

# *An experimental study on the effects of gamified cooperation and competition on English vocabulary learning*

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## **Abstract**

Gamification has become a popular approach to blending learning with fun and enjoyable experiences. However, gamification research has been criticized for mostly focusing on game mechanics and related outcomes while paying little attention to the psychological processes that mediate the relationship between these mechanics and outcomes. Furthermore, the majority of existing gamification studies have focused on competitive game features. Thus, the full potential of cooperative gamification has yet to be explored. Given this background, the current study compared how gamified cooperation and competition impact task effort, learning achievement, motivation and social relatedness in English vocabulary learning with a mobile application. The study utilized Social Interdependence Theory to explicate the psychological processes in gamified cooperation and competition. 75 participants were randomly assigned to either the gamified cooperation or the gamified competition condition and studied English vocabulary for 14 days. No difference was observed between the conditions regarding task effort, learning achievement and motivation. However, social relatedness in the gamified cooperation group was significantly higher than in the gamified competition group. The current findings emphasize that the positive influence of gamified cooperation on creating meaningful connections amongst learners should not be ignored, even though it facilitates similar learning and motivational outcomes as gamified competition.

## **Introduction**

Mobile devices (eg, smart phones) have become valuable tools for language learning (Sung, Chang, & Yang, 2015). This is mostly because they enable access to the learning content anywhere and anytime (Baldauf, Brandner, & Wimmer, 2017). Furthermore, it is possible to design learning

**Practitioner Notes**

What is already known about this topic

- Gamification facilitates enjoyable learning experiences.
- Leaderboards and badges are common gamification implementations.
- Gamification studies have mostly focused on competitive game features.
- Social Interdependence Theory posits that cooperative learning yields better learning outcomes compared with competitive learning.

What this paper adds

- Links gamification features with psychological processes.
- Tests the assumptions of Social Interdependence Theory in gamified language learning.
- Compares the impact of gamified cooperation and gamified competition on motivational, social and learning outcomes.

Implications for practice and/or policy

- Gamified competition can be as effective as gamified cooperation in terms of learning achievement.
- Gamified competition can be as motivating as gamified cooperation.
- Teachers can prefer gamified cooperation to gamified competition to foster stronger social relationships amongst the learners.

environments for mobile devices with personalized learning experiences, continuous practice opportunities and instant feedback (Ahn & Lee, 2015; Golonka, Bowles, Frank, Richardson, & Freynik, 2014). Consequently, mobile-assisted language learning has gained significant attention in recent years, and an increasing amount of research has been conducted to enhance learner engagement and learning outcomes on mobile learning platforms (Dehghanzadeh, Fardanesh, Hatami, Talaei, & Noroozi, 2019). One emergent interest regarding this issue concerns the utilization of gamification in mobile-assisted language learning.

Gamification refers to the application of game mechanics and game thinking in non-gaming contexts (Hamari, Koivisto, & Sarsa, 2014). Studies have shown that individuals are more likely to engage with activities that are enjoyable and fun for them (Nakamura & Csikszentmihalyi, 2003). Drawing on this, the premise of gamification is that blending learning experiences with game elements would lead to increased motivation, task engagement and performance outcomes in a learning activity. Some studies have found support for this assumption (Dehghanzadeh *et al.*, 2019; Hamari *et al.*, 2014), whereas others have reported mixed results (Garland, 2015).

Gamification research has been criticized for yielding context-dependent results rather than a generalizable theory (Helmefalk, 2019). Unfortunately, gamification research has mostly focused on the effects of game mechanics on particular outcomes (eg, motivation and behaviour) while dismissing the psychological processes that mediate the relationship between these mechanics and outcomes (Sailer, Hense, Mayr, & Mandl, 2017). Therefore, it is difficult to draw causal inferences about why particular game mechanics produce contradictory outcomes in different contexts.

The most common gamification forms include badges and leadership boards (Looyestyn *et al.*, 2017). With the former, players are given a badge when they complete a task or reach a specific milestone in the game (Roy & Clark, 2019). Meanwhile, leadership boards rank game

players according to a performance criterion. Previous research has mostly utilized game elements (including leadership boards and badges) either in the form of competing with others or competing with oneself (Hanus & Fox, 2015; Looyestyn *et al.*, 2017). Thus, the current literature offers limited knowledge about the use of gamification elements in promoting cooperation amongst learners (Morschheuser, Hamari, & Maedche, 2019).

There has been a growing interest to utilize gamification in English vocabulary learning in recent years. Several studies have found that gamified English vocabulary learning facilitates higher motivation and engagement amongst the students (Abrams & Walsh, 2014; Chiang, 2020; Guaquate & Castro-Garces, 2017; Hasegawa, Koshino, & Ban, 2015; Homer, Hew & Tan, 2018; Lui, 2014; Medina & Hurtado, 2017; Sun & Hsieh, 2018). Numerous studies have also reported that gamified English vocabulary learning yields increased vocabulary learning (Abrams & Walsh, 2014; Guaqueta & Castro-Garces, 2018; Homer *et al.*, 2018; Ketyi, 2016; Lui, 2014; Zhou, Yu, Liao & Shi, 2017). In general, studies on gamified English vocabulary learning utilized points and badges to motivate students for individual vocabulary learning (Abrams & Walsh, 2014; Guaqueta & Castro-Garces, 2018; Hasegawa *et al.*, 2015; Homer *et al.*, 2018; Ketyi, 2016; Zhou *et al.*, 2017). So far, only few studies applied gamification for group learning activities. Such studies utilized various gamification applications to organize competitions during in-class vocabulary learning activities (Chiang, 2020; Medina & Hurtado, 2017; Sun & Hsieh, 2018). Overall, the social (ie, cooperation and cooperation) potential of gamification for English vocabulary learning has been explored to a limited extent.

