Investigating the impact of gamification components on online learners' engagement

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Abstract

As online learning and teaching are becoming an educational trend, online students' engagement will directly impact the learning and teaching effects and outcomes. A scientific application of gamification in online learning, teaching, and online course design will improve online learners' learning experience and help build a better virtual learning context for online learners worldwide. This study focuses on how gamification can engage online students from skills, emotional, participation, and performance perspectives. The gamification components investigated in this study are Points (also called Anar Seeds in the context of this study) and Badges, the most widely used components in gamification design in education, and online instructors have primarily used them to motivate students' learning and acknowledge their achievements by timely rewarding specific learning behavior or performance. A mixed method has been applied to explore further the relationships between gamification components and online students' engagement and how online students perceive the impacts of gamification on their online learning experience. The findings show a significant correlation between Points and online students' skills, emotional, participation, and performance engagement, while it exists only between Badges and online students' participation engagement. The findings also reveal mixed perceptions of online students towards gamification. Study limitations regarding lack of age criterion, limited measurement indicators, and oversimplification of survey responses have also been discussed. It is suggested that future research can be conducted from either the instructors' or the gamification designers' perspectives to determine any other factors that might contribute to the implementation of gamification in the online learning context.

Keywords: Gamification, Points, Badge, Online learners, Engagement

Introduction

Online learning is defined by Singh and Thurman (2019) as "Education being delivered in an online environment through the use of the internet for teaching and learning. This definition includes online learning on the part of the students that is not dependent on their physical or virtual co-location. The teaching content is delivered online, and the instructors develop teaching modules that enhance learning and interactivity in the synchronous or asynchronous environment" (p. 302). According to Seaman et al. (2018), online teaching and learning have risen steadily for the past decade in higher education institutions. In 2016, approximately 31.6% of

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students took at least one online education course. In 2021, 11.2 million college students (60%) took at least one class online, and about 8.9 million students (47%) took college classes exclusively online (NCES, 2022). After the pandemic, online learning has become the new normal worldwide (Bozkurt, 2020; Theirworld, 2020; United Nations, 2020).

As online learning trends continue, new questions have also arisen. People began to face the issue of students' satisfaction and whether online learning was as effective as face-to-face learning in terms of learning outcomes (Robinson & Hullinger, 2008). Kucuk and Richardson (2019) claimed engagement to be an additional predictor of satisfaction. Previous studies revealed that engagement positively affects satisfaction in online education (Gray & DiLoreto, 2016), and students who engage in online courses would experience more satisfaction.

Among various strategies for enhancing students' learning experience, gamification has been considered a growing education phenomenon due to its impact on students' learning (da Rocha Seixas et al., 2016; Göksün & Gürsoy, 2019). The term "gamification" was coined by British game developer Pelling (2002) to describe his concept of applying accelerated user interface design inspired by games to make electronic transactions more enjoyable and efficient. Nowadays, Deterding et al. (2011) define gamification as applying game design elements in non-playful contexts. Students' motivation and engagement can be promoted if they play or interact with designed gamification components under appropriate strategies. The most used gamification components include Points, Badges, Leaderboards, Progress Bars, and Avatars. Prior research has shown that gamification could serve as an instructional method to improve teaching, increase student engagement and interactivity, and encourage learners to grow their skills (Zainuddin et al., 2020). Therefore, gamification has been widely applied in numerous online educational settings by being integrated into the course or instructional design (Ahmed & Asiksoy, 2021; Chung & Lin, 2022; Do et al., 2023; Inangil et al., 2022; Khaleel et al., 2019; Ng & Lo, 2022; Romero-Rodriguez et al., 2019). Among the related research, minimal attention has been paid specifically to how gamification can influence online learners' engagement until recently (McNeill et al., 2024; Özhan & Kocadere, 2020; Taşkın & Kılıç Çakmak, 2023; Xiao & Hew, 2024). Though these studies have explored how gamification impacts learner engagement in online contexts, the types of engagement examined in each study are often insufficient. Plus, their analysis of a blend of different gamification components may result in ambiguity regarding which specific gamification design elements most effectively improve the learning process within a particular context or for a distinct group of learners. Moreover, these findings were derived from a contextually restricted environment (i.e., pertaining to specific courses or subjects), which limits the generalizability of the conclusions and their applicability to other educational contexts. Based on these gaps detected in prior research, this study will explore the potential impacts of gamification components (Points and Badges) separately on online students' engagement (skills, emotional, participation, and performance) based on a global social learning platform named "CourseNetworking" and aims to shed light on future gamification design and development in other educational contexts.

Literature review

Engagement

Student engagement, also initially known as student involvement, learning involvement, or learning participation, has been getting more attention, in part, due to Astin's (1984) "Student involvement: A developmental theory for higher education." Student engagement, as a term, is not well defined. Kuh (2003) views engagement as "the time and energy students devote to educationally sound activities" (p. 25), and Appleton et al. (2008) defined engagement as students' psychological investment and behavioral involvement in the learning activities.

Student engagement study went through a process from a single dimension to a multi-dimension (Hu & Li, 2017). Earlier research on students' engagement tended to only focus on the behavioral dimension, but later, it expanded to both the behavioral and emotional dimensions (Finn, 1989; Marks, 2000; Newmann et al., 1992; Willms, 2003) and, finally, included the cognitive dimension (Fredricks et al., 2004; Jimerson et al., 2003; Klem & Connell, 2004; Qiping Kong, 2000). Since none of the research specifically mentioned the dimensions concerning *online* students' engagement, Dixson (2015) proposed his engagement dimension for online students built upon the measurement of traditional classroom student engagement conducted by Handelsman et al. (2005). Dixson claimed that online student engagement should be measured concerning what students do (actively and in their thought processes) as well as how they feel about their learning and the connections they are making with the content, the instructor, and other students in terms of skills, participation, performance, and emotional engagement. From this perspective, an online student engagement study should be conducted from four dimensions, namely, (1) skills engagement (i.e., keeping up with readings, putting forth effort), (2) emotional engagement (i.e., making the course enjoyable, applying it to their own lives), (3) participation/interaction engagement (i.e., having fun, participating actively in small group discussions), and (4) performance engagement (i.e., doing well on tests, getting a good grade) (Handelsman et al., 2005, p. 187).

Meyer (2014), Banna et al. (2015), and Britt (2015) asserted the importance of student engagement in online learning because student engagement can be shown as "evidence of students' considerable effort required for their cognitive development and their given ability to create their knowledge, leading to a high level of student success" (Martin & Bolliger, 2018, p. 206). Learning engagement hinges significantly on interactions between learners and their learning environment, which is viewed as a pivotal factor influencing learning behaviors (Neufeld et al., 2006). Learners who actively participate in interactions are more likely to carry out effective educational exchanges, which can lead to greater benefits from online learning (Gokool-Ramdoo, 2008; Yu et al., 2020), an educational context where teaching content is provided through modules designed by instructors to improve learning and foster interactivity in both synchronous and asynchronous settings (Singh & Thurman, 2019). According to Banna et al. (2015), if content played a central focus in the past, engagement plays a vital role in stimulating online learning today.

