TITLE: Effects of Gamification on Active and Reflective Learners` Engagement and Cognitive Load

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Effects of Gamification on Active and Reflective Learners' Engagement and Cognitive Load

Oyunlaştırmanın Aktif ve Yansıtıcı Öğrencilerin Meşguliyeti ve Bilişsel Yükü Üzerindeki Etkileri

Fatma Burcu TOPU[*]

ABSTRACT: This study aimed to investigate the effects of gamification on active and reflective learners' engagement and cognitive load. It also compared both groups' experiences in a 10-week gamification process. It employed triangulation, one of the mixed research designs in this study. Participants consisted of 70 undergraduate students (45 active, 25 reflective learners). According to the results, both active and reflective learners had a high rate of behavioral, emotional, and cognitive engagements in gamification and low cognitive load. There was no significant difference between the groups' engagement and cognitive load. It was determined that the Challenge and Competition, Engagement in Group Tasks and In-Class Activities, Leaderboard, and Reward System were common themes regarding the pros and cons of the gamification process. The "Challenge and Competition" theme had the highest frequency in terms of the pros of the gamification process, whereas the "Engagement in Group Tasks and In-Class Activities" theme had the highest cons. Although common themes related to the pros and cons of gamification were available, similarities and differences were determined by active and reflective learners' opinions on various codes in themes. Consequently, characteristic features affected the reaction toward gamification elements and processes.

Keywords: gamification, active and reflective learners, engagement, cognitive load.

ÖZ: Bu çalışmanın amacı, oyunlaştırmanın aktif ve yansıtıcı öğrenenlerin meşguliyeti ve bilişsel yükü üzerindeki etkilerini araştırmaktır. Ayrıca her iki grubun 10 haftalık oyunlaştırma sürecindeki deneyimleri karşılaştırmalı olarak sunulmuştur. Bu çalışmada, karma araştırma desenlerinden biri olan çeşitleme kullanılmıştır. Katılımcılar 70 lisans öğrencisinden (45 aktif, 25 yansıtıcı öğrenen) oluşmaktadır. Sonuçlara göre, hem aktif hem de yansıtıcı öğrenenler oyunlaştırmada yüksek oranda davranışsal, duygusal ve bilişsel meşguliyet ve düşük bilişsel yüke sahiptiler. Grupların meşguliyeti ve bilişsel yükü arasında anlamlı bir fark yoktur. Oyunlaştırma sürecinin olumlu ve olumsuz yönlerine ilişkin olarak Meydan Okuma ve Rekabet, Grup Görevlerine ve Sınıf İçi Etkinliklere Katılım, Liderlik Tablosu ve Ödül Sistemi'nin ortak temalar olduğu belirlenmiştir. Oyunlaştırma sürecinin artıları açısından toplamda "Meydan Okuma ve Rekabet" teması en yüksek frekansa sahipken, eksiler açısından "Grup Görevlerine Katılım ve Sınıf İçi Etkinlikler" teması en yüksek sıklığa sahip olmuştur. Oyunlaştırmanın artıları ve eksileri ile ilgili ortak temalar mevcut olmasına rağmen, aktif ve yansıtıcı öğrenenlerin temalardaki çeşitli kodlara ilişkin görüşlerinde benzerlikler ve farklılıklar tespit edilmiştir. Sonuç olarak, karakteristik özellikler oyunlaştırma unsurlarına ve sürecine yönelik tepkiyi etkilemiştir.

Anahtar kelimeler: oyunlaştırma, aktif ve yansıtıcı öğrenenler, meşguliyet, bilişsel yük.

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Gamification uses game elements and thinking processes to support motivation and engagement in non-game activities (Deterding et al., 2011). Gamification elements cover game mechanics and dynamics. Game mechanics include challenging tasks, luck factor, racing and competition, rewards, feedback, collaboration, player participation, exchange and relationship between players, and winning and losing in collaboration for achieving goals. Game Dynamics include the limitations, emotions (curiosity, competitiveness, disappointment, happiness, etc.), a consistent and continuous story, the development and progress of the player, social interactions, and relationships for status and altruism (Simões et al., 2013; Werbach & Hunter, 2012; Zichermann & Cunningham, 2011). Gamification elements allow for overcoming cognitive and emotional obstacles during the activity process (Domínguez et al., 2013; Yildiz et al., 2021). It can also activate or constrain the participants' actions to generate emotions, cognitions, and consequences of events in the desired direction (Mullins & Sabherwal, 2020).

The spread of digital media, especially in the commercial field, has obtained positive results in applications that use gamification elements (Dicheva et al., 2015; Hamari, 2017; Kuo & Chuang, 2016). Depending on these results, educators have begun to use gamification as an alternative approach to improve the learning-teaching process and ensure the continuity of the students' active participation in the course. This has accelerated the integration of gamification into education (Buckley & Doyle, 2017; Saleem et al., 2022). At this point, more gamification studies with various implementations in different learning environments need to be conducted for a broader perspective.

Engagement in Gamification

Dropping out the course and attendance issues continue as a problem that cannot be overcome in teacher-centered educational environments (Hew et al., 2016). Therefore, engagement is accepted as a prerequisite for the student to get a positive perspective towards the learning process (emotional), to acquire the desired knowledge and skills (cognitive), and to participate actively in course (behavioral) (Appleton et al., 2008). It is emphasized that student engagement with behavioral, emotional, and cognitive sub-dimensions (Fredricks et al., 2004) is an important force in the educational setting (Coates, 2007; Fredricks et al., 2011).

The primary function of gamification is to create a learning environment equipped with gamification elements to prompt the students' engagement in goal-directed activities (Adams & Du Preez, 2022; Buckley & Doyle, 2017; Huang et al., 2019). Through gamification by activating positive or negative emotions, participants are expected to cognitively interact with the learning process and exhibit targeted learning behaviors. This indicates the importance of considering gamification from emotional, cognitive, and behavioral aspects. (Mullins & Sabherwal, 2020).

Many studies confirmed that gamification could increase students' engagement with the learning process (Huang & Hew, 2021). Studies on gamification were available that deal with one or more sub-dimensions of engagement. Erümit and Yılmaz (2022) found out that gamification activities enriched with various game elements (competition, leaderboard, level-up, points, prizes, cups, and badges), and Kahoot as the gamified application had a significantly positive effect on undergraduate students'

cognitive engagement by comparing pre-test and post-test results. Ibáñez et al. (2014) reported that using gamification in programming education had a positive effect on undergraduate students' cognitive and emotional engagement. Pakinee and Puritat (2021) determined a significant difference between gamified and non-gamified groups' engagement in favor of gamified conditions. It was also available studies reported similar results: Zainuddin et al. (2020) behavioral, cognitive, emotional, and agentic sub-dimensions of engagement, Huang et al. (2019) behavioral and cognitive engagement, and Tsay et al. (2018) performance and behavioral engagement.

There is a strong relationship between motivation and engagement if a learning environment is enriched with more enjoyable gamification activities (Adams & Du Preez, 2022; Baiden et al., 2022; Jayalath & Esichaikul, 2022). That is why many studies focus on gamification elements and tools in the literature. Bai et al. (2021) determined that absolute and relative types of leaderboard affected students' course engagement in different ways. Çakıroğlu et al. (2017) revealed that using a combination of gamification elements (goal/mission, leaderboard, points, reputation and real gifts) affected positively the pre-service teachers' engagement. Hew et al. (2016) determined that graduate students using gamification elements (points, badges, and leaderboard) in the experimental group had more motivation to engage with difficult tasks and produced more quality artifacts than the control group. As seen in the mentioned studies, the badges, leaderboard, points, and levels were the most commonly used gamification elements to increase the students' engagement in learning environments (Dicheva et al., 2015; Saleem et al., 2022). In addition, Kahoot and ClassDojo were the most preferred gamified applications (Ekici, 2021). Accordingly, students can engage in attractive competition in the classroom by interacting with innovative gamification tools (Zainuddin et al., 2020).

Despite the mentioned positive results for engagement in the gamification environment, Erümit and Yılmaz (2022) noticed that the same gamification elements got different effects on students' engagement in sub-dimensions. They revealed that gamification did not have a significant effect on undergraduate students' emotional and behavioral engagement by comparing pretest and posttest results. Similarly, Ding et al. (2017) determined that a gamified online discussion, called gEchoLu did not have a significant effect on graduate students' behavioral, emotional, and cognitive engagement. Based on these contrasting results in the literature, it is important to consider the engagement sub-dimensions in gamification activities.

Cognitive Load in Gamification

The activities, including gamification elements supported by various audio-visual activities and materials, may give students with different personal traits excessive mental effort due to challenging tasks and competition (Becker, 2005). Difficult activity or task in gamification may cause negative feeling (e.g., anxiety, frustration) while trying to overcome the challenge (Mullins & Sabherwal, 2020). Turan et al. (2016) determined that students in gamified groups had quite high cognitive load levels. Overloading the working memory causes cognitively negative impacts on student directly and learning process indirectly (Moreno, 2010; Sweller, 2010).

On the other hand, cognitive load theory stresses that it is necessary to keep students' working memory and mental effort at optimal level to perceive the knowledge

and encode it in their minds (Mavilidi & Zhong, 2019). Students can easily construct links between contents on subject, when interrelating knowledge pieces is presented together (Moreno, 2010). Thus, they make less mental effort to gain knowledge (Debue & Van de Leemput, 2014). Accordingly, gamified education, which is likely to influence the working memory and mental effort may increase motivation and engagement more than traditional education (Ninaus et al., 2015).

Based on these different perspectives in the literature, it is necessary to consider cognition and emotion while involving the participants in the learning process in order to achieve the desired outcomes in gamification (Mullins & Sabherwal, 2020). This current study, examining students' cognitive load levels in gamification is predicted to strengthen the few researches focusing on cognitive load in the literature.

