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ORIGINAL PAPER

Investigating the Effectiveness of Gamification on Group Cohesion, Attitude, and Academic Achievement in Collaborative Learning Environments

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Abstract
Although collaborative-learning as an instructional method has shown promising results since the 1970's, a number of significant problems within collaborative learning environments have been encountered. These problems relate to aspects of group dynamics including group cohesion, participation, communication, collaboration, and trust. Although the literature suggests various instructional techniques to increase group cohesion and learners' attitudes towards group learning environments, new methods and techniques should be explored in order to address and eliminate these problems. Gamification, which is the use of game elements and techniques in non-gaming environments, can be leveraged as a new method in order to increase group cohesion and group performance within collaborative learning environments. The aim of the current study is to investigate the effect of gamification (both online and face-to-face) on the attitudes of students towards group learning environments, their course, group cohesion, and their academic achievement. The study aims to promote learners' collaboration in groups utilizing gamification elements. In this quasi-experimental design study, gamified (44 students) and traditional (48 students) groups were compared. Although no significant difference was established between the gamified and traditional groups in terms of students' attitudes towards group learning environments and the course, the gamified group outperformed the traditional group in terms of group cohesion scores and team member evaluation scores.

Keywords Gamification · Collaborative learning · Group cohesion · Attitude

Introduction

Collaborative learning, which is based on Vygotsky's (1978) sociocultural theory has been a popular and effective teaching strategy since the 1970's. The theory argues that a learner cannot achieve an understanding of a new idea or concept without acquiring support from a teacher or peer. Prince (2004) defined collaborative learning as an instructional method where students work together in small groups in order to accomplish a common goal. However, there are various factors that can affect the outcomes of collaborative learning. In this respect, researchers have explored group dynamics including participation, collaboration, communication, trust, and cohesion, in order to clarify how and why teams or groups can progress to accomplish learning goals, (Greenlee and Karanxha 2010). Ku et al. (2013) found that positive team dynamics promoted higher levels of teamwork satisfaction. When teams are cohesive, team members are drawn to remaining together as a group (Schermerhorn et al. 2002). Although collaborative-learning techniques have shown promising results, Shea (1995) encountered a number of significant issues in collaborative learning environments including: many students strongly prefer to work alone and dislike dealing with the problems created by working in groups; several students are simply irresponsible, fail to do their assigned work, and leave the rest of the group to deal with their irresponsibility; and groups tend to have dominant members who often do the work and monopolize group discussions. These

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problems are all associated with relational group dynamics including group cohesion, participation, communication, collaboration, and trust. Sharing considerable time with other group members (Liang et al. 1995) and training together with those group members (Prichard and Ashleigh 2007) can positively impact on group cohesion and group performance. Although the literature suggests various teaching techniques for increasing group cohesion and learners' attitudes towards group learning environments, new methods and techniques should be explored towards eliminating problems in collaborative learning environments. Gamification, which is the use of game elements and techniques in non-game environments, can be leveraged as a new method in order to increase group cohesion and group performance in collaborative learning environments.

Gamification has promising outcomes in different domains including health, marketing, interactive systems, and education (Deterding et al. 2011; Hamari et al. 2014; Lee and Hammer 2011; Muntean 2011; Seaborn and Deborah 2015). Previous research on gamification in learning environments has mainly focused on engagement, motivation, academic achievement, satisfaction and attitude in learning environments (Çakıroğlu et al. 2017; Codish and Ravid 2014; Da Rocha Seixas et al. 2016; Leaning 2015; Marti-Parreño et al. 2016). Mechanics and dynamics from video games are used to gamify non-game environments (Deterding et al. 2011). Game mechanics include "points, levels, challenges, virtual goods and spaces, leaderboards, gifts, and charity" (Bunchball, 2010, p1.). Users are motivated by game mechanics because of game dynamics include "individuals' fundamental needs and desires, desire for reward, status, achievement, self-expression, competition, and altruism, among others" (Bunchball, 2010). Although there have been numerous gamification studies with promising results, the use of gamification in education should not be restricted to motivation, satisfaction, academic achievement, and engagement. There has been limited research undertaken with regard to the potential of gamification method to promote teamwork and group cohesion, which is still considered one of the problems in collaborative learning environments.

The current study is also significant in terms of its design, as one of the limitations of current gamification research is a lack of comparison between groups (Hamari et al. 2014). Furthermore, as suggested by Hanus and Fox (2015), gamification methods are best applied in online learning environments. In the current study, gamification dynamics and mechanics were embedded both in a face-to-face learning environment and an online learning environment in order to promote collaborative learning.