Martin and Borup (2022) claimed that for a comprehensive understanding of online learner engagement, researchers must thoughtfully examine and identify engagement through communication, interaction, presence, collaboration, and community in online

learning environments. Since gamification (Points and Badges are the most widely used components) has now been widely integrated into online instructional settings (Ahmed & Asiksoy, 2021; Chung & Lin; Inangil et al., 2022; Khaleel et al., 2019; Milenković et al., 2019; Ng & Lo, 2022; Pakinee & Puritat, 2021; Romero-Rodriguez et al., 2019), it is worth further exploration on how the connection or interaction between gamification components and online learners can influence their learning engagement.

Gamification

Gamification has long been discussed as a practical strategy to engage students in learning. The definition of the term gamification was first introduced around the 2000s (Braga, 2022). Until now, a formal and scientific definition for gamification has still not been agreed. Hamari et al. (2014) described gamification as "a process of enhancing services with (motivational) affordances to invoke gameful experiences and further behavioral outcomes" (p. 3026). Werbach (2014) defined gamification as a process of making activities more game-like or generating a game-like experience. The most widely referenced definition of gamification thus far was put forth by Deterding et al. (2011), who claim gamification is the use of game elements and game design techniques in non-game contexts. Nowadays, gamification has been widely adopted in many fields, including business, marketing, health, technology design, and education, and has been considered an important strategy to ensure student involvement and engagement (Johnson et al., 2014).

Game mechanics and components

Gamification needs to be realized by integrating game mechanics and game dynamics into non-game situations (Bunchball, 2010). Game mechanics refers to the elements that allow players to exhibit higher engagement via motivation. According to Werbach and Hunter (2012), the most important mechanics are challenge (e.g., puzzles or other tasks that require effort to solve), competition (i.e., one player or group wins, and the other loses), chance (i.e., elements of randomness), cooperation (i.e., players must work together to achieve a shared goal), resource acquisition (i.e., obtaining useful or collectible items), feedback (i.e., information about how the player is doing), rewards (i.e., benefits for some action or achievement), turns (i.e., sequential participation by alternating players), transactions (i.e., trading between players, directly or through intermediaries), win states (i.e., objectives that make one player or group the winner—draw and loss states are related concepts).

   To realize the game mechanics discussed above, learners need to interact with the "design objects" in the foreground, which refers to the gamification components. Yılmaz (2015) discussed specific examples of gamification components based on Werbach and Hunter's (2012) "Gamification Toolbox" and categorized these components into Avatar (i.e., the characterization of the players in the game), Awards (i.e., an element of goal that should be achieved in a particular process, a promise to reach a target and motivation for subsequent stages), Points (i.e., an expression of every measurable change and behavior), Badges (i.e., visual designs that symbolize the achievements of a user after a completed task), Leaderboard (i.e., a competitive environment that presents the latest ranking in a construct where the users compete with each other), Level/Progress Bar

(i.e., a progression indicator to differentiate player's knowledge and experiences and indicate what needs to be complete), and Quests (i.e., a complete view of the goals and observation of where the player is in the big picture).

Schacht and Schacht (2012) identified three primary objectives that gamification mechanics aim to optimize for an ideal user experience: (1) display progression, (2) provide feedback, and (3) engage in a specific behavior. To fulfill these targets, Points, Badges, and Leaderboards have been considered the favorite gamification components concerning the gamification design in an online context (Antonaci et al., 2019). For example, Huang and Hew (2015) proved that Points motivated students and encouraged them to take on challenging tasks and engage in extracurricular learning. Mazarakis (2015) also realized that providing "social ranking feedback" in Points would enhance participation. Similarly, a study conducted by Hakulinen et al. (2015) found that most participants reported feeling motivated by Badges, leading them to conclude that achievement Badges seem to be an effective tool for motivating students. However, the complexity of game mechanics does not guarantee that every game component has the same impact on learner engagement in a given learning environment. For those studies claiming gamification works, few have clarified whether these findings account for the influence of factors beyond gamification components. Given this, our study seeks to explore further the differential impact of individual gamification components on specific learner groups and investigate how gamification mechanics influence engagement. This will be achieved in the present study through a combination of correlational analysis and data-driven insights derived from a survey specifically designed to capture learners' perceptions of gamification.

Gamification theories

The most discussed theories for explaining gamification mechanics are the Self-Determination Theory (SDT) and the Flow Theory (Krath & von Korflesch, 2021).

According to the Self-Determination Theory mentioned by Ryan and Deci (2000), people's inherent growth tendencies and innate psychological needs are the basis for their self-motivation and personality integration. They identified three types of needs: (1) competence (Harter, 1978; White, 1963), people need to gain mastery of tasks and learn different skills, (2) relatedness (Baumeister & Leary, 1995; Reis, 2013), people need to experience a sense of belonging and attachment to the others, and (3) autonomy (deCharms & Carpenter, 1968; Deci, 1975), people need to feel in control of their own behaviors and goals. These are essential factors for facilitating optimal functioning for human growth and integration.

Besides, inspired by the positive reinforcement mechanics of behaviorist theory (Skinner, 1953), Deci (1975) also divided human motivation into two main types: intrinsic motivation and extrinsic motivation. In this theory, Deci (1975) described the intrinsically motivated individual as those who engaged in an activity because of their inherent interest but not due to an external source. In contrast, the extrinsically motivated individual refers to those who perform a task for an external outcome different from the task itself. The fulfillment levels of the three psychological needs will affect people's motivation status, help transfer extrinsic motivation to intrinsic motivation, and increase engagement. Instructional designers and educators often

apply these theories as the designing principles to explain and support their gamification design thinking in online contexts (Gené et al., 2016; Khalil et al., 2017; Ortega-Arranz et al., 2017, 2019; Romero-Rodriguez et al., 2019; Tsay et al., 2018).

The Flow Theory was defined by Csikszentmihalyi (2000) as a state of human absorption characterized by intense concentration, loss of self-awareness, and a feeling of being perfectly challenged. To maintain this psychological state, designers need to be very careful in designing online gamified tasks that are neither too hard for learners to be discouraged nor too easy for learners to feel bored. This theory has been adopted by designers or educators when they need to decide the difficulty levels of certain gamification elements in online courses (Hansch et al., 2015; Ortega-Arranz et al., 2019).