To address these gaps, this study compares how gamified competition and cooperation impact task effort, learning achievement, motivation and social relatedness in English vocabulary learning with a mobile application. The current study draws on Social Interdependence Theory (SIT) to conceptualize the utilization of leadership boards and badges in designing gamified learning experiences in competitive and cooperative modes. The study extends the current understanding of the link between game elements, psychological processes and outcomes of game play (ie, behavioural, social and motivational outcomes). In addition, it demonstrates the potential of using SIT in designing gamified language learning environments.

### **SIT and gamification**

SIT is about social interaction, and it explains how goal structures in a group setting influences one's interactions with others (Johnson & Johnson, 1989). Social interdependence exists when group members can effect one's goal attainment. According to the theory, task goals in a group setting create either positive interdependence, negative interdependence or no interdependence (Johnson & Johnson, 2009). Positive interdependence occurs when one can only achieve his/her goals if all the other group members achieve their goals as well (Johnson & Johnson, 2005). In positive interdependence situations, groups succeed or fail as a whole. Thus, positive interdependence induces cooperation amongst the members, which is reflected as constructive communication, mutual help, trust, exchange of resources, knowledge sharing and social support (Johnson & Johnson, 2009). Negative interdependence exists when one can achieve his or her goals only if the others cannot achieve their goals (Johnson & Johnson, 1989). In negative interdependence conditions, the winner gets all the credit/reward whereas the losers get nothing. Consequently, negative interdependence induces competition amongst the group members, which results in less or ineffective communication, distrust, hiding information and misleading others (Gillies, 2016). No interdependence exists when one's goal attainment is not related to others' goal attainment (Johnson & Johnson, 1989). The lack of interdependence leads to individualistic efforts and behaviours since group members have no common or competing goals.

SIT has implications for gamification since competition and cooperation are essential dynamics in games. The prominent approach in gamification has been to stimulate competition amongst the participants by providing social comparisons amongst them (Morschheuser *et al.*, 2019). For example, many gamification implementations have utilized leaderboards where participants could compare their performance with others (de-Marcos, Domínguez, Saenz-de-Navarrete, & Pagés, 2014). Competition thus motivates individuals to master the game by valuing their competence via immediate comparisons (Morschheuser *et al.*, 2019). Furthermore, competition induces the excitement of performing better than other players (Dindar & Akbulut, 2014). Consequently, competition has been found to facilitate positive motivational outcomes such as enjoyment (Liu, Li, & Santhanam, 2013), engagement (Hamari *et al.*, 2014), flow experiences (Dindar, 2018) and future game play intention (Ryan, Rigby, & Przybylski, 2006). Several studies have also found a positive impact of competition on performance (Plass *et al.*, 2013). However, competition might also have detrimental effects on motivation and performance. For example, the high emphasis on winning rather than participating in the activity, or having unbalanced opponents (ie, novices playing against experts), might demotivate individuals to take part in competition (Liu *et al.*, 2013). Furthermore, competitive game elements (eg, leaderboards) can cause continuous stress for the less achieving individuals (Christy & Fox, 2014) and have negative effects on the social intimacy and connectedness amongst the competitors (Tripathi, 1992).

Cooperation has so far been applied to a limited extent in gamification (Morschheuser *et al.*, 2019; Star, 2015). Cooperation in gamification can be realized through introducing shared goals and rewards to the players (Johnson & Johnson, 1989; Tauer & Harackiewicz, 2004). It is known that a major motivation to play games is to belong to a team and work towards shared goals (Dindar & Akbulut, 2014, 2015). Players derive a strong satisfaction from overcoming challenges through team work (Rigby & Ryan, 2011). Furthermore, cooperating with others strengthens the social bonds within the group and facilitates social relatedness amongst its members (Deci & Ryan, 2000). Thus, having meaningful relationships and working towards a common goal boosts motivation and engagement in cooperative gamification implementations (Hamari *et al.*, 2014; Morschheuser *et al.*, 2019). However, it has also been noted that cooperation might hinder motivation and performance if the cooperative work interferes with individuals' autonomy (Deci & Ryan, 2000; Tauer & Harackiewicz, 2004).

SIT has been one of the most widely applied theories in educational psychology (Johnson & Johnson, 2009). Overall, studies in educational settings have found that individuals display higher task motivation, exert more effort on tasks and perform better in cooperative learning activities than competitive ones (Gillies, 2016). Considerable research has also found cooperation to be more beneficial than competition for players' socialization and psychological health (Chen & Pu, 2014; Peng & Hsieh, 2012). Confirming such findings, gamification studies have revealed that individuals put more effort into a task in gamified cooperation than in gamified competition (Marker & Staiano, 2015). Also, higher participation in group work and greater intimacy amongst group members were observed in gamified cooperation than in gamified competition (Chen & Pu, 2014; Morschheuser *et al.*, 2019). However, most of these gamification studies were conducted in non-educational settings. So far, only a few studies have compared the effects of competition and cooperation in gamified learning settings, and found no difference between them in terms of learning achievement (Ke & Grabowski, 2007; Plass *et al.*, 2013; ter Vrugte *et al.*, 2015). In addition, gamified competition and cooperation were found to equally contribute to the increased situational interest and enjoyment during gamified learning (Plass *et al.*, 2013). These findings are interesting because they contradict the general consensus about the superiority of cooperation over competition on learning outcomes and learner motivations in

conventional learning settings. To our knowledge, no study has compared the impact of competition and cooperation on the social relationships amongst the individuals in gamified learning. Thus, it is questionable whether, as assumed by SIT, learning with gamified cooperation leads to better social relatedness than gamified competition in gamified learning settings. Considering the limited amount of research on the topic and the inconclusive findings, the current study seeks to address this gap and investigate the impact of gamified cooperation and competition on task effort, learning achievement, motivation and social relatedness amongst learners on a mobile English vocabulary learning application. Our specific research questions are as follows:

**RQ1:** Is there a difference between gamified competition and gamified cooperation conditions in terms of effort to complete the English vocabulary learning tasks?

**RQ2:** Do gamified cooperation and competition conditions differ from each other in relation to learning achievement in English vocabulary learning?

