

Research Paper

Role of the Students' Learning Styles on Motivation and Perception towards Gamified Learning Process

Fatma Burcu Topu^{*a}^a(ORCID ID: 0000-0002-2130-8579), Atatürk University, Turkey, burcutopu@hotmail.com^{*}Corresponding author

ARTICLE INFO

Received: 08 May 2023

Revised: 22 August 2023

Accepted: 22 August 2023

Keywords:

Gamified learning process

Learning styles

Motivation

Perception

doi: 10.53850/joltida.1293970

ABSTRACT

The characteristic differences of participants affect their reactions to various gamification elements. Thus, it is critical to reveal the impact different type of students on gamified interventions, and the relation of personality features and gamified learning process. In this study, it is compared the motivation and perception of participants with different learning styles towards gamified learning process, and determined the correlation between motivation and perception. It is also figured out the enabler and barrier factors of students' motivation and perception by learning styles in the 7-week gamified learning process. Participants consist of 95 prospective teachers with different learning styles. This study is based on the triangulation as a mixed research method. As data collection tools, the instructional materials motivation survey, course evaluation questionnaire, learning styles inventory of Felder and Soloman, and interview form are used. It is conducted the non-parametric tests, Mann-Whitney U and Spearman's rank correlation for quantitative data analysis, and the content analysis for in-detail qualitative data analysis. Results point out that there is not any significant differences between categories of each learning style dimension in terms of motivation and perception. Students have the high level motivation and perception by each category of four learning style dimensions. There are positive and medium correlations between motivation and perception of students by learning styles. It is also determined the various enabler and barrier factors of students' motivation and perception in gamified learning process. Frequencies and percentages of enablers are the higher than barriers considering students' learning styles. These results prove that the gamified activities-tasks considering the learning styles have a power to motivate students with different characteristics to the learning process and provide the positive perception towards the gamified process. It is also discussed the quantitative and qualitative directions for the further researches.



INTRODUCTION

Gamification has come out to increase the engagement of customers on digital platforms in order to achieve especially commercial goals (Deterding et al., 2011). It is utilized the motivating game elements to ensure the participants' interaction with the activities for a long time (Ghaban & Hendley, 2019; Zichermann & Cunningham, 2011). The use of gamification has become widespread among educators who realize this powerful feature. Studies using various game elements have attempted to reveal whether gamified activities have positive affective, behavioral, and cognitive pedagogical outcomes (Dicheva et al., 2015; Krath et al., 2021; Luo, 2022). However, it is important to be careful with the selection of gamification elements, as each elements could not be adjusted to each context (Pakinee & Puritat, 2021).

The gamified learning process gave an opportunity not only to reduce the negative feeling of students but also to improve their learning outcomes (Yildiz, 2021). In this line, it has a critical role to reach large target audiences with different personality traits by embedding various game elements such as competition, challenge, rewards, progress, collaboration, fun into the gamified activities (Werbach & Hunter, 2012). Although extrinsic motivators have been criticized, a well-designed reward system used in gamification has a higher potential as a strong extrinsic motivator in achieving goal (Zichermann & Cunningham, 2011). The various gamification elements and gamified tools motivate and engaged students in a competitive and entertaining learning process (Yildiz, 2021; Fiş Erümit & Karakuş Yılmaz, 2022, 2021). Based on the mentioned positive results, it is used various gamification elements and gamified tools in this study, and examined the motivation and perception of the students with different learning styles towards gamified learning process.

Motivation and Perception in Gamified Learning Process

To motivate students throughout the learning process, sense of curiosity should be aroused, teaching goals and individual values should be compatible with each other, they should be confident of their own competence for success, and learning outcomes should be similar to their expectations (Keller, 2008). In this line, gamification is a guiding approach to using game elements to motivate

participants towards targeted acquisitions in any context (Deterding, 2012). The fundamental function of gamified process is to improve participants' motivation by triggering their positive emotions (Buckley & Doyle, 2017). Kapp et al. (2014) argues that gamification is an excellent solution to motivate students to progress in teaching and achieve goals. Gamification also provides an opportunity to increase students' learning experiences as well as their interaction with educational materials. Thus, it helps to increase the motivation of students for the improvement of their learning (Ghaban & Hendley, 2019; Glover, 2013; Ong et al. 2013; Sailer et al., 2017).

The relationship of gamification with challenge and entertaining makes it necessary to consider the emotional and motivational aspects of the learning process. Although few of studies had negative results (Hanus & Fox, 2015; Kwon & Özpolat, 2021; Kyewski & Krämer, 2018), majority of studies put forward the potential of gamified activities to boost students' motivation and perception towards the learning process. Fitz-Walter et al. (2017) figured out that various game elements such as feedback, goals, competition, and getting coins ensured the more enjoyable and motivated learning process than non-gamified environment. However, it was not observed significantly behavioral change between groups. Fiş Erümit and Karakuş Yılmaz (2022, 2021) revealed that the intriguing and competitive gamified activities helped students to be successful by motivating them. Yildiz et al. (2021) figured out that motivation of teacher candidates in gamified group used Edmodo, and Kahoot apps increased significantly higher than the other group.

According to Buckley and Doyle (2017), gamification encourages the students acting with extrinsic motivation such as rewards to participate in the process and ensures that they have a positive perception toward the process. Ghaban and Hendley (2019) confirmed that students, motivating by game elements, engaged in the learning process longer than non-gamified group. Bai et al. (2021) determined to have different effects of leaderboard types on students' motivation, engagement, and attitude. Denden et al. (2021) found out that strong correlation between the majority of gamification elements and perceived enjoyment.

On the other hand, researchers emphasize that individual differences can be considered to avoid the demotivation effect of various game elements (Ghaban & Hendley, 2019; Hanus & Fox, 2015; Hassan et al., 2022; Kwon & Özpolat, 2021; Kyewski & Krämer, 2018). For this reason, this study aims to keep the motivation and perception of students with different learning styles at the high level by using various gamification elements and gamified tools.

Learning Styles in Gamified Learning Process

The learning styles are strong indicators of individual preferences of students for processing and learning the information, as well as their interaction with learning materials, environment, and other students (Felder & Silverman, 1988). Many studies based on various learning style classifications report that learning differences are due to characteristic preferences (Hassan et al., 2021; Khenissi et al., 2016). The characteristic differences of participants affect their reactions to gamification elements as well (Buckley & Doyle, 2017; Oliveira et al., 2022). Since different participants enjoy different gamification elements, it is important to design a gamification experience that suits various types of participants (Fitz-Walter et al., 2017). Some students can get more benefit from gamified course, whereas others can be affected negatively. They may be in favor of different gamification elements by their personality types (Ghaban & Hendley, 2019). For this reason, it is important to consider the learning styles of students participating in gamified learning process (Fan et al., 2015).

In recent years, it is available studies focusing on different learning style models, personality traits, and students' characteristics in gamified learning process. Denden et al. (2021) revealed that personality traits and gender affected the undergraduate students' perception toward the majority of gamification elements such as leaderboard, progress bar, feedback, badges, and points. Hassan et al. (2021) determined that students' motivation increased by a quarter in the gamification process which was carried out considering the learning styles. Ghaban and Hendley (2019) determined that gamification elements (leaderboard, points, and badges) more motivated the extroverted students and these students engaged in gamified websites the longer time than others. Buckley and Doyle (2017) found out that participants with global or active learning styles had a positive perception toward gamified process. In addition, extraverted participants liked gamification, while conscientious participants less motivated in gamified process. Nevertheless, they highlighted that participants perceived positively toward gamified process even if they had the lower conscientiousness personality trait. Smiderle et al. (2020) found that gamification affected students with different personality traits in distinct way. Fan et al. (2015) determined the notable differences between achievements of students with different learning styles.

Oliveira et al. (2022) revealed that although both gamification versions (personalized and non-personalized gamification) ensured the high flow experience for students, personalization the learning process based on personality traits had not any significant effect on students' motivation, perception, enjoyment, and flow experience. Pakinee and Puritat (2021) proved that the selection of gamification elements by considering the personality traits ensured positive perception and more engagement in the learning process whereas could not guarantee to get increasing the learning performance for every personality types. Ong et al. (2013) determined that students' academic and intrinsic motivation and perceptions were largely independent of personality type. Accordingly, majority of the studies considering various learning style models such as the five factor model have achieved positive results. However, learning styles have a controversial as well as important role in the learning process (Khenissi et al., 2016). For this reason, this study examines the role of the students' learning styles in a gamified learning process.

This study is based on the learning styles model of Felder and Silverman (1988). The reason for choosing this learning style model is that it provides the detailed definition for various learning styles, inclusive of different personality types of students participating in gamified learning process using many multimedia materials and gamified activities-tasks with various features. It has also a mature state of validity and reliability scoring system. In this way, it helps to distinguish among strong, moderate, and mild ranking of the students' learning styles. Furthermore, these dimensions are similar to the indicators of sub-dimensions of most learning style models (Buckley & Doyle, 2017; Felder & Spurlin, 2005; Hassan et al., 2021; Khenissi et al., 2016).

This learning styles model consists of several dimensions. The scope of each category in the four learning style dimensions is as follows:

Active / Reflective Learners: It shows how the student prefers to process the information. The active learners learn by physically participating in an activity, learning material, or discussion while the reflective learners learn by reflecting on learning material through individual reasoning.

Sensing / Intuitive Learners: It shows the student's tendency to perceive information. The sensing learners tend to focus on facts, concrete information on content, details, and numbers while the intuitive learners tend to focus on possibilities, abstraction, underlying meaning, and hunches.

Visual / Verbal Learners: It shows the students receive the information through which channel most effectively. The visual learners get information better with pictures, diagrams, graphs, demonstrations, while the verbal learners get better with written or verbal explanations.

Sequential / Global Learners: It shows the student follows which way in the process of understanding the information. The sequential learners follow the linear thinking process and solve problems step by step by dividing problems into the sub-problems while the global learners follow the holistic thinking process, and develop their own problem solving methods quickly by understanding the abstract picture under the problem.

Accordingly, in this study, it is compared the motivation and perception of students with different learning styles towards gamified learning process.

