INFLUENCE OF GAMIFICATION ON STUDENT ENGAGEMENT IN ONLINE DISCUSSIONS USING SELF-DETERMINATION THEORY

Rico Putra Pradana, Universitas Indonesia
Ave Adriana Pinem, Universitas Indonesia
Putu Wuri Handayani, Universitas Indonesia

ABSTRACT

This study uses self-determination theory to examine the effect of gamification on the students' behavioral, emotional, and cognitive engagement in online discussion forums by providing more instructor badges than automatic badges and using a quasi-experimental one-group pretest–posttest design. Behavioral engagement was measured using the number of posts and replies; emotional engagement was measured using perceived relatedness; and cogitative engagement was measured by the quality of the post/reply's content. Sixty participants used the developed online discussion website and held two 3-day discussion sessions (non-gamified and gamified) with different topics. The data were collected using user logs (number of posts and replies), questionnaire responses (perceived relatedness), and assessment rubrics (scores on the post/reply content), analyzed using the one-way repeated measures analysis of variance. The results revealed that gamification affected emotional engagement, which was influenced by the "like" feature, which made it easier for participants to appreciate others' activities. However, this feature also decreased the number of replies (behavioral engagement) because the students perceived "liking" as an easier way to appreciate other posts/replies instead of writing a reply. The number of posts also decreased since participants' motivation in the second session tended to focus on the quality of the content caused by the badge list page, which guides the expected best content from the participant. This study can provide guidance to universities in implementing gamification in LMS.

Keywords: *gamification, online learning, higher education, e-learning*

INTRODUCTION

In response to the Covid-19 pandemic, the Indonesian Ministry of Education and Culture issued directives for remote teaching and learning activities (Ministry of Research and Higher Education, 2020). The use of e-learning is expected to meet these needs. Several Indonesian universities are already using e-learning in their learning processes. XYZ University is one of the universities that has implemented a learning management system (LMS) for various learning activities, including online discussion forums.

Although the e-learning platform has various benefits, its impact would be suboptimal if students had low interest in using it. Studies conducted prior to the Covid-19 pandemic state that students are less involved in online discussion activities and rarely access learning material in discussion media (Ding et al., 2017; Hasan et al., 2019). The problem of low student engagement in online discussions

has been challenging for the effective use of an LMS (Ding et al., 2017). Therefore, we observed the utilization of the LMS at XYZ University in 24 online classes. The results indicate that from an average of eight discussion forums available in each class—attended by approximately 205 students—there was only one post made by one student per class, with an average of 12 replies per post. This low number of students encouraged us to research student involvement in the online discussion forum. Student engagement consists of three components: behavioral, emotional, and cognitive engagement (Ding et al., 2017; Nisiotis & Kleanthous, 2019). Gamification is defined as the use of game elements in non-game environments. Zeybek and Saygı (2023) describe that gamification can increase learning motivation, engagement, and achievement in an online educational environment and state that it is used most commonly in higher education, specifically at the undergraduate level (Zeybek & Saygı, 2023).

Most studies have focused on the design of gamification in certain learning environments and its impact on learning. Grabner-Hagen and Kingsley (2023) analyzed the mechanics within gamification design in a blended learning environment—face-to-face instruction and an LMS. Sanchez et al. (2019) analyzed the impact of gamified quizzes on student learning. Legaki et al. (2020) analyzed the impact of gamification using points, levels, challenges, and leaderboards on learning statistics education. In a systematic review of gamification trends for young learners, Behl et al. (2022) state that universities should identify the best gamification techniques and software for e-learning. Oliveira et al. (2023) reported that universities should design tailored, gamified educational environments that shape students' needs and preferences.

Gamification can increase student involvement in online discussions. It enhances cognitive and behavioral engagement in online discussions (Ding, 2019). By contrast, Ding et al. (2017) show that gamification only significantly positively affects partial emotional engagement (perceived relatedness). Hasan et al. (2019) demonstrate that the application of gamification in online discussion media positively influences behavioral engagement in discussions. Hamari (2017) indicates that all user activities recorded during the post-implementation (gamification) period are significantly higher than pre-implementation (no gamification).

