The Use of Gamification in an Introductory MIS Course: the Views of Game Participants and Game Conductors

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Abstract

Gamification gives opportunities for instructors and majors to attract more students. However, there are limited studies and understanding about gamification in education and its suitable implementation. So, this work guide a simple process to implement gamification in classroom environments and evaluate the results of implementation using self-reported from students who are assigned to be game conductors and game participants. The results from an experimental study show the increase of students' perceived usefulness (understanding, problem solving skills, creativity, and topic interests) and their engagement intention (game engagement intention, class attendance intention, and class participation intention) after conducting or joining in-class games. Guidance to easily implement gameful experiences for students could be applied from an example in this study.

Keywords: Gamification, undergraduate student, introductory MIS course, perceived usefulness, engagement intention

1. Introduction

Despite what can be seen today are the growth of high-technology industries and the strong opportunity of the IT-job market, enrollment in IT-related fields such as MIS are declined [1-3]. Enrollment concern is a common observation among different countries such as USA, Australia, Canada, South Africa, Western European countries, and Kuwait [3]. Student's interest towards MIS is one of determinants when a student chooses his/ her major. Redesigned curricular is one approach to increase MIS majors. Moreover, using an introductory MIS course as a recruiting strategy is vital [1]. New teaching methods such as a project-based approach, and new technologies and tools could be applied to attract more students by motivating students, enabling a self-directed learning, and enhancing students' perceived enjoyment [1, 3, 4].

Gamification is forecasted to be one of promising trends in the second decade of the 21st century [5]. Gamification implementations give the potential to reform MIS education [4]. It is an adaptation of game elements with the goal to impact motivational, attitudinal, and behavior constructs, which could motivate and reward students in self-learning [6-9]. It allows students to learn easier through entertainment and competition and to stay motivated in the classroom for a long period [10]. Some gamification benefits are providing positive emotional experiences, increasing engagement and motivation levels in classrooms, increasing social interaction between students, giving students ownership of their learning, providing immediate feedbacks to students, and so on [8].

Brewer et al. added gamification elements to motivate children ages 5 to 7 years old to complete the tasks regarding mobile touch and gesture interaction in laboratory studies. The use of gamification increased the task completion rates from 73 percent to 97 percent. Gamification elements, such as points and prizes, could be applied to design mobile applications for young children in the future [11]. Caton and Greenhill explored the influence of the award and penalty game mechanics on a third□year undergraduate game production module and offered a gamified framework to keep students contributing to team efforts equally.

Initial results showed that awards and penalties could improve students' attendance and performance and increase students' motivation [12]. Mesquita, Toda, Brancher, and Do Carmo utilized a social network tied with gamification concepts such as badges, points, levels, and leaderboards to improve students' participation. The results revealed the achievement of a project's goal in a gamified social network environment more than a traditional education environment [13]. Poole, Kemp, Patterson, and Williams investigated the use of gamification and customer engagement principles in college business courses. Findings supported that gamification was an effective tool for enhancing students' engagement and learning [14]. losup and Epema applied social gaming elements to undergraduate and graduate courses. Gamification was correlated with the increased percentage of passing students and students participating in voluntary activities and assignments [15]. Latulipe, Long, and Seminario introduced lightweight teams, combined with flipped classroom and gamification approaches. The approaches could lead to higher students' engagement levels [16]. Armier Jr et al. investigated students' willingness to join gamified activities in a technology integration course. The results showed the significant differences between mid- and post-tests in terms of individual participation, group pursuits, individual work, group meeting frequency, group preparation, and purchased items and between control and treatment groups in terms of hours spent in the groups [9]. Hamari et al. examined the effects of flow (challenge and skills), engagement, and immersion on learning in game-based environments. Findings revealed that game engagement had a positive impact on learning. Game challenge had a positive effect directly to learning outcomes and through engagement. Flow had a positive impact on both being engaged and immersed in educational games [17]. Tan and Hew studied how meaningful gamification in blended learning impacts student learning, engagement, and affective outcomes. Meaningful gamification was applying the game mechanics and activities based on the self-determination theory. Results indicated that the experimental group participated more in the discussion forums and produced higher quality of group artifacts than the control group [7]. Alabbasi explored graduate students' views on the use of gamification in education, using exploratory research and survey. Findings showed students' positive perceptions toward the use of gamification in online learning [18]. Kenny et al. explored how student-generated gamification projects can enhance learning according to Bloom's Taxonomy of Learning. Preliminary results supported the potential of student-led gamification to improve learning and develop gamification self-efficacy [4]. Smith conducted a quasi-experimental study to explore the impacts of gamified modules on learning and attitudes toward a statistics course. Results showed the positive outcomes of gamified exercises on the attitudes of cognitive competence, effect, value and perceived difficulty [6].