Rational of the Study

In the literature, criticisms are available from a negative point of view, as well as the positive results of the use of gamification in learning environments. These criticisms are that gamification directs individual's actions and feelings (Kim & Werbach, 2016). Accordingly, if gamification is based just on giving rewards and having fun, it will have just a drug effect (it can bring happiness for a while and then harm the purpose) (Werbach & Hunter, 2012). Since the reward system, such as points, leaderboards, and badges leads individuals to excessive competition, it causes the process to be based on ambition. Moreover, it negatively affects the learning outcome by causing some students at the bottom of the leaderboard to break away from the learning environment (Hanus & Fox, 2015; Tarhan & Öztürk, 2022). In other words, if gamification is used unconsciously, it becomes a distorted system in which students drift away from the learning goal, are unaware of what they are doing, and collect points by crushing each other without engaging in a cognitive process (Luo et al., 2021).

Considering all these, it should be well planned what the facilities and limitations are in the gamification process, and what, why, and how to gamify (Kapp, 2014). Therefore, gamification elements and gamified tools, such as applications and websites, must be run with integrity (Luo et al., 2021). In gamification activities, convenient gamification elements and tools should be preferred depending on the learning process, subject, context, and technological infrastructure (Dicheva et al., 2015; Werbach & Hunter, 2012). It is also important to keep competition and cooperation in balance (Simões et al., 2013). In this way, creating interesting and entertaining learning environments encourages the student's active participation in the learning process, and it can be ensured the continuity of their engagement (Adams & Du Preez, 2022; Aldemir et al., 2018; Kapp, 2014). For this reason, in this 10-week learning process, why some gamification elements and tools were preferred is explained in detail in the "gamification process" section. Thus, this study with a long-term process is a guide to further gamification studies.

The characteristic preferences in learning process affect the individual's interaction with learning environments and materials (Felder & Silverman, 1988). Hamari (2017) also stated that individual differences and personal characteristics could affect the participants' perspective on gamification. Buckley and Doyle (2017) stressed that personality differences affected the students' reaction toward the gamification elements used as behavioral triggers. They also determined that global or active learners

had positive impression of gamification. Ibáñez et al. (2014) found that the gamification approach was utility at different levels for students, and students more willing to cooperate participated more in learning activities.

According to Domínguez et al. (2013), gamification will only ensure positive results for some. For instance, in gamification activities, some students may not be pleasured competing with their friends and the leaderboard may negatively affect them. Pakinee and Puritat (2021) revealed that even if various gamification elements were used in a learning environment, the performance and knowledge of students with different personality type could not be improved. They determined that extraverted and imagination/openness students similarly enjoyed the gamification whereas conscientiousness and agreeableness students felt bored with some gamification elements (e.g., point, progress bar, and rank). On the contrary, Eikelboom (2016) found out that all students were open to experience and got similarly engagement in the gamified learning environment, even if they had different personality traits. Fan et al. (2015) determined that students in experimental group (gamified) achieved higher learning outcomes than control group, even if students had different learning styles (e.g., active and reflective).

The mentioned researches show that many learning differences are due to learning style and personality traits. For this reason, characteristic preferences and personality differences are seen as an important variable in learning environments based on gamification as well (Fan et al., 2015; Hamari, 2017; Werbach & Hunter, 2012). Although it is emphasized that student characteristics are important for gamification, few studies have been found examining the effect of gamification on the learning outcomes of students with different individual characteristics and learning styles.

The main purpose of gamification is to ensure the active participation of the students in the learning process (Kapp, 2014). Eikelboom (2016) has also stated that gamification can enable the active participation of more introverted students in the learning process. In this line, this study compares the gamification experiences of students with just active or reflective learning styles of Felder and Soloman's Inventory (Felder & Soloman, 1994). According to this inventory, active learners participate actively in group work, project, discussion, and activity whereas reflective learners prefer to work alone and think quietly in the process of acquiring new knowledge. Considering the role of gamification in making students activate, this study will reveal that gamification whether or not ensures not only active learners but also reflective learners receive the positive learning experience. From this point, this study aims to enrich the learning environments with various gamification elements, tools and multimedia materials, reflecting the power of gamification, enhancing engagement, keeping the cognitive load at optimum level, and creating a friendly learning experience for both active and reflective participants.

On the other hand, the previous studies mostly compared gamified and non-gamified learning environments and examined either general engagement or one-two of the sub-dimensions of engagement. Moreover, just a few of these studies focused on cognitive load. This current study will comparatively reveal how the gamification process affects the active and reflective learners' engagement sub-dimensions (behavioral, emotional and cognitive), cognitive load, and gamification experiences. In

this respect, this study will strengthen educational research based on gamification and will be a reference for future researches.

Within this framework, this current study investigates the effects of gamification on active and reflective learners' engagement and cognitive load. It also found out experiences of both groups in 10-week gamification process. Accordingly, it is addressed the following research questions.

1. Does gamification have an effect on active and reflective learners' behavioral, emotional, and cognitive engagement?

2. Does gamification have an effect on active and reflective learners' cognitive load?

3. Are there any significant correlations among active and reflective learners' behavioral, emotional, cognitive engagement, and cognitive load?

4. What are the experiences of active and reflective learners in 10-week gamification process?

Method

Research Design

Triangulation was employed, which is one of the mixed research designs, to answer different research questions and to ensure the validation of the findings in this study (Creswell, 2014). Thus, it aimed to increase the accuracy and reliability of the data obtained by using quantitative and qualitative data collection tools at the same time, and to interpret the findings together. Accordingly, at first, active and reflective learners' behavioral, emotional and cognitive engagement, and cognitive load levels were compared. Then, the correlation among active and reflective learners' behavioral, emotional, cognitive engagement and cognitive load was determined. Finally, the comparative case study was conducted (Bartlett & Vavrus, 2017; Yin, 2003) to compare with active and reflective learners' experiences for the 10-week gamification process.

Participants

Purposeful sampling was used in selection of participants (Creswell, 2014). Before the implementation, the Felder and Soloman Learning Style Inventory (Felder & Soloman, 1994) was conducted to third-year students in the department of computer education and instructional technology at a university in east Türkiye and then active and reflective learners were selected among these students. Accordingly, participants consisted of 70 undergraduate students. 45 (24 females, 21 males) were active learners and 25 (11 females, 14 males) were reflective learners. Additionally, on a voluntariness basis, 40 active learners and 24 reflective learners among all participants filled in structured interview forms. The demographic information of students is presented in Table 1.

Table 1

Demographic Information of Participants

	Active Learners			Reflective Learners			General Total
	Female	Male	Total	Female	Male	Total	
Engagement and Cognitive Load Scales	24	21	45	11	14	25	70
Structured Interview Form	21	19	40	10	14	24	64

Instruments

Students' Engagement was measured by School Engagement Measure (Fredricks et al., 2005). The 19-items scale was divided into three sub-dimensions: behavioral engagement (five items, α=.52-.83), emotional engagement (six items, α=.67-.79), and cognitive engagement (eight items, α=.58-.73). It was adapted into Turkish by Çengel et al., (2017) (behavioral engagement α=.68, emotional and cognitive engagement α=.80, and total engagement α=.89). This five-point likert scale was ranged from 1 (never) to 5 (all of the time). Accordingly, the higher rating was evidence the greater engagement.

Cognitive Load Scale was applied by Paas and Van Merriënboer (1994) and was calculated the reliability coefficient of this scale as α=.82. It was adapted into Turkish by Kılıç and Karadeniz (2004) (α=.78). This one-question scale was ranged from 1 (very very low) to 9 (very very high) points. The scale was used to determine how much mental effort the learners made in this gamified course. Accordingly, 1 point was evidence of the learner's lowest (minimum) mental effort and highest (maximum) performance, whereas 9 points was evidence of the learner's highest (maximum) mental effort and lowest (minimum) performance.

Structured Interview Form was developed to elaborate the students' experiences in gamified course process by the researcher. Students were expected to explain what gamification activities the more/less effective for learning topics about teaching methods and were asked why they thought so. In addition, it revealed the pros and cons of using gamification elements and tools in terms of students' course engagement. It also asked students to that what extent gamification activities confused the mind, facilitated learning of subjects, reduced difficulty in understanding the subjects, liked this course, and contained the knowledge about the subjects. An instructional technologies expert checked clarity of the interview questions.

Gamification Process

The gamification process was carried out in "Special Teaching Methods-II" undergraduate course, which covered nine teaching methods as topics. The implementation period was, in total, 40 hours for ten weeks which were four hours (2 days*daily 2 lesson hours) per week. The gamification process is summarized in Table 2 according to week (W)-day (D).

Table 2

Gamification Process

Weekly Process		Gamification Process
Prior the Process	W1-D1 W1-D2	-Preparing course syllabus
		-Determining gamification rules and elements
	W2-D1	-Applying learning style scale to students
	W2-D2	-Introducing gamification process to students
	W3-D1	
	W3-D2	-Assigning the students to groups for gamified activities
During the Process	W4-D1	-Layered Curriculum
	W4-D2	-Personalized System of Instruction
	W5-D1	-Cooperative Learning
	W5-D2	-7E and 5E Learning
	W6-D1	-Brain Based Learning
	W6-D2	-Social Cognitive Learning
	W7-D1	-Anchored/Situated Learning
	W7-D2	-Inquiry Learning
	W8-D1	-Blended Learning
Following the Process	W8-D2	-Applying the engagement and cognitive load scales to students
	W9-D1 W9-D2	-Filling the online structured interview forms by students
	W10-D1	-Adding each student's total score to course grade, considering their earned badges during all semester
	W10-D2	

The details of the weekly gamification process, summarized in Table 2, are as follows.

Before the process, the course syllabus considered the Activity Cycles of Werbach and Hunter (2012) was prepared by the course instructor as the researcher of this study. The gamification rules and elements were determined. Then, the learning style scale was applied to students. The gamification process (gamification rules, activities, and web-based/mobile gamified applications) was introduced to students. Finally, the students were assigned to groups for gamification activities.