Current research gaps regarding gamification study on online learners' engagement

Concerning the gamification studies in an online learning context, not many of the growing gamification studies have focused explicitly on how gamification impacts online learners' engagement in the last five years. Özhan and Kocadere (2020) explored factors influencing academic success in a gamified online learning environment, with a focus on flow, emotional engagement, and motivation. Using gamification elements like team collaboration, achievement, and levels, they found that flow and emotional engagement significantly impacted motivation. These two factors explained 68% of the variance in motivation, while flow, emotional engagement, and motivation together accounted for 22% of the variance in academic success. Taşkın and Kılıç Çakmak (2023) investigated the effects of gamification on students' behavioral and cognitive engagement in online learning environments. Through a quasi-experimental design with a control group, they found that gamification boosts engagement by promoting greater interaction with the content. McNeill et al. (2024) explored the potential of data mining to analyze student engagement patterns in an asynchronous online course incorporating gamification. Their findings showed that gamification positively impacted engagement, with features like Points, Badges, and Leaderboards leading to a 15.1% increase in posts and a 25.9% increase in average thread length. The strategic emphasis on Points, mentioned 134 times, significantly enhanced participation and overall engagement. Besides, Xiao and Hew (2024) conducted a randomized controlled trial to examine how redeemable tangible rewards affect students' intrinsic motivation, engagement, and learning performance in a fully online gamified flipped classroom. Their findings suggest that offering tangible rewards significantly boosted behavioral engagement, reflected in higher completion rates of pre-class tasks and in-class quizzes. Additionally, tangible rewards positively impacted cognitive engagement, as shown by students' reported use of metacognitive self-regulation strategies.

It can be observed that each study examined a combination of different gamification components, leading to potential uncertainty about which specific gamification components are most effective for enhancing learning in particular contexts or for distinct groups of learners. Furthermore, the results were derived from contextually limited environments, focusing on specific courses or subjects, which limits the generalizability of their conclusions and their applicability to broader contexts.

Research questions

Though studies have also shown that gamification can be used to improve students' engagement (Dixson, 2015; Hanus & Fox, 2015; Sanmugam et al., 2016), the research on gamification applications in the online learning environment is still in its early stages, and studies of its impact on students' online learning experience need further exploration. Based on the above literature reviews and emerging research gaps, this study explores the impacts of gamification on students' engagement in an online learning context and what theoretical and practical implications can facilitate future gamification design and improvement. The research questions for this study are as follows:

RQ1: Does a specific gamification component correlate with online students' engagement, or to be more specific,

RQ1.1:   Does the gamification component Points correlate with online students' skills engagement, emotional engagement, participation engagement, and performance engagement, separately?

RQ1.1:   Does the gamification component Badges correlate with online students' skills engagement emotional engagement, participation engagement, and performance engagement, separately?

RQ2: How do online students perceive the impacts of gamification on their learning engagement?

Methods

Online learning platform

The data was collected from the online course platform CourseNetworking (CN), developed based on the concept of "academic social networking," which is opposed to the typical learning management system (LMS). Traditionally, the LMS focuses on course delivery and management, including informing and guiding students on what to do next. In CN, students not only take online courses but also communicate with each other through social discussion and create their own "ePortfolio" to demonstrate their latest academic achievements to their peers. Students can share their learning interests and post to each other or follow someone like they usually do on Facebook or Twitter. In effect, CN serves both as an LMS platform for instructors to deliver online courses and as the "social media platform" for students from all over the world to interact with each other. Two distinguishing gamification components of the CN platform are introduced below.

Gamification mechanics and components on CN

Points mechanics: Anar seeds

On the CN platform, Anar Seeds (hereinafter referred to as Points) is a reward system that monitors student activities and offers real-time Points. Learners receive extrinsic award, Anar Seeds, in the form of Points for participating in certain learning activities, such as making a post with a certain number of words, reflecting on a post, rating
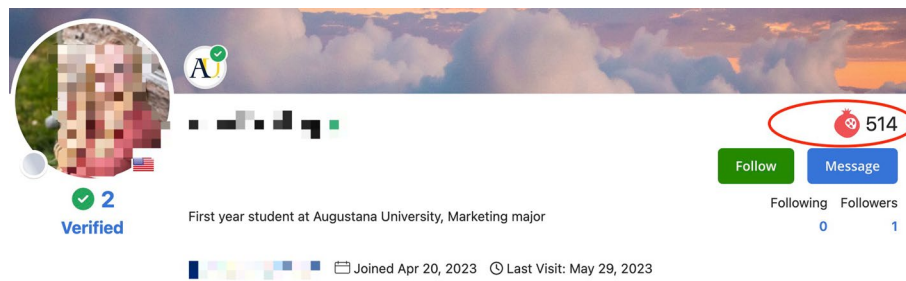
Fig. 1 Anar seeds (i.e., points) displayed on a student's CN profile/ePortfolio

BADGES

Fig. 2 Badges earned by a CN user

a peer's post, and visiting the course. Course instructors may set a goal for students to complete; meanwhile, the system tracks and reminds students about their progress in attaining the goal. Rewarding systems such as these provide incentives to students and recognition for their participation, serving as positive reinforcers for learning (Kapp, 2012) (Fig. 1).

Badge mechanics: CN digital badges

Badges are digital micro-certificates that can be used to motivate learners and recognize their competencies and experiences. CN offers a series of ready-to-use to make the Badge-issuing process as simple as possible. Currently, there are 26 course-level ready-to-use Badges, such as Critical Thinking, Problem Solving, Best Post, Top 10%, Best Participant, and Outstanding Award. Online instructors can modify the description and skills tags of these Badges before awarding them to their students. Besides these ready-to-use Badges, instructors and institution admins can also create new Badges. Badges earned by a student are automatically added to their profile/ePortfolio, where they can share it to other social media or download the baked Badges with metadata (Fig. 2).

Measurement

This study adopted the Online Student Engagement Questionnaire (OSE), validated by Dixson (2015), to measure online students' engagement levels. The survey comprised 19 items that measure four subscales of online students' engagement regarding their online courses: (a) skills engagement (questions 1, 3, 4, 5, 6, 7), (b) emotional engagement (questions 2, 8, 9, 10, 11), (c) participation engagement (questions 12, 13, 14, 17, 18, 19), and (d) performance engagement (questions 15, 16). The OSE exhibited concurrent validity and strong reliability ($\alpha = 0.91$) and could be applied to offer an easy, valid, and reliable way to measure students' engagement in online courses. The survey to measure online students' engagement on the CN platform in this study has been slightly modified based on Dixson's OSE to help online learners better understand the questions

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on the CN virtual contexts (see Appendix). The modification was made under the supervision of one quantitative study consultant, one qualitative study consultant, and one professor specializing in instructional design study to ensure its validity. Confirmatory Factor Analysis (CFA) was conducted using Jamovi to test the validation of the modified OSE scale. The CFI is 0.931, and the root mean square error of approximation (RMSEA) is 0.0510, demonstrating an acceptable CFA model fit. The Cronbach's alpha of modified OSE in this study is 0.926, indicating high inter-item reliability.

Data collection

The survey was published on the CN platform on March 23, 2023, and was closed on April 10, 2023, during which all active online students were invited to take the survey voluntarily. The survey will show up once online students open their online courses, and they can choose whether to take the survey or not.