**RQ3:** Is there a difference between gamified cooperation and competition conditions in terms of task interest and enjoyment in English vocabulary learning?

**RQ4:** Is the social relatedness amongst the learners in gamified cooperation conditions different than the social relatedness amongst the learners in gamified competition conditions?

## Methodology

### *Participants*

The participants of the study were 75 Chinese university students recruited from four different universities in China. Their ages varied between 18 and 26 ( $M: 20.55$ ;  $SD: 2.03$ ). The majority of them were female ( $n_{\text{females}} = 59$ ;  $n_{\text{males}} = 16$ ).

### *Procedure*

Participants were recruited through online advertisements published in the social media account of the Baicizhan mobile language learning application. There was no English language proficiency limit set for participation. The participants were dispersed across different geographical locations. Thus, all the communications—including research consent and data collection—were conducted through online platforms. As the first step, participants were asked to fill out a consent form that explained the nature of the study and the types of data to be collected. Then, the volunteers were randomly assigned to one of six experimental conditions in which they completed gamified English vocabulary learning either in (three) cooperation or (three) competition groups. The number of participants in each group ranged between 11 and 13. At the end of the study, four participants were awarded a gift card (each worth 45 euros) through a raffle. Participants were informed that they could quit the study any time they wished, and they could still win a gift card even if they withdrew from the study.

In the gamified competition condition, the mobile language learning application presented participants with 20 new English words to be learned daily. If a participant studied all the words presented by the application, he or she received 20 points for the day. At the end of each day, participants were presented with a leaderboard that showed their ranking in the group they belonged to. If two participants received the same score, the participant who finished the studying task earlier was ranked higher. After 14 days of vocabulary learning with the application, the participant who received the highest score in the group was announced as the winner.

In the gamified cooperation condition, participants were asked to study 20 English words presented daily by the mobile language learning application. If a participant studied all the words

presented in a day, the group he or she belonged to received 20 points. If all the group members completed their daily task, the group points were doubled for that day. The daily point total of a group was calculated by summing up all the points earned by its members. The total group score was calculated through summing up the daily group scores. Participants in the gamified cooperation condition were informed daily about their daily and total group scores. Depending on their total group score, groups in the gamified cooperation condition received a specific badge after 14 days of vocabulary learning with the application. The badge titles hierarchically ranged from “the most amazing group in China” to “the most amazing group in the Universe.” The badge titles and the points required to earn them were announced to the participants at the beginning of the experiment. Figure 1 summarizes the data collection procedure.

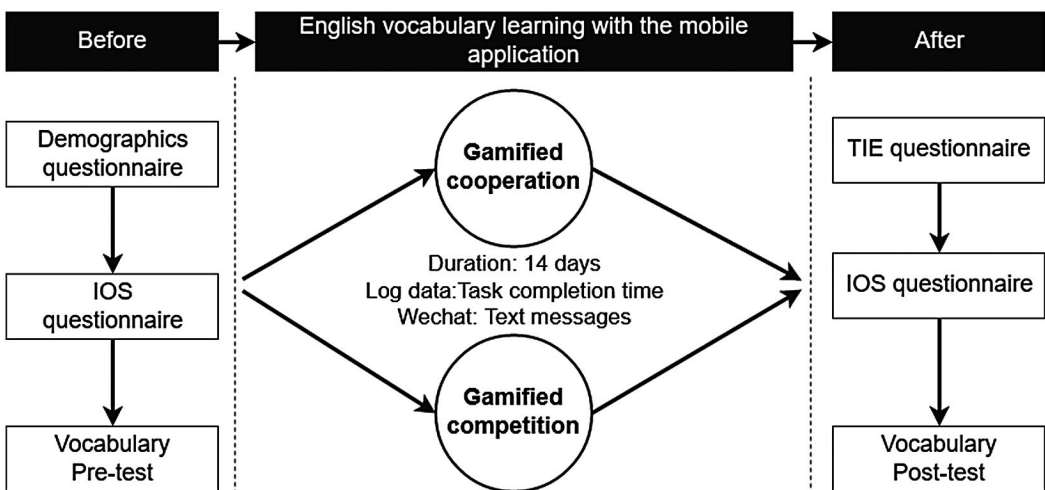
### Measures and instruments

#### The Baicizhan mobile language learning app

Baicizhan is a popular mobile English vocabulary learning application in China. The application teaches English words in a drill and practice manner. Word learning begins with asking learners to choose the photo that matches the written sentence on the screen. Then, Baicizhan provides feedback to the participant by indicating the correctness of the choice and presenting the correct answer if it is wrong. Later, the app presents different types of multiple-choice questions with the same words to facilitate revision of the words that have been learned. Baicizhan App Company collaborated with the researchers during the study and provided the data about daily task completion time for each participant. No other data were received from the company.

#### WeChat

WeChat is a widespread mobile messaging application in China. A separate WeChat group was created for each of the experimental groups in the current study. These WeChat groups served three purposes: (1) Guiding participants throughout the data collection process; (2) Presenting the daily leaderboard scores in competition groups and presenting the daily group scores in the cooperation groups; and (3) Facilitating communication amongst the group members. These



IOS: Inclusion of self in the other; TIE: Task interest and enjoyment

Figure 1: Data collection procedure

processes were conducted by the second author who was present in all WeChat groups utilized for the study. The communication between the groups members in WeChat groups were later downloaded for analysis with the consent of the participants.

#### Demographics questionnaire

The questionnaire asked participants about their age, gender, education, WeChat ID and Baicizhan ID.

#### Vocabulary test

The vocabulary test included the 280 English words that the participants learned during the study. Considering the participant profile (ie, Chinese college students), the words were chosen from College English Test 6 (CET6), a national English proficiency test for undergraduate and graduate studies in China. Vocabulary items were chosen from CET6 because it requires a higher proficiency compared to other standard English tests for college students in China (eg, College English Test 4). The vocabulary test was presented to the participants before and after the gamified learning intervention in a multiple-choice format. Participants' scores for the pre- and posttests were calculated within a range of 0 (min) and 100 (max). The internal reliability scores for both the pre- and posttests were around .99.