During the process, in order to prevent breaking away students from the learning process, an activity-based level determining and scoring system was preferred instead of a consecutive progression and level-up. Accordingly, the gamification activities about nine teaching methods were based on two kinds of Activity Cycles. One of them, Engagement Loops, is what and why students do it and what the system responds to them. Engagement Loops are students' actions and responses of the system to these actions, such as awarding points and badges. That award as feedback motivates students to engage in gamification activities. The other of them, Progression Stairs, is how well students progress toward learning goals. Progression Stairs are the assigned short- and long-term tasks to students for progression toward learning goals such as level up. The

current study used gamification elements and tools during the process considering Activity Cycles each stage (all steps of pre-/in-/post-class activities) is listed in Table 3.

Table 3

Gamification Elements and Tools Using in the Activity Cycles Process

	Tasks/In-Class Activities, Gamified Tools	Gamification Elements	Engagement Loops	Progression Stairs
Pre-Class Stage — Step 1	Performing several tasks which assigned each group about all processes in a lesson (research-planning-design-development-implementation-evaluation) considering each teaching method in syllabus	-Challenges -Cooperation -Relationships	✓	
Step 2	Evaluating each task by researcher as the course instructor using the self-developed checklist considering the quality and the completion status of task until deadline	-Competition -Feedback		✓
Step 3	Painting different parts of groups' paper-cups in different colors by instructor considering the checklist score of each task	-Feedback -Status -Progression		✓
Step 4	Earning Edmodo badges with different levels depending on the painted parts of group cups	-Rewards -Progression -Level	✓	✓
In-Class Stage — Step 5	Inserting hidden questions/keywords as a password into multimedia learning materials (online and paper puzzles, QR codes et al.) for groups to find answer	-Challenges -Cooperation -Competition	✓	
Step 6	Giving ClassDojo points/badges to the top three groups who fastest and correctly answered the hidden questions/keywords	-Leaderboards -Status -Rewards	✓	✓
Step 7	Assessment of completed (online/paper based) tasks/in-class activities by classmates on Facebook Assessment of completed (online/paper based) tasks/in-class activities by classmates on Facebook	-Relationships -Feedback	✓	✓
Step 8	Determining the most liked tasks on Facebook	-Status -Progression		✓
Step 9	Announcing on Facebook the most successful groups	-Status -Relationships	✓	
Step 10	Giving the Edmodo badges to the group members who performed the most liked tasks	-Leaderboards -Rewards	✓	✓
Step 11	Asking questions to students about the teaching method in the Public Personnel Selection Examination (Kamu Personeli Seçme Sınavı [KPSS]) via online assessment tools (Kahoot, Socrative, or Google Form)	-Challenges -Competition -Progression	✓	
Step 12	Rewarding ClassDojo points/badges to the top three students getting the highest score	-Leaderboards -Status -Rewards	✓	✓

Post-Class Stage	Step 13		Determining by instructor as a participating observer the top students who the most attended the lessons, actively participated tasks and in-class activities, helped their group mates, made effort in collaborative activities, and earned the highest ClassDojo score	-Leaderboards -Status -Progression -Level	✓ ✓
	Step 14		Instructor gave top students specific Edmodo badges for each positive behavior during the semester	-Rewards -Progression -Level	✓ ✓

As seen in the Activity Cycles in Table 3, the students' performance was determined by ClassDojo points/badges and Edmodo badges they got participating in the activities. In addition, students, individually or as group member, were given different points/badges considering the difficulty level of online/paper-based tasks/in-class activities. Intentionally, the instructor did not tell the class who the best students were and when she gave them Edmodo badges. Thanks to the whisper newspaper, the instructor tried to emerge the students who earned the Edmodo badges, and thus, to keep students' engaged in learning tasks and activities. The activity photos in the gamification process are presented in Figure 1.
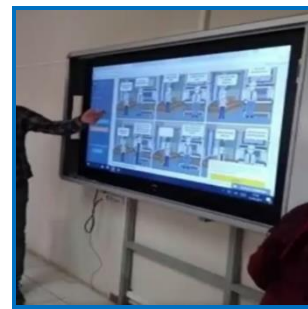
Figure 1

The Activity Photos in Gamification Process

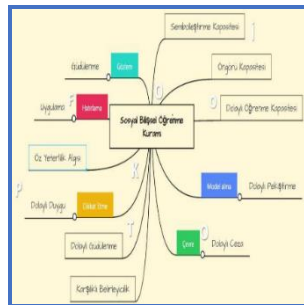**Painted paper-cup of a group**

Group performing a task/in class activity

Completed task/in-class activity

In-class activity questions about a teaching method

Keyword/password hidden in a multimedia material
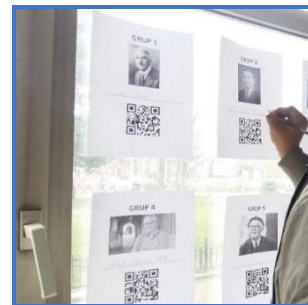
QR code activity
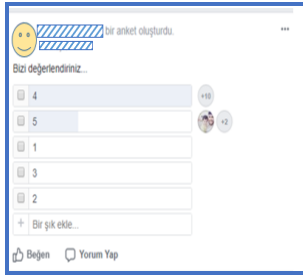
Assessment of group performance by classmates on Facebook

Announcing group performance on Facebook
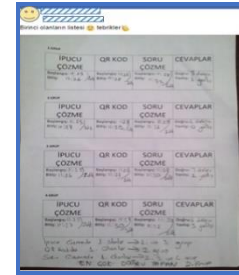
Announcing the most successful groups on Facebook

The KPSS examination score

Leaderboard in ClassDojo online class
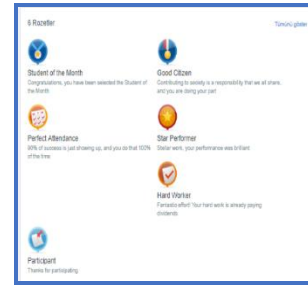
Specific Edmodo badges for students' positive behaviors

Following the whole gamification process, the instructor (researcher) applied the engagement and cognitive load scales, and the online structured-interview forms to students. Finally, the instructor added each student's total score to course grade, considering their earned badges during all semester.

Data Analysis

SPSS 18 software was used to analyze the quantitative data. According to both groups, it was tested the equivalence of variances and normality of data (Field, 2009). The conformity of data to the normal distribution was determined using skewness, kurtosis and standard error values as seen in Table 4.

Table 4

Skewness, Kurtosis and Standard Error Values of Data

Variables	Active Learners				Reflective Learners			
	Skewness	Std. Error	Kurtosis	Std. Error	Skewness	Std. Error	Kurtosis	Std. Error
Behavioral Engagement	-.896	.354	.900	.695	-.711	.464	-.212	.902
Emotional Engagement	-.503	.354	-.072	.695	-.674	.464	.573	.902
Cognitive Engagement	-.141	.354	-.623	.695	.301	.464	-.747	.902
Total Engagement	-.108	.354	-.652	.695	-.065	.464	-.728	.902
Cognitive Load	.203	.354	-1.187	.695	.621	.464	.355	.902

For the first research question, MANOVA was conducted to compare the two groups' behavioral, emotional and cognitive engagement data. For these variables was calculated the multivariate and univariate normality ($p>.05$) and the correlation between engagement sub-dimensions for singularity and multi-collinearity ($r<.90$) (Pallant, 2016). It also examined the equality of variances and linearity (Levene's F tests $p_{behavioral}=.341$, $p_{emotional}=.597$, $p_{cognitive}=.748$, Box's M test $p=.391$, $p>.05$). Accordingly, MANOVA results were interpreted considering the Wilks' Lambda values. For the second research question, it was used the independent samples t-test to compare the cognitive load data of two groups. It tested the homogeneity of the variances and normally distribution of this variable for each group ($p>.05$). For the third research question, Pearson's multiple correlation was conducted to determine the correlation between engagement and cognitive load variables of each group.

As for the fourth research question, content analysis (Merriam & Tisdell, 2015) was conducted on NVIVO 12 software to analyze all qualitative data of each group in detail. Firstly, themes and codes were determined. Then, themes and codes were shown in matrix tables and figures to compare the frequencies and percentages of each group. Finally, the quotations of students' statements in each group were presented (Active Learner=AX, Reflective Learner=RX).

Ethical Procedures

This study was approved by the Ethics Committee of Graduate School of Educational Sciences at Atatürk University in Türkiye (Approval Date: March 25, 2022. Approval Number: E-29202147-101.02.02-2200096880).

Results

Engagement of Active and Reflective Learners in Gamification

The behavioral, emotional, cognitive and total engagement averages of active and reflective learners are presented in Table 5.

Table 5

Behavioral, Emotional, Cognitive, and Total Engagement Averages of Active and Reflective Learners

	n	Behavioral Engagement		Emotional Engagement		Cognitive Engagement		Total Engagement	
		M	SD	M	SD	M	SD	M	SD
Active Learners	45	4.21	.53	3.82	.81	3.68	.78	3.87	.61
Reflective Learners	25	4.22	.64	3.68	.90	3.60	.75	3.79	.65

According to descriptive findings in Table 5, active and reflective learners were high rate of behavioral, emotional, and cognitive engagements in gamification ($M>3.4$).

However, the active learners' total engagement averages were higher than the reflective learners.

MANOVA was used to examine the difference between engagement sub-dimensions (as dependent variables) of active and reflective learners (as fixed variables). The results are presented in Table 6.

Table 6

MANOVA Results Regarding Active and Reflective Learners' Engagement Sub-Dimensions

Effect	Value	F	p	partial η^2
Intercept	.018	1224.92	.000	.982
Engagement	.989	.235	.871	.011

The results in Table 6 indicated no significant difference between active and reflective learners' behavioral, emotional and cognitive engagement (Wilks' Lambda=.989, $F_{(2,68)}$=.235, p>.017).

