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The effects of gamified instructional material on learners' perceived motivation and academic achievement

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Highlights

- Effective use of gamification components is important in gamified learning environments.
- According to the students' views, the gamified learning material had a positive effect on learning, academic achievement, and motivation.
- Alternative measurement and evaluation tools can be used in gamification.

Abstract

Since motivation is known to be a critical factor, approaches, methods, techniques, and materials that would affect motivation positively are utilized in learning and teaching processes. Gamification is used by including game components into teaching processes to enhance students' motivation, attract their attention to the lesson and boost academic achievement. The aim of the present study was to explore the effect of using gamified materials in the instruction of electronic spreadsheet programs on learners' perceived motivation, academic achievement, and opinions regarding the gamified teaching material. The study was conducted using triangulation in the explanatory sequential design combining qualitative and quantitative research methods. In the fall semester of 2021-2022, the participants consisted of 90 undergraduate students attending the Faculty of Education of a university in Türkiye. Data collection was conducted through personal information forms, instructional materials motivation survey, electronic spreadsheet program achievement test, opinion survey and system records. The data were analysed using descriptive statistics, repeated measures analysis of variance and descriptive analyses. The results indicated that there was no significant difference in terms of motivation and academic achievement between the experimental group (using gamified materials) and control group (using videos). It was also seen that the students in the experimental group generally held positive opinions about gamified teaching materials.

Article Info: Research Article

Keywords: *E-learning, gamification, motivation*

1. Introduction

Information and Communication Technologies (ICT) have been changing every field of life considerably, bringing about novel practices in the field of education as well (Ratheeswari, 2018; Telli Yamamoto, 2018; Das, 2019). ICT provides students and teachers with opportunities for individual needs in the learning and

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teaching process, presents the content effectively (Ratheeswari, 2018; Bozkurt and Uçar, 2018) and serves as a facilitator (Aparicio et al., 2016). For example, thanks to ICT, e-learning is widely practiced today in various forms (computer-managed learning, computer-assisted learning, synchronous online learning, asynchronous online learning, adaptive e-learning, interactive online learning individual online learning, and cooperative online learning etc.) (Tamm, 2021). Similarly, developments in the field of ICT have led to the diversification of the e-learning resources such as communication tools, virtual learning environments, simulations and learning management systems (Holmes and Gardner, 2006).

With the approaches that have emerged from ICT-supported education, learning has become more dynamic, permanent and transferrable (Ivanovic and Milenkovski, 2019). According to the standards specified by the International Society for Technology in Education (ISTE) (2017) for teachers, educators should benefit from technology to create, adapt and design individualized learning environments that are arranged in line with the learners' needs and differences. To this end, new approaches and methods have been explored to ensure motivation, which is a critical factor for learner achievement.

Motivation broadly defines what individuals want to do, what they choose to do and what they are driven for (Keller, 2010). In more general terms, motivation is an effective concept in initiating, guiding and sustaining target-oriented behaviours (Cherry, 2023). In the educational context, motivation indicates one's choice of a goal and the effort to purse the goal or the desire to fulfil a task (Keller and Deimann, 2017). Motivation can be generated by intrinsic or extrinsic factors. Learners with intrinsic motivation are able to be motivated without needing any external support, while for individuals who need extrinsic motivation, environment plays a critical role (Güler and Güler, 2015).

One of the methods used to make teaching materials motivationally attractive is the ARCS model. ARCS addresses four main components to ensure motivation in individuals. These components are categorized as Attention, Relevance, Confidence and Satisfaction (Keller, 1987; Keller, 2000). These four components represent the groups of conditions required by a person to be fully motivated, with each component having parts or sub-categories that represent specific aspects of motivation (Keller, 2000).

With the resources provided by advancements in ICT, one of the methods used by teachers to increase learners' motivation towards the subject and the course is gamification. It is considered that gamification can be benefitted in e-learning environments using digital technologies, which are today an integral part of the learning processes particularly of university students (Henderson et al., 2017).

2. Literature

Gamification can be defined as using the components included in game design in non-gaming contexts (Deterding et al., 2011; Yıldırım and Demir, 2014). Similarly, Werbach and Hunter (2012) define gamification as the use of game components and game design in a non-gaming context. The concept of gamification refers to technological, economic, cultural, and societal developments in which reality takes a more game-like form, consequently leading to positive improvements in skills, motivational benefits, creativity, playfulness, and engagement and increasing overall happiness (Hamari, 2019). Gamification follows two main paths of development, namely intentional gamification, and emergent gamification. Intentional gamification is transforming any action, system, service, product, or organizational structure into one which includes similar experiences, skills and practices found in games. Intentional gamification is used to facilitate the changes in behaviours and/or cognitive processes commonly and optionally. Since gamification is inspired by games, it is generally performed by employing game design. Emergent gamification can be defined as the cultural and societal changes that emerge gradually, albeit unintentionally, with the pervasive increase in the interaction with games. With the pervasive role of games

in human life, the effects of practices that are reminiscent of games, game communities and players are seen in cultural and societal structures (Hamari, 2019).