#### Task effort

Task effort in the current study was measured with two indices: *daily task completion time* and *task completion rate*. Daily task completion time refers to the time of the day (eg, 9:47 a.m.) when a participant finishes the daily task in the application. *Task completion rate* was calculated by counting the number of days a participant completed the task. Thus, *task completion rate* varied between 0 (participant did not complete the tasks in any of the days) and 14 (participant completed the tasks on all days).

#### Task interest and enjoyment

Task interest and enjoyment (TIE) is a sub-scale of the Intrinsic Motivation Inventory (Deci & Ryan, 2000). The scale asks participants to rate how much they enjoyed a specific learning activity on a seven-point Likert scale. For the current study, a Chinese version of the TIE was used (Wang, 2004). The reliability of the scale on the current sample was .84 (Kaiser-Meyer Olkin measure of sampling adequacy = .86;  $p_{\text{Bartlett's test of sphericity}} < .001$ ). The scale was applied to the participants after the intervention.

#### Social relatedness

Social relatedness amongst the group members was measured using both self-reported and behavioural measures. In terms of the self-report, the Inclusion of Other in the Self Scale (IOS) (Aron, Aron, & Smollan, 1992) was used to measure the level of perceived relatedness within the experimental groups. The single-item scale asked participants to rate how much they are related to each participant in the group on a seven-point visual scale (1: *unrelated*; 7: *very related*; see Figure 2). The IOS scale was applied both as a pre- and posttest. The behavioural measure of the social relatedness comprised the average *daily text messages sent* by the participants in the WeChat group during the experiment. The literature states that high-quality relationships involve frequent communication. For example, it has been found that decreased text messaging amongst students indicate decline in interpersonal connection and relationship quality (Clark, 2017). Also, text-messaging has been found to facilitate increased social relationships (Sun, Lin, Wu, Zhou & Luo, 2018). Therefore, higher amounts of texting in the WeChat group were regarded as an indicator of greater social relatedness to others, whereas a lesser amount of texting in the group was regarded as decreased social relatedness.

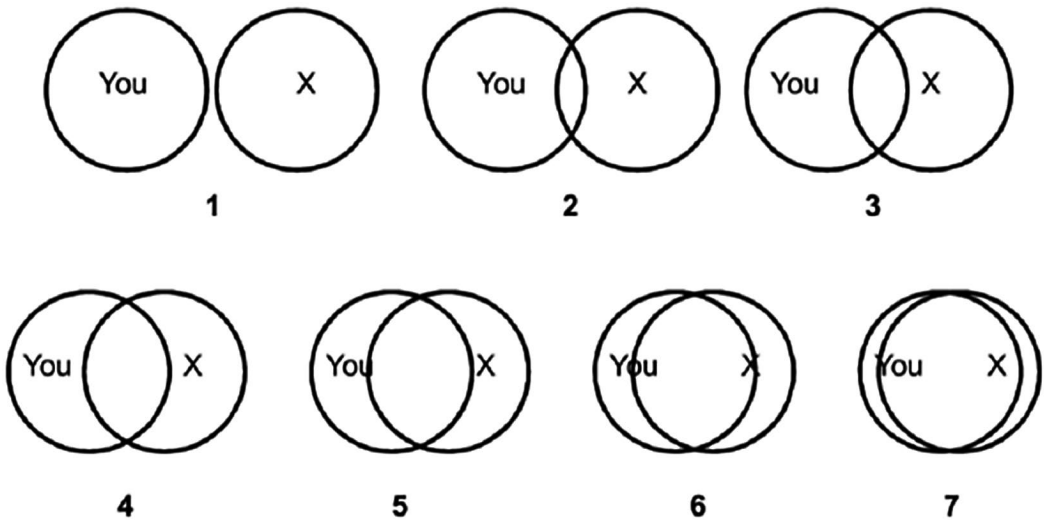


Figure 2: IOS Scale

## Results

### *Descriptive statistics*

Prior to the analyses regarding the research questions, participant profiles in different experimental conditions were compared. Independent samples *t*-test showed no difference between gamified competition and gamified groups in terms of age ( $t_{(73)} = 1.770$ ;  $p = .081$ ;  $M_{\text{gamified cooperation}} = 20.15$ ;  $SD_{\text{gamified cooperation}} = 1.814$ ;  $M_{\text{gamified competition}} = 20.097$ ;  $SD_{\text{gamified competition}} = 2.184$ ). According to the chi-square test of independence, no difference was observed between gamified competition ( $n_{\text{males}} = 9$ ;  $n_{\text{females}} = 27$ ) and gamified cooperation ( $n_{\text{males}} = 7$ ;  $n_{\text{females}} = 32$ ) in terms of the proportion of males and females ( $X^2(1, N = 75) = .555$ ,  $p = .456$ ). Overall, the current findings indicate both experimental conditions included participants with similar demographics profile.

### *Comparison of gamified cooperation and competition in terms of task effort (RQ1)*

In the current study, the task completion rate and daily task completion time were the two indices of task effort. Task completion rate was not normally distributed (Skewness =  $-2.828$ ; Kurtosis =  $7.184$ ). Neither logarithmic nor square root transformation yielded normal distribution. Thus, a Mann–Whitney U-test was conducted to compare the task completion rates of gamified competition and gamified cooperation. According to the test, gamified cooperation and gamified competition did not differ from each other significantly ( $Z = -1.521$ ;  $p > .05$ ). This finding shows that during their 14 days of vocabulary learning with the mobile application, the total number of days tasks were completed was similar for participants in the gamified cooperation ( $M: 13.4$ ;  $SD: .82$ ) and gamified competition ( $M: 11.6$ ;  $SD: 4.1$ ) groups.

