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Devising Gamification for Vocabulary Development and Motivation: An Experimental, Mixed-Model Study[1]

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SUMMARY

This study aims to scrutinize the effects of gamified Turkish vocabulary teaching on vocabulary development, and motivation on learning words. A nested mixed-method experimental design (gamification-based vocabulary learning for the experimental group instructor-led vocabulary learning for the control group) and was conducted with 34 fourth-grade students. Data were collected using the Vocabulary Achievement Test (VAT) and the Vocabulary Learning Motivation Scale (VLMS), interview forms, diaries and activity notebooks, video recordings, and researchers' diaries. Significant differences were found between the pretest and posttest scores of the gamification-based and instructor-led vocabulary learning groups measuring vocabulary achievements and motivation. There were considerable differences in favor of the experimental group between mean pretest and posttest scores of the experimental and control groups for vocabulary achievement, whereas no significant differences were found in terms of motivation. It was found that experimental group's vocabulary achievement, awareness and competencies were improved; as well as their willingness and motivation to engage in vocabulary learning, use of previously unknown words, vocabulary development, and embracing of the gamification application and its components, and also showed indicators of intrinsic and extrinsic motivation. On the other hand, quantitative results of the control group were at acceptable levels, although their qualitative results were poorer in terms of generating themes and being able to evaluate learning progress. The study was concluded with recommendations for practitioners and future research.

Keywords: Gamification, language learning, vocabulary learning, vocabulary, motivation.

INTRODUCTION

The process of linguistic development, which starts at birth, is the starting point of acquisition of the vocabulary that will serve the individual throughout their life. Vocabulary acquisition begins with interactions with family members and others in their vicinity, and continues through formal learning experiences. Systematic vocabulary instruction allows individuals to learn new words, to make semantic and contextual connections between the words they know, to associate newly-acquired words with the words they already know, and to express the words in their vocabulary in written and oral communication forms. The need for the effective acquisition of words gave rise to the emergence of the vocabulary concept and of teaching methods used to develop vocabulary.

In recent years, infrastructures that integrate technology have had important implications on the theoretical approaches adopted for the systematic teaching of vocabulary. In other words, as technology becomes integrated ever more rapidly into language instruction, approaches such as web-assisted learning, computer-assisted learning, distance learning, e-learning and mobile learning have started to replace conventional learning approaches. Studies conducted to date have shown that implementing new practices in the process of language instruction and web-based learning models provide greater benefits than conventional models (Yusofa & Saadon, 2012); students have a positive attitude toward independent and individual learning in various technology-based language learning environments (Shih- Yin, 2005); newly developed instruction models improve the self-efficacy of students (Baltrus, 2003), and custom systems developed for language instruction have a positive effect on student achievement (Yamada, 2009; Wang et al., 2009; Arias et al., 2010). The technology-assisted language instruction activities developed by researchers, include digital narrations (Connolly, 2008), game-like applications and platforms (Berns et al., 2013), blogs (Pontydysgu, 2007) and online lessons, and these have helped students develop positive attitudes toward learning, have

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increased their interest and motivation, have facilitated and streamlined learning, have made the process of learning fun and have decreased levels of anxiety. In this context, utilizing new and contemporary approaches to language instruction, and vocabulary instruction in particular, allows learners to engage in independent and individual learning, provides rich learning environments, makes the learning process fun, and increases interest and motivation.

The concept of gamification in education is based on the utilization of game techniques, dynamics and structures in educational environments in order to encourage individuals to engage in the desired behaviors in educational environments, to increase motivation and to develop attachment to the environment (Deterding et al., 2011; Lee & Hammer, 2011). Gamification refers to the use of video game components as a means of improving user experience or strengthen the attachment of users to the environment in non-game systems (Deterding et al., 2011). The gamification approach involves integrating game mechanics into an Internet website, educational tool, online community or other enterprise systems as a means of encouraging participation and increasing motivation and attachment (Bunchball, 2016). It is also thought that, through gamification, it becomes possible to use game-based mechanics, game thinking and game aesthetics to bring people together, to encourage them to learn, to increase motivation and to resolve problems (Kapp, 2012). The main goal in gamification is to entertain and encourage people, to strengthen their attachment to the environment and to provide them with access to rich experiences (Kim & Lee, 2013). Similarly, the practice of gamification is noted to be highly effective in improving learning, achievement, motivation and participation (Cheong et al., 2013; Hsin et al., 2013). In short, gamification aims to make use of the game components that ensure motivation and sustain interest during games to similarly motivate and keep the learner in the system when conveying particular educational content that would not originally involve a game. In short, gamification in education should aim to make the educational environment meaningful for the student, and to help the student achieve intrinsic motivation by integrating game components into the environment.

It is argued that educators can use the practice of gamification to create attractive and effective learning environments in which their students can utilize their skills (Hakulinen et al., 2015; Su & Chengt, 2015). Previous studies have shown that use of gamification activities in class increases student achievement, motivation and participation (Buckleya & Doyle, 2014; Dominguez et al., 2013; Hsin et al., 2013), meets student needs (Barrio et al., 2016), attracts students' attention (Lam, 2014) and helps students adopt such new behaviors as trying new learning methods (Karatas, 2014). It has also been shown that a carefully designed gamification process can help students spend more time on course-related materials (Muntean, 2011), and can be used for the teaching of higher-level thinking skills such as measuring knowledge and performance, faster decision making, and performing multiple operations, as well as in helping students think the unthinkable, empathize and develop a commitment to the class (Kapp, 2012). A general assessment of literature on gamification shows that this approach is recognized as being very effective in increasing the motivation and participation of the digital generation, and helping them develop age-appropriate behavior.