Instructor badges have been demonstrated to influence autonomous motivation, a type of motivation that encourages someone to behave according to their needs, which is stronger than automatic badges (Ding et al., 2017). The previous studies had some limitations; however, Hasan et al. (2019) discussed behavioral engagement and did not focus on online discussion forums. Hamari (2017) and Sitra et al. (2017) discussed the application of gamification in the form of badges using experimental methods but not in the context of online discussions. Furthermore, Hamari (2017) suggests conducting quasi-experimental research using a one-group pretest–posttest design to identify differences in behavior caused by gamification. Therefore, this paper's study examines the effect of gamification on all components of student engagement (behavioral, emotional, and cognitive engagement) in online discussion forums by providing more instructor badges than automatic badges and using a one-group pretest–posttest design. The results are expected to provide answers related to online discussion design with gamification, which can improve student engagement.

LITERATURE REVIEW

E-Learning and Asynchronous Online Discussion

Clark and Mayer (2016) defined e-learning as "instruction delivered via digital devices (such as desktop computers, laptops, tablets, or smartphones) that are intended to support learning." Nowadays, students can access their teaching materials anytime and anywhere through the internet (Tamm, 2019). Asynchronous learning can thus be used to carry out learning activities through e-learning (Epignosis, 2014; Ghirardini, 2011).

Asynchronous online discussion allows students to ask questions or discuss anytime and anywhere by creating a post on a discussion forum or commenting on a post (Abawajy & Kim, 2011). According to Ding (2019), three main components of asynchronous online discussion are a sense of community, participation, and cognitive thinking. The sense of community explains the interactions/relationships between students in discussions that can encourage the students to create more posts (Ding, 2019). Active participation in online discussions can be realized through reading and creating

posts in the discussion (Ding, 2019). Cognitive thinking is the ability to think at a higher level (higher-order thinking), such as analysis, synthesis, and evaluation, which can be found in discussion activities (Oh et al., 2018).

STUDENT ENGAGEMENT

According to Nisiotis and Kleanthous (2019), student engagement is a commitment or effort put forth by students to be involved in or participate in learning activities. Student engagement comprises three components: behavioral, emotional, and cognitive engagement (Ding et al., 2017; Nisiotis & Kleanthous, 2019). Behavioral engagement is a form of student learning behavior, such as actively participating in learning activities, including contributing to discussion activities (Ding et al., 2017). Emotional engagement is the psychological or emotional reaction to the posts made by peers/teachers, such as feeling attracted, bored, happy, and sad (Ding et al., 2017; Fredricks et al., 2004). Cognitive engagement is a form of attention, willingness, and effort to understand complex concepts, master difficult skills, and use higher-order thinking skills (Ding et al., 2017; Fredricks et al., 2004; Sedláček & Šeďova, 2020).

GAMIFICATION

Deterding et al. (2011) defined gamification as "a process of using game elements in a non-game context to motivate and engage users." The use of game elements is expected to make non-game activities feel similar to those of playing a game (Sailer et al., 2017). Gamification can make non-game activities fun, encourage social interaction in the learning community (Ding et al., 2017), and may increase motivation and performance in performing an activity (Sailer et al., 2017). Various game elements can be used in implementing gamification in an activity, including badges, points, leaderboards, progress bars, reaction systems, levels, meaningful stories, avatars, teammates, and challenges.

SELF-DETERMINATION THEORY

Self-determination theory (SDT) is the most popular theory for analyzing gamification (Kirchner-Krath et al., 2021). It is "a theory of motivation and personality that discusses how individuals interact and depend on the social environment" (Legault, 2017). Self-determination theory divides motivation into two types: intrinsic and extrinsic (Ryan & Deci, 2000). Intrinsic motivation is in play when an action or activity that is conducted for the satisfaction that can be felt simply by doing these activities, whereas extrinsic motivation involves performing an action or activity to obtain things beyond the satisfaction of doing these activities (Ryan & Deci, 2000). According to Ryan and Deci (2000), only intrinsic motivation can improve one's creativity and learning outcomes. They also explain that giving gifts, which is a form of extrinsic motivation, can reduce intrinsic motivation in various fields. Therefore, we used SDT as a reference to increase the participants' intrinsic motivation in the discussion.