An independent samples *t*-test was run to compare the gamified cooperation and gamified competition groups in terms of daily task completion time. The results showed that participants in the gamified competition condition completed the daily tasks significantly earlier than the participants in the gamified cooperation condition ( $t_{(73)} = 2.808$ ;  $p = .006$ ; partial eta-squared =  $.097$ ) (see Figure 3).



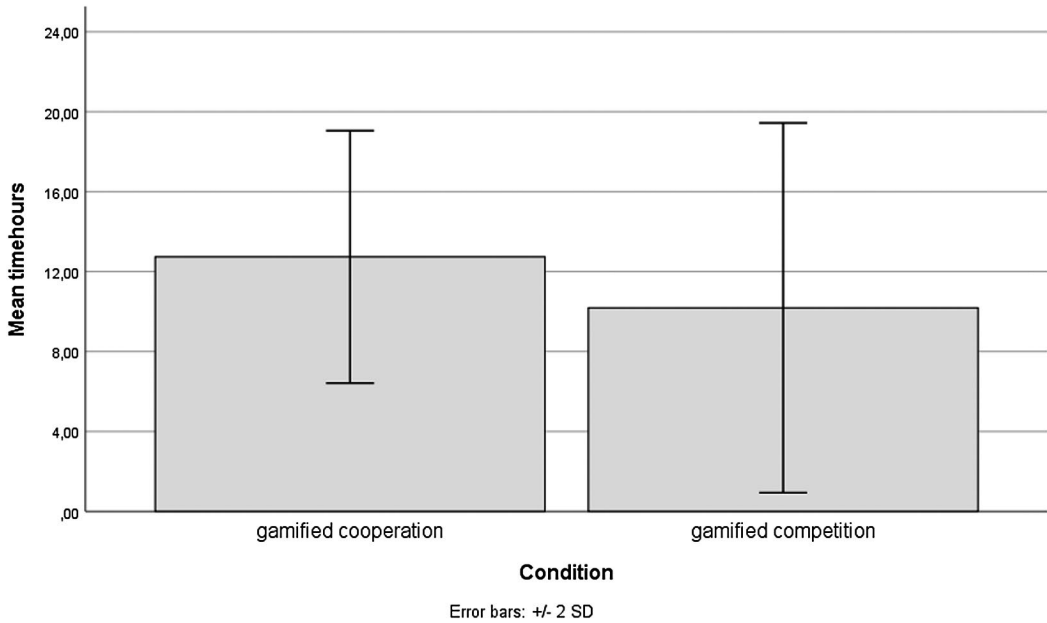


Figure 3: Daily task completion time for the groups

#### Comparison of gamified cooperation and competition in terms of learning achievement (RQ2)

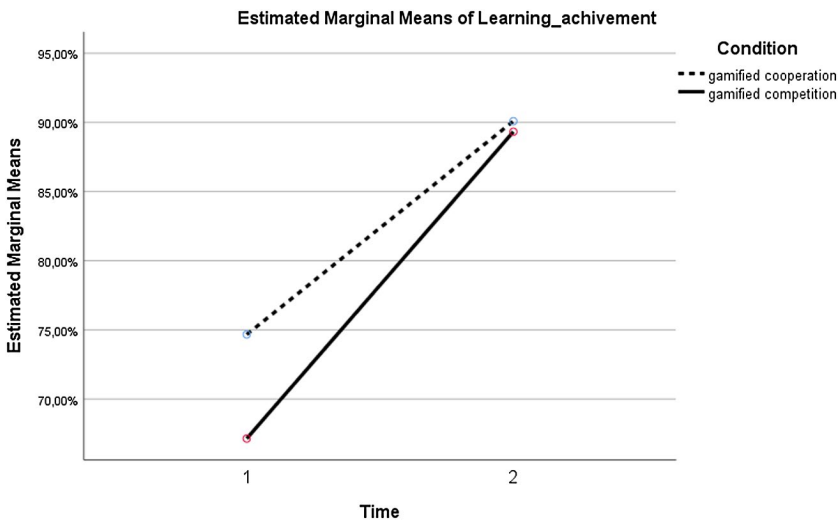
A 2 (condition: gamified cooperation and competition)  $\times$  2 (time: pretest and posttest) mixed repeated measures ANOVA was run to compare the gamified cooperation and competition conditions across the vocabulary pre- and posttest scores. As seen in Table 1, the effect of time was significant. This means that participants in all conditions have improved their English vocabulary knowledge during the intervention (also see Figure 4). There was a significant interaction between gamification type and time ( $F_{(1,68)} = 4781$ ;  $p < .05$ ). This means that the change from pre- to posttest vocabulary scores were not the same for the experimental conditions. Post hoc comparisons have revealed that vocabulary pretest scores for the gamified competition ( $M = 67.1$ ;  $SD = 23.7$ ) condition were significantly lower than for gamified cooperation ( $M = 74.6$ ;  $SD = 17.2$ ). However, there was no significant difference between gamified competition ( $M = 89.3$ ;  $SD = 9.9$ ) and gamified cooperation ( $M = 90.1$ ;  $SD = 10.1$ ) in the vocabulary posttest scores. In addition, an independent samples  $t$ -test was conducted to compare the learning achievement change from pretest to posttest for both conditions. Results revealed that the improvement in gamified competition groups ( $M = 22.18$ ,  $SD = 15.59$ ) from pretest to posttest was significantly higher than the gamified cooperation groups ( $M = 15.42$ ,  $SD = 10.07$ ;  $t_{(68)} = 2187$ ;  $p = .04$ ;  $\eta_p^2 = .66$ ). These findings imply that the significant difference between the experimental conditions in terms of change from pre- to posttest is due to lower pretest scores in gamified competition condition. Overall, the current findings indicate no significant difference between gamified competition and gamified cooperation in terms of learning achievement at the end of the study, although the gamified cooperation group performed better in the pretest.

