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Research paper

Gamifying Student Routines to Improve Campus Experience Through Mobile Application in Indonesia

Janssen, Andre Rusli*, Maria Irmina Prasetiyowati

Department of Informatics, Universitas Multimedia Nusantara, Tangerang, Indonesia
**Corresponding author E-mail: andre.rusli@umn.ac.id*

Abstract

Smart campus is an emerging concept in recent years that enables as a part of the smart city movements which leverages the use of information technology in building a comprehensive and sustainable living environment. Several campuses in Indonesia and abroad have already started the movement and integrate the colleges' data and provide a digital experience for the campus communities. In order to motivate the communities, in this case the students, to leverage IT tools and platforms to improve their learning experiences, utilizing gamification and mobile technologies are seen to be the suitable combinations. Gamification as a concept to enhance user participation is also gaining a lot of tractions in recent years, including in the higher education sector. Many researches have shown that gamification is effective to improve motivations in core learning activities, to push students to be more proactive in gaining knowledge. This research is conducted to integrate a new mobile application to the existing smart campus platform in Universitas Multimedia Nusantara, Indonesia, while also gamify several student routines and activities to enhance the campus experience. The system is built as a hybrid mobile application and evaluated for its user acceptance by analyzing its users' perceived usefulness and perceived ease of use which are derived from the technology acceptance model (TAM). Based on the feedbacks gathered from the users, the gamified system is perceived to be easy to use and useful to increase student's participation and to motivate the users to actively complete their campus routines.

Keywords: *smart campus, gamification, Marczewski gamification framework, technology acceptance model, Universitas Multimedia Nusantara*

1. Introduction

In the last view years, the smart city concept has grown rapidly along with other related fields such as mobile technologies and the Internet of Things (IoT). A smart city can be defined as "multiple sectors cooperating to achieve sustainable outcomes through the analysis of contextual real-time information shared among sector-specific information and operational technology systems" [1]. As an important part of any city, universities and colleges around the world have also been doing their part to be able to provide a comprehensive digital campus, a smart campus, for their communities.
In general, the view is that smart campus is an inevitable trend and advanced pattern of digital campus. Liu, Zhang, and Dong [2] defined that a smart campus has three dominating characteristics which are:

a. It provides a comprehensive intellisense environment and integrated information service platform for teachers and students, which is personalized and customized based on the role,
b. connectivity and collaboration come true through integrating information service based on computer network into school's application and services, and
c. it provides a mutual exchange and mutual perception interface between school and outside by the use of intellisense environment and integrated information service platform.

As a medium to achieve a sustainable and accessible smart campus, mobile devices evidently serve as ideal facilitating platforms for improving the efficiency of campus life [3] for their portability and ease of accessibility. Mobile devices have become necessary devices used by millions of college students in their daily lives. Based on a survey from APJII [4], at least 24.4 million internet users in Indonesia are aged from 10 to 24 years and 10.3 million of them are students. Smartphones are the main choice of communication tools used, thus it is not surprising to conclude that the majority of students in universities own and use smartphones in a daily basis.
Following along with the trends of smart campus, currently many higher education establishments in Indonesia and abroad have already started to build and adopt various information technology tools and platforms to enhance campus experience for the faculty members and their students [5][6][7][8]. However, despite the convenience provided by the platforms, students still often find themselves troubled keeping up with in-campus schedules and activities due to lack of motivation in doing things that could have easily become mere routines during their time in colleges.
Gamification is a concept that has grown rapidly recently, fig. 1 displays the results of academical searches about gamification from the Google Scholar [9] which shows that the community's interest in gamification design and frameworks is evident. Many researches aim to define gamification, but the most widely known definition is the use of game design elements in non-game contexts [10]. Gamification is also viewed as a process that aims to change non-context games such as teaching, learning, and so on to be more interesting, by utilizing the use of game thinking and elements in non-game context [11]. In accordance to improving smart campus experience and to improve students' motivation in completing their activities and routines in the higher educational level, this research aims to analyze the users and capture similar problem scope happening in one representing university in Indo-

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nesia, Universitas Multimedia Nusantara (UMN), which is done by implementing gamification in mobile application to the smart campus concept.