The aim of the current study is to promote learner teamwork with gamification dynamics and mechanics (online + face-to-face) in order to overcome problems associated with collaborative learning environments. The aim of the study was to promote learners' studying in groups with gamifying elements. Of the aspects of group dynamics, group cohesion, attitude toward group environments, academic achievement, team member evaluation scores, and attitudes toward the course were chosen as dependent variables. This study aims to answer the following research questions:

RQ1. Is there a significant difference between the gamified group and traditional group (control group) in terms of attitudes toward Information Technology course?
RQ2. Is there a significant difference between the gamified group and traditional group (control group) in terms of group cohesion?
RQ3. Is there a significant difference between the gamified group and traditional group (control group) in terms of team member evaluation?
RQ4. Is there a significant difference between the gamified group and traditional group (control group) in terms of attitudes towards group environments?
RQ5. Is there a significant difference between the gamified group and traditional group (control group) in terms of academic achievement?

Literature Review

Gamification

Although there are many definitions of gamification to be found in the literature, there is no common or well-established definition, as yet. Some of the definitions proposed are field dependent; Huotari and Hamari's (2011) definition highlights enhancing service and creating value in the marketing field, while Zichermann and Cunningham (2011) highlight engagement and problem-solving aspects. There are also definitions proposed by education researchers focusing on the instructional aspects of gamification (Deterding et al. 2011; Kapp 2012). Deterding et al. (2011) defined gamification as the use of game design elements and techniques in non-gaming environments. Kapp (2012) proposed a more specific definition of gamification as "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems" (p. 10).

Gamification is a concept related to entertainment games, or more generally games, and serious games. However, it is important to make the distinction among these terms. Entertainment games do not have planned educational goals as the primary goal is simply to have fun. On the other hand, serious games are based on an educational purpose and do not contain significantly entertaining components (Ulrich and Helms 2017). In serious games, real world problems are

implemented within a gaming environment. Gamification is a combination of these two concepts; the purpose being to instill the entertaining component of games into real world learning environments in order to support learning in a more engaging and entertaining way.

Gamification is an umbrella term which includes several components. Several frameworks (Bunchball 2010; Hunicke et al. 2004; Werbach and Hunter 2012) have been proposed to outline these components and the fundamental principles of gamification. One well-cited example is the Mechanics, Dynamics, and Aesthetics (MDA) framework (Hunicke et al. 2004), which was introduced to define game design elements. Another similar, yet simpler, framework was proposed by Bunchball (2010), which classified gamification into two elements as dynamics and mechanics. Even though there are certain differences in terms of these frameworks' terminologies, the gamification concepts and elements included are similar. Mechanics are the most concrete gamification components which determine the rules, procedure and algorithm of the game. Badges, points, virtual rewards, leaderboards, gifts, levels and challenges are the most commonly used examples of mechanics (Hamari et al. 2014). These elements are predefined by game designers so as to promote player engagement. On the other hand, dynamics are abstract concepts that emerge from players' interaction with the mechanics. Game designers use specific mechanics based on the dynamics to be achieved. Achievement, competition, status, reward, relationships, and emotions are all examples of gamification dynamics.

In recent years, gamification has become a popular practice and has been applied in a variety of domains including health and wellness (Seaborn and Deborah 2015), corporate training (Hamari et al. 2014; Sailer et al. 2017), interactive systems (Flatla et al. 2011), and education (Deterding et al. 2011; Hamari et al. 2014; Lee and Hammer 2011; Muntean 2011; Seaborn and Deborah 2015).

Gamification in Education

Gamification as a learning strategy has gained popularity in the education context due to its potential to promote motivation and learner engagement. It aims to make the learning experience more entertaining through the provision of innovative approaches to provide feedback, increase students' interest and stimulate learning desire (Muntean 2011). Furthermore, it can help educators to solve classroom participation issues (Kim et al. 2018) as gamification elements can keep learners in a state of flow in non-game activities (Zichermann and Cunningham 2011). Kim et al. (2018) proposed a definition for gamification practices in education context as; "Gamification in learning and education is a set of activities and processes to solve problems related to learning and education by using or applying the game mechanics" (p. 29).

There is a large body of literature exploring the benefits of gamification within an educational context. Research results have shown that gamification promotes; engagement (Çakıroğlu et al. 2017; Da Rocha Seixas et al. 2016; Leaning 2015), motivation (Hakulinen et al. 2013; Hoogveld and Paas 2002; Neeli 2012; Su and Cheng 2015), positive attitude (Yildirim 2017), learner participation and collaboration (Knutas et al. 2014; Li et al. 2013; McGonigal 2011; Moccozet et al. 2013), achievement (Çakıroğlu et al. 2017; De-Marcos et al. 2016; Su and Cheng 2015; Yildirim 2017), and behavioral change (de Sousa Borges et al. 2014; Hakulinen and Auvinen 2014; Lee and Hammer 2011).