#### Comparison of gamified cooperation and gamified competition in terms of task interest and enjoyment (RQ3)

An independent samples  $t$ -test was conducted on the average TIE scores to compare the task interest and enjoyment of participants in the different gamification conditions. No significant difference was observed ( $t_{(70)} = .729$ ;  $p > .05$ ) between gamified cooperation ( $M = 5.26$ ;  $SD = .88$ )

Table 1: Mixed ANOVA results on learning achievement

	SS	df	MS	F	p	Partial Eta-Squared
Between-subject						
Gamification	596.745	1	596.745	1.341	>.05	0.019
Error	30266.253	68	445.092			
Within-subject						
Source						
Time	12282.681	1.000	12282.681	148.002	<.001	0.685
Time * Gamification	396.759	1.000	396.759	4.781	<.032	0.066
Error	5643.315	68.000	82.990			

Figure 4: Learning achievement scores [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

and gamified competition ( $M = 5.09$ ;  $SD = 1.09$ ). Figure 5 displays the average TIE scores for both conditions.

#### Comparison of gamified cooperation and gamified competition in terms of social relatedness (RQ4)

The first measures of social relatedness were IOS scores. The IOS pretest scores did not show normal distribution (Skewness = 2.045; Kurtosis = 4.450). This was because most of the participants had no prior contact with the other members of their groups. Thus, the IOS pretest scores were mostly scattered around the minimum score (ie, 1). Considering this, we have subtracted the IOS posttest scores from the IOS pretest scores to calculate the social relatedness change for the participants from the beginning to the end of the intervention. An independent samples  $t$ -test showed that social relatedness increased significantly higher in the gamified cooperation groups ( $M = .68$ ;  $SD = .35$ ) compared with the gamified competition groups ( $M = .26$ ;  $SD = .20$ ) ( $t_{(73)} = 6.364$ ;  $p < .001$ ; partial eta-squared = .357). Figure 6 displays the IOS pre- and posttest scores for both conditions.

The second indicator measured for the social relatedness was *daily text messages sent*. The variable displayed normal distribution after a square root transformation (Skewness = 1.276;

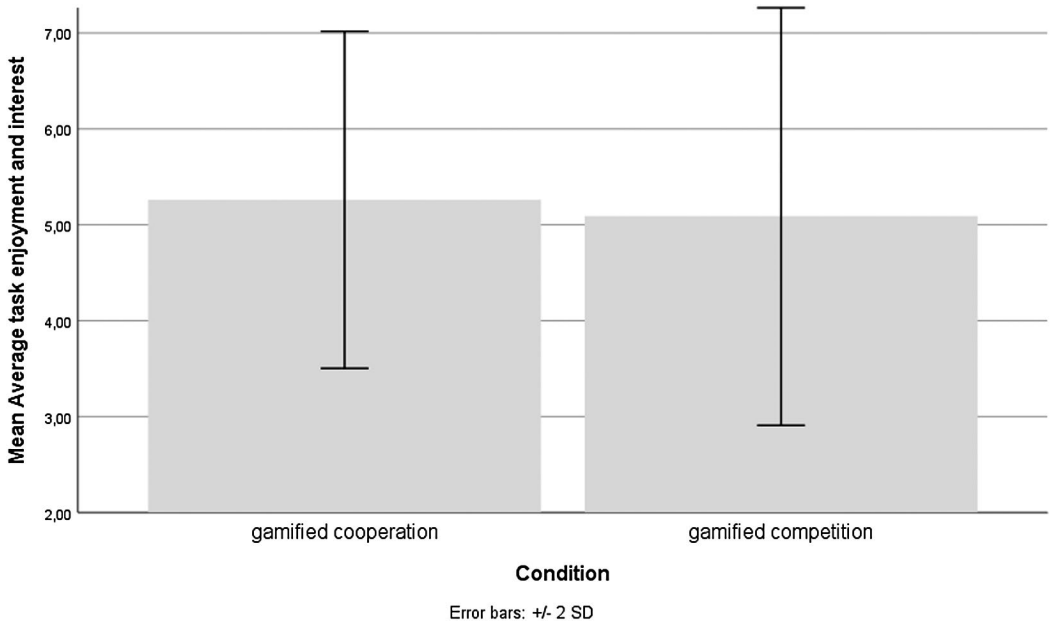


Figure 5: TIE scores for gamified competition and gamified cooperation conditions

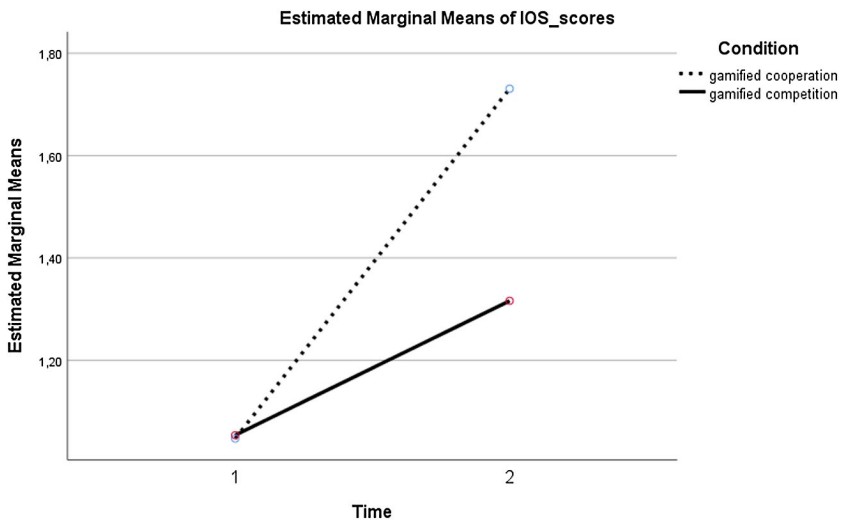


Figure 6: Comparison of IOS scores  
 [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

Kurtosis = 1341). An independent samples *t*-test revealed that participants in the gamified cooperation condition ( $M = .83$ ;  $SD = .70$ ) sent significantly more daily text messages to each other, compared with the participants in the gamified competition condition ( $M = .41$ ;  $SD = .41$ ) ( $t_{(73)} = 3.110$ ;  $p < .005$ ; partial eta-squared = .10). Overall, the current findings show that cooperating with others during gamified vocabulary learning facilitates higher social relatedness amongst the group members, which is reflected in the higher amounts of text messaging and stronger feelings of closeness.