Participants

440 responses were collected from the online learners on CN who came from 19 countries around the world; notably, the majority of the population was from Malaysia, Sri Lanka, and the United States. The online courses taught on the CN platform are over 100, ranging from natural to social science. Over half of the participants had been

Table 1 Demographic information of the respondents (n = 440)

	n	%
Country		
Malaysia	252	57.3
Sri Lanka	81	18.4
United States	64	14.5
France	9	2.0
Singapore	5	1.1
China	4	0.9
India	4	0.9
Finland	1	0.2
Indonesia	1	0.2
Iraq	1	0.2
Ireland	1	0.2
Jordan	1	0.2
Laos	1	0.2
Maldives	1	0.2
Myanmar	1	0.2
Oman	1	0.2
Russia	1	0.2
Rwanda	1	0.2
Yemen	1	0.2
Unknown	9	2.0
Registration on CN (years)		
< 1	146	33.2
1–5	292	66.4
≥ 6	2	0.4

registered members on CN for at least 1 year (Table 1), and all participants had taken at least one online course and had collected either Points or Badges on the CN platform. The majority of CN users are college students, with a smaller fraction of high school and adult learners. This study did not collect data on participant age or gender specifically due to access limitations.

The survey also included three open-ended questions following the 19 items to collect qualitative data from online learners' voluntary responses regarding their perceptions of gamification's impacts on their engagement. Finally, 562 lines of perceptions were collected from 440 online students for qualitative coding.

CN also permitted data collection concerning online students' achievement of Points and Badges. The CN data team provided the number of Points and Badges achieved by each participant in the survey.

Data analysis

For quantitative analysis, IBM SPSS Statistics 28 was used to run the correlation between Points collected by online students and their skills, emotional, participation, and performance engagement separately. The correlation was also run to check the relationship between the number of collected Badges and online learners' skills engagement, emotional engagement, participation engagement, and performance engagement, respectively. As the normality assumption was not met, Spearman's rho for non-parametric tests was used to assess these correlations.

For qualitative analysis, Nvivo 14 was adopted to code and analyze the textual content of online learners' responses regarding their perception of gamification impacts, aiming to provide methodological triangulation of the quantitative data (Ivankova et al., 2006). Another scholar who studies game-based learning and serious games assisted with coding, checking the major themes together, and triangulating the code book with 100% agreement.

Results

Correlation outcomes

For the first research question, among the 440 survey responses, 234 Points achievers completed all 19 questions in the survey; therefore, their engagement scores have been sorted out for correlation analysis. The mean (SD) skills engagement, emotional

Table 2 Statistical analysis of mean OSE subscale (skills engagement, emotional engagement, participation engagement, and performance engagement) scores for Points achievers (n = 234)

	Mean (± SD)	Minimum value	Maximum value
Skills engagement (6–30)	23.94 (3.565)	6.0	30.0
Emotional engagement (5–25)	19.62 (3.031)	5.0	25.0
Participation engagement (6–30)	20.74 (4.61)	6.0	30.0
Performance engagement (2–10)	7.77 (1.463)	2.0	10.0

engagement, participation engagement, and performance engagement scores for Points achievers were 23.94 (3.565), 19.62 (3.031), 20.74 (4.61), 7.77 (1.463), respectively (Table 2).

Of all 440 participants, only 86 who acquired at least one Badge have been sorted out for the correlation study. As shown in Table 3, the mean (SD) skills engagement, emotional engagement, participation engagement, and performance engagement scores for Badge achievers were 19.62 (8.688), 15.47 (8.439), 15.98 (10.421), and 5.79 (3.726), respectively.

Significant positive correlations between Points and the OSE score were detected (Table 4). As it shows, the coefficients between the score of Points and the four domains of the OSE (put in sequence: Skills engagement, Emotional engagement, Participation engagement, and Performance engagement) were 0.146 ($p < 0.05$), 0.274, 0.248, and 0.293 ($p < 0.01$), respectively.

Meanwhile, only one significant positive correlation between Badges and four domains of the OSE was found. The coefficient between the Badges and Participation engagement was 0.225 ($p < 0.05$), and no significant correlations have been observed between the Badges and the rest of the OSE domains (see Table 5). These results have answered RQ1.1 and RQ1.2.

To answer RQ2, the impact of gamification on online students' engagement was further explored by conducting a textual analysis of online students' perceptions of

Table 3 Statistical analysis of mean OSE subscale (skills engagement, emotional engagement, participation engagement, and performance engagement) scores for Badge achievers (n = 86)

	Mean (± SD)	Minimum value	Maximum value
Skills engagement (6–30)	19.62 (8.688)	0	30.0
Emotional engagement (5–25)	15.47 (8.439)	0	25.0
Participation engagement (6–30)	15.98 (10.421)	0	30.0
Performance engagement (2–10)	5.79 (3.726)	0	10.0

Table 4 Spearman's correlation coefficients between Points and OSE subscale (skills engagement, emotional engagement, participation engagement, and performance engagement) scores (n = 234)

	Skills engagement	Emotional engagement	Participation engagement	Performance engagement
Average points	0.146*	0.274**	0.248**	0.293**

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

Table 5 Spearman's correlation coefficients between Badges and OSE subscale (skills engagement, emotional engagement, participation engagement, and performance engagement) scores (n = 86)

	Skills engagement	Emotional engagement	Participation engagement	Performance engagement
Total badges	0.094	0.194	0.225*	0.054

*Correlation is significant at the 0.05 level (2-tailed)

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Table 6 Examples of perception regarding gamification impacts

Themes	Codes	Definitions	Quotes
Positive perceptions	Skills Engagement	What students do (i.e., staying up on readings, listening/reading carefully)	*"seeing an increase in my anar seeds give me motivation to keep studying and browsing through study materials"*
	Emotional Engagement	How connected or applicable students feel to the course/content (i.e., applying course material to their lives, really desiring to learn the material)	*"The Anar seeds force me to think of new questions to ask that haven't been posed by other students"*
	Participation Engagement	Students interact with others to enjoy the content/course ((i.e., participating actively in small-group discussion forums, helping fellow students)	*"Anar seeds, competition among learners, which can encourage them to work together and support one another"*
	Performance Engagement	Students' desire/goal to succeed in the course ((i.e., getting a good grade, doing well on tests/quizzes)	*"i love anar seeds it gives me extra credit in my class"*
Negative perceptions	Skills Engagement	What students do (i.e., staying up on readings, listening/reading carefully)	*"Tbh.I don't really care about those things,it's all about self discipline"*
	Emotional Engagement	How connected or applicable students feel to the course/content (i.e., applying course material to their lives, really desiring to learn the material)	*"No, it just give me pressure to add more words when im submitting assignment when i didnt need to"*
	Participation Engagement	Students interact with others to enjoy the content/course ((i.e., participating actively in small-group discussion forums, helping fellow students)	*"While I compete with myself, I am not a competitive person in relation to others"*
	Performance Engagement	Students' desire/goal to succeed in the course ((i.e., getting a good grade, doing well on tests/quizzes)	*"I feels like this do nothing for me but if tis can be one of the grade for the certificate would be great"*

gamification, which were reflected in their responses to the three open-ended questions. Examples of evidence for coding have been illustrated in Table 6. The textual analysis has triangulated the statistical results and cross-validated the research findings.