Research Gap and Purpose of the Study

Many studies have assumed that students have similar positive feedback about using of gamification elements and have not taken into account the individual differences of them (Denden et al., 2021). Despite the positive results in many studies, the point of psychological perspective, the external motivating factors such as reward lead to reward addiction and compulsory behavior among students with different personality types (Glover, 2013). Moreover, gamification elements such as competing and rewarding may negatively affect the motivation and perception of some students (Dominguez et al., 2013; Hanus & Fox, 2015; Kyewski & Krämer, 2018; Kwon & Özpolat, 2021; Pakinee & Puritat, 2021). In order to minimize these possible negative effects, it is significant to keep the game elements in the optimum line by adjusting them according to the learning context and student characteristics (Glover, 2013). In other words, it is critical to reveal the relation of personality features and gamification in order to enable students to overcome the difficulties in gamified learning process (Ghaban & Hendley, 2019).

The characteristic differences of participants affect their reactions to various gamification elements (Buckley & Doyle, 2017; Fan et al., 2015; Ghaban & Hendley, 2019). According to Smiderle et al. (2020), the efficiency of gamification depends on the characteristic features of students. Many researchers admitting the benefits of learning styles point out that it is a significant factor in education. The gamified process suited of student characteristics can increase their motivation and provide the more engagement of them (Khenissi et al., 2016). Thus, it is critical to figure out the impact different type of students on gamified learning interventions (Denden et al., 2021; Luo, 2022). However, gamification studies regarding learning styles are based on adaptation of the online gamified learning environments (Buckley & Doyle, 2017; Denden et al., 2021; Fan et al., 2015; Ghaban & Hendley, 2019; Hassan et al., 2021; Oliveira et al., 2022; Pakinee & Puritat, 2021; Smiderle et al., 2020). As to this study focuses on the role of learning styles in gamified learning process, which includes face-to-face and in-class activities-tasks as well as various multimedia materials.

Although the importance of the effect of learning styles on motivation and perception in gamification is emphasized, it is available few studies which deal with these two variables together (Oliveira et al., 2022; Ong et al., 2013). While some of the studies investigated the effect of learning style on motivation (Ghaban & Hendley, 2019; Hassan et al., 2021), others examined the effect of perception (Buckley & Doyle, 2017; Denden et al., 2021; Pakinee & Puritat, 2021). Moreover, the mentioned studies is mostly based on the five factor learning style model depending on its suitability for online gamified course. As for this study, it is preferred the inventory of Felder and Soloman (1994) based on learning styles model of Felder and Silverman (1988). In this model, it can be defined in detail of learning style sub-dimensions of students with different personality types who participate in gamified learning process including various in-class activities-tasks and many multimedia materials. Thanks to the strong validity and reliability scoring system of this model, the learning styles of each student can be also ranked as strong, moderate, and mild levels (Buckley & Doyle, 2017; Felder & Spurlin, 2005; Hassan et al., 2021; Khenissi et al., 2016). For this reason, this study will be a reference for new research on face-to-face gamified learning process that will be based on this learning style model.

Using various game elements in the learning process may not always produce positive results. At this point, it is critical how gamified process is implemented (Dominguez et al., 2013; Kapp et al., 2014; Sailer et al., 2017; Werbach, & Hunter, 2012). Applied correctly of gamification throughout the learning process enables students to enrich their experiences (Deterding, 2012; Dicheva et al., 2015). Therefore, it should be careful with the selection of gamification elements which get time and effort to implement and cannot be adjusted to each context (Kwon & Özpolat, 2021; Pakinee & Puritat, 2021). In this line, it is aimed to keep the motivation and perception of students with different learning styles at the high level by using various gamification elements and tools in this study.

On the other hand, most of the studies have applied to the quantitative research methods. This current study will quantitatively compare the motivation and perception of students with different learning styles as well as qualitatively reveal the enabler and barrier factors of students' motivation and perception by learning styles in the 7-week gamified learning process in detail. Accordingly, it is addressed the following research questions.

1. What are the learning styles scores and levels of students participating in gamified learning process?
2. What are the motivation levels and averages of students towards gamified learning process by learning styles?
3. Do learning styles have an effect on students' motivation towards gamified learning process?
4. What are the perception levels and averages of students towards gamified learning process by learning styles?
5. Do learning styles have an effect on students' perception towards gamified learning process?
6. Is there any correlation between motivation and perception of students by learning styles?
7. What are the enabler and barrier factors of students' motivation and perception by learning styles in the 7-week gamified learning process?

METHOD

Research Design

It was used the triangulation as a mixed research method to strengthen the results by obtaining comprehensive data (Creswell, 2014). In this line, it was compered the motivation and perception of participants with different learning styles towards gamified learning process with Mann-Whitney U test, and determined the correlation between motivation and perception with Spearman's rank correlation test. It was also figured out the enabler and barrier factors of students' motivation and perception by learning styles in the 7-week gamified learning process with contents analysis. The research design of this study is summarized in Figure 1 and explained in-detail in the following sections.

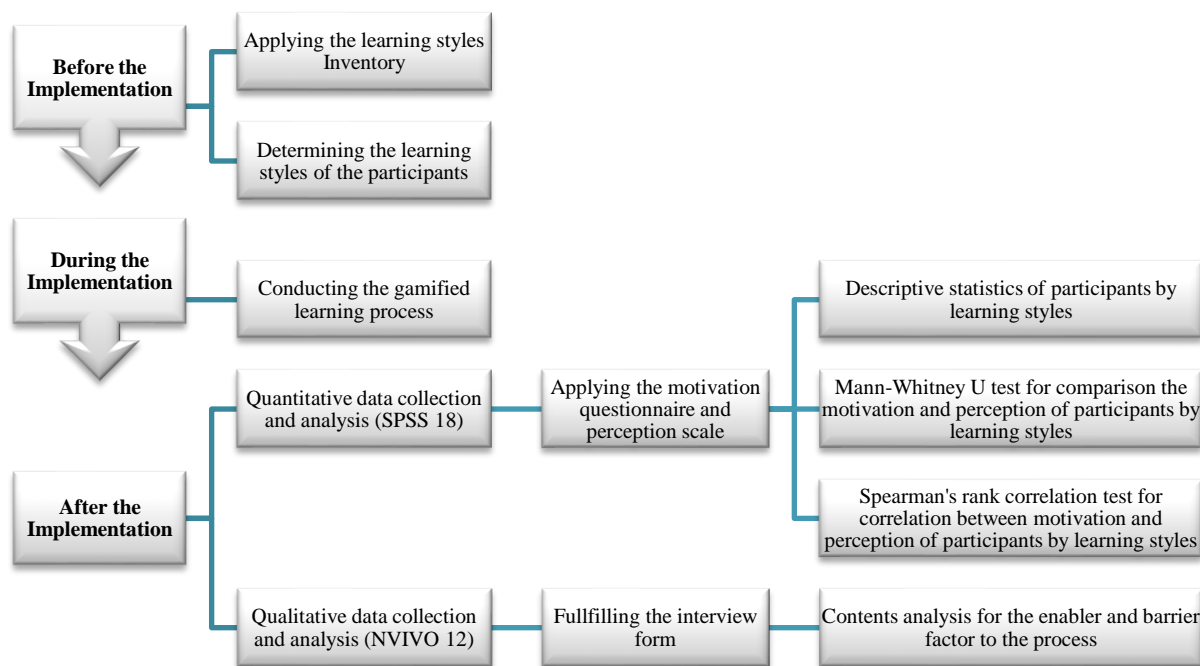


Figure 1. Summary of the research design

Participants

The participants consist of 95 prospective teachers with different learning styles by inventory of Felder and Soloman (1994). In addition, 78 of the participants voluntarily fulfill the interview form. Distribution of participants by learning styles and gender is summarized in Figure 2.