## Discussion and conclusion

The present study aimed to investigate the task effort, learning achievement, motivational and social outcomes associated with gamified English vocabulary learning in cooperative or competitive conditions. Gamified competition was realized through ranking learners with a leaderboard and announcing a single winner at the end, while gamified cooperation was achieved by giving a shared goal to the group members and rewarding the whole group with badges rather than rewarding specific individuals.

Two analyses were conducted to test the effects of gamified cooperation and gamified competition on task effort (RQ1). The first analysis showed that participants in both gamified cooperation and gamified competition conditions were equally persistent in completing the daily vocabulary learning tasks over the 14 days. These findings are in line with past studies that highlighted the positive impact of gamification on task engagement and effort (de-Marcos *et al.*, 2014). However, our findings do not support SIT research that reported a significant advantage of cooperative learning over competitive learning in terms of task effort (Garland, 2015; Johnson & Johnson, 2009). Such a contradiction can be explained in several ways. First, participants in both gamified competition and gamified cooperation conditions completed the learning tasks on most of the days in the current study. However, 14 days of English vocabulary learning might not be enough to differentiate the effects of gamified cooperation and gamified competition on task effort, especially since studies have shown that the effect of gamification on task effort decreases over time (Hanus & Fox, 2015; Looyestyn *et al.*, 2017). According to SIT, cooperative learning facilitates social commitment and obligations towards accomplishing shared group goals (Johnson & Johnson, 1989). Furthermore, one aspect of cooperative learning is that individuals might receive cognitive, motivational and emotional support from other team members when they face affective challenges such as frustration or demotivation during learning (Hadwin, Järvelä, & Miller, 2017). In competitive learning settings, however, social commitment and group support are not evident. Considering such aspects, it can be assumed that gamified cooperation might invoke higher task effort in long-lasting learning activities compared with gamified competition. Therefore, the observed decrease in task effort from the beginning to the end would be less in gamified cooperation in long-lasting learning tasks. Future studies should test this assumption.

Second, it has been claimed that low-achieving learners in competitive settings might drop out if they feel that they have no chance of winning (Christy & Fox, 2014; Liu *et al.*, 2013). Based on this, it could be expected that low-achieving participants in the gamified competition condition would put in less effort to compete daily in the vocabulary learning tasks. However, the current findings do not support this assumption. According to Bandura (2016), individuals might exert effort on a task to avoid self-loathing. Drawing on this contentious argument, it is possible that low-achieving learners in the gamified competition setting completed the daily tasks as much as possible to avoid being at the very bottom of the leaderboard rather than trying to be close to top. It might be the case that being at the bottom might trigger more negative effects than not being at the top. Some empirical findings support this view. For example, Cherry and Ellis (2005) found that grading student performance in a rank order (ie, from highest performer to lowest performer) significantly improved student performance compared with criterion grading (eg, grading performance on a 0–10 scale). The improvement following performance rank-order grading was also evident in the lowest performing students. Given this and the current findings, future research is necessary to have a more in-depth view on the effects of gamified competition on task effort, specifically amongst low-achieving learners. Overall, the current findings indicate that both gamified competition and gamified cooperation can be effective in sustaining task effort, though they might activate different psychological processes.

The second analysis on task effort showed that the gamified competition group completed the daily tasks significantly earlier than the gamified cooperation group. It is known that game design features influence individuals' behaviour in the game context (Hamari *et al.*, 2014). In the current study, if the scores of two participants were equal in the gamified competition condition, the one who completed the daily tasks earlier ranked higher on the leaderboard. This feature might have facilitated early daily task completion time in the gamified competition condition only, since there was no emphasis on completing the daily task early in the gamified cooperation condition. Therefore, the current findings on daily task completion time can be explained by the impact of the game design features on behaviour rather than the superiority of competition over cooperation.

Gamified competition and gamified cooperation facilitated similar learning achievement scores, according to the vocabulary posttest scores (RQ2). These findings are in line with previous gamification studies that found no difference between competition and cooperation in terms of learning achievement (Ke & Grabowski, 2007; Plass *et al.*, 2013; ter Vrugte *et al.*, 2015). The similar results can be explained by the task characteristics and the structure of the competition (Tauer & Harackiewicz, 2004). SIT mainly deals with goal interdependence that explains how outcomes (eg, scores, recognition) will be distributed amongst the learners (Johnson & Johnson, 1989). However, it is known that social interdependence in learning settings can also occur in the form of task interdependence. Task interdependence occurs if participants have to work together, join their skills and exert shared effort in order to achieve task goals (Sargent & Sue-Chan., 2001). Studies have shown that cooperation would lead to better learning outcomes in collaborative settings with high task interdependence (Katz-Navon & Erez, 2005). On the other hand, competition has been found to be effective in learning settings in which learners are able to pursue the task goals autonomously (Cherry & Ellis, 2005). The current study imposed goal interdependence on the participants rather than task interdependence. That is, participants in both conditions could study English vocabulary autonomously with no interference from the others during the learning. Therefore, the current findings show that both positive (ie, gamified cooperation) and negative (ie, gamified competition) goal interdependence can be equally effective in facilitating better learning achievement if the learning task does not require social interaction and coordination of task efforts during learning.

