

Gamified E-Learning Model Based on Community of Inquiry

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Abstract—E-Learning has become the solution to overcome the barriers of time and place in conventional learning. However, the conventional e-Learning faces the lack of user engagement to the system, making the interaction within the system not optimal. Gamification concept can be used to diminish less engagement of the participants. Gamified e-Learning provides new way of learning by raising the student's motivation and engagement to the e-Learning system using game elements. This paper aims to propose the gamified e-Learning model based on the Community of Inquiry (CoI) model. The gamified e-Learning model in this paper is based on the experiment that compare the learning process within two weeks of simulation using gamified e-Learning system and non-gamified system. This experiment which conducted to high school students in Indonesia shows positive impact of the proposed model. The interviews with the respondent are also held to support the finding.

Keywords—Community of Inquiry; Gamification; e-Learning; Collaborative Learning

I. INTRODUCTION

E-Learning provides a solution to create an environment that helps the students and facilitators to overcome the barriers of time and place in face-to-face learning. Gamification, as a concept to raise user's motivation and their engagement towards a system [1], has possibility to be embedded in e-Learning environment. The idea of gamified e-Learning focuses on using game design elements in e-Learning environment in order to trigger student's active involvement in learning process [2]. Active involvements are formed and created by challenges offered in the gamification concept.

Learning process should be developed through

collaboration and communication [3], therefore gamification tries to create such process. The collaboration formed with several interactions that related to communication created between the students and the facilitators. Communication between students and facilitators plays an important role in learning process to enhance social engagement [4]. Gamification elements exist to keep up these interactions between users.

One of the e-Learning models used in educational purposes is the Community of Inquiry model. Community of Inquiry has three elements: social presence, cognitive presence and teaching presence. Educational experience between the students and the facilitator occurs in community through interaction of those three core elements [5]. The three elements will be the basic for this collaborative learning in gamified e-Learning. Dewey (1959) found out that "the educational process has two sides, psychological and sociological; and neither can be subordinated to the other or neglected without evil results following" [6]. As for Dewey, education is a work of collaboration between actors involved in the process. Therefore, Community of Inquiry is one of context of collaborative learning where the learning system designed to encourage critical thinking from the students and also push up their deep understanding of the knowledge [5].

Games bring different experience and drive the user's motivation and engagement in the same time [7]. Gamified e-Learning adapted the concept with simpler design to enhance student's interest in online learning system. Gamification concept implemented to raise student's participation in the learning process.

In order to develop an effective learning process, a gamified e-Learning model is needed. This model should be able to raise user engagement by adapting the Community of Inquiry model. Experiment is needed to state the effectiveness of the model. This paper aims to propose such learning environment that support Community of Inquiry by using gamification concept.

II. COMMUNITY OF INQUIRY

The model of Community of Inquiry assumes that learning occurs within the community through the interaction of three core elements; cognitive presence, social presence, and teaching presence. In this model, deep and meaningful learning takes places in a Community of Inquiry composed of facilitators and students as the key in the educational process [8]. Each element has indicators which are grouped into categories to indicate the phase or aspect of each element [5].

TABLE I
THE ELEMENTS OF COI

Elements	Category	Sample of Indicators
Cognitive Presence	Trigger event Exploration Integration Resolution	Sense of puzzlement Information exchange Connecting ideas Apply new ideas
Social Presence	Emotion expression Open communication Group Cohesion	Emotions Risk-free expression Encouraging collaboration
Teaching Presence	Instructional management Building understanding Direct instruction	Defining topic Sharing personal meaning Focusing discussion

Table 1 shows the elements involved in Community of Inquiry. Cognitive presence is taken to extent the students in any particular configuration of a Community of Inquiry which enable them to construct their understanding through sustained communication [5]. Cognitive presence is a vital element in critical thinking, a process and outcome that is frequently presented as the ostensible goal of all higher education. Social presence is defined as the ability of students to project their personal characteristics into the communication, thereby presenting themselves to the other students as “real people”. Tinto (1978) said social presence supports affective objectives by making the group interactions appealing, engaging, and thus intrinsically rewarding, leading increase in academic, social, and institutional integration and resulting in increased persistence and course completion [8]. Teaching presence includes designing and managing learning sequences, providing subject matter expertise, and facilitating active learning. This element is a means to an end to support and enhance social and cognitive presence for the purpose of realizing educational outcomes [5].