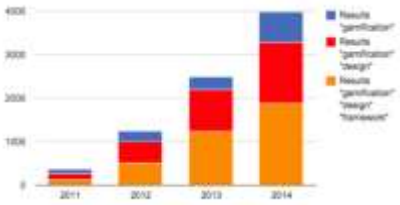


Fig. 1: Results of academic searches about gamification [9]

Several previous researches are conducted to improve formal learning activities such as exercises, projects/labs, and interaction with learning environments using gamification [12]. Other publications also show that gamification is effective in improving student motivation by implementing several game elements into the system such as points, badges, leaderboards, levels, and rewards [13] [14]. Despite the number of researches that has been conducted to prove the effectivity of gamifying education, few, if not any, tries to elaborate scheduling and student's formal learning activities in a gamified higher education system as a mobile application and this is one of our research's contribution. Furthermore, to assess the user acceptance of the gamified student personal application in UMN, we incorporate the concept derived from the technology acceptance model (TAM) [15] [16] to measure the perceived ease of use and perceived usefulness of the application gathered from user feedbacks which also contributes to the gamification community especially those researching its effectivity in the educational field.

2. Gamification

2.1. Marczewski's Gamification Framework

One of the most widely known and popular gamification frameworks is the Marczewski's Gamification Framework [17], as shown in Fig. 2. The framework is divided into three main parts. The first part shows the 8 questions that must me asked before the gamification process is started, the second part covers the things to remember about gamification, and the last part explains about the intrinsic motivation which includes relatedness, autonomy, mastery, and purpose.



Fig. 2: Marczewski's Gamification Framework [17]

Before starting the gamification process, the 8 questions are first thought and answered, as explained below.

1. What is being gamified?
   Student routines or activities such as attending classes on schedules, early or in time submission of assignments, and online quizzes activities.
2. Why is it being gamified?
   Because even though the activities are obvious to the students, it is often forgotten as mere routines. Users need to be motivated using other ways.
3. Who are the users?
   The users are the active students in UMN. Types of user exist in the campus and their respective intrinsic motivations are as follows.
   - Philanthropist, motivated by the objective to excel at time management.
   - Player, motivated by rewards in the shape of points (which can be exchanged for virtual goods) and badges.
   - Socialiser, motivated by the ability to compete and transparently see their competitions.
   - Free Spirit, motivated by the autonomy to use or not to use the application and the ability to change profile backgrounds as they like it.
   - Achiever, motivated by the ability to always strive to be the best in managing their time, to always be on time for task submissions and classes.
4. How is it being gamified?
   By developing a personalized mobile app using gamification elements such as game dynamics and mechanics such as:
   - Reward (points, experience points, badges)
   - Status (title, levels)
   - Achievements (badges)
   - Self-expression (virtual goods – profile background)
   - Competition (leaderboard)
5. Analytics are set up.
   The developed system will be tested to the user and a user acceptance test based on TAM is conducted.
6. Tested with users.
   Gather some student respondents to try the application and get feedbacks.
7. Acted on feedback.
   Feedbacks gathered from the testing processes are then evaluated and used to further improve the system.
8. Released the solution.
   After many testings and evaluations, the system is deployed to be used daily by the students.

The RAMP model is related to types of user who will use the gamified system. Each point caters different user type and will initiate different level of motivation depending on the types. Relatedness is for the users within the socializer type, autonomy for the free spirits, mastery for the achievers, and purpose for those belong in the philanthropist. Furthermore, Marczewski also points out two other types other than the previously mentioned user types, which are disruptor and player that can be motivated by change and reward respectively, as can be seen in fig. 3.