It is important for learners to encounter various motivation and reinforcement elements as they play, in addition to learning. Gamification is an approach that has the potential to keep learners attached to the system by providing incentives, thus sustaining motivation. There have been many studies in literature on game-based educational practices and their use on the development of vocabulary (Benoit, 2017; Chen et al., 2018; Fachriyani & Syafe'i, 2018; Franciosi, 2017; Medina & Hurtado, 2017; Muller et al., 2018; Pirrie, 2017; Plump & LaRosa, 2017; Tsai & Tsai, 2018; Wu & Huang, 2017; Wu, 2018) but only a limited number of applied and longitudinal studies on gamification. Given this state of affairs, there is a need to conduct further research into the gamification approach to the important process of vocabulary instruction. To this end, the present study investigates the effects of vocabulary teaching through gamification in a Turkish course on the vocabulary development of fourth-grade students, and on their motivation to learn new words. In line with this general purpose of the study, answers were sought to the following questions:

1. For vocabulary learning achievement and motivation, are there significant differences between the mean pretest and posttest scores received by students involved in gamification-based and instructor-centered vocabulary learning groups?
    - For vocabulary learning achievement and motivation, is there a significant difference between the mean pretest and posttest scores of the gamification-based vocabulary learning group?
    - For vocabulary learning achievement and motivation, is there a significant difference between the mean pretest and posttest scores of the instructor-centered vocabulary learning group?
2. What are the views of the students on the two different vocabulary teaching methods implemented in the Turkish course?

METHOD

The study is a mixed-method, nested experimental design, in which the main model is experimental, and the qualitative data is nested in quantitative data. When the reverse approach is adopted, that is to say, when quantitative data is nested in qualitative data, it becomes an approach that is closer to a phenomenological design (Creswell & Plano Clark, 2015). The structure of the former approach was preferred in the present study, in which qualitative methods were nested in the experimental process. Accordingly, qualitative data was collected prior to, during and after the experimental process.

Participants

Participants in the study consisted of fourth-grade students attending school in Turkey. Participation in the experimental and control groups was voluntary and random, with each participant having an equal chance to end up in either group (Erkus, 2011). There were a total of 34 participants, 18 of them assigned to the experimental group and 16 assigned to the control group.

Procedure

After designing the VLAT, the VLMS, interview forms and the gamification application, a pilot study was conducted to test the treatment validity and its appropriateness for experimental treatment. In the following stage, the first pre-treatment interviews were conducted with the participants, and the VLAT and VLMS pretests were administered. The gamification treatment was then applied to the experimental group participants for 32 hours in a computer laboratory over a period of four weeks. At the end of the fourth week of treatment, second interviews were conducted with the participants. In the remaining four weeks of the experimental process, the treatment was applied for a further 32 hours, and following the end of the treatment, the VLAT and VLMS posttests were readministered. The experimental process was concluded after conducting a third and final interview with the participants. Simultaneously with the experimental process, the control group was taught the same course content through a classroom-based instruction method that did not involve gamification, and the corresponding qualitative and quantitative data was collected. The study proceeded with an analysis and evaluation of the collected data.

Gamification design

The D6 gamification design model developed by Werbach & Hunter (2012) was examined, and the dynamics, mechanisms and components were selected from among the gamification elements included in the model based on the needs and purposes of the study. Accordingly, constraints, narrative and progression were selected as the dynamics; cooperation and feedback were selected as the mechanics; and achievements, quests, content unlocking, points, badges and trophies were selected as the components. The following steps were taken in the gamification design on the basis of this model.

- *Define the objectives*: The goal was for the experimental group participants to learn new words, to build their vocabulary and to increase their motivation to learn vocabulary via gamification activities. In this context, a story entitled “Journey to the Living Planet” was created, and the website of the application had the same title as the book.
- *Delineate target behaviors*: Each participant in the experimental group was expected to carry out the assigned tasks that would enable them to reach the living planet.
- *Describe the players*: Separate usernames and passwords were defined for each participant in the experimental group so that they could go on individual journeys.
- *Devise activity loops*: Eight planets were designed to match the content of each text included under the themes “Science and Life” and “Planet Earth and Space”. In line with the contents of the texts, these planets were named Planet Technology, Planet of Vehicles, Planet Edison, Planet Snowflake, Planet Future Planet Fun, Planet Simulator and the Central Planet. Daily lesson plans were prepared involving keyword activities, unknown word activities, word-visual matching activities, vocabulary building activities and self-expression activities for each planet. The relevant texts from the Turkish textbook were placed inside the planets so that students could read the texts from the planets section. For the keyword activity, keywords specified in the teacher’s guide were identified, and activities were planned and included in the captain’s log. A visual and three sample sentences were added to the “Word Pool” for each item on the list of unknown words so that students would be able to search the word pool for any unknown words they encounter in the texts they read from the planets section. After using the word pool and gaining a general idea about the word, students would then access the website of the Turkish Language Institute via the “My Dictionary” section and look up the dictionary definition of the word in the “Contemporary Turkish Dictionary” hosted on the website. An “Activities” section was created to reinforce the

newly acquired words. This section offered the participants the opportunity to reinforce the words they had learned recently by presenting them with unknown words and visuals, and asking them to match words with the visuals. The vocabulary-building and self-expression activities were meant to help the participants make active use of the recently acquired words.