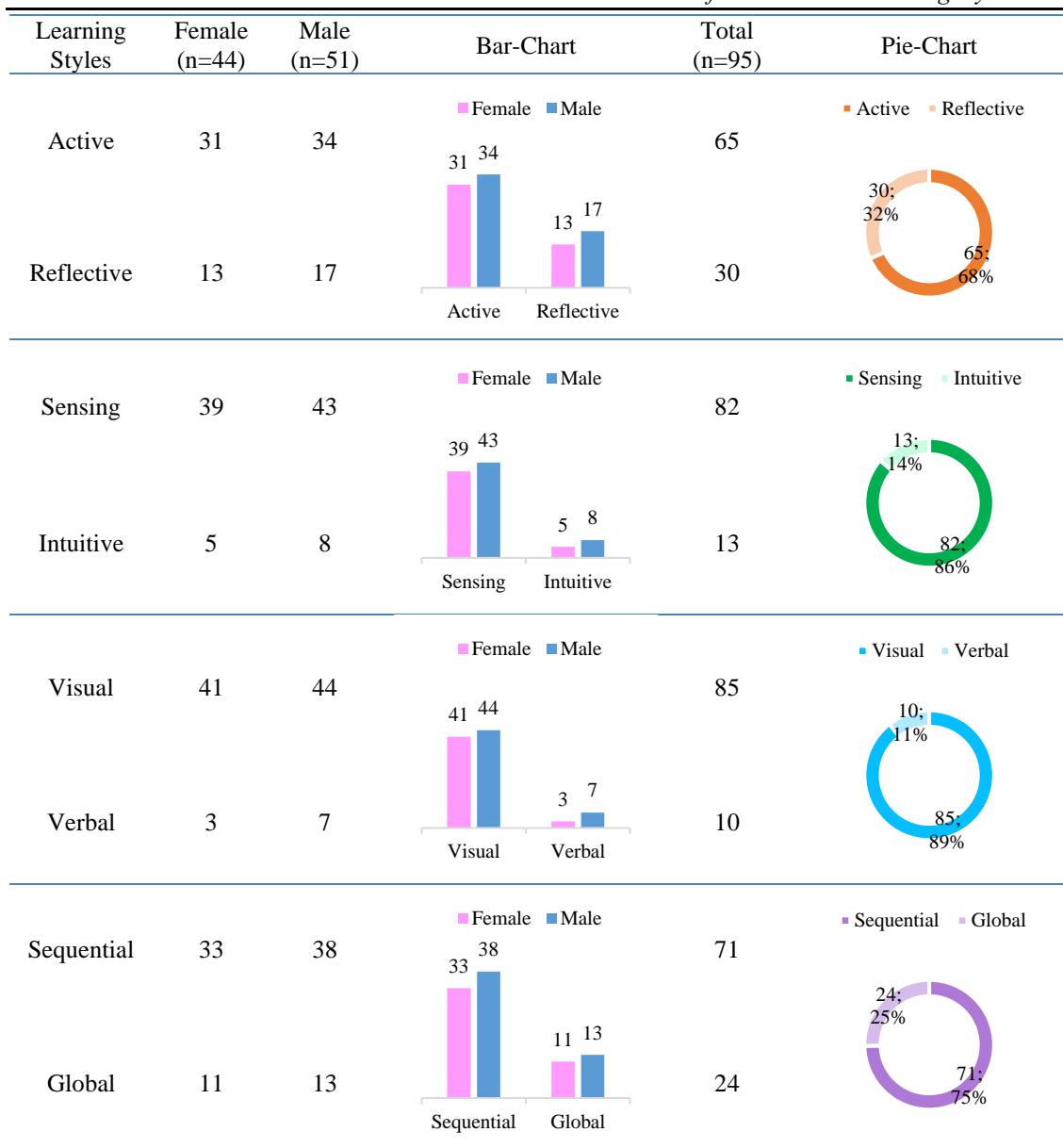


Figure 2. Distribution of participants by learning styles and gender

Data Collection Instruments

Instructional Materials Motivation Survey of Keller (1987) was five-point likert survey and was ranged from strongly disagree (1) to strongly agree (5). The original survey with 36 items consisted of attention, relevance, confidence, and satisfaction factors and the reliability coefficient of the survey calculated as 0.96 whereas the adaptation of survey to Turkish by Kutu and Sozbilir (2011) with 24 items applied to the undergraduate students consisted of attention-relevance and confidence-satisfaction factors. The reliability coefficient of the survey calculated as 0.83.

Course Evaluation Questionnaire with three-factor was developed by Earley (2012) to examine the perception of participants in public health training toward course lecture, the exercise activity, and the overall training effectiveness. The six-point likert questionnaire consisted of 11 items was ranked from strongly disagree (1), disagree (2), disagree more than agree (3), agree more than disagree (4), agree (5), and strongly agree (6). Turkish items were checked by a language expert. The reliability coefficient of the questionnaire calculated as 0.92.

Learning Styles Inventory of Felder and Soloman (1994) was based on learning styles model of Felder and Silverman (1988) including four dimensions. These dimensions of inventory called active/reflective, sensing/intuitive, visual/verbal, and sequential/global. The inventory which had 11 items for each dimension consisted of 44 items. Each item had two choices, a and b. "a" options in the inventory represented the active, sensing, visual, or sequential part of the each dimension, and "b" options represented the reflective, intuitive, verbal, and global parts of the each dimension. According to the number of choice of a and b options, it was determined the level of learning style of the participant as mild, moderate, or strong. According to the given answer to each 11-item dimension, 1 point was assigned to options a and b. It was calculated the total score of each of a and b options. It was determined the learning style of the participant for each dimension based on the difference between a and b option scores. The

levels of the learning styles were as (+-) 1_(+-) 3 mild, (+-) 5_(+-) 7 moderate, (+-) 9_(+-) 11 strong (Felder & Spurlin, 2005). The inventory was adapted to Turkish by Samancı and Keskin (2007) applied to the undergraduate students. There was not any change in the number of items and dimensions after the Turkish adaptation. Cronbach’s alpha calculated as 0.64.

Interview Form was created by researcher to reveal the enabler and barrier factors of students’ motivation and perception in the 7-week gamified learning process by the researcher. Accordingly, they were asked to explain their feelings and thoughts about the gamified learning process, the situations that motivate or demotivate them to learn with reasons. The draft form was checked by an instructional technology expert specialized in gamification. At the end of the course, the researcher who was the lecturer of the learning process sent online the structured Google form to all participants in order to ensure freely fulfilling the open-ended questions. However, just volunteers responded to the form.

The Gamified Learning Process

Werbach and Hunter (2015) suggest D6 design model for effective gamified process. The gamified learning process in current study is based on D6. The gamified learning process which in total 28 lessons for 7-weeks (four lessons per week) is conducted by the researcher who is the course instructor. The details of D6-process outlined in Figure 3 are explained below.

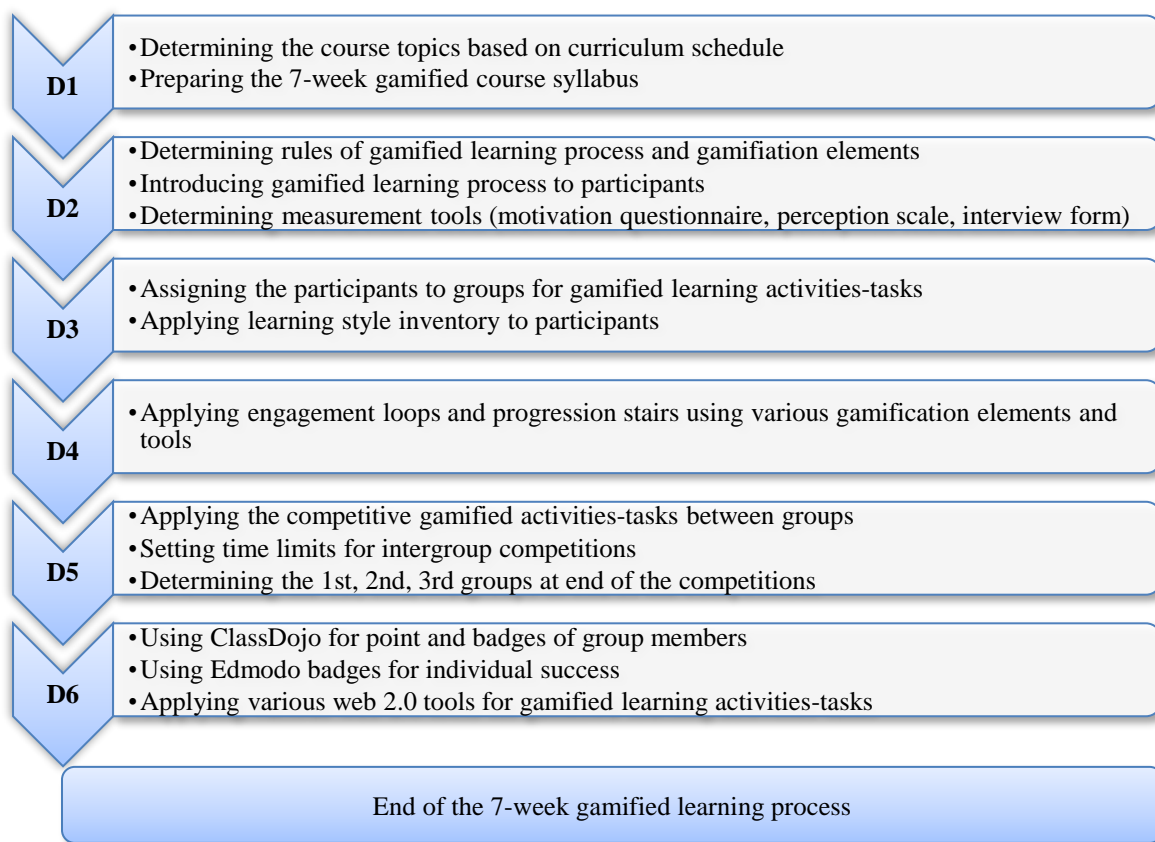


Figure 3. Details of gamified learning process

Define objectives (D1)

It is important to clarify the expectations from the participants. Therefore, first of all, it was determined the course topics about the learning and teaching approaches to be taught with weekly gamified learning activities based on curriculum schedule in this study. These course topics are as follows: Situated learning, blended learning, social cognitive learning, problem based learning, inquiry learning, gamification, flipped classroom, educational game, and mobile learning. Then, it was prepared the 7-week gamified course syllabus.

Delineate target behaviors (D2)

It was determined rules of gamified learning process and gamification elements. In this line, it was expected from participants to perform various in-class activities-tasks by using web 2.0 tools and multimedia materials related to weekly topics. According to completion time the assigned task, each group members got ClassDojo positive points and badges considering that ranks (three points for the first group= Snowy Peak badge, two points for the second group= Take Flight badge, one point for the third group= Mission Completed badge). In addition, three students who gave the more correct answers to the questions asked by the instructor

about the weekly topics than others got various ClassDojo badges (three points for the first student=Gold Cup badge, two points for the second student=Gold Medal badge, one point for the third student=Gold Star badge).

On the other hand, it were given various ClassDojo negative points and badges to students who exhibited negative behavior in weekly lessons (minus one point for the student who not care about giving the correct answer to the question=Inadequate Answer badge, minus one point for the unwilling student to participate in group activities=Inadequate Participation badge). In this way, it was tried to prevent students engaging with something other than gamified learning activities-tasks. The participants should follow these rules in order to be at the top ranking of the ClassDojo leaderboard.

Furthermore, according to instructor's in-class observations, the participants who had the best positive behaviors throughout gamified learning process got various Edmodo badges with one-point at the end of the process. The screenshots of ClassDojo positive/negative points and badges, and Edmodo badges are presented in Figure 4.