Gamified competition and gamified cooperation also facilitated the same levels of TIE in the current study (RQ3). Research has shown that performance outcomes in a task are related to the effort exerted on a task, which is determined by motivation (Hadwin *et al.*, 2017; Wigfield & Eccles, 2000). Supporting this assertion, the current study found that gamified cooperation and gamified competition invoked equal amounts of TIE, which is reflected as similar task efforts and the same learning achievements. Our findings are similar to a previous study that found no motivational differences between competition and cooperation in gamified math learning (Plass *et al.*, 2013). It has been found that gamified cooperation can facilitate positive motivational experiences through social interactions and feelings of relatedness (Rigby & Ryan, 2011). Studies also showed that competitive gamification can boost motivation if a game is designed with fair rules, clear goals and social comparison opportunities (Garcia, Tor, & Schiff, 2013; Tauer & Harackiewicz, 2004). Drawing on this, our findings indicate that it is possible to motivate learners in gamified settings either through facilitating positive social relationships or fair social comparison opportunities.

A significant difference was observed between gamified cooperation and gamified competition across the social relatedness measures (RQ4). That is, participants in the gamified cooperation condition shared more text messages with their group members and the perceived social

relatedness amongst them was higher than amongst the participants in the gamified competition condition. These findings corroborate SIT research that highlights the positive impact of cooperation on increased social interaction and relatedness amongst individuals (Chen & Pu, 2014; Peng & Hsieh, 2012). Recently, there has been growing empirical interest in using games to support the social inclusion of students (Hanghøj, Lieberoth, & Misfeldt, 2018). The current findings contribute to this line of research and suggest that gamified cooperation might be more effective than gamified competition in terms of developing feelings of belonging and attachment amongst the learners. This is because gamified cooperation can facilitate positive social interactions such as mutual support, information exchange and constructive communication.

In conclusion, the present experimental study investigated the effects of gamified cooperation and competition on English vocabulary learning on a mobile application from the perspective of SIT. More specifically, the study compared gamified cooperation and gamified competition in terms of task effort, learning achievement, task interest and enjoyment and social relatedness. The results showed no differences between the experimental conditions in terms of task effort, learning achievement and task interest and enjoyment, which indicates that both gamified competition and gamified cooperation can be equally effective in yielding increased motivation, task effort and learning outcomes. However, the current study underlines that, despite these similar outcomes, gamified cooperation and gamified competition might trigger different psychological processes. In this study, gamified cooperation resulted in higher social relatedness amongst the learners compared with gamified competition. This result demonstrates that the social benefits of gamified cooperation should be taken into account when designing gamified learning, even if it does not yield better performance or motivational outcomes than gamified competition.

The current study has some practical implications for English vocabulary learning. Vocabulary development occurs through conscious and continuous encounters with words until they are stored in the long-term memory (Zou, Huang, & Xie, 2019). Students might find such repeated exposure to new words boring and frustrating (Nation, 2001). Thus, a major challenge in English vocabulary learning is to keep learners motivated over time. Studies have shown that even highly motivated learners find it difficult to self-study English without external support (Nielson, 2011). In order to tackle this challenge, the current study suggests that gamification in English vocabulary learning should move from individual learning space to group learning space. Specifically, we argue that gamifying English vocabulary learning with competitive and cooperative group activities can facilitate sustained motivation and effort amongst the English language learners. In terms of gamified competition, educators can utilize leader boards provide social comparison amongst the learners. Observing their progress relative to the others might push learners to exert continuous effort on vocabulary learning. The task effort in gamified competition might be due either to aim for higher rankings or avoid lower rankings. In terms of gamified cooperation, educators can develop interdependency amongst the learners by giving them a group learning goals rather than individual goals. The individual accountability of each individual for the group success can yield sustained engagement with the vocabulary learning tasks. The current study further states that gamified competition and gamified cooperation can both create fun and enjoyable English vocabulary learning experiences when designed with clear goals and fair rules. However, educators are advised to use gamified cooperation activities if they aim to strengthen social bonds amongst the learners along with the vocabulary development.

### **Limitations and future work**

The current study has several limitations that should be addressed in future studies. First, the existing study was conducted with Chinese participants. Gamification targets altering motivation

and behaviour to reach specific goals. However, human motivation and behaviour is not separate from culture. It has been argued that gamification can have different impacts on different cultures (AlMarshedi, Wanick, Wills, & Ranchhod, 2017). For example, some cultures value competition whereas others are more cooperation-oriented (Hofstede, Hofstede & Minkov, 2010). Considering this, future studies should test whether the current findings about gamified cooperation and competition can be applied to broader cultural contexts than China. Second, the majority of the participants in the current study were females. Several studies have underlined gender-specific differences in gamification. For example, it has been found that social relationships are more important for females than males in gamified environments (Koivisto & Hamari, 2014). Further, females enjoy competitive games to a lesser extent compared with males (Hartmann & Klimmt, 2006; Kron, Gjerde, Sen, & Fetters, 2010). Drawing on such findings, the current findings might carry gender-specific features. Third, the vocabulary posttest scores indicate a possible ceiling effect. That is, the participants in both experimental conditions scored high in the vocabulary posttest. Future studies on gamified vocabulary learning should use more difficult question items to measure learning achievement. Fourth, gamification was limited to within-group activities in the present study. A possible future avenue of research would be to design a gamification experiment as a combination of within- and between-group activities. For example, it is worth investigating how cooperating within the group while competing with other groups would affect learning outcomes. Some recent studies on crowdsourcing platforms yielded promising results on this issue (Morschheuser *et al.*, 2019). Fifth, the current study was conducted on a moderate sample size. Sixth, this study utilized an English vocabulary test to measure learning achievement. Therefore, the current findings might not be applicable to other language learning activities such as grammar, reading or writing. Seventh, it is possible that gamification has different impact on learners at different English proficiency levels. Thus, it is worth studying whether motivation, task effort and social relatedness differ amongst learners at different proficiency levels within gamified cooperation and competition conditions. Finally, the current study did not measure participants' motivations regarding English vocabulary learning. Future research can explore whether preceding motivations (eg, self-efficacy, topic interest) would influence the learning process and outcomes in gamified cooperation and competition conditions.

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### **Statements on open data, ethics and conflict of interest**

The research was conducted under the guidelines of Finnish Advisory Board on Research Integrity (TENK).

The anonymized data are available upon request, by contacting the corresponding author.

There is no potential conflict of interest identified by the authors.

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