Human basic psychological needs for autonomy, competence, and relatedness are at the core of SDT (Legault, 2017). The need for autonomy is the need for a sense of freedom in determining actions based on self-consideration (Legault, 2017; Sailer et al., 2017), which relates to behavioral engagement, where the participants determine how they will participate in discussion activities. The need for relatedness is the need to build relationships and a sense of concern for others (Legault, 2017), and relates to emotional engagement in which psychological or emotional reactions to friends or teachers in class can arise in discussion activities. The need for competence is the need for a sense of competence and effectiveness when interacting with the environment (Legault, 2017; Sailer et al., 2017), which relates to cognitive engagement in which the participants' attention, will, and efforts are mobilized for understanding complex concepts, mastering difficult abilities, and using higher-order thinking skills in discussion activities. Self-determination theory can be used to determine the game elements that will be used in applying gamification to an activity (Wee & Choong, 2019).

HYPOTHESIS DEVELOPMENT

This study evaluates the effect of gamification on components: the number of posts and replies (behavioral engagement), perceived relatedness scores (emotional engagement), and the grades/scores for the post and reply (cognitive engagement). Behavioral engagement in online discussion activities can be measured through the active participation of students in discussions (Ding et al., 2017), for example, through the number of posts

and replies made by them (Ding, 2019; Hamari, 2017). Emotional engagement can be assessed through the variable perceived relatedness, which is measured using a questionnaire adapted from the Intrinsic Motivation Inventory (Ding, 2019). Cognitive engagement in online discussion activities can be measured using the grade obtained based on the quality of the post/reply content during discussions (Ding, 2019). Gamification significantly affects the number of posts and replies made in the discussion (Barata et al., 2013; Hamari, 2017), perceived relatedness (Ding et al., 2017), and the grades obtained in the discussion (Barata et al., 2013). On the basis of this explanation, this study proposes four hypotheses:

H1. Gamification affects the number of posts made in online discussions.

H2. Gamification affects the number of replies made in online discussions.

H3. Gamification affects the perceived relatedness felt in online discussion activities.

H4. Gamification affects the grades obtained by the online discussion participants.

RESEARCH METHOD

Research Design

This study used a mixed-methods design, where quantitative data were obtained through logs of participant activity in discussion forums and questionnaires, and qualitative data were obtained through interviews. We recruited 60 participants through volunteer sampling of all active XYZ University students in the even semesters of 2019–2020. The participants attended a general course for character-building lectures and topics of discussion that related to knowledge for that course.

A one-group pretest–posttest design was used in this study: the participants held two 3-day discussion sessions in a discussion forum with different topics. The first session did not have gamification (pretest), and the second did (posttest). At the end of each discussion session, the participants were asked to fill out a questionnaire containing closed questions to measure perceived relatedness and open questions to investigate their experiences during the discussion. After the collected data was processed, interviews were conducted with six participants to deepen the research results. Quantitative data were analyzed using one-way repeated measures analysis of variance (ANOVA), and qualitative data were analyzed using a general inductive analysis.

RESEARCH INSTRUMENT

Discussion Forum

We created a website prototype as an experimental tool, the design of which was based on the LMS in the XYZ University to reduce the participants' adaptation burden. This prototype had two versions: non-gamified and gamified. Both versions have the same main functionality, but the gamified version has two additional components: badges and likes (the reaction system). These two elements were chosen because they can fulfill three basic human psychological needs in SDT (Ding, 2019; Sailer et al., 2017; Saputro et al., 2017). This forum allowed participants to read, create, modify, delete, and reply to posts and replies in the forum; notifications that notify participants of new posts/replies; and basic functionalities such as logging in, logging out, account registration, and viewing personal profiles. Table 1 summarizes the participants' demographic characteristics.

