Improvement of Information Sharing in Teaching and Learning Using Gamification Technique

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Abstract *— Gamification is a new technique of using game mechanisms or elements in non-gaming contexts for commercial or educational purposes. Information management process in Institut Pendidikan Guru (IPG) in Malaysia often creates problems because there is no systematic method of storage management. IPG lecturers store their teaching materials using different kinds of methods. This situation causes loss of resources, and difficulty for them to be retrieved and identified when they're needed. Dealing with large volumes of resources, it is essential to use technological solutions that enable flexible storage, retrieval, processing and interpreting of information. To solve the problems, this article introduced a model that uses single platform which is named Information Sharing for Learning (iS4L) for managing teaching and learning resources in IPG. The resources can be stored and accessed at any time. The model also applies the technique of gamification to motivate and encourage users to use the application which consequently increases the volume of resources stored. The quantitative data provided by the online survey reveals that gamification has the potential to attract, motivate, engage and retain users.*

Keywords *— Resource as a service, Information management, Information sharing, gamification.*

I. INTRODUCTION

The presence of the Industrial Revolution 4.0 (Industry 4.0) which emphasizes the development of virtual reality technology without much use of manpower definitely affects many aspects of life. In this context, tertiary education is among the most important areas that is not excluded from receiving the impact of this latest development. The emergence of Industry 4.0 is a new development that affects many parties, especially the Higher Education. The existence of the Public Higher Education Institutions (IPTAs) throughout the country generally aim to produce quality human capital to fill future vacancies [1].

The presence of Industry 4.0 is inevitable, and the impact will be felt throughout the world including Malaysia. The use of technology in education is gradually increasing especially the Information and Communication Technology (ICT). ICT leads to greater benefits for higher education as it reduces the cost of maintenance, enhances learning outcome of students, and protects the environment by reducing the use of papers. The emerging of ICT also triggers the Institut Pendidikan Guru (IPG) to make changes in its administration and provide service-oriented computing platforms and greater flexibility in accessing and delivering resources over the Internet. This platform is expected to provide the method of accessing the content and delivering the content across the world, so it can be used in institutions for delivering the e-contents and sharing the resources such as digital libraries.

This approach can be defined as a Resource-as-a-Service (RaaS), meaning that all users especially students can easily access the contents and learning materials as well as share the resources via Internet facilities. The efficiency and performance of IT-based product design applications are improved from time to time. There are several features that can be recognized in computing transactions such as storage management and sharing services. One of the greatest challenges faced by IPG in implementing this Raas is to convince teachers and lecturers to share their teaching resources and materials and collaborate with other teachers. They believe it was essential to protect their works and information from sharing with other people. They also believe it was time-consuming to funnel their works into a corporate database. This behavioural problem is often too difficult to overcome regardless of how powerful the information management solution that the organization sought to deploy.

Sharing resources are becoming a trend because of the availability of effective platforms such as social networks and standard educational application management etc. Information sharing via social networks such as Facebook, Twitter and LinkedIn1 has become second nature in our personal and professional lives. However, encouraging people to share their resources is not an easy task. It needs a

specific method and technique to attract their interest to participate in the process of information sharing.

This article is organized as follows: section 2 describes related work on system design and gamification technique, Section 3, illustrates the structure of gamification platform in details. Finally, result and discussion, followed by concluding remarks in section 5.

II. RELATED WORK

A. *System Design*

The Resource-as-a-Service (RaaS) is a model of cloud computing that allows providers to sell individual resources for a few seconds at a time. In the RaaS, users are able to purchase exactly the resources they need when they need them [2]. The concept of RaaS has become an important element in organizations today especially in academic institutions like IPG. RaaS has eventually become a type of innovation that is adopted in the operation of the organization. IPG, as an institution which operates and deals with academic knowledge must also adapt towards this type of innovation to accommodate their academic purposes.

It is important to note that the use of RaaS does not automatically translate to development of a conducive academic environment but the activities performed with RaaS such as collaboration, interaction, monitoring the progress of students, downloading as well as uploading of academic materials etc. will lead to an improved academic environment and consequently improve the performance of students [3].For students to do well in their academic activities, effective learning is very important. Recently, information and communication technologies (ICTs) are important tools that aid students' effective learning. Effective learning encourages reflection, allows dialogue, promotes collaboration, applies the theory learned into practice, creates a community of peers, allows creativity, and motivates students [4][25][26].

The 'Information Sharing for Learning' model (iS4L,http://www.is4l.com.my) has been built as a storage and sharing academic information platform. This model is to support the process of information gathering and dissemination, thereby increasing the academic activity at IPG. To implement and test the strategies used in improving gamification practices, the iS4L underlying promotional plan, shown in Fig. 1. With the addition of new staff and students every semester, as well as visitors to this site, we hope this platform will continue to operate and meet the needs of all parties and further assist the development of IPG.