It is important to note that integrating gamification elements does not guarantee their effectiveness. Effectiveness depends on how it is implemented (Hamari et al. 2014), as well as learner characteristics and context (Buckley and Doyle 2017). It requires significant effort and good planning in order to match gaming elements with instructional objectives. As underlined by Kapp (2012), appropriate gaming strategy and the use of game elements should be decided based on the characteristics of the learning environment and instructional goals. Furthermore, entertaining gamification components in non-game environments might not always result in the behavioral change being sought (Fitz-Walter et al. 2017). Finally, Nicholson (2015) warned about the limitation of gamification considering Skinner's operant conditioning theory; that whilst it can motivate players in the short term as players perform the desired behavior as long as they receive the rewards, it can just as easily fade away when the rewards are stopped. In addition, Nicholson (2015) argues that for long-term change to be effectual, gamification systems should be used for the initial establishment and that the system should fade away so as to create an authentic transition from the gamification environment to a real-world setting.

Learner Engagement and Attitudes in Gamified Learning Environments

A significant body of the latest gamification research in higher education has focused on the engagement and attitudes of learners (de Sousa Borges et al. 2014; Marti-Parreño et al. 2016). Engagement is defined as the level of interest and enjoyment experienced in a task (Shernoff 2013), and can be classified as academic, affective, cognitive, and social (Finn and Zimmer 2012). Gamified learning environments offer promising affordances to foster learners' motivation and engagement (Denny 2013; Domínguez et al. 2013; Su and Cheng 2015). Similarly, it can positively influence learners' attitudes towards the learning environment (Yildirim 2017). It is important to note that integrating game mechanics into the learning experience does not guarantee increased engagement

or positive attitudes as several factors also need to be considered. Nicholson (2012) argues that gamification mechanism needs to be user-centered, meaning that activities should be made relevant to the user. Lee and Hammer (2011) linked effectiveness of games in general with engagement; in that games allow students to make mistakes and retry without fear which results in increased student engagement.

Finally, gamification might not be an effective method to promote engagement for all learner profiles, as some learners might not even like gamification mechanics such as badges and leaderboards (Hakulinen and Auvinen 2014; Hamari 2013; Hanus and Fox 2015). In their study, Abramovich et al. (2013) reported that while the use of badges positively impacted on the performance of low-performing students, they found no such impact on already high-performing students. Similarly, Hakulinen and Auvinen (2014) revealed that the effectiveness of badges were dependent on students' goal orientation, reporting that not all high-performing students were motivated by the prospect of accumulating badges. Finally, Hanus and Fox (2015) argued that gamification as a new method might have a novelty effect, which means that after learners become familiar with this new form of teaching their excitement and motivation might wane and decrease.

To conclude, much of the research in terms of gamification in education has focused on its potential to enhance affective constructs. However, several researchers have underlined the need to be cautious about learner profile awareness, implemented context, and activities conducted prior to integrating game mechanics within a learning environment.

Group Cohesion in Collaborative Learning Environments

Group cohesion in learning environments is an important factor for both group members' performance as well as the overall group's performance. Lawler et al. (2000) defined group cohesion as "the perception of the group as a unifying force or object" (p. 620). They underlined that higher group cohesion should motivate members to stay in the group, encourage them to take initiatives to achieve the group's common goal, and avoid members to take action against other group members. In learning environments, higher group cohesion motivates learners to accomplish the collaborative task while lower lower group cohesion may cause conflicts among group members and even make such tasks as an obstacle to learning. Therefore, in collaborative learning environments group cohesion should be promoted as an attractive force between individuals.

Gamification's impact on group-based learning is an area that needs to be investigated. Marti-Parreño et al.'s (2016) text-mining-based analysis of gamification research revealed that the relation between gamification and social interaction to be one of the least investigated topics. The available studies investigated the collaboration among group members and learning outcomes, and concluded that gamified learning has the potential to foster collaboration and interaction within the group environment (Marti-Parreño et al. 2016). In their study, Knutas et al. (2014) reported that gamification elements were effective in promoting collaboration and peer support within the online learning environment. In another study, it was reported that integrating gamification components to an online social network-based learning environment increased student engagement and collaboration (Li et al. 2013). Beside these favorable research results, some scholars (Hanus and Fox 2015) underlined the risks of gamification's competitiveness and social comparison, arguing that gamification competition elements such as badges and leaderboards has potential negative effects on students' motivation and satisfaction. Thus, it is of significant importance to investigate gamification's effectiveness on group cohesion and group members' attitudes in group-based learning environments.

Achievement in Gamified Learning Environments

Gamification research has shown that affective affordances is the major driver of integrating game mechanics into learning environments (Dickey 2007). In addition to affective constructs, gamification's effect on learning performance is one of the most important questions that needs to be investigated. In their extensive analysis of gamification literature using text-mining analysis, Marti-Parreño et al. (2016) revealed that effectiveness and assessment was one of the most investigated constructs. They further revealed that cognitive outcomes, mainly declarative and procedural knowledge and retention of learners, were the primary focus of gamification researchers. Gamification has the potential to enhance high-order thinking skills, declarative knowledge, and test performance (Kim et al. 2018). Previous research has revealed that gamification has been used to increase the academic achievement of learners in various domains, including media theory (Leaning 2015), ICT (Çakıroğlu et al. 2017; Domínguez et al. 2013), geometry (Da Rocha Seixas et al. 2016), science education (Su and Cheng 2015), and engineering education (Barata et al. 2013; Codish and Ravid 2014). De-Marcos et al.'s (2016) study shed light on the social aspect of gamification, with the researchers suggesting that the combination of gamification and social approaches has promising potential to enhance students' learning performance.