Table 1.
Participants' Demographic Characteristics

Variable		Number	Percentage
Age	15–20 years	19	31.7%
	20–25 years	41	68.3%
Gender	Male	18	30%
	Female	42	70%
Have used e-learning other than the LMS of the university	Yes	52	86.7%
	Not yet	8	13.3%

Assessment Rubric

We measured the grades obtained by the students based on the quality of the post content and their replies during online discussion activities. A scoring rubric was used as a guide for assigning a score for each post and reply (Appendix C), which was adapted from Brown (2014) regarding the application of active learning in online

teacher education lectures. This rubric was also used to design criteria for collecting badge skills (Brown, 2014).

Questionnaires and Interviews

The participants completed the questionnaire at the end of the first and second discussion sessions (Days 3 and 6, respectively). This questionnaire comprised two parts. The first part included a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) to measure the variable perceived relatedness (emotional engagement) adapted from the Intrinsic Motivation Inventory. The second part involved open-ended questions to evaluate the participants' attitudes toward online discussion activities in each LMS version adapted from Ding (2019). Furthermore, several interview questions were developed based on the results of the analysis of the collected experimental data. Appendix A describes the interview instruments and Appendix B presents the questionnaire instruments.

GAMIFICATION DESIGN

Gamification Components

The second discussion forum (gamified version) applies two gamification components: badges and likes. Using the "likes" feature, the participants can like posts/replies in the discussion forum and investigate the number of likes they have given and the number of likes their posts/replies have received. Furthermore, the participants could obtain badges when they give/receive likes and create posts/replies whose content meets certain criteria. A list of badges and their respective acquisition criteria was also provided in the gamified version. The participants could see a list of badges that they have successfully collected on their profile page, which could only be seen by themselves. The participants received a notification every time they successfully received a badge or like. Examples of pages containing a list of badges, a profile page, and a "likes" feature are provided in Figures 1, 2, and 3.

Two types of badges were used in this study: participatory and skill. Participatory badges help participants recognize what activities they can do in the gamified version, one of which is the badge system, so that participants are motivated to be involved in discussion activities (Ding et al., 2017). The gamified version provided four participatory badges (Figure 4), which were awarded on