Gamification is divided into three categories as intrinsic gamification, extrinsic gamification and behaviour changing gamification. Intrinsic gamification is used to support innovation, strengthen communication, enhance performance and productivity as well as generating positive business processes. External gamification, on the other hand, aims to improve the relationships between companies and clients in line with their marketing goals, increase engagement through more visits, boost loyalty to the product and make more revenue. Behaviour changing gamification is implemented with the aim of creating new useful habits and behavioural changes in a community (Werbach and Hunter, 2012). Gamification is an approach that can also be utilized in educational processes (Kapp, 2014). It is reported that gamification in the teaching process helps in attracting learners' attention to the subject and the course (Yıldırım and Demir, 2014, Güler and Güler, 2015), supports concentration, increases motivation, encourages students to participate more actively (Çeker and Özdamlı, 2017), and that the elements of gamification are effective in facilitating learning and enhancing motivation (Kapp, 2014).

Gamification consists of three elements as the dynamics, mechanics, and components. These categories, arranged in order of abstraction, are related to their higher levels. Dynamics include elements within a wide range such as how the process would progress, what type of relationships are to be built and the narrative in which it will take place. Dynamics outline the overall scope of the gamification process. The fact that all the dynamics can be designed contributes to the design of the gamification process. The elements included at the level of dynamics are constraints, emotions, narrative, progression, and relationships. Mechanics are the fundamental processes that drive the action forward and encourage player engagement. Mechanics ensure the system to be attention-grabbing in the gamification process. The elements at the level of mechanics include challenges, chance, competition, cooperation, feedback, resource acquisition, rewards, transactions, game turns and win states. Game components are the more visible reflections of the mechanics and dynamics that are in the forefront of the system. Important game components that could be used in the gamification process include achievements, avatars, badges, challenges, collections, battles, gifting, leader boards, levels, points, tasks, guilds, and virtual objects etc. The most appropriate components should be selected when designing gamification. The steps of gamification called D6 which are frequently used in the designing process of gamification comprise defining the objectives, delineating the target behaviours, describing the intended players, devising appropriate short-term engagement loops and long-term progression loops, being sure not to forget the fun and deploying the appropriate tools (Werbach and Hunter, 2012; Werbach and Hunter, 2014).

Recent studies conducted on gamification appear to be in different fields such as software engineering (Souza et al., 2017; Ivanova et al., 2019), medicine (Topalli and Cagiltay, 2017), e-commerce (Isabelle, 2020), entrepreneurship (Kauppinen and Choudhary, 2021), computer sciences (Zahedi et al., 2021), and English as a Foreign Language (EFL) (Güzel, 2023). Some of these studies were conducted with participants at the level of primary education (Páez-Quinde et al., 2022) while a significant number of them included participants at undergraduate (Souza et al., 2017; Aguilera and Martínez 2017; Tejada-Castro et al., 2018; Zahedi et al. 2021, Kauppinen and Choudhary, 2021, Güzel 2023), and graduate levels (Topalli and Cagiltay, 2017; Hernández-Fernández et al., 2020; O'Connell, et al., 2020). These studies have generally focused on such variables as motivation, academic achievement and interest as well as the learning process stages of gamification and its elements (Yıldırım and Demir, 2014; Zdonek, 2018; Páez-Quinde et al., 2022). Building upon the studies in the literature, the present study was planned and executed considering that gamification could be used especially in distance and online undergraduate education conducted recently due to the pandemic in order to increase learner motivation and make teaching more effective. To this end, the present study aimed to compare learners' perceived motivational states and academic achievement in the process of gamified electronic spreadsheet program instruction with the video-based instruction process and to determine the learners' opinions regarding the gamified instruction process.

In line with this purpose, the study addressed the question "What is the effect of gamified materials in the electronic spreadsheet program instruction on the learners' perceived motivation and academic achievement and what are the opinions of the learners regarding the gamified materials?" with the help of the following sub-problems.

1. What are the statuses of the learners regarding the use of gamified materials and video materials that do not include gamification elements in electronic spreadsheet program instruction?
2. Is there a significant difference between the perceived motivations of the learners in the instruction provided with gamified electronic spreadsheet program material and the perceived motivations of the learners in the instruction provided with the video material without gamification elements?
3. Is there a significant difference between the academic achievement of the learners in the instruction provided with gamified electronic spreadsheet program material and the academic achievement of the learners in the instruction provided with the video material without gamification elements?
4. What are the learners' opinions about the gamified materials in electronic spreadsheet program instruction?

3. Methodology

3.1. Research Model/Design

The present study employed the triangulation design from mixed model designs. Mixed method can be defined as the combination or integration of the research and data of the quantitative method and qualitative method by using the two methods together. In the study, quantitative data were collected and analyzed using an explanatory sequential design (Cresswell, 2014) and qualitative data were collected to provide the quantitative data. In order to strengthen the research, quantitative data collection instruments were used in the pre-test phase of the quasi-experimental design, and quantitative and qualitative data collection instruments were applied simultaneously in the post-test phase. Quantitative approaches were adopted for the 1st, 2nd and 3rd research questions, while qualitative approaches were applied for the 4th question.