III. GAMIFIED E-LEARNING MODEL

The main objective of using gamification for e-Learning system is to create an environment that could motivate the students to be more active and trigger them to create community of learning. Users involved to share their understanding about some topics and discussed it with other users. This involvement helps the students deepen their understanding about the given topics and create community of learning to

support their learning process. Thus, the learning objectives will be accomplished better.

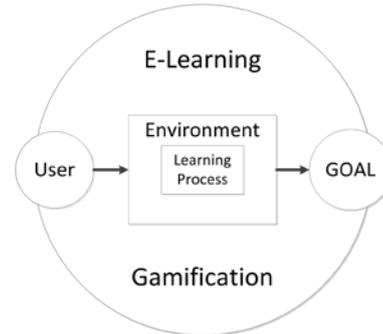


Fig. 1. Gamified e-Learning Model

The proposed gamified e-learning model as shown in the Fig. 1 contains four main components: the user, the learning process, the goal, and the environment. The user will perform the learning process within an environment that facilitated by gamified e-Learning system in order to reach the learning objectives.

A. Role of User

The user model consists of two types of user: facilitator and student. Facilitator assists the student to keep the learning process on track. As this interaction is crucial, facilitator is needed to have good communication and technical capabilities. The students are required to involve actively in the learning process. The proposed model expected to encourages the students to be more active in the learning process.

The Fig. 2 below shows the role for each user. In discussions, student shares their understanding with the other students and collaborate each other. Through discussion and communication in the system, teaching presence is not only taken by facilitator but also the students themselves. Discussion process is a way to explore, share and create new ideas and even construct their understanding about the material. The discussion process will build their cognitive presence which will integrate what they thought.

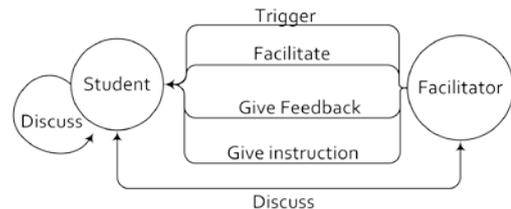


Fig. 2. Role Assignment

B. Environment

The Table II below represents the environment model of gamified e-learning system. This model shows the components needed to develop an e-Learning system that used in the proposed model.

TABLE II
GAMIFIED E-LEARNING ENVIRONMENT

Student		Facilitator	
Gamification Elements			
Material	Assignment	Quiz	Discussion
Learning Management System (LMS)			

The e-Learning system was built based on Moodle Learning Management System (LMS) framework. The LMS manages the online learning infrastructure to simplify the development process. The e-Learning system requires certain teaching materials, such as quizzes, assignments, and discussion triggers. Thus we need to provide the course materials to be placed on the LMS framework. The materials that have been bundled with the LMS will be enhanced with the gamification elements, such as badges, leaderboard, score, progress tracking, and titles. Facilitators facilitate the students to experience the gamified e-Learning system with the use of prepared materials and system.

C. Learning Flow

The Fig. 3 shows the learning process in the system and the gamification elements that support every process. Every process has different characteristics where each of them needs special treatment. The definition of each process is shown below.

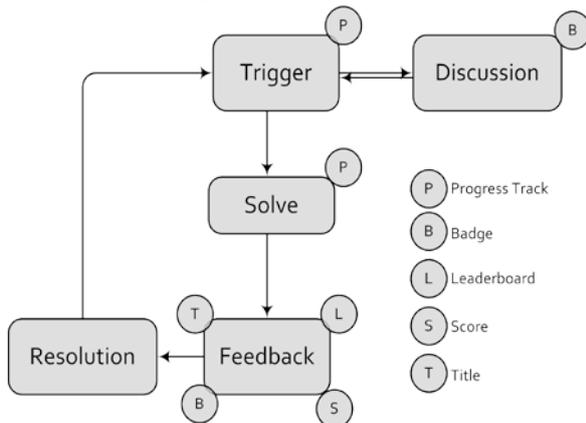


Fig. 3. Learning Flow in Gamified E-Learning

1) *Trigger Event*: The learning process started by giving several triggers to the student. These triggers were provided by facilitator in order to give the student motions and cases to encourage the thinking and learning process. These serial of triggering events are aim to develop critical thinking of the students and able them to build up their knowledge. Therefore, this will create cognitive presence where the students will be able to construct their meaning about the topic given through sustained communication. Gamification element used in this section must be able to catalyze student's eagerness to response the provided triggers. Progress track is one of the elements that satisfy the criteria. Therefore, it is used on this process to further

encourage student to complete their tasks. The progress track element allow the student measure their performance, therefore raises their motivation [9].