Figure 1.
Badges List Page

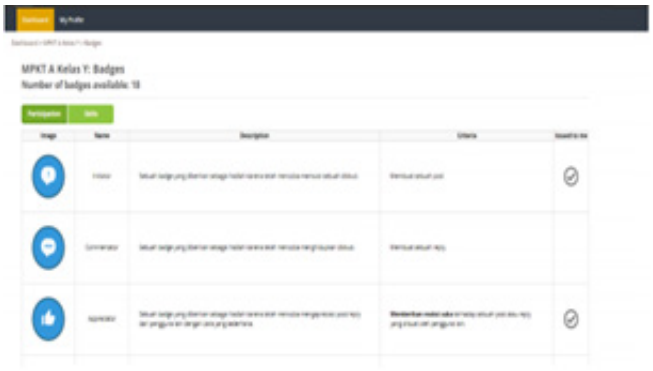

Figure 2.
Profile Page in Gamified Version

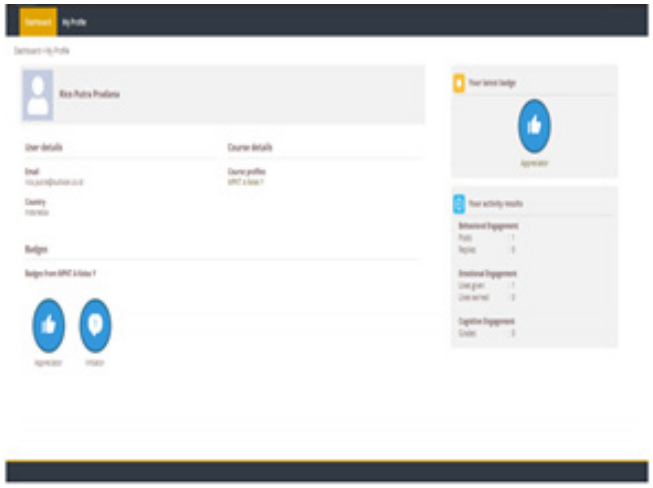

Figure 3.
Likes Feature

performing basic activities, such as creating posts and replies and giving/receiving likes. Skill badges were awarded if a skill was successfully mastered by the participants (Ding, 2019). The gamified version provided 14 skill badges (Figure 5) with badge collection criteria that refer to an assessment rubric adapted from Brown's (2014) research on the application of active learning in online teacher education lectures.

Figure 4.
Participatory Badges

Figure 5.
Skill Badges

RESULT

Pre-Analysis

Perceived relatedness was measured using a Likert scale questionnaire. The questionnaire's validity was evaluated using Pearson's product moment test (Santosa et al., 2017) and reliability using Cronbach's alpha (Field, 2009; Raharjo, 2019). Both tests were conducted using IBM SPSS v25. The questionnaire was considered valid with Pearson's r value of the score for each item with a positive total score and $p < 0.05$ (Raharjo, 2019). Furthermore, the questionnaire was considered reliable because the non-gamification and gamification questionnaires had Cronbach's alpha values of 0.814 and 0.763 (> 0.6) (Field, 2009).

This study used one-way repeated measures ANOVA to process the quantitative data. Its three basic assumptions are the independence of observations, normality, and sphericity (Laerd Statistics, 2018). The assumption of the independence of observations is fulfilled because the study sample was obtained randomly through the volunteer sampling method so that the score of each individual in the sample was independent. This study had the same number of samples for the pretest and posttest conditions (60 people), and the sample size was >30 so that the assumption of normality is not obliged to be fulfilled (Laerd Statistics, 2018). Furthermore, the sphericity assumption test can be ignored because this study only has two treatment conditions: pretest (non-gamification) and posttest (gamification) (Field, 2009).

ANOVA

A one-way repeated measures ANOVA was used to assess the effect of gamification as an independent variable on each dependent variable, including the number of posts and replies made by participants, the grades obtained by participants, and the perceived relatedness scores that were felt during online discussion activities. The results revealed that two dependent variables have a significant difference in scores: the reply variable ($F(1, 59) = 6.868$, $p < 0.05$) and the perceived relatedness ($F(1, 59) = 13.088$, $p < 0.05$). However, the increase in the mean value occurred only in the perceived relatedness variable, whereas the reply variable decreased. ANOVA results, descriptive statistics, and hypothesis test results are presented in Tables 2, 3, and 4, respectively.

Table 2.
ANOVA

Variable	Sig. (*p value*)
Number of posts	0.350 (> 0.05)
Number of replies	0.011 (< 0.05)
Grade	0.111 (> 0.05)
Perceived relatedness	0.001 (< 0.05)

Table 3.
Descriptive Statistics

Variable	Non-Gamification (N = 60)		Gamification (N = 60)	
	M	SD	M	SD
Number of posts	0.22	0.454	0.28	0.585
Number of replies	5.02	4.459	3.87	2.777
Grade	293.50	253.623	254.83	182.687
Perceived relatedness	16.7083	1.26405	17.1542	1.12567

*Note: M = mean, SD = standard deviation

Table 4.
Hypothesis Testing

Hypothesis		Result
H1	Gamification affects the number of posts made in online discussions.	Rejected
H2	Gamification affects the number of replies made in online discussions.	Accepted
H3	Gamification affects perceived relatedness that is felt in online discussion activities.	Accepted
H4	Gamification affects the grades obtained by the online discussion participants.	Rejected

GENERAL INDUCTIVE ANALYSIS

Interviews were conducted to investigate the reasons behind the rejection of hypotheses H1 and H4 and the decrease in the mean value in the number of replies. These qualitative data were analyzed using a general inductive analysis. This approach broadly consists of four stages: preparing data, understanding data, categorizing, and refining the identified categories (Thomas, 2006). Appendix C summarizes the results of the analysis of the interviews answers.