Cognitive Load of Active and Reflective Learners in Gamification

Independent samples t-test was used to determine the difference between cognitive load level of active and reflective learners. The results are presented in Table 7.

Table 7

Independent Samples t-test Results Regarding Active and Reflective Learners' Cognitive Load

	M	SD	df	t	p	η^2
Active Learners	4.02	1.93				
			68	.395	.694	.049
Reflective Learners	3.84	1.68				

The results in Table 7 showed no significant difference between active and reflective learners' cognitive load level (t(68)=.395, p>.05, η^2=-.049). However, both active and reflective learners had low cognitive load level (M<5).

Correlation between Active and Reflective Learners' Engagement and Cognitive Load

Pearson's multiple correlation test was carried out to determine correlation between active and reflective learners' engagement and cognitive load level. The results are presented in Table 8.

Table 8

Correlations between Active and Reflective Learners' Engagement and Cognitive Load Level

		Behavioral Engagement	Emotional Engagement	Cognitive Engagement	Total Engagement	Cognitive Load
Active Learners	Behavioral E.	1				
	Emotional E.	.454**	1			
	Cognitive E.	.453**	.613**	1		
	Total Engagement	.665**	.856**	.903**	1	
	Cognitive Load	-.261	-.309*	-.435**	-.425**	1
Reflective Learners	Behavioral E.	1				
	Emotional E.	.660**	1			
	Cognitive E.	.297	.680**	1		
	Total Engagement	.689**	.936**	.857**	1	
	Cognitive Load	-.347	-.277	-.256	-.334	1

*p<.05.
**p< .01.

According to detailed results in Table 8, a positive and high level correlation was determined between engagement-sub-dimensions of both active and reflective learners. In addition, active learners' cognitive load level was negatively correlated with emotional, cognitive, and total engagement (*p*<.01). However, it was found no significant correlation between reflective learners' cognitive load level and engagement-sub-dimensions (*p*>.01).

Active and Reflective Learners' Experiences in Gamification

It was determined the active and reflective learners' views on gamification process. The results are shown in Figure 2.

Figure 2

The Active and Reflective Learners' Views on Gamification Process
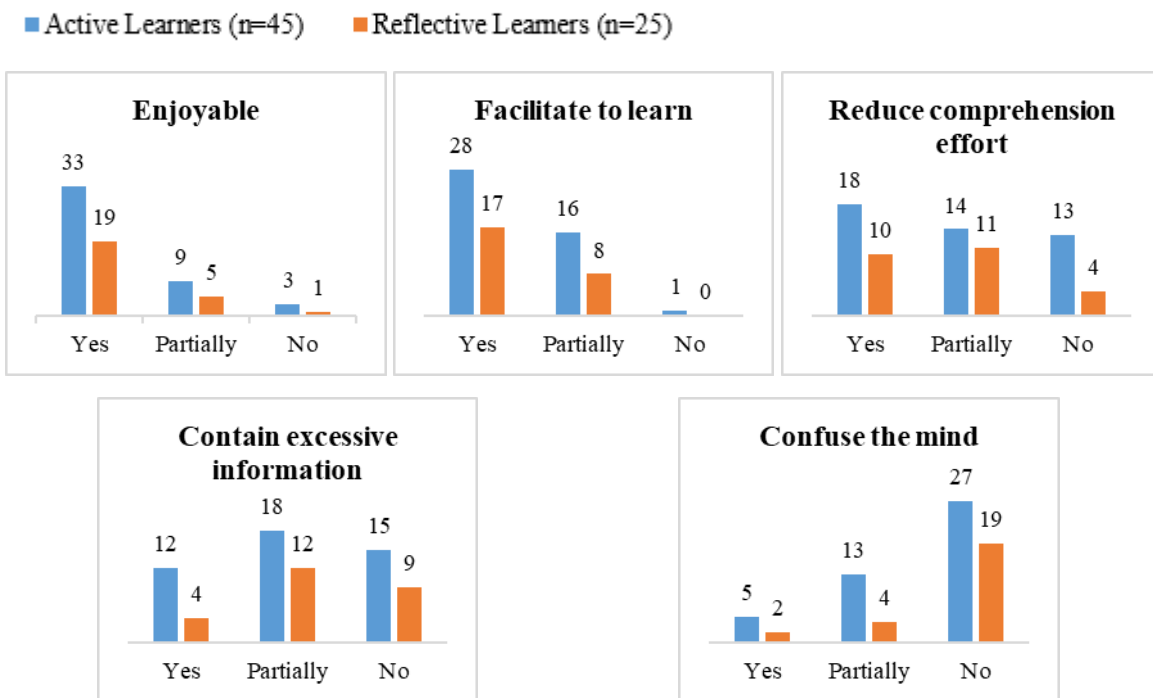
It is clear from Figure 2, both active and reflective learners had mostly positive views on gamification process. Accordingly, both of them thought that gamification activities facilitated the learning of subjects, reduced difficulty in understanding the subjects, did not confuse the mind, and even if it was an enjoyable process, it contained partially excessive information.

The participants' favorite gamification elements and tools in this course were determined. According to active (AX) and reflective (RX) learners, the frequencies, percentages, and quotations are presented comparatively in Table 9.

Table 9

Active and Reflective Learners' Favorite Gamification Elements and Tools

| Gamification Elements/ Tools	Active Learners (n=40)			Reflective Learners (n=24)		
	f	%	Quotations	f	%	Quotations
ClassDojo Points and Badges	29	73%	*"My favorite app was ClassDojo. It created a competitive environment as we could instantly see the points and badges on the smart board. Thus, it made the lesson fun and encouraged me to attend the lesson." (A32_Male)*	17	71%	*"ClassDojo is a very nice app. I was motivated when point/badges were given, and also asking questions by randomly choosing students in this way ensured everyone's active participation." (R23_Male)*
(Kahoot/ Socrative/ Google Forms) KPSS Questions	23	58%	*"I think KPSS questions on online apps was very useful for us. Solving the kinds of questions could encounter in the KPSS exam was increased my motivation and participation in the course" (A17_Male)*	16	67%	*"I liked KPSS questions on online apps the most. Because it showed us how much we understood the teaching methods and what kind of questions there were about these subjects in KPSS." (R5_Female)*
(Online/ Paper Based) Tasks/ In-	20	50%	*"Since it was used the various apps, web tools, and materials related to*	16	67%	*"With web apps, we all got the chance to participate activities at*

Class Activities			the subject, there was definitely a suitable material for each student. This made the lesson more colorful and increased student understanding and participation in the lesson. That's why I like these kinds of activities the most." (A49_Female)			the same time. Thus, the lessons were more active. That's why I liked much more these in-class activities." (R7_Female)
Leaderboard	19	48%	"Leaderboard was the most enjoyable application in the lessons. Trying to get top on the list made me even more determined. When I lost the competition, I thought about how I could be better and my interest in the lesson increased." (A12_Female)	16	67%	"Since I wanted my name to appear on the leaderboard as well, I felt to work harder. So, my inner motivation increased. That's why I liked much this app." (R50_Male)
Painting Paper-Cups	19	48%	"The most fun activity was painting paper-cups, as I could evaluate my progress in learning by myself. This is the first time I encountered such an activity. I really enjoyed it and I was motivated. Because everyone tried to have their paper-cup fully painted." (A6_Female)	14	58%	"The paper-cup painting process was a good practice, we could clearly see how much we improve ourselves or how much we lacked." (R18_Female)
Competition Activities	16	40%	"I really enjoyed the competition activities in this course. I think that these activities definitely made a difference to all other courses in terms of entertainment, motivation, and participation." (A58_Female)	12	50%	"I liked much the competitive activities. It increased my motivation and desire for the lesson. Thus, I started to learn permanently by listening to the lessons more carefully." (R67_Female)
(QR codes/ Puzzles) Hidden Questions	13	33%	"I was excited to follow the clues in the QR code, solve the hidden questions and fulfill the given tasks. It was my favorite activity as it created an atmosphere of entertainment and increased motivation." (A27_Female)	12	50%	"Qr code app was amazing. In this way, we were constantly active during the course. It was fun too." (R9_Male)
Edmodo Badges	10	25%	"I liked the Edmodo badge the most, as acquiring it had a positive effect on me." (A3_Male)	7	29%	"Getting a badge in Edmodo was my favorite app because it motivated me." (R2_Male)
Announcing/ Assessment on Facebook	8	20%	"I think that sharing the in-class activities on Facebook was a very effective way in terms of announcing to everyone instantly." (A37_Female)	5	21%	"I think that sharing information instantly on Facebook increased in-class interaction. This produced a positive result in the course." (R66_Female)

According to Table 9, Class Dojo points and badges ranked first line as the most favorite one compared to the other gamification elements and tools for both groups (>70%). KPSS questions and tasks/ in-class activities followed it (>50%). More than 40% of active learners pointed out the leaderboard, painting paper-cups, and competition activities as the favorite gamification elements and tools, while more than 50% of reflective learners, in addition to these mentioned ones, also pointed hidden questions (such as QR codes/ puzzles). On the other hand, even if they were at the bottom of the list in Table 9, Edmodo badges and announcing/assessment on Facebook were still the favorites of 20% of the participants in both groups.

As to the pros and cons of gamification process, firstly, the common themes were determined. According to these themes, a concept map highlighted the frequencies of active (fA) and reflective (fR) learners is shown in Figure 3.

