A concept paper on the impacts of individual gamification elements on user’s intrinsic motivation and performance

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Abstract. Gamification is a growing trend that has the potential to improve user’s motivation and performance in e-learning. However, it is still heavily debated as there is an ongoing discussion within the gamification community whether individual gamification elements may actually weaken or improve intrinsic motivation and performance. To date, research on individual gamification elements is still yet underexplored making it difficult to understand whether individual gamification elements may prove beneficial or harmful to user’s intrinsic motivation and performance. Therefore, this concept paper is intended to explore the effects of three commonly employed game elements namely points, leaderboard, and badges on intrinsic motivations and performances in a flow experience perspective. It is to hope that through this study, a clear understanding of individual gamification elements can be achieved and more in-depth work can be done in the future.

1. Introduction
The growth of social networking sites and video games have influenced them with a new way of thinking and different learning preferences and this requires a new educational approach [1,2]. Although technology keeps on progressing, this, however, did not hinder educator or researcher to search for new approaches to motivate students in the education sector. One of the popular approach in education to improve user motivation is through gamification. Gamification commonly defined as the use of game design elements in non-game context [3]. It is different from a computer or digital games where gamification simply takes the essence of games design elements such as points, levels, badges and leaderboard. These game design elements, when applied into the non-gaming context also known as gamification, will make learning activity more engaging and fun.

Gamification structure can be referred to the MDA framework [4] which introduced three basic components of the gamification: Mechanics (M), Dynamics (D) and Aesthetics (A). Game mechanics described the particular rules and components of the game that can drive user actions, game dynamics describe how the rule manifest during actual gameplay based on the players’ input to the system as well as interactions among players, and game aesthetics is the desirable emotional responses evoked in the player when interact with the game system [5].

In education, gamification has been identified to have a positive outcome in terms of motivation and engagement [6]. Engaged learners are more likely to want to perform better whereas motivated learners are likely to put more effort into their learning activities in order to reach the learning goal. motivation affordance in gamification often associated with Self Determination Theory (SDT). There are two main
types of motivation as suggested by SDT which is intrinsic and extrinsic motivation [7]. Intrinsic motivation can be referred to as doing something because it is inherently interesting or enjoyable where else extrinsic motivation refers to doing something because it leads to a separable outcome [7].

SDT suggests that competence, relatedness and autonomy are the need satisfaction to maintain intrinsic motivation [7]. These three motivational needs when afforded through game elements, have been found to increase intrinsic motivation in people [8]. Likewise, when these needs are thwarted, people will become disaffected and withdraw [9]. Competence relates to the understanding on how to attain various external and internal outcomes and being effective in performing the necessary actions, autonomy describes as the ability to being self-initiating and self-regulating of one’s own actions and relatedness is referred developing satisfying connections with others [10]. Cognitive evaluation theory (CET) which is a sub-theory of SDT, stated that external events such as reward and feedback that conduce toward feelings of competence and accompanied by a sense of autonomy can enhance intrinsic motivations [7].

Gamification concept generally performs as external events that influence intrinsic as suggested in CET. Game design elements or mechanics such as points, badges and leaderboard may be considered as an external reward as these game mechanics can provide feedback on performance and driver to motivate user’s behaviour [11]. While most of the gamification trend nowadays applied game mechanics in e-learning, it is also possible that these game mechanics could apply manually in the classroom. However certain advantage proves better to apply game mechanics digitally. The main advantage is more convenient and time-saving. Teacher does not constantly monitor every activity in order to award them based on their performances [12]. Furthermore, current gamification tools such as Moodle and Kahoot has already incorporated game design elements to drive user motivations. Recently, the most commonly employed game mechanics are points, badges and leaderboard [6,13].

The previous studies of game design elements, although notable for addressing the issue of engagement and motivation, provide limited insight on the effects of individual game design elements. Most of the studies examined a combination of game mechanics or treated gamification as a universal construct, neglecting the fact that individual game mechanics might give different result [13,14]. Due to the insufficient information and empirical evidence on effects of individual game mechanics on user motivation and performance, it is very difficult to determine which game mechanics can increase intrinsic motivations to support better performance [16]. Therefore, this concept paper aims to explore the effects of individual game mechanics on intrinsic motivation and performance and propose a conceptual framework as the main idea for this study to be explored further in future.