DISCUSSION AND IMPLICATIONS

Our results indicate that gamification did not significantly affect the number of posts made in the discussion (H1 is rejected). This is in line with Dicheva et al. (2015), who reported that gamification did not affect teaching and learning activities. In addition, the participants were not required to post in either discussion session. Furthermore, the interview results (Appendix A) show that the participants were not aware of the benefits of grades and badges, so the new motivation in the second discussion session that was generated by these two things disappeared. The participants may find it helpful to have clear information about these benefits so that they know how to participate in the discussion and ultimately increase their involvement (Ding et al., 2017). In addition, the participants could not see the profiles of other participants on the gamified version to measure their abilities compared with others. The participants tended to compare the badges collected, trying to collect the same badges as most participants (Hamari, 2017). Thus, even though the participant understood the assessment rubric, the lack of information related to the achievement obtained by their peers impaired their frequency of posting. The tendency for student behavior to be less active in class and willing to start discussions can also affect the number of posts.

The results also reveal that gamification significantly decreased the number of replies (H2 accepted). In line with Ding (2019), the interview results reveal that the "like" feature made it easier for participants to appreciate other participants, thereby decreasing the need for replying to a post to appreciate other participants. In addition, the participants' motivation in the second discussion session was predominantly to write good-quality content than to post as much as possible. This may be due to the badge list page, which can be used as a guide in designing the post/reply content she/he wants to create (Groening & Binnewies, 2019).

However, when participants tried to write quality content to obtain a badge but failed to obtain it, they experienced a sense of despair, thus diminishing the motivation to actively discuss it. Furthermore, the participants no longer felt an obligation to post replies because they had already done so in the first session.

Consistent with Ding et al. (2017), our results show that gamification significantly increased the perceived relatedness scores in the second discussion session (H3 accepted). Ding (2019) stated that the like feature can indeed support the fulfillment of the need for relatedness. Consistently, our interview results reveal that participants felt it easier to appreciate other participants through the like feature. This appreciation is a form of caring for others, which is an encouragement from fulfilling the need for relatedness (Legault, 2017). In addition, analysis of the open-ended answers revealed that more participants felt they could share ideas/opinions — both the same and different opinions — in the second session of the discussion than in the first session.

Finally, the results reveal that gamification had no significant effect on the grades obtained by online discussion participants (H4 rejected). The rejection of H4 may be because H1 was not proven. This happens because the total score that participants get during the discussion is proportional to the number of posts made in the discussion. Consistently, Barata et al. (2013) state that the number of posts and the grades are strongly correlated.

Furthermore, the analysis of the open-ended answers indicates that the topic of discussion in the second session was less interesting. The instructor should first determine which topics the participants would be interested in, because the reason for the lack of interesting discussion topics based on the interview results is the participants' lack of understanding of the topics raised in the second session.

IMPLICATIONS

This research has several important implications for discussion instructors, managers of online discussion forums, and future studies. This study fails to prove that gamification can significantly affect the number of posts made in the discussion, which is likely due to the inappropriate design of the gamification component (Ding, 2019). Dicheva et al. (2015) suggest considering students' abilities and motivation when choosing and designing badges to be used in the learning process.

The participants could not look at the profiles of other participants to compare their achievements with those of others. According to the theory of social comparison, social proof theory, and social validation, the comparison of student achievement can encourage participants to be more active in discussion (Hamari, 2017). Our results also indicate that the participants experienced a feeling of despair when they failed to obtain the badges they had been chasing. In addition, the like feature made participants prefer to give likes as a form of appreciation for the activeness of other participants, rather than expressing it via a reply, thus decreasing the number of replies.

The instructors should first comprehensively assess the ability and motivation of students when designing a gamification component that will be applied in online discussion activities. A functionality that allows students to compare their achievements with others should also be provided. Furthermore, badges can have negative effects, such as feelings of despair when the efforts to obtain them lead to failure. Therefore, attention must be paid to the various components of gamification that will be applied to the forum, along with their positive and negative influences.