- *Don't forget the fun*: Participants were expected to make progress, to learn about new things through experiences and discoveries, and to earn points, badges and trophies matching their level of development as they made progress. In addition, the start and end animations were designed to make the gamification process fun. Each planet was designed in shapes and colors aimed at attracting the attention of the participants in an effort to help them experience an imaginary journey.
- *Deploy the appropriate tools*: The components, mechanics and dynamics were deployed. At each planet, the participants were awarded badges once they had completed all the tasks. Names and designs that would be attractive to the participants were selected for the badges. The participants were awarded a "Word Hunter Trophy" after they completed the fifth planet, and an "Astronaut Trophy" after they completed the eighth planet. In the activities section, on the other hand, participants who completed an activity were awarded achievement points proportional to the number of correct answers they provided.

Expert opinion was consulted regarding the appropriateness and feasibility of the laboratory and Web environments. After completing the gamification design, a pilot study was conducted with 20 fourth-grade students who did not take part in the main part of the study, over 16 class hours. The instructional and technical operability of the system was tested, and interviews were conducted with the participants regarding its application. Improvements were made in the word matching and word search infrastructure of the web environment, and the environment was finalized by providing more detailed instructions related to the educational content on the basis of the feedback from the pilot study participants.

Data Collection Tools

Vocabulary Learning Achievement Test (VLAT)

The VLAT was developed on the basis of the texts in the Turkish textbook used by all fourth-graders in Turkey in the 2015/2016 academic year, and within the framework of the themes "Science and Life" and "Planet Earth and Space" of the Turkish Curriculum. The test consists of a total of 24 questions, 21 of which are designed to measure reading comprehension skills, and the remaining three designed to measure writing skills. The Cronbach's alpha reliability coefficient of the test was .725 and the average difficulty was .64.

Vocabulary Learning Motivation Scale (VLMS)

The VLMS consists of 24 items that are scored on a 3-point Likert scale and has a three-factor structure (intrinsic motivation, extrinsic motivation, instrumental/goal-oriented motivation). The Cronbach's alpha reliability coefficient of the scale in the factor analysis was α=.855; and the internal consistency coefficient calculated using the split half method was α=.837.

Interviews

A total of five interview forms were prepared aimed at garnering information about the views of the experimental and control group participants prior to, during and after the experimental process. Relevant literature was reviewed prior to preparing the interview questions, and a semi-structured interview form was prepared comprising open-ended questions. Expert opinion was obtained regarding the form, which was used after making improvements based on the expert recommendations.

Data collection and analysis

The first interviews with the experimental and control groups prior to the experimental process were conducted using the same form, and different forms were used for the second and third interviews. The same questions were asked to both groups in the first interviews in order to permit an overall assessment of the participants' views regarding words and vocabulary learning. Different questions were asked to the groups in the second and third interviews in order to evaluate the empirical process in the case of the experimental group, and to learn about experiences and to keep the teaching process under control so as to permit the potential presence of confounding variables to be questioned for the control group.

In the data collection phase of the study, interviews were conducted with the participants to learn about what vocabulary learning means to them, what they feel about vocabulary learning, their willingness to participate in and their competency in the vocabulary learning activities conducted in class, and their views concerning the strengths and weaknesses of these activities. The interviews were recorded using an audio

recorder. Individual interviews were conducted with 31 participants, 18 from the experimental group and 13 from the control group. After the interviews were completed, the VLAT and VLMS pretests were administered to all the participants simultaneously. The control group participants continued receiving structured instruction in class, and the process of applying the treatment to the experimental group participants was launched. Throughout the treatment process, video recordings were made of the participants' efforts in the laboratory and Web environments. The participants tasks in the Web environment and instructions for additional activities were contained within used the Captain's Log, and they kept a notebook of their journal entries. In addition, qualitative data was triangulated by keeping a researcher's diary. Second interviews were conducted with the experimental group and control group participants during the experimental process. Once the treatment period was over, the VLAT and VLMS posttests were administered simultaneously to the experimental and control group participants. Third interviews were conducted with the experimental and control groups at the end of the process.

Data Analysis

The analysis of the quantitative data garnered during the study was conducted via an item analysis for the achievement test, and a factor analysis for the motivation scale. Multivariate statistical techniques were used for the analysis of the quantitative portion of the data collected as part of the experimental design. Within the framework of a 2x2 split-plot factorial design, the time of measurement and the method of instruction were used as the independent variables for the MANOVA test, and vocabulary learning achievement and motivation were used as the dependent variables. To check whether the assumptions for the MANOVA test were met, the following steps recommend by Pallant (2010) were taken:

- Mahalanobis distance values were examined to check whether the data had multivariate normal distribution and contained outliers
- Skewness and kurtosis values were interpreted to check whether the data had univariate normal distribution, as a method frequently used for this purpose.
- Scatterplot diagrams were examined to check for linearity, and all data boundaries were observed to form ellipses, indicating that the linearity assumption had been met.
- The homogeneity of the error variances of the collected data, as another assumption, was checked with a Levene F test, producing significance values of between 0.06 and 0.88, indicating no problem with the homogeneity of the error variances of the dependent variables
- In addition to error variances, variance-covariance matrices should also be homogeneous. A Box's M test was conducted to test this assumption, and the results ($F=1,064$, $p>.05$) showed that the variance-covariance matrices were homogeneous
- Correlation values between the dependent variables were examined to check whether a problem of multicollinearity exists. The correlation values examined varied between .43 and .46 for the matched pretests and posttests, indicating that this assumption was also meet. The assumptions for the conducting of a MANOVA analysis were confirmed with these tests.

The participants' entries in the Captain's Log, the participants' and researchers' diaries, the interviews with the participants and the video recordings were used in the analysis of the qualitative data of the study. The participants' works in this section were examined one by one, and lists of the words used were created for each planet.

The participants' and researchers' diaries and the interviews with participants were analyzed for content, requiring the coding of data, the identification of themes, the organization of the codes and themes, and the description and interpretation of the findings.