2) *Discussion*: Discussion process is applied in the online forum. Student will collaborate with each other to integrate their knowledge and learn from the other's perspectives based on the provided triggers and cases. Discussions done in forum are the process on building up the student's knowledge. The role of teaching presence in this part is to maintain the discussion on track, to ensure the students get the required knowledge. In order to run the discussion well, social presence is needed. Mutual trust among students and teacher should be established. Gamification element used in this part should be able to encourage open communication. Badge element motivates the student to be more active and involved on the system. Giving badges to the student who has completing particular task creates positive challenge. Thus, encourage the student to complete more task in order to get emotional reward [10].

3) *Solve*: The triggers and materials that previously given will be evaluated through a series of test. It consists of several methods, such as quiz, assignment, final test, and so on. The purpose of the test is to measure student's understanding about the materials, thus reflecting the most important part of online learning, student's cognitive presence. The gamification element used in this part must be able to boost their critical thinking and let them determine their ability in a same time recompose their understandings. Progress track could be used in this part. It will let the students to measure their understanding in the same time encourage them to learn more, to fill up their progress track.

4) *Feedback*: The important role of teacher in this part is to give constructive feedback to the students based on their learning performance. Students will feel motivated in a time their works are appreciated. Feedback given in this section aims to correct students' misunderstanding and give them clues on which part that they need to learn more. In order to give effective feedbacks, it is need to give it in simple, encouraging, and pleasant way. That is why gamification has an important role in this part. Most of the gamification elements were used in this part. Score, as personalized feedback, used to help student and facilitator to understand the knowledge acquisition and the student's performance [11]. Those elements create competitive atmosphere between the students. Giving the score for the student's activity in the system make the students feel appreciated, thus drive them to achieve more. Leaderboard represented based on the score that have been obtained by the students. The leaderboard let the student to compete each other to get higher rank by doing particular task in the system.

This competitive environment could be a motivation for the student to show their ability and understanding about the learning materials to the others [12]. Badge element used to give the student implicit order and motivation to solve the tasks [13]. By providing the list of badges that can be achieved by the students, it will indirectly give the command to the student to complete particular task indicated in the specific badges criteria. Progress track also used as one of the evaluation. It provides the student a monitoring system of which task that has been solved or not. Therefore, they can track whether they have finished the tasks or not.

5) *Resolution*: The resolution is the final process where the student will remodel their knowledge based on feedback and learning process. In this part students are expected to get a wide understanding about the materials, and expected to be able to apply it. After this part, the process will iterate again with new triggers.

IV. EXPERIMENT

The proposed gamified e-Learning model has been tested through an online learning experiment for high school students. The simulation materials was about programming foundations. The respondent taken from the participants of open course of basic programming that was held by the faculty. This experiment aimed to test out the impact of embedding gamification on e-Learning system using CoI approach. The quantitative analysis using t-test and interviews were held upon the experiment in order to validate the result.

A. *Experiment Method*

In this experiment, 38 high school students were chosen as the participants in the online learning simulation for two weeks. They were divided into two groups and enrolled into two separated online classes. Group A experienced the gamified online class while group B put into normal online class. The groups were switched in the second week, so that both groups will experience both of the systems. The only difference between the two classes was the presence of gamification elements on one group. Both of the classes receive same materials and treatments for two weeks. In the end of simulation, the activity logs were collected and compared for both group to find out the significance of adding and removing gamification elements in both groups.

Following the simulation, six of the respondents were selected based on their activity in the simulation. By choosing various respondents based on their activeness, it is hoped that the interview result covers the wide range of aspects, from the side of inactive respondents to the side of the active one. The proposed questions for interview were based on the

three components in CoI model. The respondents were asked about what they felt about a particular activities when they did the simulation, as well as their opinion about some important components in the system such as course page view, discussion forum, gamification elements, and assignments. The interview results then compared and analyzed based on their activities in the simulation.