Fig. 3: Marczewski's Gamification User Types [17]

2.2. Game Dynamics and Mechanics

In order to achieve the desired gamified system, game elements which can be further classified as game dynamics and mechanics are used. Game dynamics or also called the human desire for reward, status, achievement, self-expression, competition, and altru-

ism. This desire is universal, and across generations, demographics, culture, and gender [18]. Several examples of game dynamics are reward, status, achievement, self-expression, competition, and altruism.

On the other hand, game mechanics are tools and techniques that act as a basis for performing gamification on websites, processes or applications that can be used to create a user experience that motivates the use of functions or content from the application [18]. Some examples of game mechanics are points, challenges, leaderboards, levels, and virtual goods.

3. Gamified Student Personal Assistant App

3.1. User Types

Before starting to develop the gamified student personal assistant mobile application, we conducted a survey to analyse the student types in Universitas Multimedia Nusantara based on the test provided by Gamified UK [19]. The result shows that the user types that must be dealt with to provide intrinsic motivation are free spirit, achiever, philanthropist, player, and socialiser. The only missing type from the Marczewski user type test is the disruptor.

3.2. Overall System

The gamified application stores and retrieves student data including their class schedule, assignment deadlines, and online quizzes, setting up push notifications and reminders for the students not to forget their routines in real time, synchronized with the student's database in the university. Using gamification elements, the app provides points, badges, and rewards to be collected by the students by doing their routines and keeping up the good works. Leaderboard is used to display the ten best performing students which is visible to all the students using the app, giving them the abilities to build a healthy competition. After collecting points, the app also provides a virtual store for the students to spend their points on virtual goods. Profile background can be customized by using their points too, to enable the users to express themselves.

Fig. 4 displays the main flowchart of the Gamified Student Personal Assistant Application. As can be seen, all students must input their credentials first and log in to the system to use the application. If a student successfully logged in, the first screen will show the daily tasks that a student must fulfil. After that, users have the options to choose the app to show their monthly schedule, profile, badges collected, leaderboards amongst other students, app stores, and additional information.

Fig. 5, then, shows the page showing the daily task of a student after he/she logs in to the application. The tasks are of several types including class schedules, task submissions, and online quizzes. These tasks are integrated with the campus' existing digital platform and databases which can also be accessed via the campus information system's website. This research brings them closer to the user by enabling the users to access these data through mobile application while implementing gamification as shown in the figures below. Fig. 6 is another page in the app that shows the page containing the list of user's badges which the user has obtained. as well as the courses being taken with the number of absences. If a badge is not owned, the mission and the amount of progress will be listed. Whereas if it is already owned, it will be stated when the badge is claimed.