Figure 3

The Common Themes on Pros and Cons of Gamification Process
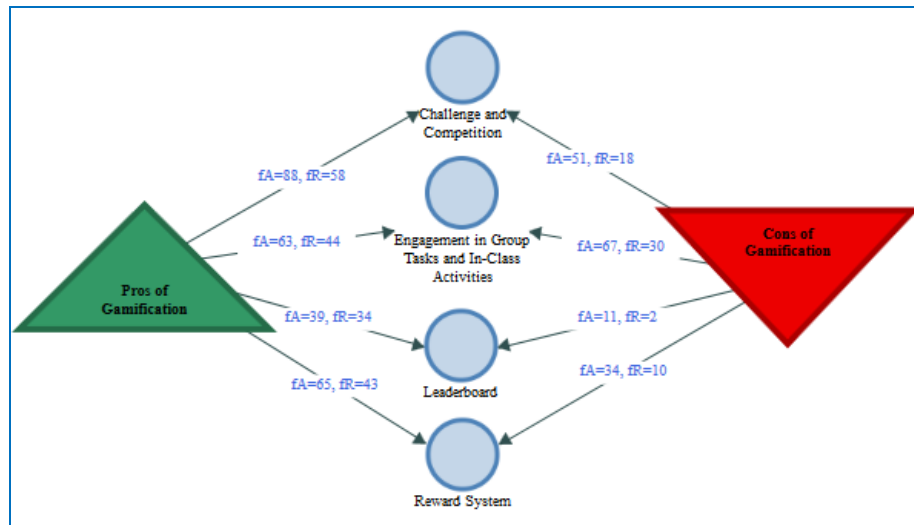
According to Figure 3, "Challenge and Competition" theme had the highest frequency totally in terms of the pros of gamification process, whereas "Engagement in Group Tasks and In-Class Activities" theme had the highest frequency in terms of the cons of gamification process.

Although it was available common themes related to the pros and cons of gamification process, it was determined similarities and differences regarding various codes in these themes in terms of active and reflective learners' opinions. Accordingly, themes and codes were shown in a matrix coding table to compare the frequencies and percentages of each group. It was also laid out the quotations of Active (AX) and Reflective (RX) learners' statements in Table 10.

Table 10

Matrix Coding on Pros and Cons of Gamification Process (nA=40, nR=24)

Themes		Pros of Gamification Process					Cons of Gamification Process					
	Codes	fA	%	fR	%	Quotations	Codes	fA	%	fR	%	Quotations
Challenge and Competition	-Active Participation	13	33%	10	42%	*"Competition increased my interest in the lesson by enabling me to be more motivated and learn meaningfully. In fact, I eagerly awaited the competition activities in the lesson, how it would turn out. When I looked at my information on the subject after the competitions, I realized that I understood the*	-Broken Up Friendship Relations	11	28%	4	17%	*"Excessive competition sometimes caused much more controversy in the class. This reduced my motivation towards the course." (A36_Male)* *"I always objected to the grading of students by competing with each other. I think that this situation made*
	-Better Learning and Higher Performance	16	40%	11	46%		-Demotivating Process	7	18%	2	8%	
	-Curiosity and Excitement	13	33%	6	25%		-Disliked-Boring-Stressful	12	30%	5	21%	
	-Enjoyable Learning Environment	22	55%	16	67%		-Extreme Ambition-Competition	15	38%	6	25%	

Theme	Positive Code	f	%	f	%	Positive Quote	Negative Code	f	%	f	%	Negative Quote
	-Higher Motivation	24	60%	15	63%	subject and that the keywords related to that subject remained in my mind." (A6_Female) "I think that the competitive environment has contributed a lot to me in terms of learning. Compared to other lessons, it was both fun and we were able to participate more actively. In my opinion, it was a method to increase motivation." (R66_Female)	-Hindering the Learning	6	15%	1	4%	students hostile to each other and kept them away from socializing. Therefore, this course greatly reduced my motivation." (R56_Male)
Engagement in Group Tasks and In-Class Activities	-Active and Better Learning	32	80%	22	92%	"Ensuring the groups participate in the lessons through activities as well as exchanging ideas and information within the group enabled us to learn better. Thus, the lessons became more fun and efficient by providing interaction in the classroom. I think that these activities made a difference to all other courses in terms of fun, motivation and participation." (A58_Female) "I am very pleased that this course, which was full of surprises with such fun activities rather than expository teaching methods and techniques, contributed to my better learning. While I could not remember anything in the other courses, I think that I really achieved meaningful learning in this course." (R5_Female)	-Causing Confusion and Noise	17	43%	4	17%	"Time-consuming tasks and materials in the activities of this course, were more than the other courses. This sometimes caused a very heavy workload. In addition, the fact that there was a lot of noise and confusion due to competition in some activities was not very helpful in understanding the lessons. This was the most negative thing prevented me from learning." (A55_Male) "The activities created a competition atmosphere as they focused on getting point and were tiring. This caused commotion in the classroom." (R60_Male)
	-Higher Motivation	15	38%	9	38%		-Disliking Group Activities	6	15%	4	17%	
	-Peer Interaction and Communication	15	38%	12	50%		-Exhausting -Intensive Learning Process	14	35%	6	25%	
	-Self-Confidence	1	3%	1	4%		-Failing Course and Time Management	17	43%	10	42%	
							-Using Too Many Multimedia Tools-Materials	13	33%	6	25%	
Leaderboard	-Active Participation and Better Learning	7	18%	7	29%	"Leaderboard made me work more determinedly, think about how I could be better when I lost the competition, and	-Demotivating Process	6	15%	1	4%	"I think that one student saw the other students' succeed or fail was not suitable situation. It dragged us into extreme
	-Competition-	7	18%	4	17%		-Extreme Ambition-Competitio	5	13%	1	4%	

	Code	n	%	n	%	Quote	Code	n	%	n	%	Quote
	Ambition					*increased my interest in the lesson.* (A12_Female)	n					*competition.* (A43_Female)
	-Desire to Learn	9	23%	3	13%							*"The fact that some classmates lost their awareness of being a class because of the leaderboard made the activities to be unattractive."* (R16_Male)
	-Higher Motivation	12	30%	15	58%	*"When I saw my own name on the leaderboard, I was happy that I was successful. When someone else was successful, I was trying harder so that I should be successful too. Therefore, the leaderboard had a positive impact on me."* (R66_Female)						
	-Reputation	4	10%	5	21%							
Reward System	-Active Participation	9	23%	5	21%		-Demotivating System	9	23%	2	8%	*"The reward system was not suitable for me, it created tension and stress, I did not like it at all. Because everything was scored and students were only trying to get rewards. The student was becoming addicted to rewards."* (A54_Female)
	-Competition	6	15%	6	25%		-Disliked-Useless System	10	25%	3	13%	
	-Desire to Learn	8	20%	5	21%	*"The fact that I got points and badges during and at the end of the course due to competitive activities encouraged me to attend the course. I felt that I had to listen to the lessons constantly. I think that such activities increased my motivation a lot."* (A32_Male)	Reward Addiction	5	13%	2	8%	
	-Feedback	7	18%	7	29%		Stressful-Worrying System	10	25%	3	13%	*"I think that reward system made students overly ambitious and harmful to each other as it offered a competition environment. In my opinion, the award should be given to the student a confidential manner. For example, received awards during the course can be presented to the student at the end of the semester."* (R35_Male)
	-Higher Motivation	24	60%	13	54%							
	-Self-Assessment	9	23%	5	21%	*"Rewarding system enabled us to perform better by providing a competitive environment. I improved myself by learning new things. It was an effective and enjoyable course."* (R9_Male)						
	-Self-Confidence	2	5%	2	8%							

According to "Challenge and Competition" theme in Table 10, more than half of both active and reflective learners emphasized that the gamification process provided them the higher motivation an enjoyable learning environment. In addition, more than one third of them stated that this learning environment allowed better learning, higher performance, and active participation. Over a quarter of them also stressed that it triggered curiosity and excitement. However, the percentage of active and reflective learners who stated that the gamification process caused extreme ambition and competition was higher than the other codes. Moreover, some students stated that this

kind of learning environment broke up friendship relations, and was disliking, boring, and stressful process. A few of them expressed that gamification was demotivating process and hindered the learning.

According to codes of the "Engagement in Group Tasks and In-Class Activities" theme, the most remarkable code, highlighted by the majority of both active and reflective learners was that the tasks and in-class activities provided active and better learning, and higher motivation. Many of them stated that peer interaction and communication increased in this course. However, one third of active and reflective learners stressed that gamification activities caused confusion and noise, and failing course and time management. More than a quarter of them explained that the learning process was exhausting and intensive, and that used too many multimedia tools and materials in this course. It was also available some active and reflective learners disliking group activities.

It is clear from Table 10 that "higher motivation" code in "Leaderboard" theme had highest percentage. Accordingly, the leaderboard motivated the reflective learners (over than half of them) more than active ones (almost one third of them). Leaderboard provided the active participation and better learning of almost one fourth of active and reflective learners, and increased the desire to learn, competition-ambition for their reputation of them. However, a small number of active and reflective learners were also available who thought that leaderboard caused demotivation and extreme ambition-competition.

As in the other themes, "higher motivation" code had the highest percentage for both active and reflective learners in the "Reward System" theme. In addition, almost the quarter of active and reflective learners emphasized that the "Reward System", provided them feedback, the opportunity to self-assessment, and increased their active participation, competition, desire to learn, and self-confidence. However, almost a quarter of active learners stressed that the reward system was stressful-worrying, disliked-useless, and demotivating and caused the reward addiction. These opinions on the cons of reward system of active learners had more percentage than reflective learners.

In summary, according to various codes in the common themes on the pros and cons of gamification, active learners and reflective learners have mostly a positive experience in the gamification process. In terms of active and reflective learners' opinions, although percentages of many codes are mostly close to each other, the percentages of some codes differed to each other. These rich findings prove that the results emerge with a detailed analysis.

Discussion

Effects of Gamification on Engagement and Cognitive Load

In this study, even if active learners' total engagement averages were higher than reflective learners, it was not significant difference between two groups in terms of these sub-dimensions of engagement. This finding proved that gamification engaged both active and reflective learners in the learning process at a high level of behavioral, emotional and cognitive engagement. According to the qualitative findings, the fact that the participants in both groups liked and enjoyed the gamification process may have

provided this result. Similarly, Eikelboom (2016) found out that all students were open to experience and got similarly engagement in the gamified learning environment, even if they had different personality traits. Yildiz et al. (2021) stressed that gamification elements provided the opportunity to overcome cognitive and emotional obstacles during the activity process.

