
Quizlet from teacher really facilitated my vocabulary learning through practices	3.51	1.12	High
Quizlet from teacher enabled me to practice on vocabulary exercises more	3.63	1.11	High
I used Quizlet more than one time for my vocabulary practice every week	3.37	0.69	Moderate
My scores on vocabulary tests increased since using Quizlet from teacher	3.37	0.79	Moderate
Teacher should have created Quizlet since vocabulary test 1	3.52	0.80	High
Students' perceptions of the impact of Quizlet on the development of autonomy			
Quizlet helped me study the vocabulary sets independently	3.22	0.85	Moderate
I could learn vocabulary autonomously on Quizlet	2.96	1.02	Moderate
I enjoyed learning vocabulary independently on Quizlet	2.96	0.98	Moderate
Quizlet supported my autonomous learning effectively	3.07	1	Moderate

students acquire target words within a limited number of hours, and this approach yields results similar to other approaches [40; 41]. Because effective vocabulary learning and **(b)** a two-fold assessment procedure, first to assess the relationship of the game elements with desired actions and academic results (i.e. grades and perceived learning), and second, to assess the game itself (i.e. game elements perception), and **(c)** it presents empirical evidence of the positive effects of gamification on academic performance and other desired behaviors of social relatedness, such as a sense of community and teamwork.

Quizlet, Moodle quizzes and "Brain Quiz" based on motivation theory and gamification experience were designed to accompany the entire course offered to undergraduate students of technical specialties in Moscow Institute of Physics and Technology. Activities focused on mastering the class, sense of belonging to the institution, and teamwork, were made central to the game.

Results showed that students who actively played the games showed a significantly greater passing rate compared to non-active players, and high engagement in problem-solving activities, even of a higher level than the class. Active players responded that the games contributed to a better learning process, the activities helped them to increase the sense of belonging to the institution and improve their learning. Furthermore, the extrinsic rewards were by far the main motivators that boosted active playing the games. Results also showed that improvements should be made in terms of joyfulness, feedback, and amount of teamwork activities, as well as the inclusion of elements to promote more players be "active" since the first phases of the player journey.

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