It is important to note that integration of gamification does not guarantee enhanced learning performance (Chang and Wei 2016; Jackson and McNamara 2013) as characteristics of content, learners, and the learning environment itself are all major factors that affect learning and performance outcomes. In fact, several studies have revealed mixed results in terms of gamification's role in learner achievement. In his study conducted with

undergraduate students, Leaning (2015) reported that although students enjoyed the gamified form of a course more than the non-gamified traditional form, no significant difference was found in the assessment performance of students. Similar mixed results were reported by other researchers (Attali and Arieli-Attali 2015; Hanus and Fox 2015). According to Codish and Ravid (2014), the common and most straightforward mechanics of leaderboards and points awarded work well for introverts, but can negatively affect extroverts. Similarly, rewards can work well for extroverts and less favorably for introverts. Researchers have highlighted the potential risks of applying gamification in education, showing that different learner personalities may perceive similar solutions in different and even very negative ways.

Method

Participants

The study's participants were 92 s-grade undergraduate students attending the Faculty of Education at a state university in Turkey. The participants were from two classes enrolled in an "Information Technology" course. The aim of the course was to enable preservice teachers to use appropriate current instructional technologies and applications in their future lessons in order to make their lessons more effective, to be aware of the current literature, and to be able to design and develop appropriate materials.

The participants were from various Education Faculty departments including Mathematics and Science Education, Elementary and Early Childhood Education, and Turkish Education. The mean age of the participants was 20 years old, ranging from 17 to 22 years. The mean daily Internet usage of the participants was four hours. While 33% of the students played digital games, 66% preferred not to. Just over half of the participants (53%) preferred Internet usage via their mobile phones, with the others preferring to use personal computers and/or the university's computer laboratories. The control group consisted of 48 students, whilst the gamification group consisted of 44 students.

Research Procedure and Design

The aim of the study was to investigate the effect of gamification (online and face-to-face) on the attitudes of students towards working as small groups, the course, and their academic achievement. It was aimed to promote learners' collaboration with the students working in groups utilizing gamification elements. In this respect, a quasi-experimental design was applied to the study. An instructor taught two classes, with one class as the control group and the other as the gamification group. For both classes, the course consisted of 27 h of in-class instruction, with the same curriculum and identical syllabus, exercises, tasks and exams over a 13 weeks semester. There were 12 groups in each class, with each group consisting of three or four students. The gamification group was supported with a gamified online platform in which the students were awarded badges, could follow their scores and the leaderboard, and had the opportunity to compete with the other student groups.

Learners' attitudes toward the course and their attitudes towards working within small groups were measured as pretests before the experimental process in order to investigate if the students' entry levels were the same in both the control group and the gamified group. After the pretests, five weeks of lecture sessions were provided, in which the two groups studied the same theoretical framework with the same instructor. Following these lecture sessions, a period of eight weeks of practical sessions began in which the gamified elements were integrated into the teaching environment for the gamified group.

Students from the gamified group were informed about the tasks they were assigned, how they could earn points and badges, and the importance of the group study exercise. The students formed their own groups, choosing the group members and their group's name.

Edmodo was the online system used to promote gamification. In Edmodo, learners can share their work and opinions on a discussion board, look at their task requirements, and keep track of their points, badges, and the leaderboard each week. In the practical sessions, there were four tasks assigned that had to be completed collaboratively. Each task was expected to be completed prior to a given deadline. After completing each task, all the groups presented their projects in the class and voted on each other's projects via an online voting system. This implementation promoted learners to compete with each other at a group level. After the voting of the projects, learners voted on their group members in terms of their individual participation in the group study. All of those results were then applied as group and individual points and badges appointed accordingly (see Fig. 1 and Table 1). On the other hand, the control group also performed the same tasks and also within small groups. However, they did not receive any points or earn any badges. The control group were also not promoted with gamifying elements to perform tasks, to become social within an online platform, or to study collaboratively.

After completion of the lecture and practical sessions, learners' attitudes toward the lesson, their attitudes towards working as small groups, group cohesion, and their academic achievement scales were implemented as posttests. Independent samples *t*-test and ANCOVA were conducted as statistical analyses using IBM's SPSS statistical software program.