Positive perception of points on online learners' engagement
Perception of points on skills engagement

Serving as the extrinsic reward for online learners' desired behaviors, such as quality posting, reflecting, and contributing to the course dialogue, Points can be effective in providing positive reinforcers for learning (Kapp, 2012). Students could accumulate Points by conducting or finishing specific online activities. Consequently, their learning behaviors are influenced or altered during the Points collection process.

Some students responded that Points motivated them to study regularly or form an active learning habit by reflecting that "seeing an increase in my Points gives me motivation to keep studying," "It gave me a motivation to collect more therefore I'm more often

on CN scrolling through notes," and "Anar Seeds…keeps one motivated to keep studying through CN." The application of the rewarding mechanics of Points proved to be effective in maintaining online students' regular or consistent visits to either the online platform or their learning material, thus helping keep their online course retention rate.

Notably, a regular visit to either the online platform to check on their status or a timely review of course-related notes could be perceived as a form of self-regulation. Self-regulation, or is often thought to be the same thing as self-control, has been defined by Vohs and Baumeister (2011) as the "overriding of one action tendency in order to attain another goal" (p. 3). It has been claimed that effective self-regulation can foster health-promoting behaviors (Fuhrman & Kuhl, 1998), positive psychological well-being (Baumann et al., 2005), and high job performance (Diefendorff et al., 2000). From this perspective, developing self-regulation skills in online learning activities with gamification may be possible for students' positive learning behaviors and performance. On the other hand, as Kuhl et al. (2006) pointed out, it is not easy to put self-regulation theory (SRT) into practice. The application of gamification (Anar Seeds) in promoting online students' skills engagement, or to be more specific, the construct of self-regulation, can be viewed as one practical strategy to put SRT into practice in an online learning context, and individuals with developed self-regulation skills may benefit more from online learning activities with gamification.

Perception of points on emotional engagement

Emotional engagement talks about online students' endeavors about their studies, their willingness to connect what they have learned to their lives, and their desire to learn. Based on these emotional engagement indicators, specific responses have been identified as positive perceptions of Points impacts on online learners' emotional engagement. Some students replied that Points help them "work hard" to get more seeds and increase their learning willingness, whereas they did not clarify what the "work hard" behaviors look like or to what extent their learning willingness can be. One student mentioned his desire by stating, "The Points force me to think of new questions to ask that have not been posed by other students." In other words, Points positively impacted students' desire to learn more by asking novel questions in their study.

One aspect that has appeared repetitively in almost one-third of all the responses concerning Points' positive impacts on online students' engagement is the "availability of tracking." Nine out of 32 online students who reflected their positive perceptions about Points mentioned that Points are practical in helping them keep on track of online learning endeavors, such as their study progress, effort spent on each course, and estimation of the workload in the courses. Online students also appreciated the ease of tracking progress and the enjoyable process of tracking Points accumulation; however, tracking availability did not directly relate to the emotional engagement indicators.

The theoretical implications hidden beneath these responses cannot be ignored. Participants also mentioned that seeing the accumulation of Points can help them "get an idea about my current position," "shows the work I have done…make me happy," and "Anar Seeds…view my power." Seen from these perceptions, Points were found to elicit participants' sense of accomplishment by showing them up-to-date progress to strengthen their self-efficacy. They can also provide the confidence to achieve

learning goals reflected as their personal "power," which can increase the participants' emotional engagement and overall desire to learn more.

Perception of points on participation engagement

According to Dixson (2015), participation engagement refers to online learners' active and diversified involvement in different learning activities, including online chats, discussions, online conversations, and forums, as well as their social interactions with their peers, including the willingness to know or to help their peers. Although few respondents explicitly mentioned gamification's impact on their participation engagement, several distinct viewpoints confirmed its influence.

One agreed that collecting Points elicited their competitive motivation and monitored "how active I am compared to others." From this response, it's interesting that the gamification mechanics impacted online learners' participation engagement not in cooperation but in competition, where the learner gained self-fulfillment by collecting enough Points to demonstrate his endeavor beyond his peers.

Of course, there are also responses mentioning both competition and cooperation. One response replied, "Points (motivated) competition among learners, which can encourage them to work together and support one another." It seems that the collection of Points helped encourage cooperation among learners to win certain forms of competition in online learning activities, and gamification can be utilized to either motivate a personal sense of competitiveness or group efforts of active participation.

Also, one response mentioned, "When I need to increase my Anar Seeds, I always try to put a good post or poll because it gives 10 and 5 Points for each." This is a typical example of how Points can enhance online students' participation engagement by encouraging them to make active polls or posts to share their thoughts with others. Similarly, another response confirmed that Points can motivate learners to complete tasks and participate in activities as long as the Points are set to be a "tangible goal to work towards."

From the above, Points are proven effective in motivating online students' participation engagement by eliciting their sense of competition, willingness to cooperate, and desire to complete tangible tasks. What needs to be taken care of is the potential harm to participation engagement caused by either the over-indulged competitions on simply collecting Points or the inappropriate setting of Points goals, which might sabotage learners' participation engagement and learning motivation.

Perception of points on performance engagement

In OSE, only two indicators (i.e., a good grade/doing well on tests) have been used to reflect online students' performance engagement. One response replied that she loved Points because they gave her extra credit in her class. However, she did not detail whether the extra credits will be accumulated to her grade or scores on tests and quizzes; therefore, further exploration is needed, such as semi-structured interviews of participants' perceptions of how the Points impact their performance engagement.

Negative perception of points on online learners' engagement and suggestions on gamification design improvement

Only one response mentioned how negative perceptions of Points impacted their specific engagement: "The gamification features do not help with my engagement. It feels like additive work since my instructor requires a certain amount of Points to receive Points in class." Interestingly, the online learner's psychological resistance to finishing learning tasks was aroused by the instructor but not by the gamification design or its mechanics. According to this perception, earning a certain amount of Points seems to be compulsory work requested by the instructor but not a motivating reward for the learner to earn on his or her willingness. This is a typical example when discussing gamification mechanics and SDT theory (Ryan & Deci, 2000) where engagement is closely linked to satisfying the three psychological needs: autonomy, competence, and relatedness. For this example, the learner's autonomy has been diminished by losing control over her actions; thus, the learner is less likely to engage willingly and actively. Given this, it should be noted that the instructor can play a vital role in maximizing the gamification mechanics in engaging online students by purposefully setting up reasonable goals and, at the same time, offering students sufficient autonomy so that they can feel a sense of control over their behaviors and the tasks that are about to finish. Otherwise, the impact of gamification mechanics would diminish.

Five respondents suggested improving Points design to facilitate online learners' engagement in learning activities. One person suggested that more Points should be awarded for high-quality content to motivate students to put forth effort on specific learning materials and enhance their emotional engagement, as indicated in Dixson's (2015) OSE scale. Three showed their interest in getting a bonus gift or claiming a "virtual currency" after their Points reached specific numbers, or they were willing to be notified once their Points accumulation was updated. These gamification design changes might not directly impact the online learners' specific engagement. However, there is no doubt that they can help maintain the positive attitudes of online learners toward their course retention and involvement in online activities. Also, one respondent mentioned it would be "helpful if there was more detailed information on what exactly each item is to better understand the Anar Seeds." This response revealed the importance of making game rules explicit and explaining to students how each gamification mechanic works, as evidenced by Alomari et al. (2019) and Machajewski (2017).