Stemler's (2001) measurement reliability was used to check the reliability of the qualitative data, in which higher levels of agreement between coders indicates a higher level of measurement reliability. Thus, the reliability assessment was based on a percent agreement between coders, and Miles and Huberman's (1994) reliability formula P (Percent agreement) =Na (Agreement)/Na (Agreement) +Nd (Disagreement) x100 was used. Reliability was found to be 90%, based on this formula, indicating that the measurement was reliable. Moreover, the entire experimental process was recorded using a video camera, and two field experts were selected to watch portions of these recordings, which covered 64 class hours.

Data was triangulated by collecting qualitative and quantitative data from the video recordings, researchers' and participants' diaries, activity notebooks, web environment software, the participant interviews prior to, during and after the treatment, and from the VLAT and VLMS. The participants' identities were kept confidential throughout the process, with code names used rather than real names.

FINDINGS

Quantitative data regarding the change in participants' achievement and motivation levels

As mentioned in the data analysis section, a 2x2 mixed (split-plot) factorial design was used to examine the effects of the Gamification-Based Vocabulary Teaching (GBVT) and Instructor-Centered Vocabulary Teaching (ICVT) methods applied to the experimental and control groups on the levels of achievement and motivation, as measured by the measurement tools. Table 1 presents descriptive statistics of the pretest and posttest scores, according to the measurement tools.

Table 1. Descriptive Statistics on Quantitative Data Collected within the Framework of the Experimental Design

	Method of Instruction	**N**	**X**	**Ss**
$VLAT_1$	GBVT	18	52.916	21.187
	ICVT	16	53.312	21.694
	Total	34	53.102	21.100
$VLAT_2$	GBVT	18	68.166	20.887
	ICVT	16	54.250	24.804
	Total	34	61.617	23.540
$VLMS_1$	GBVT	18	65.000	5.530
	ICVT	16	65.312	8.942
	Total	34	65.147	7.220
$VLMS_2$	GBVT	18	65.888	7.607
	ICVT	16	67.375	6.064
	Total	34	66.588	6.862

$_1$ Pretest

$_2$ Posttest

To evaluate the significance of the descriptive statistics presented in Table 1, and to see whether the achievement and motivation scores changed over time with the instruction methods applied, multivariate statistical analysis methods were used. As two different methods of instruction were applied, being gamification-based vocabulary teaching and instructor-centered vocabulary teaching, the level of significance for the mixed-design MANOVA test to be conducted was set at 0.025 (0.05/2), following Pallant's (2010) recommendation. Table 2 presents the results of the conducted mixed-design MANOVA test.

Table 2. Results of the Mixed-Design MANOVA Test for the Mean VLAT and VLMS Scores by the Variables Time of Measurement and Method of Instruction

Source of variance	**Wilks' Λ**	**F**	**Hypothesis sd**	**Error sd**	**p**	**η^2**
Method of instruction	.932	1.132	2	31	.335	.068
Time of measurement	.704	6.517	2	31	<.025	.296
Time*Method	.767	4.703	2	31	<.025	.233

As the results of the mixed-design MANOVA test reported in Table 2 show, the participants' scores from the measurement tools do not vary significantly based on the method of instruction (Wilks' Λ=.932, $F_{(2,31)}$=1.132, p=.335). This finding indicates that the scores on the measurement tools cannot be grouped on the basis of the instruction methods used. In terms of time of measurement, on the other hand, the scores recorded by the measurement tools vary significantly (Wilks' Λ=.704, $F_{(2,31)}$=6.517, p<.025, η^2=.296). In other words, regardless of which method of instruction was used, the pretest mean scores from the measurement tools were significantly different to the posttest mean scores. In terms of the interaction effect of Time of measurement*Method of instruction, the linear combination of the scores for the variables vocabulary learning achievement and vocabulary learning motivation was found to differ significantly

between the gamification-based vocabulary teaching and instructor-centered vocabulary teaching groups (Wilks' Λ=.767, $F_{(2,31)}$=4.703, p<.025, η^2=.233). This finding shows that providing instruction through two different methods brought about a significant difference over time in the scores received by the participants on the measurement tools. To interpret the effect size of a statistically significant difference, Cohen (1988) proposes treating η^2=.01 as a small effect, η^2=.06 as a moderate effect and η^2=.14 as a large effect. Thus, the effect size of η^2=.296 for the variable of time of measurement indicates a large effect. The interaction between time of measurement*method of instruction also has a large effect (η^2=.233). In other words, time of measurement explains around 30% of the variance in the linear combination of the mean scores on the tools for the measurement of vocabulary learning achievement and vocabulary learning motivation, and the interaction between time of measurement*method of instruction explains 23% of the variance. Huck (2012) recommends to establish the interpretation on the interaction between group variables. Similarly, Green and Salkind (2007) recommend carrying out follow-up tests when statistically significant results are obtained for the interaction between intergroup and intragroup variables. Accordingly, to evaluate the variables individually, 2x2 mixed design univariate ANOVA tests were used, which makes it possible to examine each of the dependent variables in detail. In what follows, the effect sizes are reported for findings that contain significant differences, and statistical power is reported for findings that do not contain significant differences. As the intergroup and intragroup variables remained the same in the new tests, the level of significance was kept at .025, which was also used in the MANOVA tests. Table 3 presents the results of the analysis of variance conducted for the VLAT data.