CONCLUSION

This study proves that the application of gamification in online discussion activities increases emotional engagement, measured using the perceived relatedness scores felt by participants in the discussion. This may occur because of the like feature, which makes it easier for participants to appreciate the activities of other participants. Conversely, behavioral engagement was measured using the number of replies made by participants in the discussion, which decreased significantly, likely because the participants preferred to use the like feature over replying to posts to appreciate other participants. In addition, the participants' motivation in participating in the second discussion session tended to focus on the quality of the reply content, which might be caused by the badge list page, which can be used as a guide in designing the post/reply content they want to make.

Our data also indicate that gamification did not significantly affect behavioral engagement (number of posts) or cognitive engagement (grade). The average number of posts made in the second discussion session increased, whereas the average grade decreased. Gamification design is one of the factors that might cause this to happen. In addition, the participants were not obliged to create posts in both sessions, which may have also caused the lack of a significant effect on these two variables. The participants also did not know the usefulness/benefits of grades and badges for him, so the new motivation in the second discussion session that should have been raised by these two things disappeared. Finally, the lack of functionality to view the profiles of other participants and compare their achievements may underline these findings.

We have several suggestions for future studies to also adopt the theory of social comparison, social proof theory, and social validation in designing functionality in a system that allows participants to compare their own achievements with other participants. The provision of the like feature also needs attention, because this feature can positively or negatively affect participant involvement in online discussions. Future studies should explore strategies to overcome the negative effects caused by the gamification component. Next, when designing a gamification component that will be applied in online discussion activities, instructors/managers must comprehensively assess the abilities and motivations of students who will be participating in the online discussion activities.

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APPENDIX A. INTERVIEW INSTRUMENTS

1. What do you like or enjoy about online discussions?
2. Which aspects of the gamification component influenced your participation in this online discussion? Please explain each gamification component used.

APPENDIX B. QUESTIONNAIRE INSTRUMENTS

3. Non-Gamified Questions

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
In discussion forums, I feel that I do not have a close relationship with the participants who have responded with replies to my posts/replies.					
I really doubt that in the future me and the participants who have responded with replies to my posts/replies will become friends in everyday life.					
I feel that I can really trust the participants who have responded with replies to my posts/replies.					
I would like to have the opportunity to interact more often with the participants who have responded with replies to my posts/replies.					
In the future, I really prefer not to interact with the participants who have responded by replying to my posts/replies.					
I don't feel I can fully trust the participants who have responded with replies to my posts/replies.					
It is possible that I and the participants who have responded with replies to my posts/replies can become friends in everyday life if we often interact in discussion forums.					
In discussion forums, I feel that I have a close relationship with the participants who have responded with replies to my posts/replies.					

4. Gamified Questions

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
In the discussion forum, I feel that I do not have a close relationship with the participants who have responded with replies or likes to my posts/replies.					
I really doubt that in the future I and the participants who have responded with replies or likes to my posts/replies will become friends in everyday life.					
I feel that I can really trust the participants who have responded with replies and likes to my posts/replies.					
I would like to have the opportunity to interact more often with the participants who have responded with replies or likes to my posts/replies.					
In the future, I really prefer not to interact with the participants who have responded with replies or likes to my posts/replies.					
I don't feel like I can fully trust the participants who have responded with replies or likes to my posts/replies.					
It is possible that I and the participants who have responded with replies or likes to my posts/replies can become friends in everyday life if we frequently interact in discussion forums.					
In discussion forums, I feel that I have a close relationship with the participants who have responded with replies and likes to my posts/replies.					