On the other hand, Erümit and Yılmaz (2022) found out that gamification activities had a significantly positive effect on undergraduate students' cognitive engagement whereas it had not a significant effect on undergraduate students' emotional and behavioral engagement. According to Ding et al. (2017), gamified online discussion platform called gEchoLu did not significantly affect graduate students' behavioral, emotional and cognitive engagement. These contrasting findings of mentioned studies may have resulted from different gamification interventions, elements or tools in different contexts. Unlike this study, Huang et al. (2019) compared the gamified and non-gamified interventions and revealed that the behavioral and cognitive engagement of undergraduate students in the gamified group was higher than in the non-gamified group. Tsay et al. (2018) determined that students' performance and behavioral engagement in gamified systems was significantly higher than in non-gamified systems. In future studies, learning engagement of students with different personality traits can be compared in gamified and non-gamified environments.

According to Becker (2005), gamification elements containing various activities and multimedia materials may cause students with different personality traits to make excessive mental effort. This current study was not encountered statistically in such a situation. There was no significant difference between cognitive load level of active and reflective learners. It was also determined that the cognitive load of both groups had at low level in this gamification process. It is necessary to keep students' working memory and mental effort at optimal level to perceive the knowledge (Mavilidi & Zhong, 2019). Furthermore, students can easily connect that knowledge if the related pieces of knowledge in context are presented together (Moreno, 2010). Thus, they spend less mental effort to learn (Debue & Van de Leemput, 2014). Accordingly, this study based on the gamified learning process prevented much mental effort from both active and reflective learners. As a matter of fact, the most of active and reflective learners had positive views on this gamification process. Accordingly, both of them thought that gamification activities facilitated learning of subjects, reduced difficulty in understanding the subjects, and did not confuse the mind. These results will encourage researchers planning to conduct the new studies on gamification. Unlike this study, Turan et al. (2016) was found out that the cognitive load level of students in gamified group were quite higher than in control group. These results can be tested with new studies.

It was determined a positive and high level correlation between engagement-sub-dimensions of both active and reflective learners. This is an expected result. Likewise, Zainuddin et al. (2020) determined that sub-dimensions of engagement had highly positive correlation with each other in a gamified environment. In addition, active learners' cognitive load level was negatively correlated with emotional, cognitive, and total engagement. This result proved that the active learners, who were highly engaged in this gamified learning process, made mental effort at low level. Yildiz et al. (2021) explained that gamification can overcome emotional and cognitive barriers in

learning process. It was not significant correlation between reflective learners' cognitive load level and engagement-sub-dimensions, although the opposite of this result emerged in the qualitative findings. This is a surprising result that is not be encountered in the literature before. It is recommended to confirm this result by conducting new studies.

Gamification Experiences of Active and Reflective Learners

According to active and reflective learners, ClassDojo points and badges were the most favorite gamification elements and tool since it immediately gave feedback and increased competition. The results of many studies in the literature proved that the ClassDojo was a powerful gamification application. da Rocha Seixas et al. (2016) found that 8th grade students who got more ClassDojo badges as reward received significantly better engagement performance. Ibáñez et al. (2014) reported that the badges were the most effective motivation source for undergraduate students to participate in activities.

The other favorite tools for both groups were KPSS questions in the Kahoot, Socrative, Google Forms applications, and the online/paper based tasks/in-class activities. Zhang and Yu (2021) stressed that Kahoot was ideal for balancing competition and interaction, and properly using Kahoot in gamification process ensured positive learning outcomes. Erümit and Yılmaz (2022) stated that students liked Kahoot because it tested what they knew about the subject in a fun way. It was a remarkable finding that the participants in both groups liked so much the gamified KPSS questions, an important and difficult national exam for students in education faculty. In order to reduce the anxiety of the education faculty students with different personality traits about this exam, questions about "Teaching Methods" taken part in KPSS can be asked by gamified tools. It is suggested to consider this result by the lecturers.

According to active and reflective learners, the leaderboard and competition activities were some of the favorite gamification elements and tools. Parallel to this result, Ekici (2021) determined that their more preferred gamification element was the leaderboard. Especially, painting paper-cups and hidden questions (such as QR codes/ puzzles) attracted the attention of both active and reflective learners, as they were not faced such activities before. Çakiroğlu and Kiliç (2018) thought that the puzzle activity could encourage the students to participate the learning process. Some students in the study of Erümit and Yılmaz (2022) stated to like mystery questions (adding questions to the video) because of encouraging learning and the real cup as a prize. Huang and Hew (2021) found out that many students found rewards with real gifts, such as tour packages and coffee coupons, were favorite gamification elements. Thereby, as was done in this current study, it is recommended to use such activities to focus the students' attention on the learning environment.

Furthermore, Edmodo badges and announcing/assessment on Facebook were still the favorites of some participants in both groups. In parallel with the student opinions in this study, according to Aldemir et al. (2018), why students liked Edmodo badges was that it provided self-assessment and was confidence-booster. Erümit and Yılmaz (2022) determined that the sharing of information about gamification activities on Facebook provided continuous feedback on their assignments and performances. For this reason, they liked announcing on Facebook. It can be concluded that students especially prefer gamification elements and tools which enable to evaluate themselves and encourage them to learn. These results give an idea to researchers and practitioners

of the gamification elements and tools that it can be preferred in the gamification processes planned in future studies.

According to qualitative results on the pros and cons of gamification, four themes were determined: "challenge and competition, engagement in group tasks and in-class activities, leaderboard and reward system." In addition, common codes in terms of gamification were available: "higher motivation, better learning and higher performance, and active participation." These codes had quite a high percentage of both active and reflective learners. Many active and reflective learners emphasized that the challenge and competition, the tasks and in-class activities, the leaderboard, and reward system in gamification process provided them the higher motivation, gave opportunity to better learning and higher performance, and increased active participation. According to Huang and Hew (2021) gamification enhances students' competence. Erümit and Yılmaz (2022) revealed that gamification increased participants' motivation, competition, and active participation and contributed to their learning. da Rocha Seixas et al. (2016) found that students, got more ClassDojo badges as reward, received significantly better perform as engagement and active participation. Similarly, Tan and Hew (2016) determined that badges ensured to the more participation of students the online forum platform. Buckley and Doyle (2017) stated that even students with a lower conscientiousness had a more positive perception in the gamification process. (Eikelboom (2016) found out that all students were open to experience and got similarly engagement in the gamified learning environment, even if they had different personality traits. Fan et al. (2015) determined that even students with different learning styles such as active and reflective in gamified group achieved similarly high learning outcomes.

As for cons of gamification, a few active and reflective learners had common negative opinions about all themes. Accordingly, they expressed that challenge and competition, tasks and in-class activities, leaderboard, and reward system in gamification were demotivating, disliking, boring, and stressful. Surprisingly, the percentage of active learners who supported this view was higher than reflective learners, although they characteristically prefer active participation. Ding et al. (2017) also stated that very few students did not enjoy gamification activities. Contrary to these results, Pakinee and Puritat (2021) found that the extraverted and imagination/openness students enjoyed the gamification whereas conscientiousness and agreeableness students felt bored with some gamification elements (e.g., point, progress bar, and rank). Similarly, Buckley and Doyle (2017) found out that the extraverted students liked gamification, whereas conscientious ones were less motivation in gamification process. Consequently, as Becker (2005) stated, gamification may have caused students with different learning styles to make an excessive mental effort due to challenging tasks and the competition. Some difficult activities or tasks in gamification may have caused negative feeling (e.g., anxiety, frustration) while trying to overcome the challenge (Mullins & Sabherwal, 2020).

According to active and reflective learners, the challenge and competition provided enjoyable learning environment. Erümit and Yılmaz (2022) also reached similar results. Huang and Hew (2021) gamification included fun elements. According to Zainuddin et al. (2020), applying to innovative gamified tools in the classroom can engage the students in an attractive competition. Ding et al. (2017) determined that thanks to competition, students were more motivated and had fun. This current study's

active and reflective learners also stressed that it triggered curiosity and excitement. One of the criticisms of gamification pedagogical aspect in literature was that focusing on rewards is likely to damage intrinsic motivation. However, in a real sense, gamification was the triggers to active participation for students powered by reward and satisfaction from this extrinsic motivation (Baiden et al., 2022; Buckley & Doyle, 2017; Ninaus et al., 2015).

Contrary to these positive views, some active and reflective learners thought that leaderboard and challenge and competition caused extreme ambition and competition. Moreover, challenge and competition also broke up friendship relations and hindered learning. Gamified activities may not appeal to unsuccessful students with little or no desire to tackle a task or compete with others (Tan & Hew, 2016). The leaderboard may negatively affect some students because of displeasure of competing with friends in gamification activities. Thus, it is important to organize the leaderboard as a gamification element well. Otherwise, it may lead to some students early dropped out the learning process (Domínguez et al., 2013).

Although Buckley and Doyle (2017) determined that global or active learners had a positive impression toward gamification, in this current study, surprisingly, more reflective learners than active learners stated a positive opinion that peer interaction and communication increased in this course. This result confirmed the claim of Eikelboom (2016) that gamification can enable the active participation of more introverted students in the learning process. Similarly, Huang and Hew (2021) found that gamification encouraged peer collaboration and interaction. Ding et al. (2017) determined that students prefer to cooperate and participate more in gamification activities. Peer-to-peer interaction for a common goal was important component to be immersion of participants in learning process (Zhang & Yu, 2021). Accordingly, gamification may have enabled the supportive interaction among participants to achieve the common goals (Krath et al., 2021).