Although there are some past studies relating to gamification in education as described above, limited research and understanding about the game-based learning still exist [4]. In addition, gamification is not a simple process and a bit complicated to implement correctly [19]. It requires time overheads and can be difficult for instructors or teachers to incorporate game elements into their courses [10, 15, 20]. Moreover, games in education are normally relegated to supplement activities and rewards rather than adding experiences to increase engagement and participation [9]. Also, most papers mainly report the gamification applications in the domain of computer science and information technology [7].

Hence, the purposes of this study are: 1) enhancing gameful experiences for students in an introductory MIS course by letting them to be game conductors or game participants, 2) exploring perceived usefulness that students (game participants and game conductors) receive from the gamified activities in terms of understanding, problem solving skills, creativity, and topic interests, 3) examining their engagement intention regarding game engagement intention, class attendance intention, and class participation intention, and 4) suggesting the guidance for instructors to incorporate gamification into their courses.

2. Research Hypotheses

2.1. Perceived Usefulness

Davis proposed a theory describing two main factors, driving users to adopt technology, that are perceived usefulness and perceived ease of use [21]. Both perceived usefulness and perceived ease of use are vital constructs in the context of information systems [22]. Users' perceived usefulness positively relates to users' satisfaction. Perceived usefulness of IS use is also positively associated with IS continuance intention [23-27]. Perceived benefits have a positive influence on behavioral intention [28]. Perceived usefulness of learners significantly drives higher learners' satisfaction in e-learning [22, 29] and significantly impact behavioral intention in the MOOC study [30]. Perceived usefulness is significantly associated with satisfaction in virtual classroom for internet-based MBA courses [31]. There is a positive relationship between perceived usefulness and behavioral intention to write web logs in the ESL classroom [32] and intention to use ARIES augmented reality [33]. Perceived usefulness of business simulation games significantly affects learning performance [34]. Perceived usefulness has a positive influence on customers' intention to participate in gamification [35]. Perceived benefits positively affect gamification self-efficacy [4]. Gamification have positive correlations with student engagement, motivation, and learning outcomes [20]. Gamification is confirmed its educational usefulness for engaging students to learn, gain experience, and stimulate cooperation [5]. A class exposed to gamification significantly has better performance than a class with a traditional lecture format [14]. Challenge or problem solving, creativity, social interaction, helping others, importance or utility to business, image or reputation, and change are beneficial attributes that should be added to the coursework applications to increase students' interests in MIS major [3].

Understanding. Games can be an effective tool to enhance understanding in complex subjects [36]. Understanding significantly increase game self-efficacy [4]. Lightweight teams (with gamification) significantly improve students' ability to study course materials [16]. Students believe that gamification could help them to improve their understanding of course materials and course content [19]. Using active learning methods such as a flipped classroom approach could increase the learning level of students [37]. A Screen cast of lectures and active learning in the classroom enable students to learn materials more effectively than only the lectures [38]. Comprehensive content is an indicator for measuring quality of content in successful e-learning systems [39].

Problem Solving Skills. Gamification is the use of game mechanics to engage individuals, motivate their behavior and solve problems [4]. It can assist students to form problem-solving and higher order thinking skills [19]. Using gamification to teach programming concepts increases social interaction between students, which occurs when they face problems and discuss with others to find the solutions [8]. Students agree and strongly agree that the meaningful gamification in a blended learning research methods class equip them with the knowledge to solve real world problems [7]. Utilizing gamification in education looks promising for creating new solution, selecting critical data, and synthesizing knowledge [5]. Gamification could increase cognitive competence, showing self-efficacy benefits of gamification [6]. Remembering, understanding, applying, analyzing, evaluating, and creating, according to Bloom's taxonomy of learning, positively influence gamification self-efficacy of game makers [4]. A contest, a part of game-based learning, in programming with computers is an effective way to develop problem-solving skills for students since they have to compare their abilities and learn from each other [40]. Using active learning approaches such as a flipped classroom increase students' self-efficacy regarding solving physics problems [37].

Creativity. Gamification with group projects could force students to think both creatively and critically. Its mechanism is designed to motivate learners to search for information from variety sources, which is later needed the creative processes for source selection and the creation of concepts and syntheses [5]. Incorporating gamification in a blended learning clearly

makes students having more opportunities to exchange ideas with others [7]. Individual's creativity significantly increases gamification self-efficacy of game makers [4].

Topic Interests. Gamification promotes on-task behavior. Game participants feel better prepared for the game [9]. Integrating gamification into a blended learning research methods class substantially makes students in the experimental group wish to learn more about the topics (survey methods) after attending the class [7]. Students in a class with gamification said, "I truly enjoyed playing games to learn the material as opposed to listening to a lecture. I would recommend this class to anyone. " [14]. Gamification improves students' engagement in content and students' positive attitudes toward learning [36]. The mechanism of gamification forces learners to find information from various areas and apply appropriate strategies to acquire information regarding the studied topics [5]. In addition, the gaming group significantly puts more effort and total time spent on the assigned topic and project more than the non-gaming group [9].

