

Labsware: Implementation of Gamification Approach in Computer Lab Activities

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Abstract— Most of computer sciences students of Universitas Multimedia Nusantara require to take a course that come with lab practicum. Despite the importance of lab practicum activity, there are indication that some student is not motivated enough to complete it. Gamification is a method of implementing game design elements in non-game contexts. This research shows how gamification can be implemented in the classroom, and the survey result of application usage. Despite its successful implementation, increased motivation due to the application of game elements are not perceived significantly.

Keywords: *gamification, education intelligence, computer lab activities, motivation, Universitas Multimedia Nusantara.*

I. INTRODUCTION

Motivation to study is one of the most important aspect for a student that is still doing their study, no matter on what level or grade they are at. According to some research, it's known that a motivation could influence the student's grade up to 5,44% [1]. Another research also explained that a student with a high motivation will have a better achievement or grade compared to those with low motivation [2].

Computer lab practicum is one of the required subject for every undergraduate students of ICT Faculty Universitas Multimedia Nusantara who took a course which included the practical activities. The purpose of this activity is to give a training and knowledge of how to actually implement the knowledge they've got from the theory classes.

But even so, there are still some students that still not motivated to do the practical activities. This is being proved by how many students being caught up by the laboratory assistant to accessing or doing other thing that is irrelevant with the course's topic. This fact itself, gave some challenge about how actually the students cab be more motivated to do the practicum.

Since 2010, there is known term of gamification, which literally means the application of game design elements in non-gaming contexts [3]. Some research figured, that by implementing gamification, a person could be more motivated and more willing to do some activities they think unattractive before [3, 10, 11]. Based on this research fact, we can assume that gamification is one of the solution to increase the motivation of student in doing the computer lab activities.

This study described how we develop Labsware, a lab practicum management system which implement gamification and evaluate the result of undergraduate students who try the application.

II. GAMIFICATION

One of the gamification's purposes is to make the subject and assignment more interesting so the user is motivated to keep involved in it [4]. With a good design implementation, the concept of the game could also do well as the motivation booster, even to the point of making the user do some specific action [5]. Gamification could be applied to many things such as, education, character building to environment, etc [6]. Some cases also proved that game could have a role more than just an entertainment or some information media. The term game itself different with the term of play. While game term contexts more into playing structure bound by the rules and competition to fulfill the goal, the term play more into freedom, expressiveness and improvisational [7]. However, even though gamification may able to improve motivation, it will not do more other than being additional support to the main function of the system itself [3].

To be able to effectively do a gamification we need to do these 4 steps [6].

1. Main object identification.
Indetifying the assignment we want to gamify. Usually, all of the assignments have identifiable goals.
2. Transversal objective identification.
Identifying another objective which could be interesting for the user. This objective will be made based on the game mechanics which could boost up the user motivation and interest.
3. Selecting the mechanics of the game.
Selecting the game mechanics which related to the available objectives.
4. Efficiency analysis.
Efficiency analysis for the gamification user based on user satisfaction, quality, and the services.

To implement gamification, we need to implements at least one game mechanic. Game mechanics is some activities or rules that make game experience. Choosing the right game mechanics is key to make an effective gamification [8]. These are some popular game mechanics that usually implemented in gamification [9].

1. Point system.

Point is the major mechanism of the gamification approach. We did some activities and in return we are given points as a reward. Points collected will be useful as one of the requirements to win the game itself or just to achieve a status. One of the most popular point system is experience points (XP). XP does not give the value of the exchange rate system but rather as a reference to the user progress. Anything that are done by the user should give XP. Generally XP is never down and can not be redeemed. XP will not be discharged, a user of the system will continue to be able to get XP as long as they using the system. This makes XP so strong in the implementation of gamification.