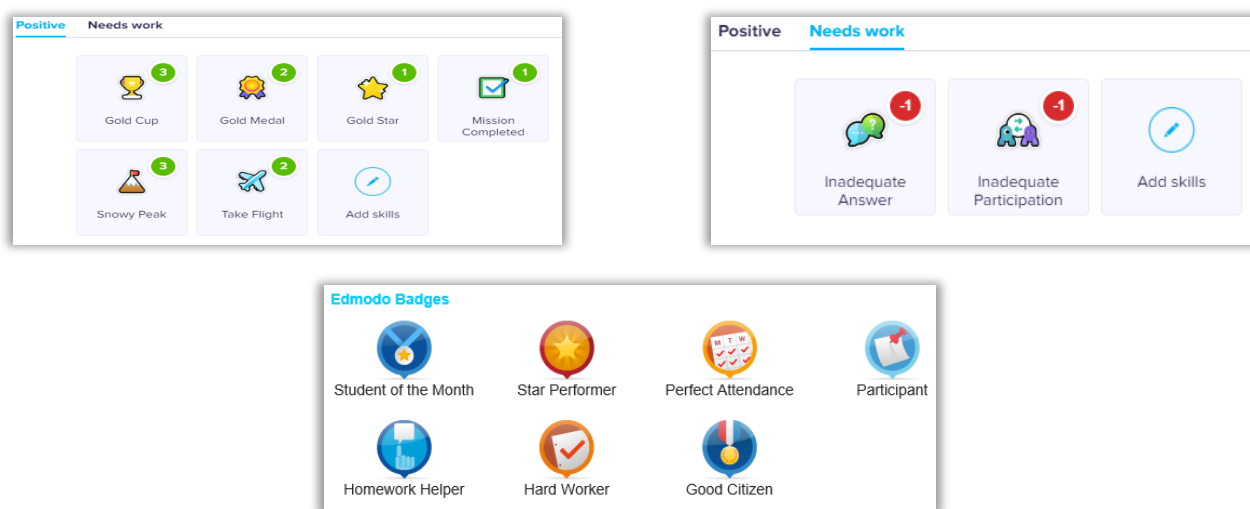


Figure 4. The positive/negative points and badges in gamified learning process

Moreover, at the beginning of the course, it was introduced the gamified learning process to participants. At the end of the process, it was determined the quantitative and qualitative measurement instruments to examine the motivation and perception of participants with different learning styles towards gamified learning process (motivation questionnaire, perception scale, and interview form).

Describe players (D3)

The participants was randomly assigned to groups for gamified learning activities-tasks. It was also applied the inventory of Felder and Soloman (1994) to determine the participants' learning styles. In addition, Felder and Silverman (1988) defined the corresponding teaching styles to the preferred learning styles in order to ensure active participation of students with different learning styles in gamified learning process. Considering this definition, examples of gamified learning activities-tasks in this study by student characteristics are presented as in Table 1.

Table 1. Examples of gamified learning activities-tasks by student characteristics

Learning Styles	Teaching Styles	Gamified Learning Activities-Tasks
Active / Reflective (Processing)	Participation	It was carried out the activities-/tasks-based intergroup competitions using web 2.0 tools (e.g. qr code, puzzle).
Sensing / Intuitive (Perceiving)	Content	It was given information and asked questions on weekly topics using web 2.0 multimedia materials (e.g. infographic, kahoot).
Visual / Verbal (Receiving-input)	Presentation	It was presented the detailed information on the weekly topics with multimedia materials created by using various web 2.0 tools (e.g. animated video, micro-teaching video).
Sequential / Global (Understanding)	Perspective	The activities-tasks are presented in a certain order considering the weekly topic scope, and various activities-tasks using web 2.0 tools were carried out to cover all aspects of the topic (e.g. giving information, making presentations, asking questions, and doing activities-tasks about topics).

Devise activity cycles (D4)

It was applied the engagement loops and progression stairs by using various gamification elements and tools. Engagement Loops is the process of activating the participant using motivators in the learning process and giving feedback such as points and badges in response to their actions. This feedback is expected to trigger the motivation of participant to continue the activity. This process continues in a loop. In this study, it was applied various gamified learning activities to motivate the participants. It was given points and badges as feedback to them depending on their performance in completing tasks in these activities. It was intended that these awards re-motivate and encourage them to participate in the further activities.

Progression Stairs are tasks with variety of difficulty levels which assigned to participants in order to make them progress towards the learning goals. In this study, it was preferred the rewarding system (points and badges) based on tasks-completion performance instead of the level-up strategy in order to ensure to keep participating in gamified learning process. However, students had to attend weekly lessons and get points and badges by participating in gamified activities-tasks in order to high ranking on the leaderboard. The activity cycles of this study are summarized in Figure 5.

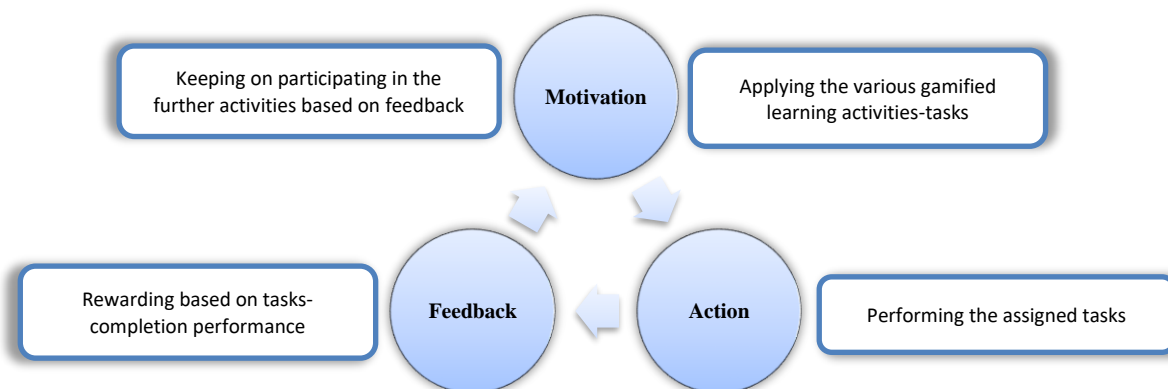


Figure 5. The activity cycles of this study

Don't forget the fun (D5)

The various gamified components was inserted into the in-class activities for enjoyable learning process. Accordingly, the groups performed the task-based activities by competing with each other. It was also set limited time for intergroup competitions. It was determined the 1st, 2nd, 3rd groups at end of the competitions depending on completion time the assigned tasks and given points and badges to each member of these groups considering these ranks. The participants who had the best positive behaviors throughout gamified learning process by in-class observation of instructor was rewarded with the various badges. The task-based activity photos in gamified learning process are laid out in Figure 6.

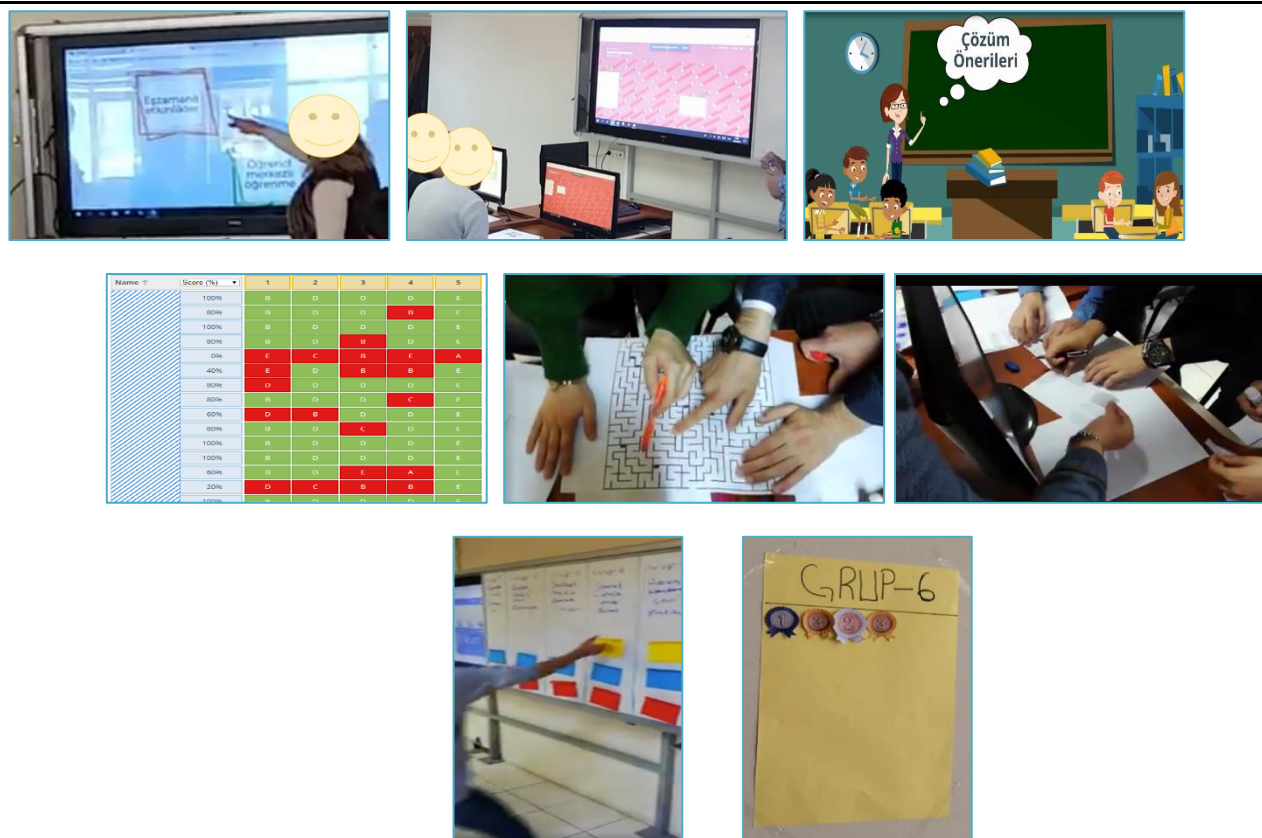


Figure 6. The task-based activity photos in gamified learning process

Deploy the appropriate tools (D6)

It is important to include appropriate gamification elements and web 2.0 tools in order to increase the efficiency of the learning process. The purpose of choosing the gamification elements and tools used in this study are summarized in Table 2.