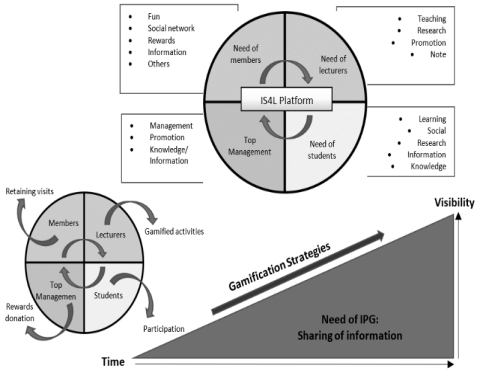

Fig. 1 Continuous iS4L promotion plan

B. *Gamification Technique*

Gamification is the application of game principles and mechanics in design fields that are not games in order to improve user motivation and engagement [5]. Gamification is a very popular modern design technique and has also been tested as a method for data collection [6] and for tasks that require human intelligence [7]. In order to implement and examine our strategy to improve gamification practices, a multi-purpose platform called 'Information Sharing for Learning' (iS4L) was developed using PHP. The goal of the platform is to support the gamifying process for academic activities in IPG. Four categories of participants are considered:

- Lecturers - introduce or promote their teaching aids or notes;
- Students - discuss, download any information, upload their projects and ask for feedback;
- Public users - interact with the educational content and context;
- Top management - contact the lecturers and students for cooperation opportunities.

Model iS4L are designed with the purpose of encouraging the participation of lecturers and students, in an information building process. This process includes looking group activities such as searching results, upload, and download of information. The participation of each activity is rewarded with points. From the accumulated points, users can convert them to bonuses in a form of gemstone (diamond, emerald and ruby), depending on the activity between users and platform. The gemstones accumulated by the users represent the achievements of participation in the process of information construction. The gemstones are categorized according to the target of the game mechanics. Based on the total gemstones collected, the user will be ranked to the top 10 list. The activities of building information are:

- Submit: Register a new practice, which is the result of an individual effort.
- Socialized: Register a comment or suggestion for a new practice "submit".

- Re-Submit: Register an updated practice, from the contributions of other users.
- Downloading: Downloading any materials users need.
- Uploading: Uploading any materials users need.

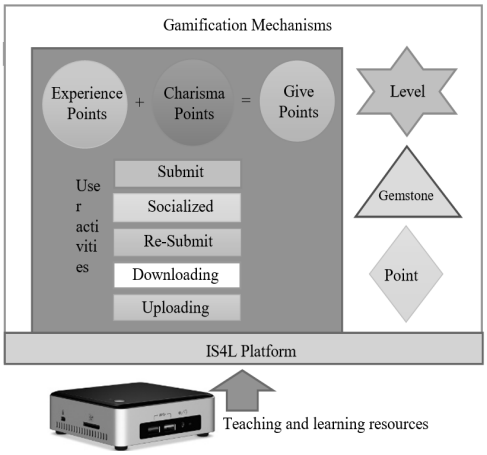

Fig. 2 The platform structure of iS4L

The platform structure shows the activities that support iS4L as a gamification platform. The activities are provided to introduce and engage users in IPG activities and educational content. The activities shown in fig. 2 above are activities that support iS4L platform as a gamification platform. These activities are designed to motivate and engage users with academic activities. Therefore, the more users interact with the application and try to achieve each of the objectives given, the more their ranking and status in the organization (IPG) are relevant. This status is represented with gemstones, which describes the qualities and capabilities of a particular member of the organization, and his or her contribution to the information management process at the organizational level. [11][26] and [27] restricted gamification to the description of elements that are characteristic of games and reserved the term for the use of gamifying design. Although this definition may raise another debate as to what is "characteristic" of games, their proposed levels of game design elements certainly give the practitioner guidance when carrying out gamification designs. As can be seen in Table I below, game interface design patterns, with solutions such as badges and leaderboard, are distinguished from game design patterns or game mechanics, which can be implemented with many different interface elements, and thus the former are more abstract and treated as distinct. The levels of game design elements are used as a guide when developing this model.

Level	Description	Example
Game interface Design patterns	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations	Badge, leaderboard, level
Game design patterns and mechanics	Commonly reoccurring parts of the design of a game that concern gameplay	Time constraint, limited resources, turns
Game design principles and heuristics	Evaluative guidelines to approach a design problem or analyze a given design solution	Enduring play, clear goals, variety of game styles
Game models	Conceptual models of the components of games or game experience	MDA Model: Mechanics, Dynamics and Aesthetics (Hunicke, LeBlanc, & Zubek, 2004); challenge, fantasy, curiosity; game design atoms; Core elements of the gaming experience
Game design methods	Game design-specific practices and processes	Play-testing, play-centric design, value conscious game design

Table I Levels of game design elements [11].