3.2. Study Group

The participants of the study consisted of 90 prospective teachers studying at the higher education level. The participants were prospective teachers who were enrolled in the "Information Technologies" course at the Faculty of Education of a university in Türkiye during the 2021-2022 academic year. The experimental and control groups were randomly selected from the classes, without any manipulation by the researchers. The courses were delivered online through the learning management system, with the same instructor teaching both the experimental group and control group. The information regarding the participants'' gender, undergraduate program, e-learning experience and gamified instruction experience stated in the personal information form are presented in Table 1.

Table 1.

Participants' genders, undergraduate programs, e-learning and gamification experiences

Variable	Group	Value	*f*	%
Gender	Experimental	Female	34	%69,39
		Male	15	%30,61
	Control	Female	38	%92,68
		Male	3	%7,32
Undergraduate Program	Experimental	Science Teaching	28	%57,14
		Turkish Language Teaching	20	%40,82
		Primary School Teaching	1	%2,04
	Control	Pre-school Teaching	40	%97,56
		Primary School Teaching	1	%2,44
E-learning experience	Experimental	Yes	24	%48,98
		No	25	%51,02
	Control	Yes	18	%43,90
		No	23	%56,10
Gamified teaching experience	Experimental	Yes	5	%10,20
		No	44	%89,8
	Control	Yes	3	%7,32
		No	38	%92,68

In Table 1, it is seen that 80% of the participants were female, 20% were male, and they were enrolled in four different programs (pre-school teaching, science teaching, Turkish language teaching and primary school teaching). Approximately 47% of the participants had e-learning experience, while nearly 53% had no previous experience of e-learning. A great majority of the participants (approximately 91%) had no experience of gamified learning.

3.3. Data Collection Tools

The data of the study were collected using personal information forms, Instructional Materials Motivation Survey, electronic spreadsheet program achievement test, opinion survey and system records.

Personal Information Form: The personal information form is a data collection instrument which was developed by the researchers and consists of questions about e-learning experiences and gamified learning experiences.

Instructional Materials Motivation Survey: Developed by Keller and adapted to Turkish by Kutu and Sözbilir (2011), the Instructional Materials Motivation Survey consists of 24 items. It is a 5-point Likert type scale with a Croanbach's Alpha internal consistency coefficient of 0,83.

Electronic Spreadsheet Program Achievement Test: The 25-item Electronic Spreadsheet program Achievement Test was developed by Tunga and İnceoğlu (2020) with a discriminant validity level of 0,387, a test difficulty of 0,452 and a KR20 reliability coefficient of 0,763. The Electronic Spreadsheet program

Achievement Test was used in the present study since it is consistent with the objectives included in the instruction of the electronic spreadsheet program course.

Opinion Survey: The survey was developed by the researchers to determine the learners' opinions about the gamified teaching environment.

System Records: They consist of information saved by the learning management system concerning such details as the time learners stayed in the system, frequency of interaction and response times to tasks.

3.4. Research Procedures

In the first stage of the research, teaching environments were set up and experimental procedures were executed in the second stage. In this regard, learning processes were designed for the experimental and control groups in line with the objectives of the learning process and the behaviours associated with these objectives in the first stage. In the second stage, pre-tests were administered, instruction was provided for the experimental and control groups and post-tests were applied.

Table 2.

Course of procedures

Group	Pre-test	Procedure	Post-test
Experimental Group	Personal information form, instructional materials motivation survey and electronic spreadsheet program achievement test	Conducting instruction through a gamified teaching environment	Instructional materials motivation survey, electronic spreadsheet program achievement test and opinion survey
Control Group	Personal information form, instructional materials motivation survey and electronic spreadsheet program achievement test	Conducting instruction through video materials	Instructional materials motivation survey and electronic spreadsheet program achievement test

Table 2 shows the course of procedures for the experimental and control groups. The experimental group was given the personal information form, instructional materials motivation survey and electronic spreadsheet program achievement test as the pre-test. Following the pre-test, instruction was delivered in a gamified teaching environment. After the instruction process, the instructional materials motivation survey, electronic spreadsheet program achievement test and opinion survey were applied as the post-test. The control group was also given the personal information form, instructional materials motivation survey and electronic spreadsheet program achievement test as the pre-test. Instruction was delivered using video materials following the pre-test. After the instruction process, the instructional materials motivation survey and electronic spreadsheet program achievement test were applied as the post-test. The study was conducted over a four-week period in both the experimental and control groups, encompassing the pre-test, procedure and post-test. After the pre-test, the experimental group was informed about the instruction process, introduced to the application and given information on how to download the application. Similarly, participants in the control group were provided with information concerning how the instruction process would take place and how they could access the video materials after the pre-test. The experimental group was expected to complete the levels regarding the weekly course topics opened up on the application. Likewise, the control group were asked to conduct the video instruction process and to complete the videos

presented concerning the weekly course topics. The objectives of the instruction conducted in the experimental and control groups consisted of the objectives and behaviours covered by the electronic spreadsheet program course.