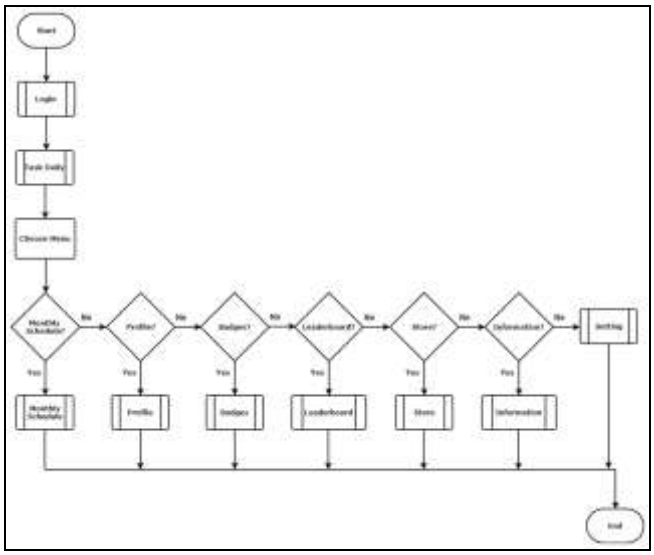


Fig. 4: Main Flowchart

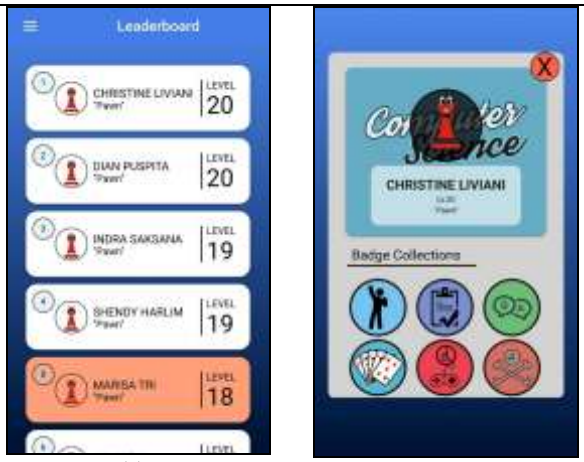


Fig. 5: Task Daily Page

Fig. 7 section (a) shows the Leaderboard page that contains a list showing the top ten users based on the highest level and number of badges owned, while fig. 7 section (b) shows the other students' profile which can be found in the leaderboard. Both of which are implemented to enable healthy competitions between students and provide a sense of social connection between the users, that they are together in this, they are not alone.



Fig. 6: Badges Page



(a) (b)

Fig. 7: (a) Leaderboard; (b) Student profile from the leaderboard;

4. User Acceptance Test

Before executing the user acceptance test, we first conducted a black box testing to ensure the application functionalities are all running properly. The user acceptance test which is derived from the concept in the Technology Acceptance Model (TAM) was then executed. The test was participated with students from the Department of Informatics in UMN. The testing was carried out by field study where respondents were asked to download and use mobile personal assistant applications for university students, then after they have tried using application for some times, the respondents is asked to fill out an evaluation questionnaire prepared based on TAM.

Furthermore, using a 5-level Likert Scale, the percentage score for data collection and evaluation is calculated by looking for the average of the respondents' answers then matching the interpretation categories based on the intervals on the Likert scale. The interpretation categories are shown in Table 1.

Table 1: Likert Scale Interpretation Categories

Interval	Kategori
0% - 19.99%	Strongly Disagree (SD)
20% - 39.99%	Disagree (D)
40% - 59.99%	Neutral (N)
60% - 79.99%	Agree (A)
80% - 100%	Strongly Agree (SA)

Calculation of score percentage is as follows.

$$\text{Score Percentage} = \frac{((SA\times5)+(A\times4)+(N\times3)+(D\times2)+(SD\times1))}{(5\times n)} \times 100\%$$

Description:

a. SA, A, N, D, and DS are categories of Likert Scale Interpretations.
b. n is the total number of respondents.

5. Conclusion

The gamified mobile applications for university students using Marczewski's gamification framework have been designed, built, and evaluated. The research shows that gamification and mobile application can enhance campus experience and improve students' motivation to do their campus activities and routines. By interviewing the users, using guidance derived from the technology acceptance model (TAM) and calculating the score using Likert Scale, the results shows that 85.28% of the users perceived the system to be useful, thus, improving their motivation in doing campus activities and routines, and 85.43% of them perceived it to be easy to use. With the detailed percentage of several variables as follows.

- Leaderboard in this research is the highest gamification element for perceived usefulness (91%) and perceived ease of use (86%). It can be seen that leaderboards helps motivate students to compete and can be easily understood.
- Virtual goods in this research is the lowest gamification element for perceived usefulness (73,5%). This is probably due to the virtual goods that can be customized by the user is only the background, some feedbacks from the user stated that only customizing the background is not enough to express themselves.
- Points in this research is the lowest gamification element for perceived ease of use (78,5%). This is considered because at the time of testing, the user does not get enough feedback in the form of information on the number of points obtained during an activity, according to few user feedbacks.
- Notification in this research is the app feature with highest perceived usefulness (93,5%) and perceived ease of use (92%). It can be said that the notification feature in this research is useful and the information is easy to understand.

Acknowledgement

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