Table 3. Results of the Follow-up Analysis of Variance Test for Vocabulary Learning Achievement by Time of Measurement and Method of Instruction

Source of variance	**Sum of Squares**	**Sd**	**Mean Square**	**F**	**p**	**η^2**
Intergroup						
Method of instruction	774.267	1	774.267	.872	.357	.027
Error	28413.531	32	887.923			
Intragroup						
Time of measurement	1109.796	1	1109.796	12.145	<.025	.275
Time*Method	867.590	1	867.590	9.495	<.025	.229
Error	2924.031	32	91.376			
Total	34089.215	67				

As the results of the 2x2 mixed-design ANOVA test reported in Table 3 shows, mean VLAT scores do not vary significantly by the method of instruction ($F_{(1,32)}$=0.872, p=0.357, power=.090). The statistical power value makes it clear that a separate quantitative evaluation of the groups on the basis of method of instruction may not be sufficient. A statistical power of .80 and above is usually recommended in studies, and power statistics below this value indicate that the dataset is not sufficiently large. In other words, more participants are needed (Ellis, 2010). In terms of the method of instruction, the statistical power is very low, and this finding makes the qualitative data and in-depth analysis of meanings more important in terms of validity and reliability. The mean VLAT scores, on the other hand, vary significantly by the time of measurement ($F_{(1,32)}$=12.145, p<.025, η^2=.275). When group variables are considered together, the interaction effect of the Time of measurement*Method of instruction also results in a significant difference in the mean VLAT scores ($F_{(1,32)}$=9.495, p<.025, η^2=.229). The significant difference caused by the interaction effect makes it possible to conduct follow-up tests. Table 4 reports the results of the dependent groups t-test conducted for the variable time of measurement, which created a significant difference, using the significance level of p=0.025/2=0.012.

Table 4. Results of the Dependent Groups t-test for the VLAT Pretest-Posttest Mean Scores

Group	□	**Ss**	**Sd**	**t**	**p**	**η^2**
Pretest	53.102	21.100	33	-3.275	<.012	.394
Posttest	61.617	23.540	33			

As Table 4 shows, a significant difference exists between the VLAT pretest and posttest mean scores in favor of the posttest ($t_{(33)}$=-3.275, p<.012). The effect size of the t-test was η^2=.394, which indicates that the time of measurement explains around 40% of the variance in students' achievement levels.

An analysis of the change in VLAT mean scores by method of instruction and time of measurement reveals that pretest mean scores of the groups were not different from each other, while a significant difference was recorded in posttest mean scores in favor of the experimental group, that is to say, the gamification-based vocabulary teaching group. An individual examination of the changes in VLAT scores from pretest to posttest for the two groups is not possible because the initial mixed-design ANOVA conducted for VLAT did not produce significant results for the variable method of instruction. Table 5 reports the results of the univariate analysis of variance for VLMS, which measured motivation.

Table 5. Results of the Follow-up Analysis of Variance Test for Vocabulary Learning Motivation by Time of Measurement and Method of Instruction

Source of variance	**Sum of Squares**	**Sd**	**Mean Square**	**F**	**p**	**η^2**
Intergroup						
Method of instruction	13.701	1	13.701	.185	.670	.006
Error	2364.608	32	73.894			
Intragroup						
Time of measurement	36.892	1	36.892	1.326	.258	.040
Time*Method	5.834	1	5.834	.210	.650	.007
Error	890.358	32	27.824			
Total	3311.393	67				

As the results of the analysis of variance conducted for the variable vocabulary learning motivation reported in Table 5 show, VLMS mean scores do not vary significantly by the method of instruction ($F_{(1,32)}$=0.185, p=0.670, power=.038), nor do they vary significantly by time of measurement ($F_{(1,32)}$=1.326, p=0.258, power=.012) or in the interaction between Method of instruction*Time of measurement ($F_{(1,32)}$=0.210, p=0.650, power=.040). Statistical power values varying between 1% and 4% indicate that more participants are needed for such tests.

An overall assessment of the quantitative findings of the study shows that when the achievement and motivation levels of the participants are considered together, significant and positive changes are observed in these variables; whereas the number of participants is not sufficient to conduct detailed individual analyses of the variables, especially for the motivation variable. The low level of statistical power is an important finding in itself, adding to the importance of analyzing qualitative data for an in-depth investigation of the underlying reasons. Aside from these general observations, when analyzing the achievement variable in isolation, the performance of the gamification-based teaching group was significantly better.

Findings on participants' word use

When keywords and words reported as unknown by the experimental group participants during the treatment were then used in their written expressions, verbal activities and verbal expressions during class, their use was treated as criteria reflecting their vocabulary learning.

The findings show that the participants used the keywords and the words in the study activities in connection with their social environments and experiences. An important finding, one that could potentially provide guidance to vocabulary teaching, is that words in the activities in question, especially those that had connotations with their experiences, were used correctly, both in terms of pronunciation/spelling and in meaning.

The participants sometimes reported that they did not know the meaning of some keywords, even though they had pronounced/spelled and used them correctly, which can be attributed to the possibility of the participants being unsure whether they have accurate knowledge of these words. Some of the participants used some of the keywords illegibly or incorrectly, and reported only later not knowing the meaning of these words, indicating that they were aware of these words having a different meaning. Another finding

was that some participants reported not knowing some of the words in earlier activities, but used them correctly in later activities. In other words, participants had learned and started to use these words during the treatment, and also displayed performances demonstrating their knowledge of these words.

Looking at the use of previously unknown words, a large majority of the participants were observed to start pronouncing/spelling and using these words correctly, indicating that the participants were able to learn these words via gamification-based vocabulary learning activities and to start using them.

The participants were also observed to use words that they did not report as unknown, but were unknown to other participants, in their writings. This indicates that the words in question were already in their vocabulary prior to the treatment, and that they had started using these words. Thus, gamification was seen to have contributed to individual learning and to the emergence of vocabulary differences between the participants.