2. Related Research
The study of gamification on motivation and performance in e-learning is not new. In previous gamification studies, rewards and feedback such as the use of game mechanics of points, badges and leaderboard prove to be successful in improving user’s motivation. However, there is literature from the psychology of motivation point of view suggest that intrinsic motivation can be undermined by the application of an extrinsic reward [7]. This indicates that although game mechanics might improve user motivation and performance, yet does not necessarily imply on intrinsic motivation. Perhaps game mechanics perceive as an extrinsic incentive might actually affect negatively on user’s intrinsic motivation. A previous study agrees with this issue and suggests that game mechanics when applied in e-learning, did not improve education outcomes and harm intrinsic motivations [17]. The reason behind this might because of the gamified system found to be controlling for the user and reduce user satisfaction need of autonomy which affects negatively on competence needs.

Cognitive evaluation theory suggests that if the external reward perceived to be controlled, it can cause user to be less competent and reduce intrinsic motivation. Another study stated that reward in gamification can actually bring a controlling aspect that leads to loss of internal motivations [18]. However, this does not necessarily lead to a negative result where external reward could improve significantly user performance without taking consideration of intrinsic motivations. One of the few studies investigate the effects of individual game mechanics propose that game mechanics improve user
performances [19]. Individual game mechanics were employed on image tagging task for their study [19]. It is also noticeable that leaderboard and levels in their study prove better outcome in terms of performances compare to points conditions. Indeed, their result shows that game mechanics successfully improve user performances however it did not affect intrinsic motivation where the participants reportedly have similar levels of intrinsic motivation. These might because of the design of the task insufficient to improve the level of competence mainly because the task was not designed to be challenging enough for the user to increase their intrinsic motivation. Challenge is describing as the focal point of motivation to allow enjoyable experience for the user [15] thus potentially increase intrinsic motivation.

Another study on individual game elements also suggests that game mechanics successfully improve user engagement [20]. Their study also stated that badge and leaderboard prove better than point condition to motivate user to be more engage in their learning activity. However, their study lack information on motivational affordance for each gamified condition especially on intrinsic motivation aspect to justify to what extent the user’s intrinsic motivation influence user’s engagement. Overall, current research on the effects of individual game mechanics on intrinsic motivation and performance is still considered few and hard to justify individual game mechanics could increase intrinsic motivation and influence user to perform better.

3. Conceptual Model

Figure 1 demonstrates the conceptual model fundamental to the design of this study as the main ideas to further explore in the future. Based on past theories for instances, the fundamental of gamification in influencing user motivation is game mechanics [11]. In recent year, points, badges and leaderboard game mechanics were heavily examined and constantly being used in e-learning in an effort to improve user motivation and performances [6,13]. Each of these game mechanics could generate a different outcome that might be useful to any application to maximize its potential to improve user’s intrinsic motivation and performance. Points serve as a reward while badges can provide user progression and achievement. Leaderboard, on the other hand, allows for social comparison and user progression. Game mechanics in gamification can support intrinsic motivation if user perceived as informational which support competence motivation needs [19]. If the game mechanics in gamification perceived as control this can decrease intrinsic motivation [19]. Besides, the task also needs to be designed to support competence motivation needs.

Challenge is the primary concern in designing a task where the challenge should be enjoyable, fun and support intrinsic motivation. To address these, Flow theory can be the basis for the gamification application design in this study. Flow was introduced by Csikszentmihalyi [21] where user can achieve optimal experience when doing any activities. Flow is one of the most influential models of enjoyment [15] where it’s drive user to be in an optimal experience state when performing a task and senses a deep level of enjoyment. Challenge is the central precondition of flow experience and another condition that are proposed are immediate feedback [22]. Flow proposes a concept of balance between user’s level of skills and challenges. When the tasks are too easy, user will feel bored. In contrast, when the tasks are too difficult for their level’s, they feel anxious. Challenge can bring enjoyable experience by creating a feeling of competence as suggested in Flow theory and through the feeling of autonomy where user chooses to accept the challenge for the sake of fun and enjoyment.
4. Methodology
To investigate the effects of individual game elements on intrinsic motivation, and performances, between-subject experiment will be conducted. The independent variables are game elements which are points, badges and leaderboards. The dependent variables are user performances (number of scores) and intrinsic motivation (Intrinsic Motivation Inventory questionnaire) that consists of subscales of interest/enjoyment, efforts, competence and autonomy.