B. *Experiment Simulation*

In the simulation period, the learning materials were given to the students every day. To support the learning process there are some triggers given in discussion forums that updated periodically. Students were encouraged to actively involve in the forums to present their thought about the materials and respond to other student's opinion. As the result of the discussion forums, the students were trying their best to understand the learning materials as the session happened in the forum. In addition, the students in the gamified system will rewarded with badges for they active involvement in the forums, indicated by the number of responses they made.

In order to evaluate the student's understanding of the learning materials, there are some quizzes and assignments that were given periodically. The student in gamified e-Learning system experienced some feedback as they do the quizzes or assignment by receiving the badges or scores depend on their achievement.

After the submission slot and quiz period have ended, there was discussions related to the topics given in the quiz and assignment. Firstly, facilitator initiates a thread about an assignment or quiz, and then the students reply their answers and how they acquire those. Other students will provide their responses, and the facilitators will keep the discussion on track. In the end of discussion, the student's knowledge will be updated. The cycle of the process that explained before will be recurring within a few days as the facilitator gives the new learning materials.

C. *Experiment Result*

In the end of simulation, e-Learning activity logs were collected and analyzed. The first step is quantifying each logs category into numbers. After that, the logs summary was compared for both classes to find out the significance. There are five components that were recorded for each class. The study calculates the differences of activity between first and second week. Two tailed t-test was used to analyze the significance.

The Fig. 4 below shows the t-test result of each activity logs. Positive value shows decreasing number of interaction and negative value shows increasing number of interaction. The research quantitative result by analyzing the system log files shows that the

students in group A have a degradation number of the participation in the system as the gamified system removed in the second week. Meanwhile, the students in group B shows the increasing number of the participation as they experience the gamified system in the second week. It can be concluded that gamification had positive impact on student's motivation quantitatively. The complete explanation of this experiment can be found on [14].

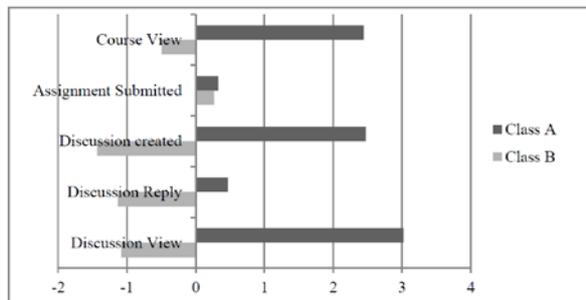


Fig. 4. Experiment Result

V. ANALYSIS

In this section, we will discuss the correlation on how gamified e-Learning supports the Community of Inquiry. The analysis given is based on the case study and the interview done to the students. The analysis is divided into three parts base on the Community of Inquiry elements.

A. Cognitive Presence in Gamified E-Learning

Cognitive presence in CoI aims to develop the critical thinking behavior of the students by providing the idealized logical sequence of critical inquiry in the e-Learning system [1]. Those sequences are triggering event, exploration, integration, and resolution. In the case study that explained above, gamification elements were used to give the implicit instruction to the student to read the materials and giving respond to the trigger discussion. The students noticed the progress track in their home e-Learning preview, indicating new material to be read. They also can view some badges that they can achieve with the explanation on how to get it. Furthermore, the interview results in general show that the progress track and badges affected their motivation to study the learning materials. The students simply feel satisfied because they received real-time responses and rewards of the task that they had done.

The next phases of the sequence are exploration and integration. The goal of this phase is to make the students fully understand the materials and able to construct the meaning of those materials. This phase held in the system by giving the students the freedom to present their opinion about the learning materials and ask the particular part that they did not understand in the discussion forum. The students presented their

ideas, respond the others, and reflect what they had done so far, triggering them to construct their knowledge.

The badge elements were used to give student implicit instruction in order attracting them to participate in the forums. This element will increase motivation towards the students. Badge element plays role as feedback that reflects student's understanding.

The last part is resolution. The goal of this phase is to make the student to evaluate knowledge they learned so far. In this phase, students faced several quizzes and assignments. Gamification elements affect student's motivation positively to complete the tasks in order to achieve the badge rewards and reach the particular score. Badges and score will be the reference for the student to find out their level of understanding about the materials, thus motivated them to learn more and helped them to know their actual target they had to achieve.