Considering the participants' use of newly acquired words in their written and verbal expressions, it was found that the participants made less frequent use of the words in their verbal expressions than in their written expressions. This indicates that the participants were more successful in using the newly acquired words in their written form than in their verbal form.

Themes and Sub-Themes that Emerged in the Interviews with the Experimental and Control Group Participants

The main themes that emerged in the interviews conducted with the experimental and control group participants prior to, during and after the experimental process were the same, but the sub-themes were different. Table 6 reports the themes and sub-themes that emerged in the interviews with the experimental and control group participants.

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Table 6. Interview Results

Themes		**Meaning Assigned to Vocabulary Learning**		**Vocabulary Learning Efforts**	
Interviews		**Experimental Group**	**Control Group**	**Experimental Group**	**Control Group**
Before the Treatment	**Sub-themes**	• Developing linguistic skills • Acquiring knowledge • Making use of learning tools • *Finding out the meanings of words* • *Learning a new language* • *Learning unknown/new words*	• Developing linguistic skills • Acquiring knowledge • Making use of learning tools • L*earning new thing* • L*earning everywhere*	• In-class/out-of-class activities • Fun and educational activities • The desire to use learning technologies • Positive feelings • Sharing with one's family • Doing on one's own • Reinforcing on one's own • *Getting help* • *Interactive activities* • *Effect of linguistic elements* • *Cooperative learning activities*	•In-class/out-of-class activities •Fun activities •Activities to discern meaning •Positive feelings •Sharing with one's family •Doing on one's own •Reinforcing on one's own •*Desire to move on to custom activities* •*Utilizing learning technologies and materials*
During the Treatment	**Themes**	**Ongoing Effects of Vocabulary Learning Activities**		**Vocabulary Learning Efforts**	
	Sub-themes	• Facilitating success • Facilitating vocabulary learning • Developing linguistic skills • *Facilitating comprehension* • *Supporting motivation* • *Supporting learning* • *Being fun and educational* • *Creating positive feelings* • *Helping in the acquisition of knowledge* • *Utilizing learning technologies* • *Supporting research*	• Facilitating success • Facilitating vocabulary learning • Developing linguistic skills	• Participating in reading/writing activities • Ability to propose different activities • *Working with keywords* • *Recognizing environment characteristics* • *Working with supplementary text activities* • *Working with multimedia elements* • *Working with unknown words* • *Word mining* • *Acquiring gamification components*	• Conducting reading activities • Ability to propose different activities • *Conducting research with words/books* • *Conducting text activities*

Table 6. (continued…)

	Themes	**Reflections of Vocabulary Learning Activities**		**Awareness of Vocabulary Learning**	
After the Treatment	**Sub-themes**	• *Supporting learning* • *Facilitating comprehension* • *Facilitating problem-solving* • *Improving communication skills* • *Affecting choice of professions* • *Helping in the acquisition of knowledge* • *Embracing gamification* • *Facilitating vocabulary learning* • *Facilitating success* • *Conducting fun activities* • *Contributing to future life* • *Having memorable positive experiences* • *Acquiring gamification components* • *Developing linguistic skills*	• *Working with unknown words* • *Working with text-processing activities* • *Difficulty of conducting research*	• Development of linguistic skills • Facilitating success • Affecting future life • *Effect of learning new words* • *Facilitating learning* • *Helping choose a learning method* • *Increasing willingness* • *Doing on one's own* • *Development of communication skills* • *Recognizing different meanings of words* • *Increasing awareness of vocabulary learning* • *Making learning fun*	• Helping develop linguistic skills • Facilitating success • Affecting future experiences • *Uncertainty regarding development status* • *Expectation of interactive activities* • *Ability to conduct research*

*Italic type indicates non-shared/different themes.

The interviews conducted prior to the treatment showed that the participants assigned common meanings to vocabulary learning. Under the themes "vocabulary learning efforts" and "meaning assigned to vocabulary learning", common sub-themes were in the majority. The greater number of common themes than non-common themes indicates that prior to the treatment, the participants had engaged in similar vocabulary learning efforts and had assigned similar meanings to vocabulary learning.

Under the theme of "ongoing effects of vocabulary learning activities" that emerged in the interviews conducted during the treatment, the experimental group participants had a greater number of sub-themes than those in the control group. The control group participants' expectations of fun and educational activities, and their desire to use learning technologies, as expressed in the pre-treatment interviews, seem to have been realized during the treatment, as the sub-themes show. The experimental participants continued to have positive feelings toward vocabulary learning, and so it could be argued that gamification-based vocabulary learning activities produced richer sub-themes as a result of the ongoing effects on the participants when compared to the in-class learning activities that did not involve gamification. For the control group participants, all of the sub-themes under the theme of "ongoing effects of vocabulary learning activities" were shared with the experimental group, and they were found to have no unique sub-themes that were different to the experimental group participants. Under the "vocabulary learning efforts" theme, the experimental group participants had a greater number of sub-themes than the control group participants, as was the case with the ongoing effects of the activities theme. The sub-themes show that the control group participants continued their vocabulary learning efforts with text activities and reading activities, whereas the experimental group participants made in-depth efforts to learn vocabulary through gamification activities involving multimedia elements. This finding shows that the experimental group participants made more of an effort to learn vocabulary then the control group participants, and were are aware of this situation.