2. Level system.
Level usually have function to indicate a specific status of a user. Using level system, user will be challenged to achieve the highest status for their pride. Levels can also be combined with a point system. For example, user will get a level up if they get a certain amount of XP.
3. Achievement system.
Usually the users are challenged to perform a specific action in order to get an achievement. Some achievement are not necessarily can be obtained by other user. This makes the player to be motivated to complete the challenge and get those achievement. One of the popular achievement system is badge system. Badges are virtual goods that is awarded to users who complete a specific activity.
4. Leaderboard system.
Leaderboard is feature to comparing score or status with other users. Usually the user will be challenged to competing with the other users. With the holding of the competition system, leaderboard can be a powerful motivator.

III. RESEARCH METHODS

The methodology in this research can be elaborated in these steps.

1. Literature study.
The study is initiated with material collection that collaborated with the research topic. Then these materials are studied and considered as the foundation and guidebook in this study.
2. Requirement analysis.
This step is established to understand the computer lab activities in Universitas Multimedia Nusantara. There are also steps in this stage, which are : system observation, survey and interview.
3. Application design.
Next step is to design the application based from requirement analysis. Purpose of this step is to describe the feature of application, process, rules, interface, etc. In this step we also do analysis to determine how the gamification will be implemented.
4. Application development.

Next step is to develop the application based on the design. Labsware is developed using HTML and PHP.

5. Testing and data analysis.

Last step of this research is do a test of the application. Test was held in Universitas Multimedia Nusantara, involved 4 class that has computer lab activities. 3 of them has Data Structure subject and the other has Advanced Programming 2 subject. All of the class has different lecturer. The test takes 2 times for each class (in week 13 and week 14). In the first test, we using non-gamification system to do the computer lab activities. For the second test, we using Labsware, the gamified system, to do the computer lab activities. We using this methods so the student can feel the difference beetwen the non-gamification system and the gamified system. After doing the second test, we doing user study by using questionnaire that given to students who participate in the test. Evaluation and data analysis are based on the result of the questionnaire.

IV. APPLICATION DESIGN AND DEVELOPMENT

Before develop the application, we need to identify the main objectives, transversal objectives, and the game mechanics in order to make effective gamification in computer lab activities.

In computer lab activities, we could conclude that the main objectives for every student are to do the assignment which has been determined for the class in certain time limit. We can also determined the transversal objectives. These are the transversal objective that we can analyze.

1. The submit time of the assignment.
The submit time of the assignment can be one thing that might be used to attract students to do the job more quickly.
2. Assignment result.
The result of the assignment is the main things in the lab activities. Therefore this can be designed in such way that the students are motivated to do it better.
3. Student ranking in class.
A rank in the class could served as interesting objectives for the students since ranking and competition could motivated a student to be the best in their own circle.

To accomodate these objectives, we need to identify the game mechanics. As for the mechanism is defined as follows.

1. Level and XP.
Level and exp system could be implemented to accomodate the assignment result. In computer lab activities, the lecturer will give score to the students based on their assignment result. This score then will be convered into XP that given to the students. The level system can be used by the lecturer to measure how much the students have grow in the subject. The level system will do flat as if the

students gain enough exp they will having a level up. the student will level up if they gain 200 XP. This is means to know the level balance between each students for further development.

2. Leaderboard.

Leaderboard will be great to be implemented to accomodate objective of submit time and assignment result. By this leaderboard, the students hopefully will be able to competed to be the best in their circle. There are two kinds of leaderboard implemented, the fastest leaderboard and the achievement result leaderboard. The fastest leaderboard made based on how fast the students submit their assignment each week. While achievement leaderboard will be based on student's level and XP.

3. Achievement.

In this system, every achievement given to the student are unique. There are 10 achievement available. Some achievement are based from the submit speed, student's level, social aspects, etc. More information about achievement available will be explained futher in Table 1.