Teaching environments

Separate teaching environments were prepared for the experimental and control groups in the study. The gamified teaching environment was structured considering the D6 gamification design. To this end, teaching objectives and behaviours were defined in the first place. Later, the mechanics and dynamics of the gamification process were identified taking the characteristics of the target audience into account and the instruction material was developed. The video-instruction process conducted in the control group included the same course objectives as the control group. Video materials were prepared for these target behaviours in the control group. Learning management system was employed for communication and transference of the processes with both groups. The system includes the announcements, materials, directions etc. to be shared with the students.

The gamified teaching environment was designed as an extension to facilitate learning activities within the electronic spreadsheet program. This allows for monitoring students' behaviours within the program, providing feedback, intervening with the objects, structures and content within the program and enabling instant interaction with the students. In the gamified teaching environment, the students are provided with the opportunity to revise, make various directions when necessary and participate in learning activities without any time constraints. The students can login with their personal usernames and passwords and continue from where they left off. The teaching environment is accessible for devices like computers, tablets and telephones which allow the installation of extensions. The licensing provided to the students at the university where the study was conducted allows all the students to access the online electronic spreadsheet program and set up the extension through a web browser. The extension can be put into any desired size and location within the electronic spreadsheet program. Gamified teaching environment screenshots are presented in Figure 1.

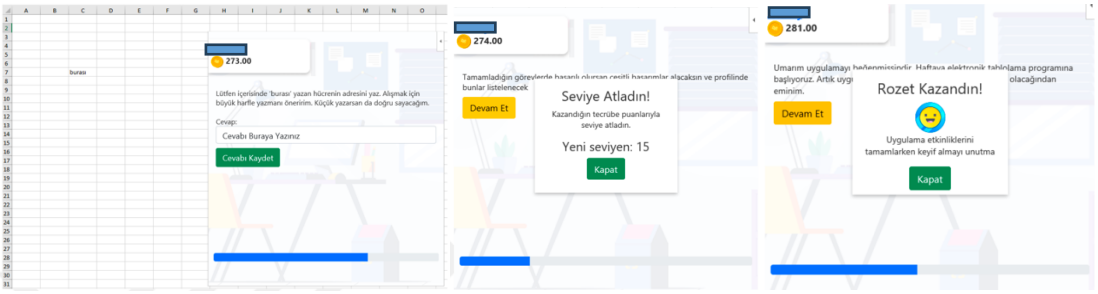

Fig. 1. Screenshots

For the presentation of a story, one of the crucial elements of gamification, a narrative was created and a scenario was developed for the electronic spreadsheet program instruction. In the narrative, the students start internship at a private company and strive to fulfil the tasks assigned to them successfully. Meanwhile, their colleagues help them learn the business dynamics. In line with the scenario, tasks, questions and dialogues are associated with the objectives using several tags to enable the students to learn at their own pace and revise when they need. This way, relevant topics can be revised according the students' behaviours regarding the tasks and questions. After the preparation of the dialogue, task and question structures, various game elements were added to the system including points, leader boardss, badges, rewards, feedback, achievements, progression bars, levels, experience scores, narratives, competition and challenges. Within the scope of graphic design activities, visual materials were designed such as the application symbol, point

icon, badges, application background, level signs, accomplishment symbols, leader boards, prize announcement visuals etc. The teaching environment presents real-life rewards given in the gamified process based on certain achievement conditions. In addition, a video template was designed to announce reward-winning students.

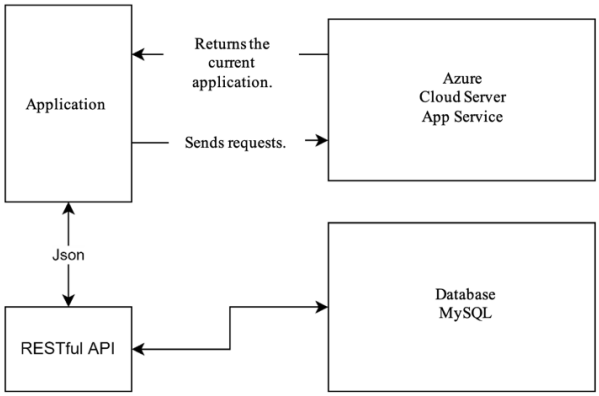

Fig. 2. System structure of the gamified teaching environment

Figure 2 displays the system structure of the gamified teaching environment. When the application developed as an extension is launched, it first sends a request to install the application from the Azure cloud server. Upon this request, the cloud server returns the interface of the most up-to-date application to the user. This allows the application to be updated remotely in real-time. The application is considerably small in size as it is presented as a web interface. The fact that the application is present in the cloud infrastructure of a powerful server minimizes the problem of accessibility. Following the installation of the application, each action of the user is sent to the web service as a request. The request is examined, processed and the result is returned. The application was developed using the HTML, CSS and JS languages. Several frameworks like jQuery and Bootstrap working with these languages were employed. After the development of the pre-face, it was set up in the cloud server infrastructure of the electronic spreadsheet program developers and tests were performed. Web service preparations were initiated upon the completion of pre-face testing. User data were stored in the Mysql database with REST API developed using the PHP programming language.