Table 2. The purpose of using gamification elements and web 2.0 tools

Gamification Elements	Purpose of Using
Competition	Providing the challenge, cooperation, relationship, and fun in competitive group activities-tasks
Points and Badges	Rewarding and feedback considering the task completion performance
Leaderboard	Determining how status the participants are progressing towards course goals
Web 2.0 Tools	Purpose of Using
ClassDojo	Giving points and badges to group members considering the task completion performance and displaying the status of participants in leaderboard
Edmodo	Giving badges considering the individual success
Puzzle and QR Code Apps	Finding the cryptic questions on weekly topics in intergroup competitions
Piktochart, Captivate, and Pawtoon	Providing the detailed information on weekly topics with infographics, micro-teaching videos, and animated videos
Padlet	Explaining the critical features of weekly topics (learning and teaching approaches) and ordering correctly the implementation steps on the topic
Kahoot, Socrative, and Google Form	Asking questions on weekly topics

Data Analysis

It is determined that the dataset by learning styles is not a normal distribution, and conducted non-parametric tests for quantitative data analysis (Field, 2009) by using SPSS 18. The descriptive statistics, mean, and standard deviation are calculated. It is compared the motivation and perception of participants with different learning styles towards gamified learning process by carried out Mann-Whitney U test. It is used Spearman’s rank correlation test to figure out correlation between motivation and perception of participants with different learning styles.

It is conducted the content analysis for in-detail qualitative data analysis by using NVIVO 12. In this way, it is revealed the enabler and barrier factors of motivation and perception of students with different learning styles in the 7-week gamified learning process. The qualitative data analysis is based on the interactive model (Miles et al., 2014) and three concurrent flows of activity were followed: data condensation (coding of data), data display (code matrix by learning styles), and conclusion drawing/verification (quotations by each code). Accordingly, the interview forms answered by each student are transferred to Nvivo as cases. All cases are examined and a code pool is created up to saturation limit. By reviewing the codes, similar codes are combined and factors are formed. Factors are classified under the categories of enablers and barriers. Code matrix is created according to the learning styles of the factors in each category. The frequencies and percentages of these factors are calculated. The factors classified under the categories of enablers and barriers by learning styles are presented in tables and strengthened by using the quotations of students with ID no (SX).

Validity and Reliability of the Study

The following validity and reliability strategies were applied in the study. The triangulation as a mixed research method was used to increase the validity and reliability of the results by completing the limitations or deficiencies of one research method with the other method (Creswell, 2014). In order to carry out the study in a systematic way, the gamified learning process was explained based on the D6 design in detail suggested by Werbach and Hunter (2015). The role of the researcher in this study was emphasized. In order to prevent loss of data and to present evidence, it was taken photos and video recordings throughout the implementation process. Data diversification was provided by using quantitative and qualitative data collection tools determined validity and reliability measurements. The volunteer students responded to the interview form. It was applied the non-parametric data analysis conditions to quantitative data (Field, 2009) and the interactive model flow for content analysis to qualitative data (Miles et al., 2014). The quotations of student statements were used to strengthen the qualitative findings. The trustworthiness of the content analysis (factors and quotations) is checked by an instructional technology expert specialized in gamification. In order to increase the clarity of the quantitative and qualitative findings, it was used suitable tables and graphics. It was also emphasized the limitations and ethical standards of the study.

RESULTS

Students’ Learning Style Scores and Levels

The students’ learning style scores and levels are presented in Figure 7.

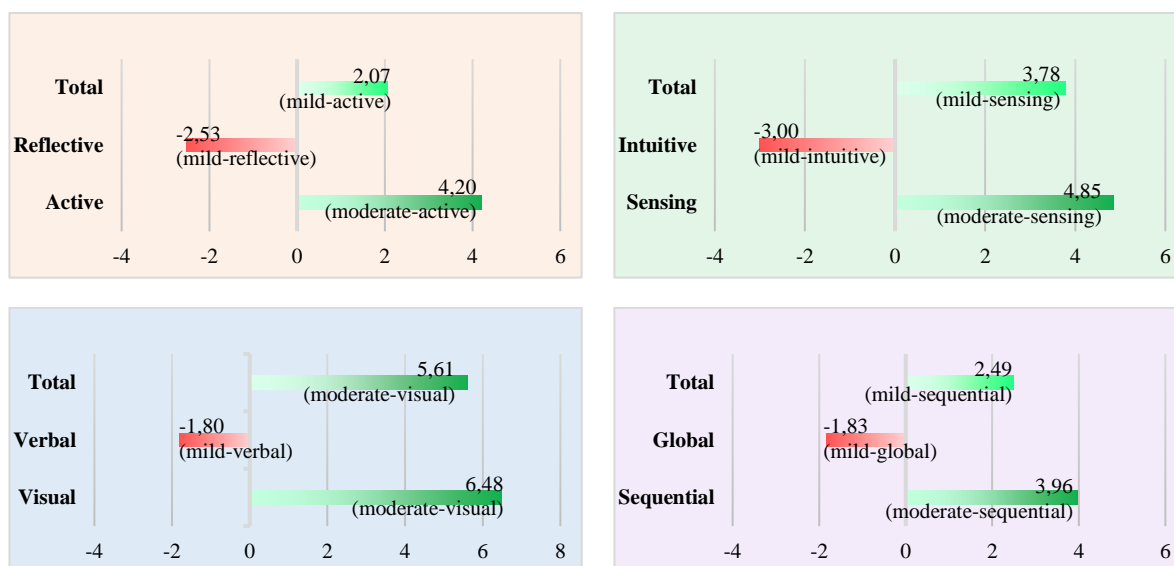


Figure 7. Students’ learning style scores and levels

According to descriptive findings, the visual/verbal dimension is the highest score and moderate level (M= 5.61) whereas active/reflective dimension is the lowest score and mild level (M= 2.07). For each category of all four dimensions, participants have

the learning style scores at mild or moderate level. However, the active, sensing, visual, and sequential students have the higher score and level than the reflective, intuitive, verbal, and global students.

Students' Motivation Levels and Averages by Learning Styles

The descriptive results regarding students' motivation levels and averages by learning styles are presented in Figure 8.

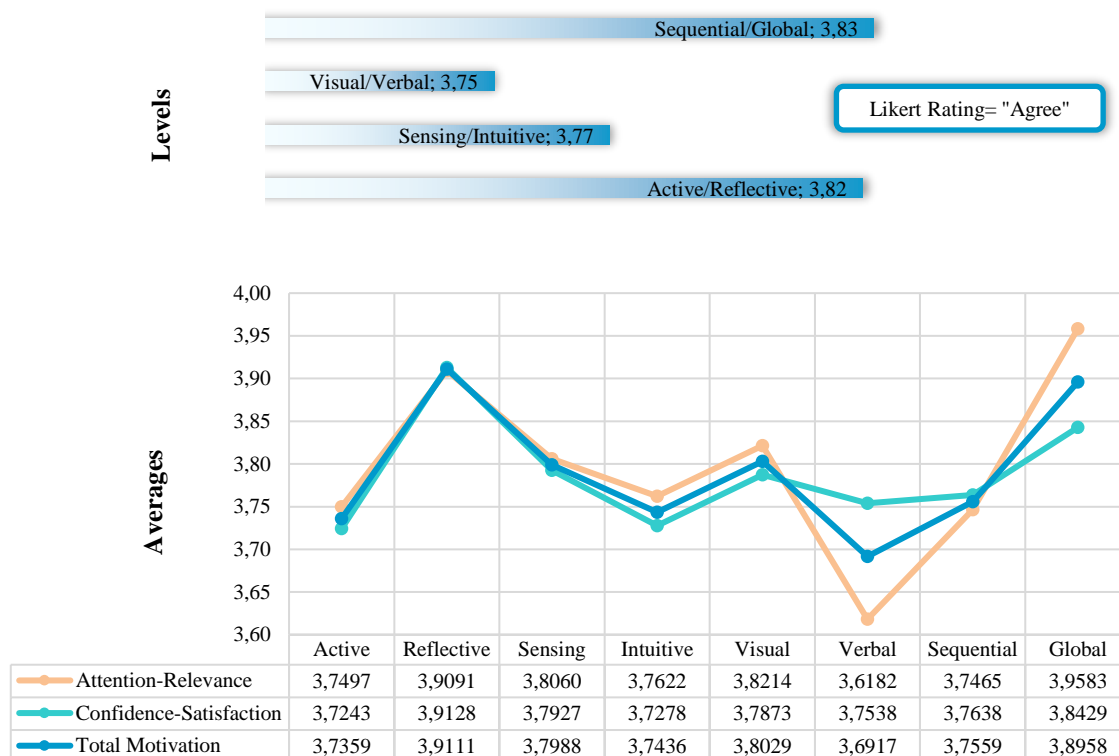


Figure 8. Students' motivation levels and averages by learning styles

As seen in Figure 8, the sequential/global dimension has the highest averages (M= 3.83) whereas the visual/verbal dimension has the lowest averages (M= 3.75). However, likert rating level is "Agree" for each category of all four dimensions. In addition, the reflective, sensing, visual, and global students have the higher averages in terms of attention-relevance and confidence-satisfaction sub-dimensions of motivation than the active, intuitive, verbal, and sequential students.

Effects of Learning Styles on Students' Motivation towards Gamified Learning Process

Mann-Whitney U test is carried out to examine the difference between motivations of students with different learning styles. The results are laid out in Table 3.

Table 3. The motivation results of students with different learning styles

Learning Styles	n	M	SD	Rating	Mean rank	Sum of ranks	U	Z	p	η ²
Active	65	3.7359	.67041	Agree	45.95	2986.50	841.500	-1.070	.285	-0.11
Reflective	30	3.9111	.58719	Agree	52.45	1573.50				
Sensing	82	3.7988	.65974	Agree	48.87	4007.50	461.500	-.775	.438	-.08
Intuitive	13	3.7436	.58478	Agree	42.50	552.50				
Visual	85	3.8029	.62647	Agree	48.24	4100.50	404.500	-.249	.804	-.03
Verbal	10	3.6917	.83777	Agree	45.95	459.50				
Sequential	71	3.7559	.70698	Agree	46.80	3323.00	767.000	-.729	.466	-.07
Global	24	3.8958	.41991	Agree	51.54	1237.00				

Table 3 indicates not any significant differences between categories of each learning style dimension in terms of motivation. However, the reflective, sensing, visual, and global students have the higher motivation averages than the active, intuitive, verbal, and sequential students.

Students’ Perception Levels and Averages by Learning Styles

The descriptive results regarding students’ perception levels and averages by learning styles are laid out in Figure 9.