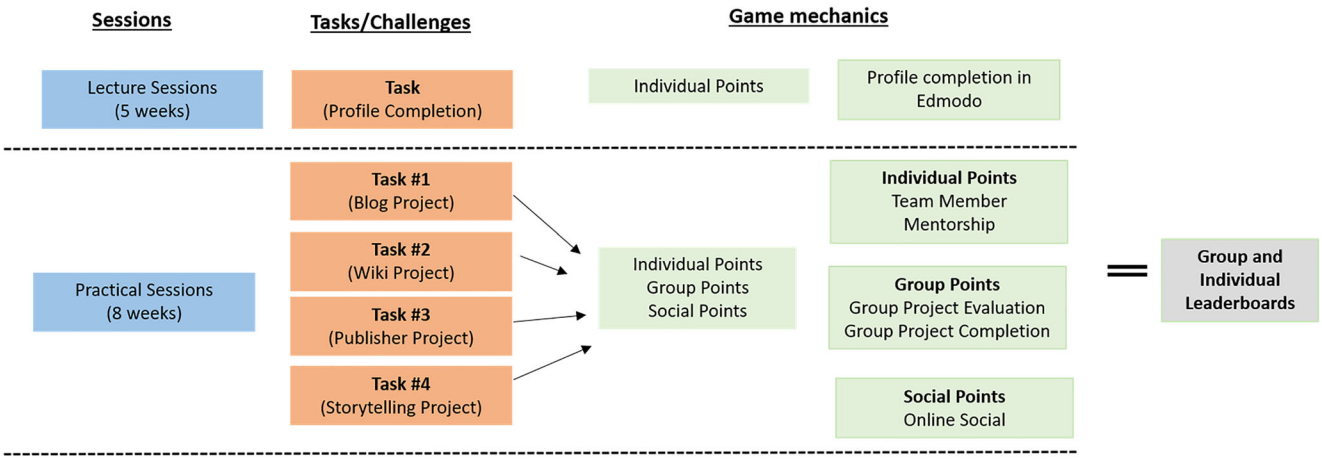


Fig. 1 Gamification Elements

Game Components that Can Be Used in Learning Environments

In the present study, following game components were integrated by taking into consideration the course content, dynamics of the course, and learners.

Badges/Points/Leaderboard: According to Kapp (2012), the least exciting and least useful elements in gamification are badges, points, and rewards. The real power of game-based thinking is in the engagement, challenge, and problem solving it offers. In the current study, the students collected points after task completion which were used for keeping score of their progress. It also provided players with a feedback system to keep track of their progress. After accomplishing tasks with high points, students earned badges based on their scores. The highest scores and earned badges were shared in the online platform (Edmodo) via leaderboards. Allowing for recognition and reward by teachers and from peer students is one of the main aspects of gamification. The important thing is that the badges, points, and the leaderboard symbolize "achievement."

Goals: Course objectives were turned into game goals which were explained at the beginning of the course. Students could see the course goals via Edmodo whenever they wanted.

Challenges/Tasks: Individual and group tasks to accomplish course goals were used as challenges or tasks. "Breaking down complex tasks into shorter and simple subtasks allows students to complete small subtasks within a larger task and help them to deal with complexity through a divide and conquer approach" (Simoes, Redondo & Vilas, 2013, p. 348). In gamification tasks, difficulty should be increased as students' skills improve (Simoes, Redondo & Vilas, 2013).

Characters: Each student was expected to complete their own profile in Edmodo, and also to design their own avatar/profile picture.

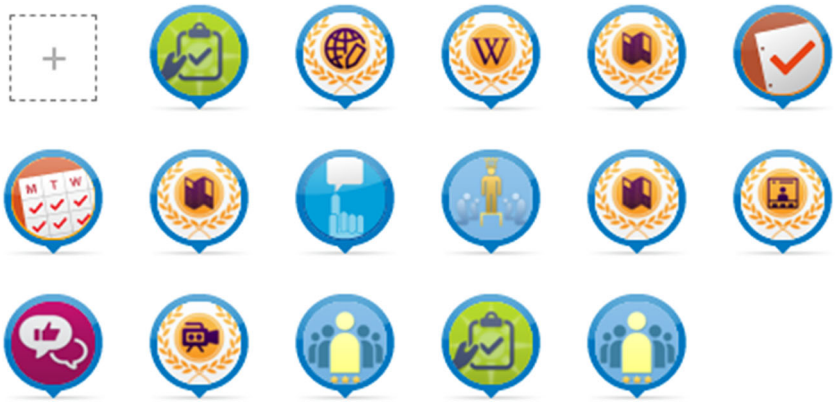
Rules: Each course task had its own set of rules to be accomplished, which were carefully explained prior to each task.

Collaboration/Social Activities: The primary course tasks required collaboration in order to be successfully accomplished. Group tasks/quests required group participation before being able to move forward and collect badges. The

Table 1 Badges with Explanations

Badge	Badge Name	Points	Reason for award
Individual	Profile Completion	10	Edmodo profile completed
Individual	Best Team Member	30	Following group members evaluating their group peers
Individual	Mentorship	20	Student who reached a total of 100 points. Mentors then help and advice other students
Individual	Online Social	10	Participation in online platform and contribution in online discussions
Group	Task Completion	20	Having completed a group task
Group	BlogMaster	30	Top three groups for the blog project
Group	WikiMaster	30	Top three groups for the wiki project
Group	PublisherMaster	30	Top three groups for the publisher project
Group	Digital Scenarist	30	Top three groups in for the digital scenarist project

Fig. 2 Badges in Edmodo



system should reward students not only for their academic achievements, but also for proper behavior and social engagement such as students helping their peers, commenting, and adding value to the online system (Muntean, 2011). In the current study, mentoring, giving feedback to other students' work, commenting/creating posts, sharing knowledge in Edmodo were all rewarded by badges and points.