A video teaching environment was designed for the control group considering their teaching objectives and the weekly course topics. To avoid any researcher intervention, the videos related to the topics were found on the internet. Open access videos on YouTube were examined and suitable ones were added to the teaching environment. The videos were not downloaded to avoid copyright issues but integrated into the learning management system using the embed-to-page option on YouTube. Course videos were presented over the learning management system to the students within the video-based teaching environment.

3.5. Data Analysis

Descriptive statistics (for the 1st sub-problem) and variance analysis for repeated measures (2nd and 3rd sub-problems) were used for the quantitative data, while descriptive analysis (4th sub-problem) was conducted for the qualitative data.

3.6. Role of the Researchers

The researchers prepared the teaching environments, participated in the virtual classes in the instruction process, introduced the teaching environments to the experimental and control groups and monitored the

activities during the instruction process. They responded to the requests of the experimental and control groups through a support e-mail address throughout the entire process.

4. Findings and Discussions

Learners' use of the Gamified Instructional Material and the Non-gaming Video Material

Students' login counts and session durations obtained from the system logs of the gamified learning environment are presented in Table 3.

Table 3.

Login counts and session durations on the gamified instruction application.

	Lowest value	Highest value	Mean ($\bar{X}$)	Standard Deviation
Login counts	4	38	17,53	7,974
Session durations	1	10544	1375,95	1703,54

In Table 3, it is seen that the application was logged a minimum of 4 times and a maximum of 38 times, with a mean login count of 17,53. When determining the session durations of the experimental students on the gamified instruction environment, the intervals of active actions were utilized. The sessions where the application was left open with no activity were excluded from the table. The shortest session duration on the application was 1 second, while the longest duration was 10544 seconds (approximately 176 minutes), with a mean session duration of 1375,95 seconds (approximately 23 minutes).

The access counts of the control group students to the video materials on the learning management system are displayed in Table 4.

Table 4.

Access counts to the video materials

	Lowest Access count	Highest Access Count	Mean ($\bar{X}$)	Standard Deviation
Video access counts	33	118	62,69	17,32

It is seen that the minimum access count to the video instruction materials is 33, the maximum access count is 118 and the mean access count is 62,69 for the control group students. It is seen that some videos were not watched by the students since the control group consisted of 41 students.

Learners' Perceived Motivation

The results of the pre-test and post-test descriptive statistics obtained from the instructional materials motivation survey are presented in Table 5.

Table 5.

Descriptive statistics of the instructional materials motivation survey

	Group	N	Mean ($\bar{X}$)	Standard Deviation
Pre-test	Experimental	49	3,4919	,77854
	Control	41	3,3468	,67017
Post-test	Experimental	49	3,8576	,76565
	Control	41	3,4259	,74615

Two-way ANOVA results of the students' scores on the instructional materials motivation survey according to the variables of test (pre/post-tests) and group (experimental and control) are given in Table 6.

Table 1.

The results of the variance analysis of the changes in students' scores on the instructional materials motivation survey according to pre-test, post-test and groups

Source of Variance	Sum of Squares	sd	Mean Squares	F	p	Partial Eta-Squared
Constant	2225,828	1	2225,828	4,284	,000	,958
Group	3,709	1	3,709	6,698	,010	,037
Test	2,210	1	2,210	3,990	,047	,022
Group * Test	,919	1	,919	1,659	,199	,009
Error	97,467	176	,554			
Total	2364,452	180				

It is seen in Table 6 that the variables of group and test do not have a significant influence on the students' scores on the instructional materials motivation survey ($p>.05$). Accordingly, it could be suggested that there is no significant difference between the changes in the pre-test and post-test scores on the instructional materials motivation survey of the experimental group where gamified instructional materials were used and the control group where video-based materials were used.

Learners' Academic Achievement

Pre-test and post-test results on the electronic spreadsheet program achievement test of the experimental and control group students are presented in Table 7.

Table 2.

Descriptive statistics of the electronic spreadsheet program achievement test

	Group	N	Mean ($\bar{X}$)	Standard Deviation
Pre-test	Experimental	49	30,86	10,033
	Control	41	23,80	10,390
Post-test	Experimental	49	51,92	14,177
	Control	41	42,54	12,092

It is seen in Table 7 that the mean pre-test scores of the experimental group students is 30,86, mean pre-test scores of the control group students is 23,80, mean post-test scores of the experimental group students is 51,92 and mean post-test scores of the control group students is 42,54. Two-way ANOVA results of the students' scores on the electronic spreadsheet program achievement test according to the variables of test (pre/post-tests) and group (experimental and control) are given in Table 8.

Table 8.

The results of the variance analysis of the changes in students' scores on the electronic spreadsheet achievement test according to pre-test, post-test and groups

Source of Variance	Sum of Squares	sd	Mean Squares	F	p	Partial Eta-Squared
Constant	248177,036	1	248177,036	1772,239	,000	,910
Group	3014,369	1	3014,369	21,526	,000	,109
Test	17673,367	1	17673,367	126,206	,000	,418
Group * Test	60,567	1	60,567	,433	,512	,002
Error	24646,308	176	140,036			
Total	300800,000	180				

According to the analysis results displayed in Table 8, the variables of group and test have no significant influence on the students' scores on the electronic spreadsheet achievement test ($p>.05$).