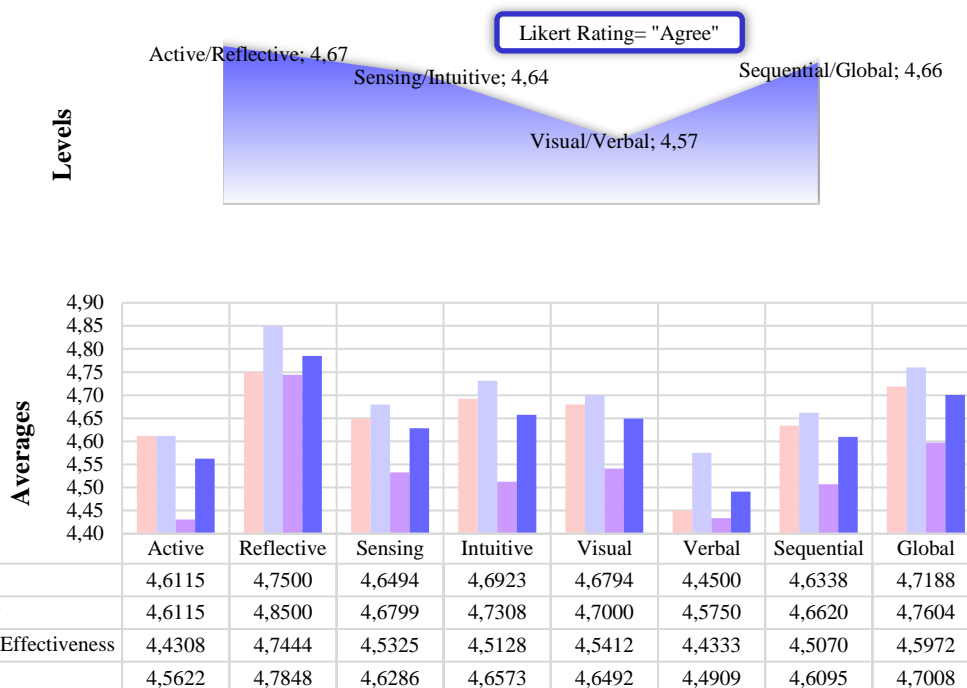


Figure 9. Students’ perception levels and averages by learning styles

As seen in Figure 9, the active/reflective dimension is the highest score (M= 4.67) whereas the visual/verbal dimension is the lowest score (M= 4.57). However, likert rating level is “Agree” for each category of all four dimensions. In addition, the reflective, intuitive, visual, and global students have the higher averages in terms of course lecture, exercise activity, and overall training effectiveness sub-dimensions of perception than the active, sensing, verbal, and sequential students.

Effects of Learning Styles on Students’ Perception towards Gamified Learning Process

The Mann-Whitney U test is carried out to examine the difference between perceptions of students with different learning styles. The results are laid out in Table 4.

Table 4. The perception results of students with different learning styles

Learning Styles	n	M	SD	Rating	Mean rank	Sum of ranks	U	Z	p	η ²
Active	65	4,5622	1,05955	Agree	46.33	3011.50	866.500	-.870	.384	-.09
Reflective	30	4,7848	,77782	Agree	51.62	1548.50				
Sensing	82	4,6286	1,02287	Agree	48.55	3981.00	488.000	-.488	.626	-.05
Intuitive	13	4,6573	,68650	Agree	44.54	579.00				
Visual	85	4,6492	,93209	Agree	47.91	4072.00	417.000	-.097	.923	-.01
Verbal	10	4,4909	1,38283	Agree	48.80	488.00				
Sequential	71	4,6095	1,06400	Agree	47.90	3401.00	845.000	-.060	.952	-.01
Global	24	4,7008	,69207	Agree	48.29	1159.00				

Table 4 indicates not any significant differences between categories of each learning style dimension in terms of perception. However, the reflective, intuitive, visual, and global students have the higher perception averages than the active, sensing, verbal, and sequential students.

The Correlations between Motivation and Perception by Learning Styles

It is carried out the Spearman’s rank correlation test to reveal the correlations between motivation and perception of students by learning styles. The results are laid out in Figure 10.

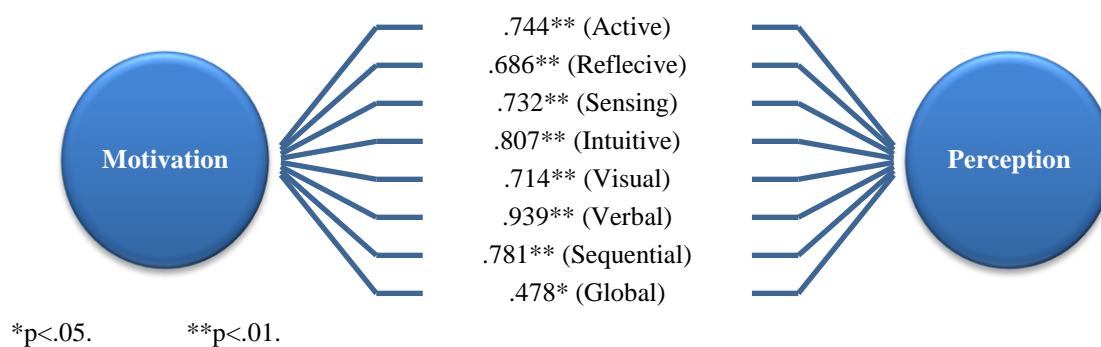


Figure 10. The correlations between motivation and perception of students by learning styles

Figure 10 indicates a positive and above medium or high level correlations between motivation and perception of students by learning styles ($p<.05$, $p<.01$, $r>0.40$) (Field, 2009).

The Enabler and Barrier Factors of Motivation and Perception by Learning Styles in Gamified Learning Process

82% of the participants (78 of 95 prospective teachers) voluntarily fulfilled the interview form at the end of the gamified learning process. The distribution of these participants by learning style and gender is presented in Table 5.

Table 5. Distribution of participants fulfilled the interview form by learning styles and gender

Learning Styles	Female	Male	Total
Active	26	28	54
Reflective	10	14	24
Total	36	42	78
Sensing	32	35	67
Intuitive	4	7	11
Total	36	42	78
Visual	34	36	70
Verbal	2	6	8
Total	36	42	78
Sequential	26	29	55
Global	10	13	23
Total	36	42	78

It was determined the enabler and barrier factors of students' motivation and perception in gamified learning process. The frequencies and percentages of results by learning styles as well as quotations of the students (SX) are presented in Table 6 and Table 7.

According to Table 6, even if participants had different learning styles, the more than three-fourth of them stated that using web 2.0 tools in gamified learning process was knowledge reinforcing. Especially, almost all of reflective and verbal learners agree with this opinion. According to almost three-fourth of intuitive learners, participating in-class activities increased retention and recall of knowledge. The majority of students also stated that performing in-class activities ensured the active participation. In addition, the more than half of students stated that getting badges and points was motivating, and engaging in gamified tasks made the learning process fun. They also stated that the competitions increased interaction between peers and triggered the desire to be at the top of leaderboard.

As seen in Table 7, time-consuming and intensive workload activities negatively affected the perception of the less than one-third of the participants. Moreover, excessive noise and confusion were factors that negatively affect the motivation. According to one-fourth of students, long duration activities and negative badges and points caused the negative emotions in them. Especially, global learners was bored the more than others in long duration activities. As for competitive tasks were one of the factors which disrupted the peer relationship. Even if it was at the lowest percentages, the time limitation for competitive tasks caused to worry about failing to complete tasks and stress in students.

In summary, the frequencies of students with different learning styles are close to each other in terms of enablers. So is it in terms of barriers. Therefore, it can be said that is available common factors as enablers and barriers affecting motivation and perception of participants with different learning styles.

Table 6. Enablers

	Total (n=78)		Active (n=54)		Reflective (n=24)		Sensing (n=67)		Intuitive (n=11)		Visual (n=70)		Verbal (n=8)		Sequential (n=55)		Global (n=23)		Quotations
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	
Using web 2.0 tools as reinforcing knowledge	61	78%	39	72%	22	92%	55	82%	6	55%	54	77%	7	88%	42	76%	19	83%	<i>“Thanks to these interesting web 2.0 tools, I think that I have reinforced my knowledge about the subjects of this course.” (S17)</i>
Performing in-class activities as ensuring the active participation	49	63%	32	59%	17	71%	42	63%	7	64%	44	63%	5	63%	32	58%	17	74%	<i>“This course has very good activities in terms of activating the student and learning by doing.” (S21)</i>
Getting badges and points as motivation-booster	46	59%	33	61%	13	54%	40	60%	6	55%	42	60%	4	50%	31	56%	15	65%	<i>“I think that Class Dojo, badges, points and reward system indirectly motivate students and increase their interest in the lesson.” (S8)</i>
Engaging in tasks as ensuring the enjoyable learning process	42	54%	26	48%	16	67%	36	54%	6	55%	38	54%	4	50%	31	56%	11	48%	<i>“The course process was quite immersive. We attended the lessons with surprise activities and without getting bored. Since the activities in the lessons were fun, better learning was achieved.” (S5)</i>
Participating in-class activities as increasing the retention and recall of knowledge	41	53%	25	46%	16	67%	33	49%	8	73%	37	53%	4	50%	25	45%	16	70%	<i>“At first, even if I could not remember of the theoretical knowledge about the subject and then, thanks to the activity we performed, I was able to recall of knowledge and answered the questions in the exam.” (S42)</i>
Participating in competitions as excitement-booster	40	51%	26	48%	14	58%	34	51%	6	55%	37	53%	3	38%	27	49%	13	57%	<i>“The competition-based activities excited me a lot and I was very motivated because it provided a sweet competitive environment.” (S39)</i>
Being on the leaderboard as the desire-booster to the top rank	39	50%	26	48%	13	54%	32	48%	7	64%	36	51%	3	38%	25	45%	14	61%	<i>“I wanted my name to be at the top of the leaderboard, and this triggered me to work harder. In this way, my intrinsic motivation increased.” (S47)</i>
Participating collaborative and competitive activities as interaction-booster within and between groups	37	47%	24	44%	13	54%	31	46%	6	55%	34	49%	3	38%	25	45%	12	52%	<i>“I think that collaborative and competitive activities contributed to increase interaction within group and to utilize each other’s experience, and to communicate more with other groups we competed with them.” (S26)</i>
Getting painted paper-cups as competitive-booster	34	44%	23	43%	11	46%	30	45%	4	36%	30	43%	4	50%	23	42%	11	48%	<i>“Painting paper-cups was nice. It both increased the competition and we were able to see what we did and how much. This has been a motivation factor for us.” (S7)</i>
Tasks completing as enhancing drive for successful	28	36%	21	39%	7	29%	25	37%	3	27%	26	37%	2	25%	21	38%	7	30%	<i>“I did my best in the task completing process to be successful. Absolutely, this increased my participation and motivation in the course.” (S76)</i>
Performing in-class activities as facilitator the learning	17	22%	9	17%	8	33%	15	22%	2	18%	16	23%	1	13%	10	18%	7	30%	<i>“Activities in this gamified process facilitated as well as accelerated the learning.” (S54)</i>