However, many active learners than reflective learners stressed that gamification activities caused confusion and noise and failed course and time management. According to Luo et al. (2021), teachers were worried about losing classroom management during gamification. The active and reflective learners also explained that the learning process was exhausting and intensive and used too many multimedia tools and materials in this course. The possible reason for these findings was the necessity of participants to follow gamification rules while they were performing assigned task and in-class activities. Using more or unnecessary instructional elements in learning environment caused to make learners more mental effort (Moreno, 2010; Sweller, 2010). Krath et al. (2021) suggested the complexity of gamification to be adapted to the personality traits for better content management.

The leaderboard and reward system increased desire to learn, competition and ambition of some active and reflective learners. Bai et al. (2021) revealed that relative and absolute types of leaderboard in gamification influenced students' engagement in different ways. Baiden et al. (2022) stressed that gamification increased students' eagerness, enthusiasm and engagement, thus improving their test performance. Furthermore, the leaderboard made some active and reflective learners build reputation, and reward system gave them opportunity to self-assessment as well as immediate feedback and increased self-confidence. Aldemir et al. (2018) found the similar results

as well. Huang and Hew (2021) determined that gamification provided recognition to students. In this way, it stimulated them to perform the activities seriously. Erümit and Yılmaz (2021) reported that sharing the leaderboard with the students encouraged them to maintain/improve their status, and seeing the gained cups and badges promoted their self-evaluation about level of learning level by providing them feedback. Getting reward depending on performance increases the confidence and satisfaction providing reinforcement (Krath et al., 2021). The feedback may have allowed them to improve engagement by adjusting their performance (Aldemir et al., 2018; Huang et al., 2019; Jayalath & Esichaikul, 2022; Zhang & Yu, 2021). The feedback is important gamification element providing students on their actions (Krath et al., 2021).

Unexpectedly, the more percentages of active learners than reflective learners stressed that reward system caused the reward addiction. Since reward system (such as points, leaderboards, and badges) leads to excessive competition, it causes the gamification process based on ambition (Hanus & Fox, 2015). This can have a negative impact on participants morally (Kim & Werbach, 2016). If points and badges were used as 'pointsfcation' (a superficial process with badges, points and leaderboards), gamification elements could be perceived as a pedagogical weakness in terms of teaching efficiency (Luo et al., 2021).

In summary, considering the themes and codes on pros and cons of the gamification process, the reflective learners as well as active learners have mostly a positive experience aspect all themes in the gamification process. This result distinguishes this study from the others. Additionally, the similarities and differences in active and reflective learners' opinions regarding various codes in themes reveal that characteristic features of students affect their reaction toward gamification elements and process in this study.

Conclusion, Limitations, and Implications

The important results were revealed in this current study which obtained rich data depending on 10-week long-term gamification process.

Firstly, this study focused on the gamification process conducted with two students' groups with different personal characteristics. Mostly positive and similar results emerged for both active and reflective learners in gamification process. According to Sweller (2010), well arranging the context and learning environment can positively affect selective attention and decrease cognitive effort. As Krath et al. (2021) emphasized, in this study, it was determined that positive behavioral outcomes, such as engagement in gamification learning activities accompanied the motivating effects of gamification. It can be concluded that gamification enables not only active learners but also reflective learners to engage in this learning process. This gamification process has managed to include even the reflective learners, who prefer to learn alone as an individual characteristic, and has provided a positive perspective and experience of all participants as output for the process. Thus, it is proven that gamification is a powerful learning-teaching approach.

Secondly, in this study, the active and reflective learners appreciated the various gamification elements and tools at different rates. This result has proved that gamification provides the opportunity to overcome active and reflective learners' behavioral, emotional and cognitive obstacles during the learning process as well as it is

a dynamic and flexible process in terms of pedagogical, social, and psychological. As Felder and Silverman (1988) emphasized, it can be concluded that although students have different personal characteristics, they perform better in environments where they actively participate and have partial control of their own learning process. The key conclusion is that gamification needs to be investigated and applied regarding personality traits to trigger learners' behavioral, emotional and cognitive engagement toward targeted learning outcomes.

Thirdly, many previous studies compared learning outcomes to gamified and non-gamified groups. However, in this study, the positive and negative experiences of students with different personality traits (active and reflective learners) towards the gamification process were investigated in detail and presented in a comparative manner. In this way, it is offered a different perspective and in-depth information to new researches by giving sight of a wide bird's view. Considering this study, in which mostly positive findings were obtained, as emphasized by Buckley and Doyle (2017), it can be said that gamification is an effective way to mediate students with different learning styles to maintain their engagement in the learning process. Therefore, pedagogically this study provides guidance on how to better use gamification in an educational context for maximum contribution to learning outcomes of students with different personality traits.

Finally, this study is limited by the characteristics of the participants (active and reflective learners), inherently. Gamification is conducted with both students' groups depending on the purpose of this study, so there is no control group. During the gamification, activity-based level determining and scoring system is preferred instead of a consecutive progression and level-up in order to prevent students breaking away from the learning process, although it seems like a limitation of this study. Nevertheless, due to the scoring system, the students may have participated in the gamification activities not voluntarily but compulsorily in order to increase their points and badges. It can be stated as another limitation of this study. Furthermore, various gamification elements are used in this study. It has not been investigated whether these gamification elements have an effect on the research results.

Consequently, it is recommended to focus on the design of gamification environments as part of a holistic learning environment, which offers various opportunities for students with different personality traits rather than studies many of them rising positive result in favor of gamification, comparing gamified and non-gamified environments. New studies carried out in this direction is likely to be more enlightening.

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References

Adams, S. P., & Du Preez, R. (2022). Supporting student engagement through the gamification of learning activities: A design-based research approach. *Technology, Knowledge and Learning*, *27*(1), 119-138. https://doi.org/10.1007/s10758-021-09500-x

Aldemir, T., Celik, B., & Kaplan, G. (2018). A qualitative investigation of student perceptions of game elements in a gamified course. *Computers in Human Behavior*, *78*, 235-254. https://doi.org/10.1016/j.chb.2017.10.001

Appleton, J. J., Christenson, S. L., & Furlong, M. J. (2008). Student engagement with school: Critical conceptual and methodological issues of the construct. *Psychology in the Schools*, *45*(5), 369-386. https://doi.org/10.1002/pits.20303

Bai, S., Hew, K. F., Sailer, M., & Jia, C. (2021). From top to bottom: How positions on different types of leaderboard may affect fully online student learning performance, intrinsic motivation, and course engagement. *Computers & Education*, *173*, 104297. https://doi.org/10.1016/j.compedu.2021.104297

Baiden, P., Essel, H. B., Vlachopoulos, D., Tachie-Menson, A., & Essuman, M. A. (2022). The effect of gamification on home economics students' motivation and engagement in drawing activities. *Technology, Knowledge and Learning*, *27*(1), 161-182. https://doi.org/10.1007/s10758-021-09566-7

Bartlett, L., & Vavrus, F. (2017). Comparative case studies: An innovative approach. Nordic Journal of *Comparative and International Education (NJCIE), 1*(1), 5-17. http://doi.org/10.7577/njcie.1929

Becker, K. (2005, July). *Games and learning styles.* Presented at IASTED international conference on education and technology-ICET. Calgary, Alberta, Canada. https://prism.ucalgary.ca/bitstream/handle/1880/46706/Games_Learning_2005.pdf?sequence=1

Buckley, P., & Doyle, E. (2017). Individualising gamification: An investigation of the impact of learning styles and personality traits on the efficacy of gamification using a prediction market. *Computers & Education*, *106*, 43-55. https://doi.org/10.1016/j.compedu.2016.11.009

Çakıroğlu, Ü., Başıbüyük, B., Güler, M., Atabay, M., & Memiş, B. Y. (2017). Gamifying an ICT course: Influences on engagement and academic performance. *Computers in human behavior*, *69*, 98-107. https://doi.org/10.1016/j.chb.2016.12.018

Çakiroğlu, Ü., & Kiliç, S. (2018). How to gamify?: Example scenarios for participation in synchronous online learning. *E-learning and Digital Media, 15*(5), 254-266. https://doi.org/10.1177/2042753018798166

Çengel, M., Totan, T., & Çöğmen, S. (2017). Okula bağlılık ölçeğinin Türkçe'ye uyarlanması [Turkish adaptation of school engagement scale]. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 17*(4), 1820-1837. https://doi.org/10.17240/aibuefd.2017.17.32772-363966

Coates, H. (2007). A model of online and general campus-based student engagement. *Assessment & Evaluation in Higher Education*, *32*(2), 121-141. https://doi.org/10.1080/02602930600801878

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th Ed.). Thousand Oaks, CA: Sage.

da Rocha Seixas, L., Gomes, A. S., & de Melo Filho, I. J. (2016). Effectiveness of gamification in the engagement of students. *Computers in Human Behavior*, *58*, 48-63. https://doi.org/10.1016/j.chb.2015.11.021

Debue, N., & Van de Leemput, C. (2014). What does germane load mean? An empirical contribution to the cognitive load theory. *Frontiers in Psychology, 5*, 1–12. https://doi.org/10.3389/fpsyg.2014.01099

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011, September). From game design elements to gamefulness: defining "gamification". In *Proceedings of the 15th International Academic Mindtrek Conference: Envisioning Future Media Environments* (pp. 9-15). Tampere, Finland. ACM. https://dl.acm.org/doi/abs/10.1145/2181037.2181040

Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2015). Gamification in education: A systematic mapping study. *Journal of Educational Technology & Society*, *18*(3), 75-88. https://www.j-ets.net/collection/published-issues/18_3

Ding, L., Kim, C., & Orey, M. (2017). Studies of student engagement in gamified online discussions. *Computers & Education*, *115*, 126-142. https://doi.org/10.1016/j.compedu.2017.06.016