Competition: When competing, as in a game, there is an adrenaline rush that keeps the player engaged and task-focused. The outcomes of the group tasks were presented in the classroom in order to be voted on by other groups and the instructor. The groups were in competition to achieve the highest score.

Feedback: After each task, the groups received feedback from the instructor and from other groups' members. The feedback helped the "students to improve their strategy and to increase their chances of success at the next attempt" (Simoes, Redondo & Vilas, 2013, p.348).

Levels: In the course context, levels are equal to learning units. They can also indicate the rating of players based on their score. Moreover, learner who achieved the highest score became the "mentor" of that week. It makes students feel as if they studied hard enough to prove their status and show off their skill. When a low-scoring student has a question, they can connect with a mentor who has "been there, done that," and someone who the low-level student may want to emulate.

Gamified Learning Environment

Edmodo was used as the gamified online platform in which all groups and their members could follow their status, information about the assigned tasks and their deadlines, instructions on how to be awarded badges and points, their earned individual and group badges, the leaderboard, as well as course-related announcements.

During the first five weeks of the course, the theoretical lectures were completed. Each student completed their own profile in Edmodo in order to obtain their first *profile completion badge* (see Figs. 1 and 2, Table 1). In the following practical sessions, there were four tasks that were required to be completed collaboratively. Each task was expected to be completed before a given deadline (*task completion badge*). After each task, the groups presented their projects to the rest of the class, and each group then voted on the other groups' projects (*BlogMaster badge, WikiMaster badge, PublisherMaster badge,* and *Digital Scenarist badge*). Following the project evaluation, each group member evaluated their own team members' contribution to the project (*best team member badge)*.

At the end of each task, the individual and group leaderboards were shared on Edmodo, which presented the top three students or groups. Moreover, students were able to earn points and badges as they become social in the online platform Edmodo (*online social badge*). Students who reach the 100 points threshold earn their first *mentoring badge*. This badge was designed in order to promote students' willingness to provide help and advice to other group members. Students in the gamification group were encouraged to study collaboratively, both face-to-face and within the Edmodo online platform.

Data Collection Instruments

Group Cohesion Scale

Price and Mueller's (1986, as cited in Alsancak 2010) Group Cohesion Scale was adapted to the Turkish context by

Table 2 MANCOVA Results in terms of Attitudes towards Information Technology Course

	Value	F	Hyp. Df.	Error df.	p
Wilks' Lambda	.9-85	.-71	524	2	.5-9

Alsancak (2010), and administered in the current study in order to investigate group cohesion. The scale is a five-point, Likert-type instrument consisting of nine items. The Cronbach's alpha value for the scale was calculated to be .92. The scale consists of items such as how other team members were helpful and whether or not team members were willing to be part of the same group again etc.

Student Attitudes Towards Group Environments Scale

The Student Attitudes toward Group Environments (SAGE) developed by Kouros and Abrami (2006) was administered to measure the students' attitudes towards the group environment. This scale was adapted to the Turkish context (as the learners' native language for the current study) by Karakus Yılmaz et al. (2017). The scale consists of four factors, revealed by Exploratory Factor Analysis (EFA), as "quality of product and process" ($\alpha = .76$), "individual contribution and outcome" ($\alpha = .75$), "student interdependence" ($\alpha = .70$), and "frustrations with group members" ($\alpha = .63$) (Karakus Yılmaz et al. 2017).

Attitudes toward Lessons Scale

Anbarli Kirkiz's (2010) Attitudes toward Lessons Scale was adapted for Information Technology lessons in order to investigate learners' attitudes toward the lesson. The points of the scale range between 20 and 100. The Cronbach's alpha value for the whole scale was calculated to be .93. Two factors were used in the current study, those being "general attitudes" and "course content". Cronbach's alpha value for the "general attitudes" factor was calculated to be .83, and for the "course content" factor was .85.

Academic Achievement Test

An academic achievement test was prepared by the instructor and the researchers according to the objectives of the course. The test included both multiple-choice and open-ended questions. The test was reviewed by three experts in order to check its content validity. The test was performed at the end of the course in order to obtain the academic achievement scores of the participants.

Results

Is there a Significant Difference between the Gamified Group and Traditional Group (Control Group) in Terms of Attitudes toward Information Technology Course?