TABLE I. ACHIEVEMENT LIST

Name	Explanation
The Newbie	First time login to system
Not a Newbie	Reach level 2
The Expert	Reach level 10
The Helper	Help 1 friend in computer lab activities
The Angel	Help more than 10 friends
Diligent Attendance	Submit 12 assignment
Oppurtunity Chaser	First to login in class
The Fast	First to submit the assignment
The Super Fast	3 times become the first to submit the assignment
Half Way to Go	Login in 8th week

To make more game-like application, we also designed some function such as simple avatar system and social media sharing (Twitter and Facebook). Simple avatar system are used to personalise each user in the leaderboard. Social media sharing function are used by user to share what they achieved in the system.

For the interface, it was decided to layouted like a book. The reason of choosing the layout is because book is like a daily journal, same like this application, portraying the student progress from each week in the level and experience score. Moreover, book is a symbol of knowledge, like the purpose of this system, to fulfill computer laboratory activities as one of the academic progress.

To describe how the application development done, these are some screenshot of the application. To explain some

functionality of the system, data used in these screenshot are dummy data.



Figure 1. Login Page



Figure 2. Student Home Page



Figure 3. Social Media Sharing Function



Figure 4. Labsware Facebook Sharing



Figure 5. Student Class Page



Figure 6. Achievement Information



Figure 7. Class Leaderboard Information

V. EVALUATION

This part explained about the result from application testing. Result described here are based from questionnaire that given to total 97 students who involved in application testing. These are the result of each question in the questionnaire.

1. Respondent data.

From the respons there are 79 man and 18 woman. by total there are 58 respondents who categorized themselves as gamer. All the respondents are active students of Universitas Multimedia Nusantara that took course with computer lab activities.

2. Implementation of gamification.

To let know the implementation of gamification is success or not, it needs respondents feedback concerning about their experiences, whether it felt like they play a game or not while doing the test. The implementation itself is referring to the application of game mechanics in the system. The result showed up 84 of 97 respondents felt different experiences during computer lab activities. There are also 59 of that 84 respondents answered they felt like they were play a game. By the percentage, 60,82% of all respondents felt a game-like experience by using Labsware.

3. Student motivation.

The quisionaire put a question whether students will be motivated to be in the highest rank if this system is fully-supported by their lecturer. Lecturer support itself means the utilisation of this system from the begining of class, include the XP based scoring system. 78 of 97 respondents of total answered they would be motivated enough to get the best. By percentage, it is 80,4% of total respondents.

4. Influence of level and XP.

The impact of level and XP in the system to students' motivation can be analyzed by Likert Scale in the questionnaire. Respondents answered from range 1 to 5, 1 refers to did not affect at all, and 5 refers to this system really brought motivation. The result are shown in Figure 8.

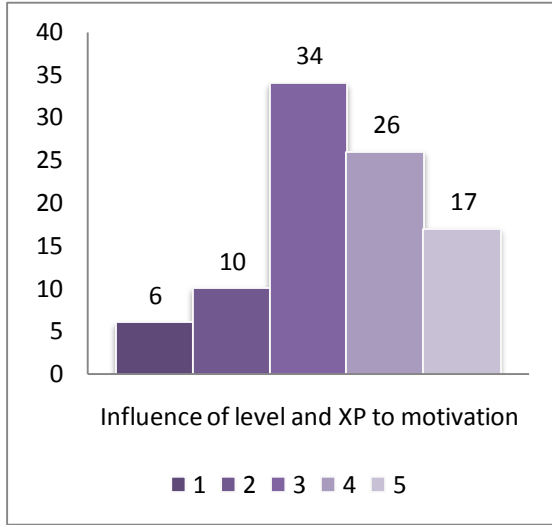


Figure 8. The influence of level and XP result

From the total of 97 respondents, there are 90 valid answers. The result shows score 3 got highest frequencies (34 answers). This was most likely due to the students who didn't fully test the system level and feel how the XP system is working. From four classes being tested, there was only one lecturer tried to give XP to students. Relatively short testing time also made the students competing without knowing their level before.

5. Influence of achievement.

Similarly with analyzing the influence of the level and XP system, to analyze the influence of achievement we use Likert Scale that were included in the questionnaire. Results of calculations on the effect of achievement is shown in Figure 9.