Domínguez, A., Saenz-de-Navarrete, J., De-Marcos, L., Fernández-Sanz, L., Pagés, C., & Martínez-Herráiz, J. J. (2013). Gamifying learning experiences: Practical implications and outcomes. *Computers & Education*, *63*, 380-392. https://doi.org/10.1016/j.compedu.2012.12.020

Eikelboom, J. J. (2016*). Engagement, gamification, and workplace satisfaction: A convergent study of user indicators* (Master's Thesis). University Of Southern Maine. https://digitalcommons.usm.maine.edu/etd/276/

Ekici, M. (2021). A systematic review of the use of gamification in flipped learning. *Education and Information Technologies*, *26*(3), 3327-3346. https://doi.org/10.1007/s10639-020-10394-y

Erümit, S. F., & Yılmaz, T. K. (2022). The happy association of game and gamification: the use and evaluation of game elements with game-based activities. *Technology, Pedagogy and Education*, *31*(1), 103-121. https://doi.org/10.1080/1475939X.2021.2006077

Fan, K. K., Xiao, P. W., & Su, C. (2015). The effects of learning styles and meaningful learning on the learning achievement of gamification health education curriculum. *Eurasia Journal of Mathematics, Science and Technology Education*, *11*(5), 1211-1229. https://doi.org/10.12973/eurasia.2015.1413a

Felder, R. M., & Silverman, L. K. (1988). Learning and teaching styles in engineering education. *Engineering Education*, *78*(7), 674-681. https://www.engr.ncsu.edu/wp-content/uploads/drive/1QP6kBI1iQmpQbTXL-08HSl0PwJ5BYnZW/1988-LS-plus-note.pdf

Felder, R. M., & Soloman, B. A. (1994). Index of learning styles questionnaire. https://www.webtools.ncsu.edu/learningstyles/

Field, A. P. (2009). *Discovering statistics using SPSS* (3rd Ed.) London: Sage.

Fredricks, J. A., Blumenfeld, P., Friedel, J., & Paris, A. H. (2005). School engagement. In K. A. Moore, & L. H. Lippman (Eds.), *What do children need to flourish? Conceptualizing and measuring indicators of positive development* (pp. 305-321). New York: Springer.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, *74*(1), 59-109. https://doi.org/10.3102/00346543074001059

Fredricks, J., McColskey, W., Meli, J., Mordica, J., Montrosse, B., & Mooney, K. (2011). Measuring student engagement in upper elementary through high school: A description of 21 instruments. *Issues & Answers Report, Regional Educational Laboratory Southeast*, *98*(098). http://ies.ed.gov/ncee/edlabs

Hamari, J. (2017). Do badges increase user activity? A field experiment on the effects of gamification. *Computers in Human Behavior*, *71*, 469-478. https://doi.org/10.1016/j.chb.2015.03.036

Hanus, M. D., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. *Computers & Education*, *80*, 152-161. https://doi.org/10.1016/j.compedu.2014.08.019

Hew, K. F., Huang, B., Chu, K. W. S., & Chiu, D. K. (2016). Engaging Asian students through game mechanics: Findings from two experiment studies. *Computers & Education*, *92*, 221-236. https://doi.org/10.1016/j.compedu.2015.10.010

Huang, B., & Hew, K. F. (2021). Using gamification to design courses: Lessons learned in a three-year design-based study. *Educational Technology & Society*, *24*(1), 44-63. https://www.j-ets.net/collection/published-issues/24_1

Huang, B., Hew, K. F., & Lo, C. K. (2019). Investigating the effects of gamification-enhanced flipped learning on undergraduate students' behavioral and cognitive engagement. *Interactive Learning Environments*, *27*(8), 1106-1126. https://doi.org/10.1080/10494820.2018.1495653

Ibáñez, M. B., Di-Serio, A., & Delgado-Kloos, C. (2014). Gamification for engaging computer science students in learning activities: A case study. *IEEE Transactions on Learning Technologies*, *7*(3), 291-301. https://doi.org/10.1109/TLT.2014.2329293

Jayalath, J., & Esichaikul, V. (2022). Gamification to enhance motivation and engagement in blended eLearning for technical and vocational education and training. *Technology, Knowledge and Learning*, 1-28. https://doi.org/10.1007/s10758-020-09466-2

Kapp, K. M. (2014). *The gamification of learning and instruction fieldbook: Ideas into practice*. John Wiley & Sons.

Kılıç, E., & Karadeniz, Ş. (2004). Hiper ortamlarda öğrencilerin bilişsel yüklenme ve kaybolma düzeylerinin belirlenmesi [Specifying students' cognitive load and disorientation level in hypermedia]. *Kuram ve Uygulamada Eğitim Yönetimi, 10*(4), 562-579. https://dergipark.org.tr/en/download/article-file/108388

Kim, T. W., & Werbach, K. (2016). More than just a game: Ethical issues in gamification. *Ethics and Information Technology*, *18*(2), 157-173. https://doi.org/10.1007/s10676-016-9401-5

Krath, J., Schürmann, L., & Von Korflesch, H. F. (2021). Revealing the theoretical basis of gamification: A systematic review and analysis of theory in research on gamification, serious games and game-based learning. *Computers in Human Behavior*, *125*, 106963. https://doi.org/10.1016/j.chb.2021.106963

Kuo, M. S., & Chuang, T. Y. (2016). How gamification motivates visits and engagement for online academic dissemination–An empirical study. *Computers in Human Behavior*, *55*, 16-27. https://doi.org/10.1016/j.chb.2015.08.025

Luo, Z., Brown, C., & O'Steen, B. (2021). Factors contributing to teachers' acceptance intention of gamified learning tools in secondary schools: An exploratory study. *Education and Information Technologies*, *26*(5), 6337-6363. https://doi.org/10.1007/s10639-021-10622-z

Mavilidi, M. F., & Zhong, L. (2019). Exploring the development and research focus of cognitive load theory, as described by its founders: Interviewing John Sweller, Fred Paas, and Jeroen van Merriënboer. *Educational Psychology Review,* 1-10. https://doi.org/10.1007/s10648-019-09463-7

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation.* John Wiley & Sons.

Moreno, R. (2010). Cognitive load theory: More food for thought. *Instructional Science, 38*(2), 135-141. https://doi.org/10.1007/s11251-009-9122-9

Mullins, J. K., & Sabherwal, R. (2020). Gamification: A cognitive-emotional view. *Journal of Business Research*, *106*, 304-314. https://doi.org/10.1016/j.jbusres.2018.09.023

Ninaus, M., Pereira, G., Stefitz, R., Prada, R., Paiva, A., Neuper, C., & Wood, G. (2015). Game elements improve performance in a working memory training task. *International Journal of Serious Games*, *2*(1), 3-16. https://journal.seriousgamessociety.org/index.php/IJSG/article/view/60/pdf_13

Paas, F. G., & Van Merriënboer, J. J. (1994). Variability of worked examples and transfer of geometrical problem-solving skills: A cognitive-load approach. *Journal of Educational Psychology, 86*(1), 122. https://doi.org/10.1037/0022-0663.86.1.122

Pakinee, A., & Puritat, K. (2021). Designing a gamified e-learning environment for teaching undergraduate ERP course based on big five personality traits. *Education and Information Technologies*, *26*(4), 4049-4067. https://doi.org/10.1007/s10639-021-10456-9

Pallant, J. (2016). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*. Open University Press.

Saleem, A. N., Noori, N. M., & Ozdamli, F. (2022). Gamification applications in E-learning: A literature review. *Technology, Knowledge and Learning*, 1-21. https://doi.org/10.1007/s10758-020-09487-x

Simões, J., Redondo, R. D., & Vilas, A. F. (2013). A social gamification framework for a K-6 learning platform. *Computers in Human Behavior*, *29*(2), 345-353. https://doi.org/10.1016/j.chb.2012.06.007

Sweller, J. (2010). Element interactivity and intrinsic, extraneous, and germane cognitive load. *Educational Psychology Review, 22*(2), 123-138. https://doi.org/10.1007/s10648-010-9128-5

Tan, M., & Hew, K. F. (2016). Incorporating meaningful gamification in a blended learning research methods class: Examining student learning, engagement, and affective outcomes. *Australasian Journal of Educational Technology*, *32*(5). https://doi.org/10.14742/ajet.2232

Tarhan, G., & Öztürk, G. (2022). Flipped learning and gamification in information technologies and software course. *International Journal of Contemporary Educational Research, 9*(1), 62-77. https://doi.org/10.33200/ijcer.969959

Tsay, C. H. H., Kofinas, A., & Luo, J. (2018). Enhancing student learning experience with technology-mediated gamification: An empirical study. *Computers & Education*, *121*, 1-17. https://doi.org/10.1016/j.compedu.2018.01.009

Turan, Z., Avinc, Z., Kara, K., & Goktas, Y. (2016). Gamification and education: Achievements, cognitive loads, and views of students. *International Journal of Emerging Technologies in Learning*, *11*(7). http://dx.doi.org/10.3991/ijet.v11i07.5455

Werbach, K., & Hunter, D. (2012). *For the win: How game thinking can revolutionize your business.* Philadelphia: Wharton Digital Press.

Yildiz, İ., Topçu, E., & Kaymakci, S. (2021). The effect of gamification on motivation in the education of pre-service social studies teachers. *Thinking Skills and Creativity*, *42*, 100907. https://doi.org/10.1016/j.tsc.2021.100907

Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage.

Zainuddin, Z., Shujahat, M., Haruna, H., & Chu, S. K. W. (2020). The role of gamified e-quizzes on student learning and engagement: An interactive gamification solution for a formative assessment system. *Computers & Education*, *145*, 103729. https://doi.org/10.1016/j.compedu.2019.103729

Zhang, Q., & Yu, Z. (2021). A literature review on the influence of Kahoot! On learning outcomes, interaction, and collaboration. *Education and Information Technologies*, *26*(4), 4507-4535. https://doi.org/10.1007/s10639-021-10459-6

Zichermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. O'Reilly Media.