III. STRUCTURE OF GAMIFICATION PLATFORM

Nowadays, gamification technique has been implemented in education sectors to engage user to embrace specific behavior [8], [9]. The role of gamification, both computer based and traditional method is to motivate and engage students in using the platform using game mechanics in education [10]. Gamification is the application of the concept of game mechanics and dynamics in designs aimed to enhance user motivation and involvement [11]. Gamification is a modern design technique that is very popular and has also been used as a means of data collection [12] and for tasks requiring human intelligence [13].

Mechanic and dynamic games are two important techniques related to gamification [14]. Mechanic games relate to the rules and benefits obtained in the game; the features that make it challenging, fun, rewarding and emotionally entertaining by game designers [15]. The emotions that result from the involvement and motivation are called dynamic games. Mechanic games are responsible and function as components in the game. This allows users to control game levels and will guide their actions. In other words, dynamics is a user-to-mechanic interaction [16] and what users do either individually or in conjunction with other users is the response to the designed mechanical system. The mechanical games used in this model are:

• Scores - To reward and manage the behaviour of different users within the same website or application. Marks are given to stimulate a person to compete.

• Challenges, Trophies, Badges / Medals - Challenges represent the user's mission to achieve and rewards will be given on top of its

implementation. Trophies, badges or medals are a recognizable sight when the user has reached a new level and resolved the challenge. In this model, the accumulated marks will be exchanged with gemstones.

• Classification table, Position, Score - User rating compared to others. This table is usually used to display user scores. The advantage of implementing this table is to provide information on user progress and motivation [17]. In this model, the top 10 positions will be sorted by accumulated points.

Participation for each activity will be rewarded in points as shown in fig. 4. The accumulated points will turn into a larger bonus such as gems (ruby, emerald and diamonds) according to the resolution, depending on the activity of each individual as shown in fig. 3. The gems collected by the users will determine the highest achievement of users and their participation in the process of building information. These gems are categorized according to the target of mechanical games. Based on the number of gems collected, users will be listed in the top 10 as shown in fig. 5. Techniques for collecting points are as follows. After signing up, X1 gets 5 marks and every time X1 logs in, it will get 2 marks. In each of the following activities, X1 will receive 2 marks. There is a lot of activity to do, so X1 will collect a lot of marks. Example of scoring calculations is:

Pointer	**Reward**
100 points = 1 ruby	
5 ruby = 1 emerald	
5 emerald = 1 diamond * *The accumulated number of diamonds will determine the top 10 of users.*	

$$Xt = 5 + 5t + 2t + 2t + 2t + 2t + 2t + 2t$$
$$= 5 + 2(5) + 2(5) + 2(3) + 2(6) + 2(4) + 2(4) + 2(3)$$