Table 7. Barriers

	Total (n=78)		Active (n=54)		Reflective (n=24)		Sensing (n=67)		Intuitive (n=11)		Visual (n=70)		Verbal (n=8)		Sequential (n=55)		Global (n=23)		Quotations
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	
Time-consuming and much workload in-class activities/tasks as the cause of negative perception	27	35%	22	41%	5	21%	21	31%	6	55%	24	34%	3	38%	22	40%	5	22%	<i>"In this course, there was a lot of responsibility on the student compared to other courses. We spent a lot of time on various tasks and activities. So, I was not satisfied with this situation."</i> (S41)
Excessive noise and confusion during activities as the cause of de-motivation	25	32%	19	35%	6	25%	19	28%	6	55%	24	34%	1	13%	19	35%	6	26%	<i>"The active participation of all students in group activities sometimes led to loss of control and noise in the classroom, or even deviation from the target subject."</i> (S7)
Long duration activities and lessons as the cause of feeling boredom	21	27%	11	20%	10	42%	17	25%	4	36%	21	30%	0	0%	11	20%	10	43%	<i>"Sometimes the long lesson time could be boring due to the long duration of the activities."</i> (S17)
Negative badges and points as the cause of stress and lack of self-confidence	20	26%	15	28%	5	21%	17	25%	3	27%	17	24%	3	38%	14	25%	6	26%	<i>"I think that the students who get a negative badges in the Class Dojo panics and it creates a sense of humiliation for the students get the lower scores in the leaderboard."</i> (S90)
Competitive tasks as the cause of negative peer interaction and discussions within and inter groups	18	23%	13	24%	5	21%	14	21%	4	36%	17	24%	1	13%	14	25%	4	17%	<i>"Sometimes, when the dose of competition is too much, small arguments can arise. This situation negatively affects my motivation towards the course."</i> (S49)
Excessive winning ambition of some classmates as the cause of the other students' de-motivation	17	22%	11	20%	6	25%	17	25%	0	0%	15	21%	2	25%	14	25%	3	13%	<i>"It bothered me that some of my friends were overly ambitious and competitive, and after a while, it reduced my motivation."</i> (S48)
Disliking group activities as the cause of low motivation and negative perception	12	15%	9	17%	3	13%	10	15%	2	18%	10	14%	2	25%	8	15%	4	17%	<i>"I do not have a positive attitude towards group activities, as failure may occur due to people who do not adequately fulfill their duties. This reduces my motivation."</i> (S8)
Time limitation for competitive tasks as a cause of worry about failing to complete the tasks and stress	10	13%	6	11%	4	17%	7	10%	3	27%	9	13%	1	13%	6	11%	4	17%	<i>"Worry about not being able to complete the tasks in a limited time was making me nervous. I didn't like this situation."</i> (S27)

DISCUSSION
Effects of Learning Styles on Motivation and Perception

In this study, all students, regardless of their learning style, participating in gamified learning process had high and close motivation level to each other and had the high positive perception level toward gamified learning process. In parallel, Ong et al. (2013) determined that students' motivation and perception in gamification were largely independent of personality type. These results proves that gamified activities-tasks have the power to motivate students with different characteristics and positively contribute to the perceptions of them to the learning process. Hassan et al. (2021) determined that gamification elements and activities chosen by considering learning styles significantly increase students' motivation. On the contrary, Pakinee and Puritat (2021) observed that gamified e-learning environment had a negative effect on perception of extroverted students. Kwon and Özpolat (2021) found that students had significantly the lower satisfaction in narrow gamifying process. According to Deterding (2012) and Dicheva et al. (2015), gamification enables students to enrich their experiences only if applied correctly throughout the learning process. As for this study, the various gamification elements and gamified activities-tasks have been inserted into the learning process by considering different student characteristics (as seen Table 1). This situation may have increased the motivation of students with different learning styles as well as helped to have the positive perceptions of them towards this gamified process.

On the other hand, Buckley and Doyle (2017) determined that active or global participants had a positive perception toward gamification. They also stressed that gamification helped to have positive perception of students acting with extrinsic motivation by encouraging them to participate in learning process. However, they revealed that conscientious participants had the less motivation in gamified process. Ghaban and Hendley (2019) stressed that gamification elements using in the application enhanced students' motivation and thus the more motivated students engaged in gamified learning process the longer time. They also revealed that gamification elements motivated the extroverted learners and reduced their dropout rates. It demotivated the neurotic students whereas it did not affect the conscientious students. Oliveira et al. (2022) revealed that personalization gamification based on personality traits had not any significant effect on students' motivation, perception and enjoyment. The reason for these contrasting results in the literature may be emerged the using of different models on personality traits and learning styles in the studies and integrating gamification into learning environments in different ways.

The Correlations between Motivation and Perception by Learning Styles

It is determined positively medium or high correlations between motivation and perception of students by learning styles. This significant correlations between the variables may have resulted from students' participation in task-based gamified activities. Namely, the goal-oriented activity is the factor that increases motivation (Glover, 2013). In parallel, Buckley and Doyle (2017) revealed the positive correlation between extraverted personality trait and perception of gamification. They also suggested that motivating external stimuli such as badges and points may contribute to student satisfaction. According to Galbis-Córdova et al. (2017), sub-dimensions of motivation had a positive effect of students' attitude towards the learning process.

The Enabler and Barrier Factors of Motivation and Perception by Learning Styles

As to qualitative findings, the more than three-fourth of students with different learning styles stated that engaging with web 2.0 tools in gamified learning process reinforced the knowledge. Especially, almost all of reflective and verbal learners agree with this opinion. When the knowledge pieces about context are presented simultaneously, it can be easily linked between them (Moreno, 2010). Furthermore, various media and materials can positively affect perceived attention, relevance, and confidence as sub-dimensions of motivation as well as increase curiosity (Galbis-Córdova et al., 2017). In current study, considering the characteristics of students with such learning styles (Felder & Soloman, 1994), it is an interesting and remarkable finding that highlights the contribution of gamification to positive learning outcomes. However, time-consuming and intensive workload activities negatively affected perception by less than one-third of the participants. Inserting more instructional elements into a learning environment lead to more mental effort (Sweller, 2010). Therefore, it is suggested to decrease the complexity of gamified learning process considering the personality traits (Krath et al., 2021; Luo, 2022) so as not to reduce the mentioned positive contribution of gamification.

According to majority of students, especially intuitive learners, performing in-class activities increased the retention and recall of knowledge and ensured the active participation. This is an expected result due to the characteristics of these students who have a tendency to get information by perceiving (Felder & Soloman, 1994). Moreover, the majority of students also stated that performing in-class activities ensured the active participation. Buckley and Doyle (2017) emphasized that students who were motivated by engaging in active learning environments are positively tendency to gamification. However, excessive noise and confusion were factors that negatively affect the motivation. Luo et al. (2021) expressed teachers' concerns about losing classroom control due to these problems.

The more than half of students stressed that getting badges and points was motivating and engaging in gamified tasks made the learning process fun. Using gamification elements and activities by considering students' learning can affect positively motivation (Hassan et al., 2021). However, long duration activities, and negative badges and points caused the negative emotions in one-fourth of students. These negative feelings may be reason why students' motivation which expected to be higher towards gamified learning process is getting around fifty percent. Some gamified studies revealed that students were the less motivated and satisfied (Kwon &

Özpolat, 2021), motivation and satisfaction of students decreased over time (Hanus & Fox, 2015). Pakinee and Puritat (2021) determined that fun and curiosity are short-lived in gamification. They suggested to insert new gamification elements into gamified tasks from time to time throughout the learning process to keep on the attractiveness of this learning process and the high engagement of students.

The global learners was bored the more than others in long duration activities. This may be due to the characteristic tendency of students with this learning style to develop their own problem-solving technique rapidly (Felder & Soloman, 1994). The same gamified intervention creates a feeling of boredom and unwillingness in students with different learning styles (Hassan et al., 2021). Some students may focus on collecting badges and points rather than on educational content. These gamification elements, especially in long duration activities, can be boring and frustrating to some students. In other words, positive results can just emerge in short-term gamified activities (Ghaban & Hendley, 2019). On the other hand, Glover (2013) stated that time-limited activities can apply to reduce reward addiction. Contrary to Glover's statement, in this study, the time limitation for competitive tasks caused to worry about failing to complete tasks and stress in students at the lowest percentages. This is an interesting finding, even if it is at the lowest percentages. Fiş Erümit and Karakuş Yılmaz (2022) revealed similar result with this study.

The half of students reported that collaborative activities and competitions as excitement-booster increased the interaction between peers and triggered the desire to be at the top of leaderboard. Similarly, Ghaban and Hendley (2019) emphasized that gamification supports the socialization of learners. Bai et al. (2021) stated the positive attitudes of many towards the leaderboard in order to keep competing with each other. Glover (2013) stressed that the leaderboard can be used to encourage collaboration as well as competitive activities. In this way, it can be a powerful motivator. However, one-fourth of students reported that these cooperative activities and competition disrupted their peer relations and caused excessive ambition. While competitive gamified learning intervention provides individual motivating, it can lead to negative emotions. Some students do not want to compete with peers as it reduces their motivation. Therefore, competitive activities should be integrated by considering individual differences into a gamified learning context to avoid the de-motivating effect (Buckley & Doyle, 2017; Buckley et al., 2017; Domínguez et al., 2013; Kyewski & Krämer, 2018; Pakinee & Puritat, 2021).