Positive perception of badge on online learners' engagement
Positive perception of badge on participation engagement

Participation engagement emphasizes social interactions among online students with their peers and instructors during the online study, their interest and desire to know others, and their active involvement in all online discussions. One respondent mentioned, "I do enjoy the Badges… I was excited about the content and meeting other like-minded individuals," thereby showing his intention to reach out to other online students that would promote his engagement to participate in different online activities.

Another reflection confirmed the respondent's preference for positive Badge impacts on her online learning by saying that "Badges, (it) can show to others how I'm

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active on cn (CourseNetworking)." Interestingly, some online learners keep motivated or engaged in learning activities by showing their achievements to their peers. In contrast to what has been discussed concerning "sense of achievement" in the emotional engagement section, where online learners concentrate on their endeavors and self-fulfillment that does not necessarily rely on connection with other social members, this response indicated the significance of being "exposed" to others, a form of social connection or interaction to help increase the intrinsic motivation which is a crucial driver of engagement—aligned with the Self-Determination Theory (Ryan & Deci, 2000), which suggests that engagement is closely linked to the satisfaction of the three critical psychological needs mentioned earlier: competence, autonomy, and relatedness. Among these factors, relatedness can explain why Badge mechanics can be practical in promoting participation engagement. When learners are aware of their achievement being acknowledged by the social community they are involved in, such positive social recognition can make individuals feel encouraged and motivated to engage in their academic endeavors.

Though not many responses mentioned the Badge impacts on their participation engagement, the implication of Badge impacts on online learners' participation engagement is worth deeper discussion and interpretation using related learning theories. Notably, Badge earning reflected the gamification mechanic impacts on learners' participation engagement. Of all the 440 responses, 86 reflected that they had earned at least one Badge during their online course-taking. In total, 181 Badges had been earned. The most earned Badge types are: "Post of the week" (38 Badges, 21% of all Badges), "Great post" (27 Badges, 14.9% of all Badges), "Academic Integrity" (15 Badges, 8% of all Badges), "ePortfolio Appreciation" (15 Badges, 8% of all Badges), "Course of the week" (11 Badges, 6% of all Badges), and "Scavenger Hunt" (11 Badges, 6% of all Badges). Among these Badges, "Post of the week" Badge (this Badge recognizes CN members whose post received the highest ranking based on peer ratings over the past seven days in their class), "Great post" Badge (this Badge recognizes CN members whose post was selected as a high-quality post by course instructors), and "Scavenger Hunt" Badge (This Badge recognizes a student's participation and/or completion of the Scavenger Hunt activity) are representative Badges that record the endeavor of the online learners' positive participation in online discussions, and active interaction with peers for completing specific online tasks.

In addition, those Badges that contribute to the promotion of online learners' participation engagement, such as the "Best Participant" Badge (this Badge recognizes active members of a class; seven Badges have been earned), "Teamwork" (this Badge recognizes learners' collaboration experience and skills, three Badges have been earned) and "Community service" (this Badge recognizes contributions to local and global communities, one Badge has been earned), though not too many of them have been obtained, put together with Badges of "Post of the week," "Great post," and "Scavenger Hunt," have covered 48.1% of all the Badges (n = 181) that have been earned. From this result and the positive correlation between Badges and online learners' participation engagement, it can be proposed that Badges designed to elicit online learners' involvement in online activities or social interactions can effectively enhance their participation interests and engagement.

Suggestions on gamification design improvement

No negative perceptions concerning Badge impacts on specific learners' engagement were received. However, ten responses suggested how to improve the Badge design, which might reflect why Badges did not fully contribute to online learners' engagement. Based on these responses, two major themes have emerged regarding the learners' expectations of Badge design improvement to facilitate their engagement.

Clear description of badge rules

One learner mentioned, "I do not really notice Badges, so maybe that feature should be emphasized more," indicating a lack of awareness toward the gamification components on the CN platform. The limited impacts of Badges on his engagement were not caused by the design flaw but by the ignorance of gamification components that can be applied in learning activities. Likewise, another learner suggested "include a list of all the ways you can earn Badges or Points if there isn't already," implying that the learners desire to know more about the gamification rules before applying them. Interestingly, this suggestion echoed the suggestion about improving Points, where the learners hoped to understand better how to accumulate Anar Seeds.

Sense of control over earning badges

Other responses demonstrated learner preferences for multiple or diversified choices of Badge earning, which would grant them a great sense of control over choosing specific Badges to fit their needs best. For example, one learner expected to have more chances of earning Badges once a week instead of passively waiting for specific Badges to be issued by the instructors or the system. Interestingly, another learner wanted to be rewarded with specific Badges as long as any tests or exams had been passed so that her success could be noticed and appreciated. In addition, one learner was curious whether it is possible to make the Badge "redeemable" as Points, which means he could have the autonomy to "trade" them for more tangible awards. Yet another learner suggested "make a higher tier Badge" to make it more engaging for competitive learners to choose from and meet their needs to obtain more challenging Badges.

These suggestions can be summarized as online learners' requests for a higher level of autonomy or a greater sense of control over their behaviors on Badge earning. Once again, the findings align with the SDT theory (Ryan & Deci, 2000), where engagement is closely linked to the satisfaction of autonomy, one of the three key psychological needs. The more that learners feel satisfied, the more chances there are for them to engage willingly and actively in certain goals.

Research implications

The outcomes from RQ1.1 revealed that the gamification component, Point (Anar Seeds), significantly correlated with four subscales of engagement (skills engagement, emotional engagement, participation engagement, and performance engagement). However, for RQ1.1, only one positive correlation between Badges and participation engagement was captured.

Next, a textual analysis was conducted based on the voluntary responses of online learners' perceptions of gamification impacts on their learning to triangulate the quantitative data and seek possible reasons for that correlation. The most representative quotes from online learners' reflections were selected and analyzed to reveal the potential impacts of gamification. The follow-up coding analysis of the results showed both positive and negative perceptions toward gamification on four engagement types, as well as online learners' suggestions about improving future gamification design that might help better facilitate their learning engagement.

Theoretical implications

Our findings open the debate on using a series of theoretical lenses to understand certain gamification components' workings better. Each specific behavioral change triggered by gamification mechanics can be well aligned with related psychological theories. The results indicated that the implementation of gamification should fulfill online learners' psychological needs to be autonomous in conducting the desired learning activities, thereby maximizing the effects of gamification mechanics. At the same time, the lack of a sense of control would diminish the learners' engagement levels. In addition, relatedness, another critical psychological need in SDT theory, explains why Badge mechanics can effectively promote participation engagement. When learners are aware of their achievement being acknowledged by the social community, it will foster a sense of belonging and create an environment where individuals feel encouraged and motivated to engage in learning activities.