The themes and sub-themes that emerged in the interviews conducted after the treatment show that the control group participants' sub-themes under the theme of "reflections of vocabulary learning activities" were not very different from the sub-themes that emerged in the interviews conducted during the treatment. The experimental group participants, on the other hand, talked about the future, in addition to the views they had expressed under the themes of "vocabulary learning efforts" and "ongoing effects of vocabulary learning activities". This indicates that participants in the group who took part in gamification-based vocabulary learning activities did not limit vocabulary learning to the current treatment, but viewed it as having implications for the future. Finally, an overall assessment of the themes and sub-themes that emerged in the interviews shows that regarding vocabulary learning awareness, the experimental group participants' vocabulary learning expectations were met, whereas the control group participants were not entirely sure about the progress they had made, and their expectation for more interactive activities continued.

An analysis of the individual views of the experimental group participants revealed that they had more general views regarding the effects of vocabulary learning on the development of linguistic skills in the pre-treatment interview, whereas in the final interview, they stated that learning new words had improved their linguistic skills.

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Participants' diaries

The themes that emerged in the participants' diaries are reported below, along with sample statements made by participants exemplifying the theme and participant codes.

Table 7. A Series of Views Originated From Participants' Diaries

Themes	Views
Embracing gamification	We say farewell today, and I am so sad because of this. It felt as if it was over in a single day ... It was so beautiful. The videos were as beautiful as the instructor, and so were the activities; everything was so beautiful (Participant D3), (D3).
	… We feel like superheroes, because we did all the tasks successfully (D9).
	… We will hop into our rocket and go. We are astronauts now. (D10).
	I wish the trophies and badges were real (D17).
Positive feelings	Fun days, fun times (D4).
	We had so much fun today. ... We did very nice things. I really liked this gamification thing (D8).
	We had a lot of fun in the computer lab today. It turns out this activity is great (D9).
Acquiring gamification components	We earned a badge and a trophy - A word hunter trophy, which means that we are word hunters. I am hunting words; that is to say, I am looking for words, so that they do not run away (D2).
	We earned the word hunter trophy, and now we will take the first step to get an astronaut trophy. I am happy. Very happy (D4).
	We earned badges... The badge says ''The moon envies you.'' This was my favorite badge, and I earned it (D6).
	I am so happy today because I earned 450 points and a badge (D14).
Self-assessment	We did an activity on the computer, and I made 450 points. Some people earned 450; others earned 300, 350 200, 250, and 150 points (D2).
	I earned 500 points today in gamification, which the highest you can get. I did 3 in 3 in three days. I think I have 1250 points, I am so happy. Few people did 3 in 3... (D3).
	I got 200 points, the highest you can get. I call this the fruit of my efforts(D15).
Awareness of vocabulary learning	There were many words I didn't know, but I knew some of them. I researched them to make sure, I looked them up in the dictionary (D3).
	We learned lots of things today, and I know many words (D11).
	We had an activity today. There were a few words that I didn't know (D12).
Conveying experience	We found the words we didn't know in the reading text and wrote down our thoughts. Then we saw their dictionary definitions and looked them up in the dictionary. ... I wrote their meanings (D3).
	I wrote a very different story in the keyword activity. It was really fun (D4).
	Today was very nice because we learned stuff on the computer. It was really very nice. I signed up for a website called ''Journey to the Living Planet''(D5).
Having intrinsic/extrinsic motivation	I finished before everyone else, and I understand quickly. It was very nice ... I do things well. I like myself (D4).
	Learning things makes me very happy. I would like to learn more (D15).

> We completed the first planet on the computer and earned medals (badges). We need to be much better. There are seven medals left; we need to earn them too (D18).

An analysis of the diary entries revealed that the participants made statements that overlapped with their statements in the interviews, talked about intrinsic and extrinsic motivational elements, and frequently mentioned the components of gamification. These findings indicate that the participants were aware of and embraced gamification, and that this awareness had a positive impact in terms of vocabulary learning awareness.

CONCLUSION AND DISCUSSION

The majority of vocabulary activities in the Turkish language course are conducted using textbooks, however there is an apparent need for innovative and flexible teaching materials that utilize technology in vocabulary teaching to supplement textbooks. An application was developed to meet this need in the present study, and a nested, mixed-method experimental design was used to examine its effects on the vocabulary learning achievement and motivation of elementary school students.

During gamification-based vocabulary teaching, the participants usually made associations with their immediate environment and experiences, and expressed the connotations of the words in this way, and this can provide guidance for the vocabulary teaching process. Biemiller (2011) argues that an educational approach based on the familiarity of the student with the words should be adopted when identifying the words to be taught in the vocabulary teaching process. Thus, in vocabulary teaching efforts, it is important for word selection to be guided by the immediate environment of the students.

One notable finding of the study is that the participants made more progress in written than in verbal expression. This may be attributed to deficiencies in participants' speaking skills, lack of self-confidence and reluctance to participate in speaking activities. Giving the students the opportunity to use the words soon after learning them may help students utilize more words in speaking activities.

The study has important implications for the adoption of mixed-method approaches to the innovative topic of gamification in education. It is also possible to design gamification activities that make use of non-technological platforms, although efforts that combine web-based applications with education seem to offer a larger number of alternatives to the achievement of the desired outcomes. These alternatives contribute to data triangulation – although mostly in a quantitative sense – as they allow activities to be conducted with a large number of participants. Examples of this include Hamari & Koivisto's (2015) study conducted with 200 participants in which data was collected via a questionnaire, but in which an experimental design was not preferred; the experimental study of 379 participants conducted by de-Marcos et al., (2016); and the study conducted by Hamari & Koivisto (2015), which had an experimental design and 1,579 participants only in the experimental group. In the use of an experimental design to study instructional practices, the principles of receiving feedback and making improvements are important teaching principles, alongside the main variables in the design. In this sense, it should be kept in mind that experimental studies conducted with a large number of participants thanks to the opportunities offered by the selected platform may not provide sufficient data to obtain findings in line with these principles. A similar problem also exists in the collection, transcription and processing of qualitative data.