B. Social Presence in Gamified E-Learning

Based on indicators on social presence, gamified e-Learning gave positive effect on the student's social activities. E-Learning with gamification impacted the students to feel more comfortable, appreciated, and motivated to learn. Students had the chance to get best score, badges, or the other form of trigger based on their activities in the forum. If the interaction is in active situation, they also have the chance get the best feedback or trigger from their classmate. Interactions in forum are form by replying forum posted or posting new forum. Gamification triggers students to reply more or post longer comments. Eggins and Slade [15] said that using the reply feature to post messages, quoting directly from the conference transcript, and referring explicitly to the content of others messages are all types of interactive response in computer-mediated conferencing.

Triggering students with gamification elements in online interaction creates active learning atmosphere. Everyone try to compete with each other to get highest score, the most badges, or be the top in leaderboard. Social interaction theorist such as Mead and Cooley [8], contend that the human needs for affiliation and self esteem are their satisfaction through interaction with others. From this perspective, giving trigger with gamification elements is the object that fuels the development and acknowledgment. This will also expressing appreciation of communicating the triggers in a text-based medium [16] which is formed by gamification elements.

Students experienced in taking part in gamified e-Learning by interacting in the forum between them. The online interaction creates engagement of the students to the system. Student's involvement may be indicated by engagement with debate, negotiation, or disagreement that results in the joining constructions

of accepted knowledge [4]. Gamification made them more enthusiastic and triggered them to be more active. Students feel more appreciated by being active in forum.

On the other hand, gamification gave sense of inferiority and embarrassed among the top students. Some of the students felt could not catch up the discussion going on in the forum. Precisely, gamification elements should encourage them to be more active and catch up others with their current discussion.

C. Teaching Presence in Gamified E-Learning

Teaching presence as proposed by Garrison, Anderson and Archer has three categories-instructional management, building understanding and direct instructions [5]. In online learning environment, teaching presence has the role to design the learning delivery such as material, topic discussion and assignment. In facilitating discourse, teaching presence is critical in maintaining what is going on in the learning process, especially the discussion forum. Maintaining interest, motivation, and engagement of the student in active learning are the important part of teaching presence [3]. Teaching presence indicators support that gamified e-Learning helps to keep student's eagerness on learning by delivering the components in a new fun way.

Facilitators gave direct instruction by delivering the material in uploaded handout in the system and also by triggering discussion in forum with interesting topic related to the current material. Facilitator also used gamification elements to deliver some instruction to the students implicitly. Students were forced to do the task given in fun way they liked. They felt more challenged with the task or quizzes because they wanted to collect the badges or be the top five in leaderboard. Some of them felt more motivated as they wanted to learn more and more, yet most of them felt that gamification did trigger them to be more active in the system.

Sharing the personal meaning is one of the indicators on building understanding in teaching presence. Gamified e-learning support this indicators, as it triggered the students to share what they know and understand to others. Based on the case study done, the students not only shared their understanding about some topics, but also challenged the class about new experiment they found during their self-learning process. This is one of the reasons why using gamification elements are important to support online learning. The challenge in online learning is to find a way to maintain student engagement remotely as they were not in the same place. Gamification elements help the facilitators to resolve the challenges.

VI. CONCLUSION

A new model of learning that constructed by merging gamification with the concept of Community of Inquiry is proposed. The model implements various gamification elements in each process within the Community of Inquiry model. The main objective of using gamification for e-Learning environment is to create such environment that could motivate the students to be more active and triggers them to create community of learning.

Combining gamification with e-Learning involved two aspects, the pedagogical aspect and also the technologies used in the system. As for the pedagogical aspects, the facilitator guides the students to keep the learning process on track. The learning process requires elaboration on both students and facilitators in order to make the model worked perfectly. As for the technologies, the e-Learning system requires certain teaching materials, thus we need to provide the course materials and enhance it with the gamification elements, such as badges, leaderboard, score, progress tracking, and titles.

Based on case study to high school students in Indonesia, gamified e-Learning model provides better user engagement. The quantitative research results by analyzing the system log files shows that removing gamification element on the system degrades number of the participations in the system. Meanwhile, adding gamification element on the system increases number of the participations.

Further experiment is required with more diverse characteristics of the students. Certain aspects were also needed to be considered to ensure the readiness of this model to be implemented in wider population.

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