APPENDIX C. ASSESSMENT RUBRIC

Category	Score	Post Criteria	Reply Criteria
Create Post	0	Not creating posts.	-
	10	Creating a post that is good enough but not with in-depth thought and preparation so that the issues raised do not meet all aspects of the big topic of the discussion forum.	-
	20	Create a post that is well designed so that it meets all aspects of the big topic of the discussion forum.	-
Make Reply	0	-	Post a reply that is not a further response to a post/reply made by another user.
	10	-	Post replies that are only in the form of agree/disagree statements so as not to enrich the discussion.
	20	-	Post replies by analyzing/responding to other users' posts/replies to widen the discussion.
Content Contribution	0	Create posts that raise issues that are irrelevant to the big topic of the discussion forum.	Post replies that are irrelevant to the issues raised in related posts.
	10	Create posts that raise issues that are relevant to the big topic of the discussion forum but do not provide additional meaningful (substantive) information for the discussion.	Post replies that are relevant to the issues raised in related posts but do not add significant (substantive) information to the discussion.
	20	Create posts that contain correct information and are relevant to the big topic of the discussion forum and provide significant (substantive) additional information for the discussion.	Post replies that contain correct information and are relevant to the issues raised in related posts and provide additional information that is significant (substantive) for the discussion.
Reference and Support Evidence	0	Create posts without including references in the form of writing or personal experience that underlies the information conveyed in the post.	Post a reply without including references in the form of writing or personal experience that underlies the information conveyed in the reply.
	10	Create a post by including personal experience as the basis for the information but excluding references from a reading or research article.	Post a reply by including personal experience as the basis of the information but excluding references from a reading or research article.
	20	Create a post by including references from a reading, research literature, or personal experience.	Post a reply by including references from a reading, research literature, or personal experience.
Clarity and Writing Mechanism	0	Create long and disorganized posts that may contain many errors in word choice, grammar, or spelling.	Create long and disorganized replies that may contain many errors in wording, grammar, or spelling.
	10	Create posts with the delivery of information that is friendly, polite, and helps readers understand the points of information you want to convey, but there are still some mistakes in writing them.	Post replies by conveying information that is friendly, polite, and helps arguments that are already in the replies of other users, but there are still some mistakes in writing them.
	20	Create posts that are clear and concise and presented in a delivery style that is easy to understand and free from grammatical and spelling errors.	Post clear and concise replies and present them in a delivery style that is easy to understand and free from grammatical and spelling errors.

APPENDIX D. SUMMARY OF INTERVIEW

Condition	Description	Example of the Response
Grade and badge benefits	Not knowing the benefit of grades and badges eliminates the motivation that should arise in the gamification session.	"My desire to post on the second session was greater because of the ratings. However, because I did not know the usefulness of grades and badges, the new motivation that emerged in the second discussion session disappeared."
Failed to obtain the badge	Participants felt hopeless when they failed to obtain the badge they were targeting.	"When I tried to create a reply post according to the criteria but didn't get a badge, I felt hopeless and lost motivation to create a post/reply again to catch up with the badges. Finally, after giving up, I stopped posting/replies."
Motivation to obtain started	Badges motivated the initiation of discussion in the second session that tends to lead to quality, not quantity.	"I feel that I have to try to create posts with full explanations so that the content meets the criteria so that I can get a certain badge."
Motivation to reply	Badges motivated the initiation of discussion in the second session that tends to lead to quality, not quantity.	"In the second version, more people have made replies, so I am more selective which posts to comment on with good and appropriate comments."
Perceived obligation to give response	Participant perceived that the obligation to reply/respond in the second session disappeared because they already responded in the first session.	"I felt that the obligation to reply/respond again disappeared because I have already responded."
Comparing achievements	Participant could not see other users' profiles to compare achievements and measure one's abilities.	"I can't see other people's profiles to compare badges and grades so I can't measure myself and my own achievements compared with others."
Respect fellow participants	It is easier to respect other participants through the like feature than writing a reply.	"My motivation for posting replies is to appreciate other participants who have also replied to my posts/replies. However, because the second version has a like feature, the way I appreciate them is by making the reply change to just giving likes."
Discussion topic	The topic of the second session's discussion was not suitable because it was not interesting and was not understood by the participants.	"Feeling less interested in the topics/issues raised in the second session of the discussion forum."