$$X_t = 10 + \sum_{i=1}^{8} a_i$$

Fig. 3 Points conversion

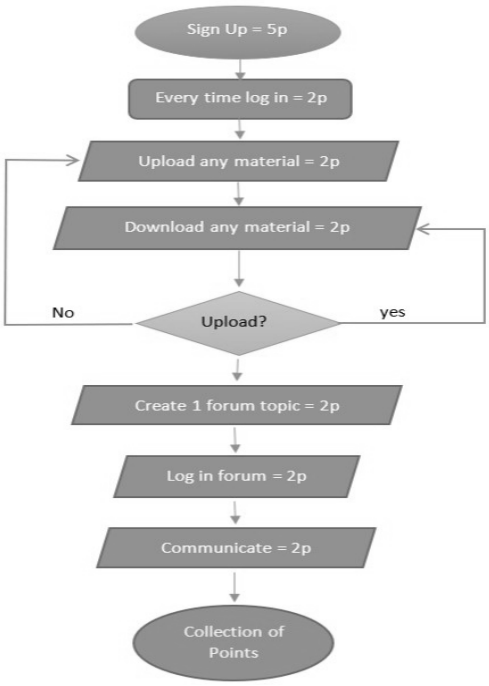

Fig. 4 Method of collecting points

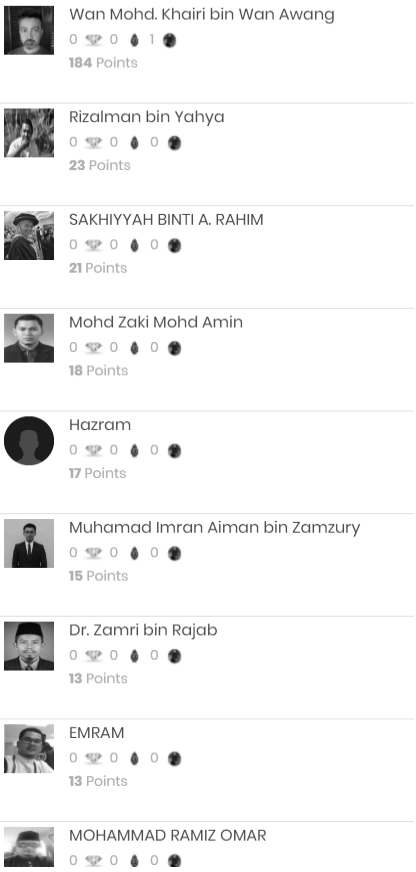

Fig. 5 Top ten users

IV. RESULT & DISCUSSION

The results of the questionnaires in the last part of the online survey, with the five-point Likert-type items, are shown in Table II. The questionnaires contain 4 sections and are focused on the final part of the results that reflect the overall quality of the portal. The finding shows the items 28 to 32 obtained mean value above 4, and this indicates that users agree and are satisfied with the overall quality of the portal. Item 31 obtained the highest mean which is 4.73 indicating that the portal designs coincide with the concepts of management and information sharing. Item 32 obtained mean of 4.6 showing that this portal can attract users to continue using it in the future. The reward mechanisms received the most attention in [18] review of the gamification literature, and the same result of our survey reveals that the tangible point rewards were seen as the most important element by users.

Table II The mean value of each gamification strategy in iS4L

Item	Mean	SD
I'm more productive and motivated to finish the task.	4.5	0.62
Have the functions and capabilities I expected.	4.46	0.50
Appropriate point reward system.	4.43	0.62
Design in accordance with the concept of management and information sharing.	4.73	0.44
I will continue to use this portal in the future.	4.6	0.62

Table III focuses on mechanisms that can attract users to continue using this portal in the future. 80% of users agreed that the list of top 10 items showing that this mechanism can motivate them to continue using this portal in future. The list of top 10 users is shown in the front page of the portal. It is important to note that some researchers categorized rewards with point systems [19] which match our survey that the pointer given mechanism scored 73.3% and followed by the virtual prize mechanism scored 66.6%, thus taking advantage of the human desire for altruism as gift-giving is a strong motivator. The mechanism for information storage and searching got the score of 73.3% and the lowest score 33.3%, this shows that the mechanism of the forum does not help persuade them to visit this portal in the future.

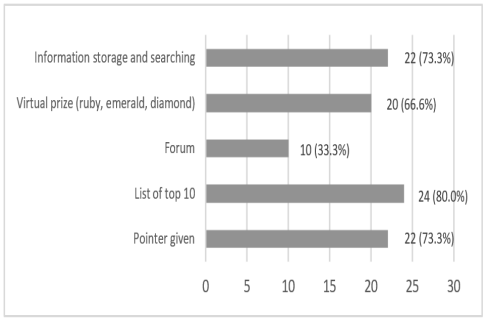

Table III Mechanism use for attracting users

Motivation can be divided into two categories: extrinsic motivation and intrinsic motivation. Extrinsic motivation refers to behaviours that can give an external reward for themselves such as money, grade, praise or reputation. Meanwhile, intrinsic motivation refers to a person undertaking an activity for its own's sake or self-fulfilment, not because of some external rewards [20].

Finally, we encourage the wide use of this portal in the future to enable IPG students to get accurate information at the right time. This model is expected to provide special encouragement to lecturers at the IPG to use this portal in their teaching and learning process. In addition, we hope that this model would provide new ideas for top management staff so that they will promote the use of this model in the process of teaching and learning in the IPG. Lecturers should look at the design or pedagogy of learning, the humanistic way of learning, the potential of technology and media and teachers' ability to engage students involved in the learning process [21].

To realize 21st-century learning, the trends of learning and best practices need to be tailored, either through integrated learning or through 'blended learning'. 'Blended learning' is a way of integrating the use of technology in learning that is appropriate for the students in their classrooms. Thus, 'Blended learning' is one of the learning techniques of the industrial revolution 4.0. According to researchers, 'Blended learning' is a combination of online learning and face-to-face learning in the classroom [22]. 'Blended learning' is a method that combines face-to-face learning with online learning [23]. 'Blended learning' is a combination of physical learning in the classroom with virtual learning [24]. Therefore, this model is expected to fully support teaching and learning in the industrial revolution 4.0

V. CONCLUSIONS

IPG has faced many problems in trying to implement the concept of resource sharing among lecturers and students. This article introduced the concept of gamification in resource sharing and teaching and learning materials. The model is developed based on two elements of gamification which are game mechanics and game dynamics. The

model could help the IPG management to monitor the activity of information sharing among lecturers and students especially in improving skillsets and knowledge.

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