Using an experimental design in mixed methods studies has its own limitations that were also encountered in the present study. Although there were no limitations in the collection of in-depth and diversified data and in spending time in the environment, it was found that a larger number of participants was needed for the experimental design to work, and in particular, for the examination of the effect of the motivation variable in more detail.

The motivation of the experimental group participants was not found to differ significantly over time when compared to the control group, which contrasts the findings of Hew et al.'s (2016) study in which instruction that utilized gamification elements achieved higher levels of motivation than instruction that did not. On the other hand, the qualitative findings of the present study related to motivation are consistent with the findings of Cahyani (2016), who used a gamification design on a web-based platform and found that the components of the system positively affected the motivation of a large majority of the participants, with Armier et al., (2016) positive findings regarding motivation and gaming experience, and with Suh et al., (2015) positive findings regarding satisfaction and intrinsic motivation.

The findings of the present study in terms of achievements, as the other main variable alongside motivation, indicate that the experimental group had a higher learning achievement over time compared to the control group.

This is consistent with the findings of the experimental study conducted by Sahin & Namli (2016) on a gamification application supported by CD-based educational software; and with the finding that instruction carried out with web-based gamification resulted in higher levels of achievement over time when compared to conventional instruction reported by Sanmugam et al. (2016) and Turan et al. (2016). The qualitative findings of the present study are also consistent with Turan et al.'s (2016) finding that a large majority of the participants were happy to receive course content in gamified form. The finding that there was an increase in the mean scores of the experimental group, as there was a significant difference between the pretest and posttest achievement scores in favor of the posttest, is consistent with the findings of the study conducted by Matsumoto (2016). The findings of the present study are also consistent with those of de-Marcos et al., (2016) regarding their gamification group, in which the variables of academic performance and learning performance resemble the achievement variable in the present study.

The findings of the study showed that vocabulary teaching conducted using two different methods of instruction resulted in significant differences in the mean vocabulary learning achievement and motivation scores of the participants. The variable of time of measurement, considered on its own, also created significant differences in terms of the mean vocabulary learning achievement and vocabulary learning motivation scores of the participants. The method of instruction did not result in significant differences in the mean scores of the participants for vocabulary learning achievement and vocabulary learning motivation, but did result in a significant difference when the mean scores of vocabulary achievement were considered in isolation. Neither the time of measurement, nor the method of instruction, nor the interaction of these two variables resulted in a significant difference in the mean scores of the participants for vocabulary learning motivation. Time of measurement resulted in a significant difference in the mean vocabulary learning achievement scores, while the method of instruction resulted in no significant difference.

The qualitative findings of the study showed that a large majority of the participants started pronouncing/spelling and using these words correctly over time. In other words, the participants were able to start using words that they had learned recently through gamification. Moreover, all of the participants in the gamification-based vocabulary teaching group made more progress in written expression than in verbal expression.

The main themes that emerged in the interviews conducted with the experimental and control group participants prior to, during and after the experimental process were the same, while the sub-themes were different. In addition, the themes and sub-themes that emerged in the interviews showed that the experimental group participants' expectations had been met, whereas the expectations of the control group participants had not been met.

In the participants' diaries, those in the gamification-based vocabulary teaching group made statements to the effect that they embraced the application, had positive feelings toward gamification activities, and acquired various components of gamification, and expressed their thoughts about this process. The diaries contained statements indicating that the participants had developed a vocabulary learning awareness, as well as intrinsic and extrinsic motivation regarding vocabulary learning and the process of vocabulary learning.

From a mixed-methods perspective, it was found that experimental group participants improved their vocabulary learning, awareness and competencies; experienced a raise in willingness and motivation for vocabulary learning; started to use previously unknown words, contributing to the development of their vocabulary; embraced the gamification application and its components; and showed indicators of intrinsic and extrinsic motivation. Similarly, the quantitative results of the control group participants were at acceptable levels, while their qualitative results were poorer in terms of generating themes and the ability to evaluate learning progress.

Recommendations

The findings of the study summarized above give rise a series of recommendations. First of all, the number of interactive elements in the activities section of the application should be increased, and the web environment should be redesigned with a more detailed interface. Similarly, additional content can be developed for listening and speaking activities, and the web platform can be redesigned. Additionally, content can be developed for teaching Turkish as a second language, and a website can be prepared with this in mind. The website infrastructure can be integrated with social network components (like, dislike, comment, share, etc.). Thus, the web-based programming of the gamification components can be redesigned for social interaction and improved. Mobile and CD-based versions of the application can be developed for its widespread adoption by different types of users.

Regarding future research, a study conducted with a larger number of participants would allow a more in-depth examination of the variables in quantitative terms, and this would increase statistical power to acceptable levels.

It would also be beneficial to focus on the components of gamification, and to study the performance of each component in the teaching process, as well as their mechanisms of effect on the dependent variables of the study. A similar study may be conducted to make comparisons with gamification approaches that are not technology-oriented.

Social learning theories, models, and approaches can be utilized for the design and testing of cooperation-oriented gamification activities for vocabulary teaching and vocabulary building. This would make it possible to examine the variable of motivation in more detail. Out-of-school activities and flipped learning may also be included in the scope of the study, and the potential of gamification in this process can be investigated. Following a similar method, younger age groups and parental involvement can be included in the research environment, and the effects of gamification on this new environment can be examined using new variables. In addition, qualitative studies may be conducted involving a cultural analysis, examining the methods used in different cultures for vocabulary building, and identifying the implications of gamification-based vocabulary teaching within such a process.

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