MANCOVA (Multivariate Analysis of Covariance) requires independence of measures, a linear relationship between each pair of dependent variables within each group of the independent variable, a linear relationship between the covariate and each dependent variable within each group of the independent variable, homogeneity of variances and covariances, and multivariate normality. MANCOVA assumptions were all met. There were two factors (dependent variables) including "general attitudes" about the course and "course content" in the scale of Attitudes towards Lessons. After adjusting for pretest scores, there was no statistically significant difference between gamified group and traditional group on the combined dependent variables, $F\ (2, 71) = .524$, $p > .05$, *Wilks'* $\Lambda = .985$ (See Table 2).

Is there a Significant Difference between the Gamified Group and Traditional Group (Control Group) in Terms of Group Cohesion?

Assumptions of independent sample *t*-test including normality and homogeneity of variance were met. Results of the *t*-test revealed that a significant mean difference was found between the control and gamification groups in terms of group cohesion scores ($p < .05$, $t\ (90) = 4.03$); with the gamification group ($M = 4.07$, $SD = .83$) reporting higher group cohesion scores ($M = 3.06$, $SD = 1.45$, $d = .83$) (Table 3).

Is there a Significant Difference between the Gamified Group and Traditional Group (Control Group) in Terms of Team Member Evaluation?

After each task, each team member evaluated their peer team members in terms of their contribution to the group task. Assumptions of the independent sample *t*-test including normality and homogeneity of variance were met. Results of the *t*-test showed a significant mean difference was found between the control and gamification groups in terms of team

Table 3 Independent *t*-Test Results in terms of Group Cohesion

	t	df	p	MD	SE	d
Group Cohesion (Equal variances assumed)	4.032	90	.000	1.00	.25	.83

Table 4 Independent *t*-Test Results in terms of Team Member Evaluation

	t	df	p	MD	SE	d
Team Member Evaluation (Equal variances assumed)	2.20	90	0.03	8.98	4.07	.45

member evaluation scores ($p < .05$, t (90) = 2.20); with the gamification group ($M = 77.09$, $SD = .83$) reporting higher team member evaluation scores than the traditional group ($M = 68.10$, $SD = 1.45$, $d = .45$) (Table 4).

Is there a Significant Difference between the Gamified Group and Traditional Group (Control Group) in Terms of Attitudes Towards Group Environments?

MANCOVA requires independence of measures, a linear relationship between each pair of dependent variables within each group of the independent variable, a linear relationship between the covariate and each dependent variable within each group of the independent variable, homogeneity of variances and covariances, and multivariate normality. MANCOVA assumptions were all met. There were four factors (dependent variables) including "individual contribution and outcome," "quality of product and process," "student interdependence," and "frustrations with group members" in the scale of Attitudes Towards Group Environments. After adjusting for pretest scores, there was no statistically significant difference between gamified group and traditional group on the combined dependent variables, F(4, 68) = .98, p > .05, Wilks' Λ = .945 (see Table 5).

Is there a Significant Difference between the Gamified Group and Traditional Group (Control Group) in Terms of Academic Achievement?

Independent sample *t*-test was conducted. According to the *t*-test results, a significant mean difference was found between the control and gamification groups in terms of academic achievement scores ($p < .05$, t (90) = 3.14); with the gamification group ($M = 76.4$, $SD = 14.23$) reporting higher academic achievement scores ($M = 65.1$, $SD = 19.70$, $d = .65$) (Table 6).

Table 5 MANCOVA Results in terms of Attitudes toward Group Environments (four factors)

	Value	F	Hyp. Df.	Error df.	p
Wilks' Lambda	.945	.-68	988	4	.420

Discussion and Conclusion

The results of this study showed that employing gamification in collaborative learning environment promoted group cohesion and achievement while it did not have any effect on the attitude of students towards the course and group learning environment. This implies that gamification elements acted as an attractive force between group members which led to higher commitment and better learning. On the other hand, gamification components did not change students' attitudes.

The real power of game-based thinking is in its engagement, challenges, and opportunities for problem solving. Behavioral engagement relates to participation which means involving in academic and social activities, and these are all crucial for academic achievement (Fredricks et al. 2004). Users can be motivated by game mechanics due to game dynamics such as an individuals' fundamental needs and desires; including their desire for reward, status, achievement, self-expression, competition, and altruism among others (Bunchball 2010). In the current study, face-to-face learning and online learning environment were supported with gamification dynamics and mechanics. The focus of applying gamification elements was to respond to the individual fundamental needs and desires of the students, their self-expression, competition, and altruism among others. Comparison of the traditional (control) and gamified groups revealed that in the gamified group there was a higher group cohesion and more positive feedback about group members, while there was no difference seen in terms of their attitude towards group-based learning. These findings explain that the gamification components promoted collaboration within the group. The results indicate that group members were more motivated to achieve the group's goals and they tended to help and trust each other more in the gamified group.