We also realized that learners are demanding the difficulty levels of specific gamification settings and ask for "tangible goals in achieving Points" or the issue of "higher tier of Badges" to challenge themselves with higher learning goals. The individual learner has specific demands for the challenge levels to remain in a so-called "flow" status that proposes "intense concentration, loss of self-awareness, and a feeling of being perfectly challenged" (flow theory) (Csikszentmihalyi, 2000). To maintain this psychological state, designers and instructors need to be careful in designing online gamified tasks that are neither too hard for learners to feel discouraged nor too easy for learners to get bored.

The mechanics of Points to drive learners' behaviors or engagement levels can also be interpreted with positive reinforcement, as described by Skinner in his theory of Operant Conditioning (1938). In positive reinforcement, a response or behavior is strengthened by rewards that lead to the repetition of a desired behavior, and the reward is usually seen as a reinforcing stimulus. In most gamification studies, Points have played the role of encouraging targets to increase or repeat the desired behaviors by fulfilling their motivational needs in the form of rewards, a stimulus that can be conducted promptly right after certain desired behaviors have been observed. In other words, one crucial feature of gamification mechanics is that it offers quick feedback to learners, thereby strengthening their sense of achievement or feeling of control over their progress, promoting their autonomy and engagement behaviors in certain activities. Several responses in the study mentioned that the collection of Points makes them want to "collect more," "earn more," "do more work," or "keep getting more," a typical example showing the function of positive reinforcement that can be realized through gamification mechanics to encourage the learners' desired engagement behaviors. Interestingly, similar responses were not

received in terms of earning Badges. Conceivably, part of the reason is that it would take learners a longer time and extra effort to obtain certain types of Badges, increasing the positive feedback timespan and reducing their sense of control over their behaviors.

In addition, when analyzing learners' preference for Anar Seeds' "tracking" functions, updated records of Points accumulation grant learners a sense of accomplishment, which can contribute to eliciting "self-efficacy" (Bandura, 1997), a concept that refers to an individual's belief in their ability to perform specific tasks or accomplish goals in various situations. Self-efficacy is one major component of Bandura's (1986) social cognitive theory, which claims that individuals with high self-efficacy are more likely to set challenging goals, persevere through obstacles, and view failures as learning opportunities. In this study, learners expressed their psychological satisfaction with what they had achieved, which can help strengthen their self-efficacy to engage in more challenging tasks. Of course, the self-efficacy theory has not yet been adequately investigated in explaining the effects of gamification (Krath et al., 2021), and more empirical research is needed.

Practical implications

This research presented the necessity of investigating the potential influence of instructors' application strategies of specific gamification components in their online class design. As is reflected in the negative perceptions of Points and some suggestions on improving the Badge design, we realized that the inappropriate settings would affect learners' motivation and engagement level and diminish the benefits of the gamification mechanics. Learners cannot take full advantage of gamification in motivating their engagement if instructors fail to inform them of the availability of those gamification components ("I do not really notice Badges, so maybe that feature should be emphasized more"), to clarify the rules of earning rewards ("Maybe include a list of all the ways you can earn Badges or Points if there isn't already"), and inappropriately set earning goals that sabotages learners' motivation ("It feels like additive work since my instructor requires a certain amount of Points to receive Points in class"). Therefore, it is implied that the instructors have played an essential role in scientifically implementing gamification components in the class activity design. Instructors are suggested to learn how to integrate gamification components to maximize their mechanics for enhancing engagement by constantly asking for learner feedback and adjusting accordingly. This can be considered a beneficial supplement to the TPACK (Technological Pedagogical Content Knowledge) skills (Koehler & Mishra, 2009), which educators rely on to effectively incorporate technology to enhance learning outcomes, especially in an online learning context.

The research also found that the design of gamification components (i.e., Points, Badges, etc.) impacts their functions and learners' user experience. In our analysis of learners' reflections on gamification impacts, some responses expressed their preference for certain features of the gamification components that have not been embedded in the gamification design. As the effects of game elements are personal and differ widely between different education levels and adult categories (Buckley & Doyle, 2017; Mekler et al., 2017; van Roy & Zaman, 2017), it is worth further exploring how instructional designers or Human–computer Interaction designers perceive

the design principles, and how their design thinking would influence the implementation of gamification to impact online learners' engagement levels.

Methodological implications

Unlike prior gamification research (Coetzee et al., 2014; Denny, 2013; Hew et al., 2016; Mekler et al., 2013) that primarily examines the collective impact of multiple gamification components on student learning, this study identifies correlations between specific gamification components and particular engagement subscales. It also addresses the issue in prior research, where few studies have determined whether their findings stemmed exclusively from the effects of gamification without being influenced by factors outside of the gamification components. This research elucidates the relationships between individual gamification components and distinct types of engagement, providing a more nuanced understanding of their effects. Then, the correlation results were triangulated using the qualitative analysis of survey responses regarding online students' perceptions of gamification in their learning. This methodological design can help researchers gain a deeper understanding of whether gamification mechanics influence different types of engagement. It also provides a thorough interpretation of the potential reasons why gamification may positively or negatively impact online learners' engagement. In addition, this methodology design contributes to the methodological diversity regarding gamification research with e-learning (Kamunya et al., 2022).

Generalizability implication

Most research on gamification in online learning has been conducted within contextually limited environments, focusing on specific courses, subjects, or fields. Examples include studies in nursing education (Inangil et al., 2022), computer science education (Khaleel et al., 2019), biometric technologies (Milenković et al., 2019), information technology (Pakinee & Puritat, 2021), physics (Ahmed & Asiksoy, 2021), adult education (Ng & Lo, 2022), curriculum design (Chung & Lin, 2022), MOOCs (Romero-Rodriguez et al., 2019) and so on. The compartmentalization of subject areas and the lack of participant diversity in these studies pose challenges to the generalizability of their findings, as gamification strategies effective in one learning environment may not necessarily apply to others.

Given this, the study seeks to address the issue of generalizability by conducting research in a learning environment with learners from diverse social and cultural backgrounds. These learners have completed over 100 online courses on the CN platform, spanning a wide range of subjects from natural to social sciences, without being restricted to any specific field. Therefore, the findings of this study have been generalized based on data collected from a diverse population, allowing the results to be applicable across various subject areas. This research design provides a comprehensive understanding of gamification mechanics and their complexity, thereby establishing a research framework that is not only applied to the CN platform but also transferrable to other online learning environments incorporating similar gamification components.

Limitations and future directions

Several limitations in this study must be pointed out. First, the survey of online learners' engagement was self-reported. As a result, the results might be influenced by respondents' biases and a lack of objective measurement. In addition, in the OSE (Dixson, 2015), the measurement of performance engagement has only two indicators, which would limit the measurement accuracy and comprehensiveness of the results. Next, not all respondents finished answering each question in the engagement survey, which lowered the correlation's accuracy rate. Following that, some respondents' reflections on gamification perception were short, oversimplified, or unclear, which might affect the researcher's interpretation of their actual views and experiences. Moreover, creating codes with fewer response sentences would weaken the validity and reliability of the study. More students' response sentences for synthesizing specific themes should be collected as evidence of their reflection and coding.