4.1. Hypothesis
The study aims to expand upon existing research on individual gamification elements by investigating the effects of points, badges and leaderboards on participants’ performance and intrinsic motivations in mandarin language quiz. Hence, the following hypothesis was formulated:

H₁: Badges and Leaderboard condition will have a higher significant level of intrinsic motivation compare to points condition.
H₂: Badges and Leaderboard condition will have a higher significant level of performance compare to points condition.
H₃: Intrinsic motivation positively predicts performance outcome.

4.2. Experiment Task
The participants will be presented with a quiz application. The quiz will be available for 1 hour and they are required to answer as many questions as possible. However, they can exit the task whenever they desire. The flow of the task is present in figure 2.
4.3. **Stimuli**
A custom application will be developed using Unity game engine which runs on windows platform. The stimuli will be identical for three groups differ only in the game elements of points, badges and leaderboards. 3 essential aspects were identified in the stimuli design: Game elements (Points, badges, leaderboard), feedback, and challenge.

4.3.1. **Game Elements**
In point’s condition, the user will receive 10 points for each corrected answer. The points score given acted as completion of the task and serve to give direct feedback for incentive purpose. In the badge’s condition, the user will receive the same points incentive with the point condition. The badge will display after participants complete the requirement to unlock a badge. Badge acted as an indication of achievement and progress, and points scores needed to progress from one badge to the next badge. In leaderboard’s condition, the user also will receive the same point incentives as with the point’s condition but were able to compare their current scores to other participants scores. The leaderboard’s condition added an incentive for social comparison and competition. The interface design of the individual gamification elements can be described in Figure 3.

![Figure 3. The application interface of points, badges, and leaderboard.](image)

4.3.2. **Immediate Feedback.** For each question, the participants answer, immediate feedback will pop up to show whether it is a correct or wrong answer. The answer will be provided for the incorrect answer to encourage participants to learn from their failure.

4.3.3. **Challenge.** Three stages of difficulty will be implemented to keep the player in the desired flow channel (Table 2). Each stage consists of a series of quizzes from certain chapters in the syllabus from the course. The quiz starts with stage 1. The system will automatically move to stage 2 once the participants earned 100 points. Likewise, the system will move to stage 3 when the participants earned 300 points.

| Stage | Chapter          |
|-------|------------------|
| Stage 1 | Chapter 1, Chapter 2 |
| Stage 2 | Chapter 2, Chapter 3 |
| Stage 3 | Chapter 3, 4 |

4.4. **Procedure**
90 students of faculty of Computing and Informatics in University Malaysia Sabah, Labuan International Campus will participate in this experiment. All the participants will be brief by the researcher about the experiment. Firstly, participants will ask to complete the demographic questions. Then, they will receive instructions for the experiment. Participants will be required to earn as many scores from the system by answering the quiz in the application. The experiment will be available in 1 hour. 3 groups will be divided in this experiment (points, badges and leaderboard condition). At the end of the experiment, participants will be asked to answer a questionnaire for the purpose of data gathering on intrinsic motivation. Scores from the experiment were gathered for the purpose of performances measurement.
4.5. Measurement

Performance data will be measured by the number of scores earned when participants answer correctly in the quiz while intrinsic motivation data is assessed with intrinsic motivation inventory (7-points Likert Scale, 1—not at all true, 7 = very true).

4.6. Data Analyst

Statistical Package for the Social Sciences (SPSS) software will be used to analyze the data. A one-way ANOVA followed by Turkey post hoc test will be used to analyze the data from the experiment for intrinsic motivation and performance data. Pearson correlation and linear regression will be used to analyze the relationship between intrinsic motivation and performance data.

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