Collaborative tasks have very complex structures and the dynamics among group members can significantly affect the overall learning process. Sharing a significant amount of time with group members (Liang et al. 1995) and training together with other group members (Prichard and Ashleigh 2007) can positively impact on group cohesion. Due to the fact that gamification creates a competitive environment, it is important to investigate its effect on group members' perception of each other. Some scholars, such as Hanus and Fox (2015), underlined the risks of gamification's competitiveness and social comparison, arguing that gamification competition elements such as badges and leaderboards can potentially negatively affect students' motivation and satisfaction. The findings of this study support the opposite argument; in the

Table 6 Independent Sample *t*-Test Results in terms of Academic Achievement

	t	df	p	ME	SE	d
Academic test (Equal variances assumed)	3.14	90		.0-0	11.37	
3.61	.65					

gamified group the peer review scores of team members were found to be higher than those of the traditional group. In other words, team members of gamified groups perceived their peers as working harder and contributing to the common goal of the group more. These findings are consistent with the findings of Knutas et al. (2014) which reported that gamification elements were effective in promoting collaboration and peer support within an online learning environment.

Group cohesion and attitudes toward group learning environments are important factors that motivate participants to accomplish their assigned tasks collaboratively. Therefore, gamification components were used to investigate the impact on students' attitudes towards group learning environments. In the current study, when gamification dynamics and mechanics were embedded both within face-to-face and online learning environments in order to promote collaborative learning, it was expected that it would create a positive impact on both group cohesion and attitudes of learners. However, although the group cohesion scores were found to be higher in the gamified group, there was no significant difference found in terms of the students' attitudes towards collaborative learning environments (through factors of "quality of product and process," "individual contribution and outcome," "student interdependence," and "frustrations with group members"). Whist components of gamification including competition, collaboration, rewards, badges, and leaderboards positively impacted on group cohesion scores, the lack of any change in attitude scores might be explained by the fact that impacting learners' attitudes is a much more drawn out process. Furthermore, as claimed by Codish and Ravid (2014), the common and most straightforward mechanics of leaderboards and points may not work well for all students. In this respect, it is crucial to conduct a qualitative study for a greater and more in-depth understanding of factors affecting preferences or performances of individuals that cannot be observed through the examination of quantitative data alone.

Another investigative factor was the gamification's effect on the students' attitudes towards their course. Although previous studies reported positive effects of gamification on learners' attitude (Yildirim 2017), the results of the current study showed no such effect. The current study's results indicated that although gamification mechanics had a positive influence on group internal dynamics, they did not affect the learners' overall attitude towards the course. Therefore, whilst researchers and practitioners might use gamification as a method of enhancing collaboration in group environments, students' attitudes towards their lessons might not be altered as a result. Furthermore, attitude is a construct that requires a greater longevity for changes to be observed. Due to the current study being only a relatively short-term intervention, this may be seen as a reason for not having observed any such change. Further studies with longer interventions may be needed in order to conclude the overall effect of gamification on attitude.

Finally, gamification's effect on achievement formed another research question investigated in the current study. Previous research has reported positive outcomes of gamification in terms of student academic achievement (Çakıroğlu et al. 2017; Da Rocha Seixas et al. 2016; Domínguez et al. 2013; Leaning 2015). The findings of the current study confirm these previous findings, as the gamified group's learning performance outperformed the traditional (control) group. This result can be better interpreted alongside other results; such as the gamified group performed better and with better collaboration, which in turn resulted in better student learning performance. Furthermore, De-Marcos et al. (2016) suggested that the combination of gamification and social approaches shows promising potential for the enhancement of students' learning performance. Along with the current study's findings, gamification can be considered as a catalyst factor in the collaborative group environment, which means that integrating this method to a traditional collaborative learning environment could also promote learning performance.

For instructors and instructional technologists, there are various take-aways from the current study. Gamification elements of this study did benefit student learning and group cohesion. These elements can be implemented in existing instructional content to promote collaborative learning. Gamification seems to have important potential for learners to perform better and enhance team collaboration, which in turn result in better student learning performance. Furthermore, online learning platforms, such as Edmodo, can be used as a technology to promote gamification as in such platforms gamification elements can be embedded easily to facilitate face-to-face instructions.

There were several limitations associated with the current study, as is the nature of all research. First of all, the participants of the study were limited to a relatively small group of university students. The study could therefore be replicated with a greater number of students from different academic levels and different age-groups. The other limitation of this

research was the possible defensiveness of the participants. Students may have attempted to defend themselves when completing the self-reported questionnaires. The students may have wanted to appear different, even though they did not write their names on the questionnaires. They might have been less likely to be honest in order to seem different.

In the future, the effect of gamification on other group dynamics including participation, communication, and trust could be explored. The current study could be replicated with a greater number of students and from different age groups or academic levels. The current study was a comparative experimental study; however, it would be interesting to conduct a qualitative study for a greater and more in-depth understanding of situations that cannot be observed through the examination of quantitative data alone.

Data Availability The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Compliance with Ethical Standards

Disclosure of Potential Conflicts of Interest The authors declare that they have no potential conflicts of interest on the development of this article.

Research Involving Human Participants and/or Animals This article does not contain any studies involving animals performed by any of the authors.

Informed Consent Informed consent was obtained from all individual participants involved in the study.

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