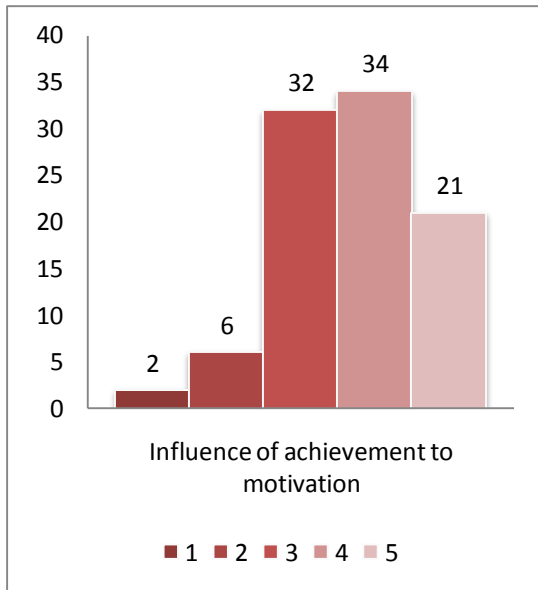


Figure 9. The influence of achievement result

There were 95 valid answers from total of 97 respondents. It got score 4 on the highest frequency of the result. It shows that the achievements was giving highly motivation to students.

Chance that the achievement system has been implemented to provide students' motivations, even though we believe the testing time was relatively short and made respondents can not get some extra achievements. The outcomes given on achievement motivation could be better if students can experiment with a longer period (e.g. one full semester).

6. Influence of leaderboard.

Same as the previous two, influence of leaderboard to motivate students analyzed by Likert Scale on the questionnaire. The result is shown in Figure 10.

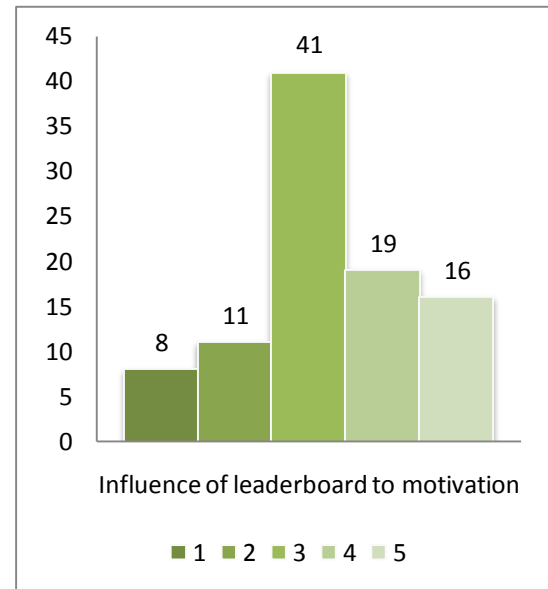


Figure 10. The influence of leaderboard result

By total of 97 respondents, there are 95 valid answers. The result shows 3 got highest frequencies (41 answers). This may happened because of no experiment from tutors to conduct a competition based on existing leaderboard. The competition suppose to award bonus points to (by example) the fastest submit get more XP, etc. Short duration of testing time also enable the questionnaire showed number 3, this is because the level-based leaderboard did not show how the competition happen between students to reach the highest level. When testing takes place, the level of each student is the same.

VI. DISCUSSION AND CONCLUSION

Based of the evaluation result, we can conclude that gamification has succesfully implemented in Labsware.

However, increased motivation due to the application of game elements are not perceived significantly. From 3 game elements that implemented in Labsware, only achievement system that give significant result to the student's motivation. We believe the short duration of testing time is the main reason why this is happened.

Although not all of the game elements give significant positive result, we still can conclude that gamification really have an effect if implemented correctly. Gamification give positive impact to students perspective about the computer lab activities. Future works should have some adjustment to the game elements such as dynamic experience system and

additional 'fun' type achievement to improve user engagement. Testing time also should take longer duration, i.e. one semester, so we could get more factual result about the effect of gamification implementation.

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