The main function of such a gamified process is to enable students with different learning styles to participate in goal-oriented activities and improve their learning outcomes (Buckley & Doyle, 2017). The fact that enablers are the more than barriers in this study proves the positive perspectives of the participants towards gamified learning process, even if they have different learning styles. It can be said that these motivators are the key factors for effective gamification process. As Deterding (2012) emphasized, designing gamified processes that use social psychological processes effectively by considering individual differences will help improve learning outcomes. Furthermore, as different participants enjoy different gamification elements, it is important to design gamified learning process which is suitable for a variety of participant types (Fan et al., 2015; Fitz-Walter et al., 2017; Kwon & Özpolat, 2021).

CONCLUSION, LIMITATIONS, AND IMPLICATIONS

This study with 7-week gamified implementation pointed out of the role of students' learning styles on motivation and perception of them towards gamified learning process. It was determined that students with different learning styles had the high motivation and perception. It was found that the reflective, sensing, visual, and global students had the higher motivation averages than the active, intuitive, verbal, and sequential students whereas the reflective, intuitive, visual, and global students had the higher perception averages than the active, sensing, verbal, and sequential students. However, it was figure out that there was not any significant differences between categories of each learning style dimension in terms of motivation as well as perception. In addition, it was determined that there was a positive and above medium or high level correlations between motivation and perception of students by learning styles. It was also revealed that frequencies and percentages of enablers were the higher than barriers considering students' learning styles. Accordingly, it can be said that this gamified learning process cover a large number of elements that respond to the various needs of students with different learning styles. Although, regardless of learning style, some students were the less satisfied with the workload, competition, and reward system in gamified learning process, this situation did not result in a decrease the level of motivation and perception.

On the other hand, Buckley and Doyle (2017) stated that the characteristic differences of participants affect their reactions to various gamification elements. However, just a few studies focused on the effects of this parameter motivation and perception. For this reason, this study will be a reference for new research on face-to-face gamified learning process that will be based on learning styles model of Felder and Silverman (1988). Nevertheless, as a limitation of this study, there is no control group since students' motivation and perception were compared by learning styles. New studies may focus on comparing experimental and control groups in terms of learning style.

As a result, the gamification process should be investigated in detail, taking into account personality traits and learning styles, in order to ensure that students exhibit positive learning behaviors (Buckley & Doyle, 2017, Denden et al., 2021; Fan et al., 2015; Pakinee & Puritat, 2021).

Ethical Approval Procedure

Ethics committee approval was received for this study from the Ethics Committee of Graduate School of Educational Sciences at Atatürk University (Approval Date: April 11, 2023. Approval Number: E-30292544234-2300117196).

REFERENCES

- 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>
- 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>
- Buckley, P., Doyle, E., & Doyle, S. (2017). Game on! Students' perceptions of gamified learning. *Journal of Educational Technology & Society*, *20*(3), 1-10. <https://www.jstor.org/stable/10.2307/26196115>
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th Ed.). Thousand Oaks, CA: Sage.
- Denden, M., Tlili, A., Essalmi, F., Jemni, M., Chen, N. S., & Burgos, D. (2021). Effects of gender and personality differences on students' perception of game design elements in educational gamification. *International Journal of Human-Computer Studies*, *154*, 102674. <https://doi.org/10.1016/j.ijhcs.2021.102674>
- Deterding, S. (2012). Gamification: Designing for motivation. *Interactions*, *19*(4), 14-17. <https://doi.org/10.1145/2212877.2212883>
- 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
- 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>
- Earley, E. A. (2012). Effectiveness of virtual worlds in public health preparedness training (Doctoral dissertation, Capella University). <https://www.proquest.com/intermediatedirectforezproxy>
- 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/1QP6kBIiQmpQbTXL-08HSI0PwJ5BYnZW/1988-LS-plus-note.pdf>
- Felder, R. M. & Soloman, B. A. (1994). Index of learning styles questionnaire. <https://www.webtools.ncsu.edu/learningstyles/>
- Felder, R. M., & Spurlin, J. (2005). Applications, reliability and validity of the index of learning styles. *International Journal of Engineering Education*, *21*(1), 103-112. [https://wss.apan.org/jko/mls/Learning%20Content/ILS_Validation\(IJEE\).pdf](https://wss.apan.org/jko/mls/Learning%20Content/ILS_Validation(IJEE).pdf)
- Field, A. (2009). *Discovering statistics using SPSS* (3rd ed.). London: Sage.
- Fiş Erümit, S., & Karakuş Yılmaz, T. (2022). Gamification design in education: What might give a sense of play and learning? *Technology, Knowledge and Learning*, 1-23. <https://doi.org/10.1007/s10758-022-09604-y>
- Fiş Erümit, S., & Karakuş Yılmaz, T. (2021). 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>
- Fitz-Walter, Z., Johnson, D., Wyeth, P., Tjondronegoro, D., & Scott-Parker, B. (2017). Driven to drive? Investigating the effect of gamification on learner driver behavior, perceived motivation and user experience. *Computers in Human Behavior*, *71*, 586-595. <http://dx.doi.org/10.1016/j.chb.2016.08.050>
- Galbis-Córdoba, A., Martí-Parreño, J., & Currás-Pérez, R. (2017). Higher education students' attitude towards the use of gamification for competencies development. *Journal of e-Learning and Knowledge Society*, *13*(1), 129-146. <https://www.learntechlib.org/p/188128/>
- Ghaban, W., & Hendley, R. (2019). How different personalities benefit from gamification. *Interacting with Computers*, *31*(2), 138-153. <https://doi.org/10.1093/iwc/iwz009>
- Glover, I. (2013, June). Play as you learn: Gamification as a technique for motivating learners. In J. Herrington, A. Couros & V. Irvine (Eds.), *Proceedings of EdMedia-World Conference on Educational Media and Technology* (pp. 1999-2008). Victoria, Canada: Association for the Advancement of Computing in Education (AACE). <https://www.learntechlib.org/primary/p/112246/>
- 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>
- Hassan, M. A., Habiba, U., Majeed, F., & Shoaib, M. (2021). Adaptive gamification in e-learning based on students' learning styles. *Interactive Learning Environments*, *29*(4), 545-565. <https://doi.org/10.1080/10494820.2019.1588745>

- Kapp, K. M., Blair, L., & Mesch, R. (2014). *The gamification of learning and instruction fieldbook: Ideas into practice*. John Wiley & Sons.
- Keller, J. M. (2008). First principles of motivation to learn and e3-learning. *Distance education*, 29(2), 175-185. <https://doi.org/10.1080/01587910802154970>
- Keller, J. M. (1987). Development and use of the ARCS model of instructional design. *Journal of instructional development*, 10(3), 2-10. <https://link.springer.com/content/pdf/10.1007/BF02905780.pdf?pdf=button>
- Khenissi, M. A., Essalmi, F., Jemni, M., Graf, S., & Chen, N. S. (2016). Relationship between learning styles and genres of games. *Computers & Education*, 101, 1-14. <http://dx.doi.org/10.1016/j.compedu.2016.05.005>
- Krath, J., Schürmann, L., & Von Korfflesch, 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>
- Kutu, H., & Sozbulir, M. (2011). Adaptation of instructional materials motivation survey to Turkish: A validity and reliability study. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education*, 5(1), 292-311. <https://dergipark.org.tr/tr/download/article-file/39824>
- Kwon, H. Y., & Özpolat, K. (2021). The dark side of narrow gamification: Negative impact of assessment gamification on student perceptions and content knowledge. *INFORMS Transactions on Education*, 21(2), 67-81. <https://doi.org/10.1287/ited.2019.0227>
- Kyewski, E., & Krämer, N. C. (2018). To gamify or not to gamify? An experimental field study of the influence of badges on motivation, activity, and performance in an online learning course. *Computers & Education*, 118, 25-37. <https://doi.org/10.1016/j.compedu.2017.11.006>
- Luo, Z. (2022). Gamification for educational purposes: What are the factors contributing to varied effectiveness? *Education and Information Technologies*, 27(1), 891-915. <https://doi.org/10.1007/s10639-021-10642-9>
- 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>
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). Thousand Oaks, CA: Sage.
- 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>
- Oliveira, W., Hamari, J., Joaquim, S., Toda, A. M., Palomino, P. T., Vassileva, J., & Isotani, S. (2022). The effects of personalized gamification on students' flow experience, motivation, and enjoyment. *Smart Learning Environments*, 9(1), 1-26. <https://doi.org/10.1186/s40561-022-00194-x>
- Ong, D. L. T., Chan, Y. Y., Cho, W. H., & Koh, T. Y. (2013, July). Motivation of learning: An assessment of the practicality and effectiveness of gamification within a tertiary education system in Malaysia. In *Proceedings of World Academy Conference* (pp. 131-146). <https://core.ac.uk/reader/148366460>
- 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>
- Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior*, 69, 371-380. <http://dx.doi.org/10.1016/j.chb.2016.12.033>
- Samanci, N., & Keskin, M. (2007). Felder ve Soloman öğrenme stili indeksi: Türkçe'ye uyarlanması ve geçerlik-güvenirlilik çalışması. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, 8(2), 37-54. <https://dergipark.org.tr/en/download/article-file/1495081>
- Smiderle, R., Rigo, S. J., Marques, L. B., Peçanha de Miranda Coelho, J. A., & Jaques, P. A. (2020). The impact of gamification on students' learning, engagement and behavior based on their personality traits. *Smart Learning Environments*, 7(1), 1-11. <https://doi.org/10.1186/s40561-019-0098-x>
- 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>
- Werbach, K., & Hunter, D. (2012). *For the win: How game thinking can revolutionize your business*. Philadelphia: Wharton Digital Press.
- Werbach, K., & Hunter, D. (2015). *The gamification toolkit: Dynamics, mechanics, and components for the win*. 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>
- Zichermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. O'Reilly Media.