Accordingly, it could be suggested that there is no significant difference between the changes in the pre-test and post-test scores on the electronic spreadsheet program of the experimental group where gamified instructional materials were used and the control group where video-teaching materials were used.

Learners' Opinions Regarding the Gamified Material

The participants' opinions about the gamified teaching material were explored under the titles of how they found the material, their satisfaction/dissatisfaction, its effects on their learning, the problems they encountered and their suggestions. In this regard, examples of participant opinions are included below. The sub-themes and codes of the theme of gamified teaching material opinion of the participants are given in Table 9.

Table 9.
Learner' opinions

Sub-themes	Codes
Views	fun (n=19), instructive (n=10), nice (n=9), interesting (n=8), enjoyable (n=7), useful (n=5), fruitful (n=5), catchy (n=5), amusing (n=4), successful (n=3), motivating (n=2), facilitating in learning (n=2), educative (n=1), effective (n=1) and functional (n=1).
Satisfying	repetition and exercises (n=13), supporting the learning (n=10), feedback (n=6), hints (n=6), gamified teaching and narration (n=6), scoring system (n=5), competition (n=4), rewards, absence of time constraints (n=4) and being less boring but motivating (n=2)
Dissatisfying	same questions (n=11), limited examples (n=2), difficult formulas (n=1), connection issues (n=1), lengthiness (1) and concentration problems (1)
Affect on Learning	affected them positively (n=32), facilitated their learning (n=11), made learning fun (n=6), increased retention (n=4), enhanced efficiency (n=3), made it amusing (n=3), ensured effective learning (n=1), increased processing speed (n=1) and improved self-confidence (n=1)
Problems	technical hitches (n=8), problems with accessing the system (n=4), problems with the repetition of the questions (n=4), internet connection problems (n=4) and problems with connecting via telephone (n=3)
Suggestions	decreasing the number of repeated questions (n=6), adding different questions (n=4), adding audio-visual materials (n=4), adding sound effects (n=2), increasing the level of difficulty (n=2), making it more colourful (n=2), improving the interface (n=1), being more explanatory (n=1), being used with other Office programs (n=1), adding educative videos (n=1), adding music (n=1) and increasing the number of rewards (n=1)

Views

Some of the participant responses to the question "How did you find the gamified teaching material?" are presented below.

> *S47: "It was more useful for learning and successful in teaching through entertainment. I believe rewarding accomplishments increases motivation for participation in the course. Since we conduct the application ourselves, we can stay in the lesson for a longer time without getting bored. I think repetition of the information and questions highly increases retention."* [enjoyable]
>
> *S41: "In my opinion, this teaching environment facilitated learning to a great extent."* [facilitating in learning]
>
> *S39: "Since it also includes repetitions, it was more permanent for us and I found it very successful."* [successful]
>
> *S33: "I found it quite successful. I think it helped me learn the lesson more effectively."* [effective]
>
> *S31: "It is a very informative program. It was an application I had fun while doing. It was exactly educative and informative. It is nice that we have the opportunity to use it after the class, too. I could increase my score whenever and however I wanted. While increasing my score, I learnt more as well. It was a fruitful application."* [fruitful]
>
> *S24: "I think it was highly educative. I believe class participation increased thanks to this teaching environment. I had prejudices against the Excel program at first, but thanks to the gamified teaching environment, I think I could comprehend it easily."* [educative]

S21: "First I didn't like it. However, I was then happy because it helped us all to learn the subject in some way without realizing, it was nice." [nice]

S19: "I think it was a lot fun. Winning awards increased interest in the lesson as well as encouraging us. I believe the application is really fruitful." [fruitful]

The responses given by the participants show that they find the gamified teaching material fun, engaging, motivating and instructive. The participants did not provide any negative responses to this question.

Satisfying

Some of the participant responses to the question "What aspects of the gamified teaching environment did you find satisfying?" are presented below.

S4: "Receiving hints from the system when the questions are answered incorrectly and getting help from the program as it is in the program" [hints]

S2: "Experiencing the questions on Excel was more instructive. I was satisfied because I was able to access the program whenever I wanted and there was no time constraints." [absence of time constraints]

S6: "It was good for me for repeating the questions and the hints it provided for the questions I couldn't answer were very useful" [repetition and exercises]

S10: "The abundance of exercises and the hints part were very nice." [hints]

S13: "I was satisfied with the virtual business environment created and the abundance of exercises." [repetition and exercises]

S15: "I was satisfied with the competition. It made me more ambitious, encouraging me to do." [competition]

S41: "Being able to progress and winning points were very good. I got very happy as my scores increased and my rank got higher and I wanted to do more :)" [scoring system]

S48: "I was very satisfied with the narration of the game." gamified teaching and narration]

S49: "I enjoyed the scoring system. I wanted to do more activities." [scoring system]

When the participants' responses regarding their satisfaction with the teaching environment were examined, it was seen that they were satisfied with it because of the repetition and exercises, supporting the learning feedback, hints, gamified teaching and narration, scoring system, competition, rewards, absence of time constraints and being less boring but motivating.