Besides, none of the respondents mentioned their perceptions of Badge impacts on their performance skills, emotional engagement, and performance engagement. Clearly, more qualitative data for these sections needs to be collected and further analyzed, and the gamification mechanics of Badges in this research must be sufficiently investigated. Finally, information about students' age distributions is missing due to the data access limitation, which would affect the interpretation accuracy of research findings, as learners in different age groups would reflect differently towards gamification mechanics.

Based on the current research findings and limitations, we suggest that future research be conducted to evaluate online learners' engagement using objective psychological measurements instead of self-report surveys. These psychological measurements are suggested to assess limited groups regarding different age ranges or learning areas. At the same time, semi-structured interviews or focus group interviews would help acquire more thorough views and perceptions from online students, instructors, and gamification designers about either their intentions to apply gamification components or design thinking for the gamification mechanics, which would greatly help people better understand the gamification impacts and how to optimize their effects in online learning contexts. In addition, as Points, Badges, and Leaderboards are the favorite gamification elements concerning the gamification design in an online context (Antonaci et al., 2019), different game elements, such as Leaderboards that have not been discussed in this research, could also be included in future gamification studies of CourseNetworking or similar platforms to gain a more precise comprehension for applying gamification. In addition, socio-demographic factors and their potential effects on online learners' gamification perceptions could also be discussed and contribute to getting more reliable findings for future gamification studies.

Conclusion

While gamification has garnered significant attention in the twenty-first century, the idea of using games or playful elements in education is not new. Throughout history, educators have employed various game-like techniques to enhance learning, from educational board games to interactive classroom activities. As a result, more questions have arisen as gamification's effectiveness in educational contexts is inconsistent and

varied from case to case. Given this background, we advocate a thorough understanding of how specific gamification mechanics work and under what circumstances they will impact certain learning activities.

This study initially explored this issue using a quantitative method in which 440 online learners' engagement was measured to see its correlation with the number of Points and Badges collected on a global social learning platform. After that, a qualitative analysis was conducted to triangulate the quantitative research results and seek more insightful findings on interpreting the reasons for the significant correlation. By doing this, we learned that the number of Points being collected was positively correlated with online learners' skills, emotional, participation, and performance engagement. We also learned that the number of collected Badges positively correlated with online learners' participation engagement. No correlation between Badges and skills, emotional, and performance engagement was detected in this study. We also explored more deeply the gamification mechanics that impact each type of engagement by textually analyzing the online learners' perceptions about the impact on their learning activities. We recognized that gamification mechanics can impact online learners' psychological states, either positively or negatively.

As prior research has revealed a double-edged effect of gamification mechanics, it is argued that over-reliance on incentive systems of gamification may reduce students' intrinsic motivation to engage in gamified learning for its own sake, diminishing their enjoyment and satisfaction in the process (Derfler-Rozin & Pitesa, 2020; Facey-Shaw et al., 2020; Fulya Eyupoglu & Nietfeld, 2019). Evidence also shows that student engagement tends to decline over time as the novelty of gamification diminishes (Koivisto & Hamari, 2014; Mollick & Rothbard, 2014). Therefore, adopting a long-term perspective in this field is essential to examine the novelty effect of gamification (van Roy & Zaman, 2017). It is valuable to investigate how students' psychological states evolve over time when exposed to specific gamification components or strategies and how these evolutions affect their learning outcomes from a longitudinal perspective.

It needs to be cautious that gamification is not a panacea for addressing complex educational issues and will not make "bad" educational content a "good" one. As a result, instructors face significant challenges if they wish to incorporate specific gamification components into their course or instructional design strategically. In our study, some students expressed negative perceptions of gamification components, not due to the components themselves, but how their instructors implemented them to facilitate learning engagement (e.g., making earning Points a mandatory task). Instructors are suggested to maximize the positive effect of gamification by purposefully setting reasonable goals and offering students sufficient autonomy to feel a sense of control over their learning behaviors. The timing of rewards, the setting of reward intensity, and the standards for earning rewards are also essential factors that instructors need to consider when optimizing the gamification effects in their instructional design.

Students in this study also suggested improving the gamification design based on their user experience. They would prefer to receive a bonus gift or claim a "virtual currency" after their Points reach specific numbers, clearly understand how gamification components function before using them, be notified by the system whenever their gamification achievement is updated, have easier access to gamification features,

gain a more flexible way of earning their rewards, and so on. These insights can guide gamification designers in innovating their approaches within online educational contexts to enhance user and learner experiences. Additionally, they can inform gamification design choices in other online learning environments where similar gamification elements are used to engage learners.

For future research, it is highly recommended that investigations be made from either the instructors' or the gamification designers' perspective to seek any other factors that might contribute to the implementation of gamification in the online learning context. Such studies will continue to evolve as new gamification efforts and ideas are designed and implemented.

Appendix

Dear Students, the following questions ask about your engagement through gamification features (Anar Seeds, badges, leaderboards/Roster) in your CN courses. The survey is anonymous and will only take about 5 min to complete. Your answers are confidential and will only be used by the learning research team to help improve instruction and learning technology. You will receive a CN Supporter badge if you complete all 22 questions.

(5 = strongly agree 4 = agree 3 = no opinion 2 = disagree 1 = strongly disagree)

Close-ended questions:

1. In my courses that use CN, I make sure to study on a regular basis
2. In my courses that use CN, I put forth effort into my courses
3. In my courses that use CN, I stay up on the readings of my courses
4. In my courses that use CN, I look over class notes between getting online to make sure I understand the material
5. In my courses that use CN, I am being organized for my courses
6. In my courses that use CN, I take good notes over readings, PowerPoints, or video lectures of my courses
7. In my courses that use CN, I listen/read carefully when I am taking my courses
8. In my courses that use CN, I find ways to make the course material relevant to my life
9. In my courses that use CN, I apply course material to my life
10. In my courses that use CN, I find ways to make the course interesting to me
11. In my courses that use CN, I really desire to learn the course material
12. In my courses that use CN, I am having fun in online chats, discussions, or via email with the instructor or other students
13. In my courses that use CN, I participate actively in small-group online discussions
14. In my courses that use CN, I am helping fellow students when I take the courses
15. In my courses that use CN, I am getting a good grade for my courses
16. In my courses that use CN, I am doing well on the tests/quizzes for my courses

17. In my courses that use CN, I am engaging in conversations online (chat, discussions, email)
18. In my courses that use CN, I am posting in online discussions regularly
19. In my courses that use CN, I am getting to know other students in the class

Open-ended questions:

20. Did gamification features (Anar Seeds, badges, leaderboards/course Roster) have any positive influence on your learning? What are these influences?
21. What game elements (Anar Seeds, badges, leaderboards/course Roster) in CN you liked the most and why?
22. What would you suggest to improve gamification elements (Anar Seeds, badges, leaderboards/course Roster) in CN? What can be done to further improve it?

Declarations

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Publisher's Note

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