Dissatisfying

Some of the participant responses to the question "What aspects of the gamified teaching environment did you find dissatisfying?" are presented below.

S35: "I was dissatisfied with how lengthy it was." [lengthiness]

S26: "I had concentration problems as I find it difficult to sit at the computer focusing on something." [concentration problems]

S15: "The questions were repeated constantly, other than that I have no dissatisfaction." [same questions]

S6: "It's good that it repeats the questions but repeating them constantly was not that pleasing." [same questions]

S1: "I was dissatisfied with seeing the same questions repeatedly." [same questions]

According to the responses of the participants regarding the aspects they were dissatisfied with, they mentioned encountering the same questions, limited examples, difficult formulas, connection issues, lengthiness and concentration problems.

Affect on Learning

Some of the participant responses to the question "How do you think using the gamified teaching environment affected your learning?" are presented below.

S1: "It affected my learning positively because we learnt more easily performing applications ourselves and answering questions." [affected them positively]

S3: "It made my learning permanent and enjoyable" [made learning fun]

S11: "Of course it affected positively. We forget what we hear, remember what we see and learn what we do, they say. I suppose we learnt what we did." [affected them positively]

S15: "We did it by seeing and performing ourselves. I think this made our learning even easier." [facilitated their learning]

S24: "I learnt more willingly thanks to the gamified teaching environment, and I think what I learnt is permanent." [increased retention]

S25: "It affected quite positively. It taught me how to use Excel, the exercises facilitated my learning since they were engaging." [facilitated their learning]

S31: "There was definitely an increase in the knowledge I gained. Learning became even easier. My interest in the course increased. There were questions I answered with pleasure as they were fun. Being able to do it without anyone and whenever I wanted increased my enthusiasm to learn." [facilitated their learning]

S44: "I used to think I would never be able to understand it as I had no familiarity with Excel, but I learnt a lot in enjoyment thanks to this course." [made learning fun]

S47: "I believe it increased the retention of what I learnt. I think it enhanced my self-confidence in learning to use Excel." [increased retention]

The participants' responses concerning the effects of the gamified teaching on their learning indicate that it affected them positively, facilitated their learning, made learning fun, increased retention, enhanced efficiency, made it amusing, ensured effective learning, increased processing speed and improved self-confidence.

Problems

Some of the participant responses concerning the problems they encountered while using the gamified teaching environment are presented below.

S44: "I'm not sure if it's a problem, but repeating the same questions constantly was a bit of a waste of time." [problems with the repetition of the questions]

S38: "I had connection problems and was logged out of the system while answering some questions" [internet connection problems]

S33: "No, I didn't face a serious problem. Just technical hitches" [technical hitches]

S32: "…it was hard to connect through telephone" [problems with connecting via telephone]

S26: "Seeing the same exercises frequently could be boring after a while. And it's not very easy for me to focus on something on the computer." [problems with the repetition of the questions]

S8: "There was no problem other than connection issues" [internet connection problems]

S1: "a few access problems while logging into the teaching environment" [problems with accessing the system]

The participants responses regarding the problems they encountered showed that they had technical hitches problems with accessing the system, problems with the repetition of the questions, internet connection problems and problems with connecting via telephone.

Suggestions

Some of the participant suggestions concerning the gamified teaching environment are presented below.

S48: "Visual content could be useful." [adding audio-visual materials]

S46: "It could be more explanatory. It can elaborate on some things in more detail." [being more explanatory]

S34: "My suggestion is it can be a little more colourful, it can include some illustrated jokes, for example, we wouldn't think only about the lesson" [making it more colourful]

S27: "It could be more fun, Music, sound effects etc." [adding sound effects and music]

S22: "It would be better if the same questions weren't repeated constantly, but it's not a big deal." [decreasing the number of repeated questions]

S13: "I could suggest that it would be nice if exercises can also be used on programs like Word, PowerPoint etc." [being used with other Office programs]

S11: "if the dialogues are added sound, it would be more interesting. All audio extensions make the environment more colourful; I suppose." [adding audio-visual materials]

S3: "sound effect, maybe" [adding sound effects]

It is seen in the responses that the participant suggest decreasing the number of repeated questions, adding different questions, adding visual materials, adding sound effects, increasing the level of difficulty , making it more colourful, improving the interface, being more explanatory, being used with other Office programs, adding educative videos, adding music and increasing the number of rewards.

5. Conclusion and Suggestions

The present study primarily examined students' use of gamified materials and non-game video elements in electronic spreadsheet program instruction through the learning management system records (experimental group students' login counts to the system, session durations and control group students' number of access to the video material). Login counts of the experimental group indicate that they logged into the application more than once during the process. The student/s with the lowest number of logins seem to log in for weekly activities. According to the times spent on the application, it is considered that the student/s whose session duration is 1 second had internet connection problems or had instant login/logouts for some other reason on their own choice. When the mean session duration is multiplied by the mean login count, it is seen that a student spent an average of 24120,40 seconds (approximately 6 hours 42 minutes) on the application.

Accordingly, it can be asserted that the participants spent more time on the application than the time allocated in the weekly lesson plan. The finding that the lowest access number to the videos is 33 in the control group reveals that the participants did not watch all the videos. The mean access number of 62,69 shows that the participants watched the videos more than once. The highest access number indicates that the most reviewed video was watched an average of 2,88 times.

The measurement-group interaction showed that the students' inclusion in the gamified teaching material environment (experimental) and video-teaching material environment (control) did not have a significance difference in terms of increasing perceived motivation. Many studies in the literature report that gamification influences participants' motivation positively (Yıldırım and Demir, 2014; Topalli and Cagiltay, 2017; Wang, 2019; Kauppinen and Choudhary, 2021; Páez-Quinde et al., 2022). However, this finding obtained from the present study is different from the results obtained in the literature. This is considered to result from the online application environment in both groups, technical problems in accessing the environment and the components used in the design of the gamified environment. Participants' expressed their opinions regarding the gamified teaching environment defining it fun, nice, enjoyable, interesting and motivating.

They also highlighted such components as the repetition system, feedback, hints, scoring system, competition, narrative, exercises, absence of time constraint and engagement in the gamified environment. On the other hand, the aspects that the students were dissatisfied with the gamified teaching environment included encountering the same questions, limited number of examples, difficulty of formulas, connection problems and lengthiness. Based on these findings, it is considered that diversifying the questions and examples in the gamification material, making the formulas in the content more understandable, providing students with technical support and decreasing the time to be spent in the teaching environment can affect motivation positively.

The measurement-group interaction showed that the students' inclusion in the gamified teaching material environment (experimental) and video-teaching material environment (control) did not have a significance difference in terms of increasing academic achievement. Some studies in the literature report that gamification positively affects academic achievement (Aguilera and Martínez (2017; Bolat et al., 2017; Isabelle, 2020; Zahedi et al., 2021). On the other hand, Kauppinen and Choudhary (2021) stated that gamified teaching process did not have a significant effect on students' ability to recall information. Liu and Wang (2019) found that gamification decreased the participants' performance. The main reasons behind the finding obtained from the present study are considered to be the online application environment in both groups, the duration of the study, subject field, technical problems experienced by some participants accessing the environment and the components used in the design of the gamified environment. The study had to be conducted in a four-week timeframe due to the pandemic circumstances and students' conditions. It is speculated that extending the duration of the study can have positive effects on academic achievement. Students' opinions regarding the environment reveal that they found the gamification material instructive, it affected their learning positively, it facilitated learning, and they were satisfied with the repetitions, active participation, reinforcement, clues and feedback elements. On the other hand, students also expressed that the examples presented in the content were limited and the formulas were difficult. This is rather related to the subject field and the presentation of the content. As also expressed by the students, academic achievement can be affected positively by increasing the examples and questions, adding more visual material to the content, reducing the time spent on the application by providing students with the opportunity to review.

It is seen that the gamified teaching material was found fun, instructive, nice, enjoyable, interesting, useful and fruitful by the students, it positively affected and facilitated learning, increased retention of information, ensured motivation, was found efficient and the students were satisfied with it. Students held positive opinions regarding the feedback, clues, rewards, scoring system, competition and narration in the gamified teaching material. In this regard, it can be stated that the gamified teaching environment made an overall

positive effect on students' learning. It is believed that the selection and inclusion of appropriate components while designing the gamified teaching material and following the D6 gamification steps (Werbach and Hunter, 2014) had positive effects on the students' opinions.

The problems encountered in the gamified teaching environment included system access, repetition of the questions, technical issues, connecting with telephone and internet connection. Internet connection is needed for the application to transfer real-time information and to offer gamification elements like leader boards and points. In this respect, students may face problems due to internet connection issues. It is considered that the students who expressed having problems with connecting through telephone had difficulty due to screen size. The students' suggestions regarding the gamified teaching environment rather focused on the questions and multimedia.

Similar to the repetition system in the present study, some studies mail fail to present clear results regarding opinions about gamification elements (Souza et al., 2017). In this respect, it is natural that some students expressed positive opinion about the repetition system while some held negative opinions.

In conclusion, it was seen that there was no significant difference between using gamified teaching material and video-based teaching material in electronic spreadsheet program instruction in terms of perceived motivation and academic achievement. However, students' opinions regarding the gamified teaching material showed that it had a considerably positive effect on motivation as well as affecting learning and academic achievement positively. Although the literature includes studies on the effect of gamification on academic achievement, there is a need for further research on the effects of gamification on academic achievement at different levels and in different areas. In this respect, studies can be conducted to measure academic achievement using other measurement and assessment tools like rubrics, self-assessment, peer assessment, portfolio besides achievement tests. Based on the participants' opinions regarding the repetition element in the present study, examining the effects of activity cycles and gamification components in the design of gamified teaching processes on motivation and academic achievement is considered to contribute to the literature.

Notes

This study is produced from the Master's thesis in which the first author is student and the second one is supervisor.

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