Thus, this study proposes hypotheses as follows.

H1a: There is a difference in game participants' understanding before and after joining gamification in an introductory MIS class.

H1b: There is a difference in game conductors' understanding before and after leading gamification in an introductory MIS class.

H2a: There is a difference in game participants' problem solving skills before and after joining gamification in an introductory MIS class.

H2b: There is a difference in game conductors' problem solving skills before and after leading gamification in an introductory MIS class.

H3a: There is a difference in game participants' creativity before and after joining gamification in an introductory MIS class.

H3b: There is a difference in game conductors' creativity before and after leading gamification in an introductory MIS class.

H4a: There is a difference in game participants' topic interests before and after joining gamification in an introductory MIS class.

H4b: There is a difference in game conductors' topic interests before and after leading gamification in an introductory MIS class.

2.2. Students' Engagement Intention

A majority of students prefer to participate in-class activities more than listen to the professor lecture for the same amount of time [38]. Active learning using a flipped classroom increase students' motivation to learn that is the willingness to attend and read materials in a development program [41]. It shows positive results in terms of fewer dropout rates, higher class attendance, positive student attitudes in learning, and increased exam scores of students [42]. Embedding educational games could also reduce student dropout rates in computer sciences and also maximize students' participation and learning [40]. Gamified learning experience significantly increases the number of downloads, posts, and attendance of students [43]. Previous studies confirm the positive impact of gamification on students' engagement and motivation [7]. Gamification elements such as stamps, tokens and the leaderboard could encourage students to put more efforts to work [16]. Lightweight teams (with gamification) significantly make the course more engaging and let students socially integrate with their friends [16]. Challenge and skill in games have positive direct effects on engagement, which are later positively associated with perceived learning [17]. Gamification plays an important role when incorporating it into the learning process. It would enhance students' engagement and increase their motivation [36]. There are promising correlations between gamification and student engagement, motivation, and feelings of autonomy and control, which are positively

correlated with learning outcomes [20]. Most lecturers consider gamification as a strong driver [10]. Educational institutes are supporting the utilization of gamification to improve intrinsic motivation such as desire to learn and engagement [18]. Gamification could be applied to learning, especially when students are lack of motivation and engagement [19]. It promotes student engagement and in-class participation by competition, leaderboards, levels, rewards, and other game mechanics [9]. Gamified assessment in a computer-programming course can enhance student engagement and let them to achieve the studied goals [44]. In other context, game-like designed training has an increasingly important role to engage trainees [35]. The engagement significantly improves perceived learning [17].

Game Engagement Intention. Students express positive attitudes toward in-class gamification because of using a fun game and providing extra motivation [10]. Students who are in a class with gamification agree that the class is very involved and engaging, consistent to the way that they like to learn [14]. There is an evidence that undergraduate students who have experience with games and desire social interaction with games are open to educational games [19]. The majority of students enjoy playing classroom games in various formats such as cards because of its competitiveness. They also try to perform well in games and try to complete project-based group tasks more for the simple game, which is not directly tied to course grades [9]. The optimal experience received from the effective personal interaction with the system or pleasant social interactions with others online make people continue to play online games [45].

Class Attendance Intention. Attendance is a measure of engagement and participation [12]. Adding meaningful gamification into a blended learning research methods class makes the course motivating [7]. Many students believe that the application of gamification in education will make classes more interesting and improve the classroom learning atmosphere [19]. Most students strongly agree and agree that gamification increases their motivation towards lectures and help them get better grades [10]. Gamified approach has a positive effect on lecture attendance [5, 43]. Gamification motivates students in some groups to attend class more often than their friends in the other groups [44]. In the extra lectures with gamification, students have high attendance because they do like to learn for the sake of learning [15]. Class attendance in college has a strong relationship with class grades [46].

Class Participation Intention. Students become engaged in classroom activities more when role playing, problem-based scenarios, and narrative game elements are introduced [9]. Gamification elements provide more engaging course for students [16]. Implementing game elements in education enhances participation among learners both in traditional classrooms and online learning [47]. Gamification triggers students to pay more attention to the designed course and forces their interactions in the classroom [15]. The courses that use gamification can increase in-class participation, which is correlated with student satisfaction [15]. There are significant differences between the gamified class and the traditional class regarding the levels of involvement, participation, and emotional reaction [14]. The use of gamification increases students' level of engagement in terms of collaborative learning and student-teacher interaction [36]. Motivational game elements can be adopted for students who are demotivated and uninvolved in learning activities [12]. An experimental study indicates that students in gamified modules are more engaged in the course and put higher efforts in homework completion [6]. Students exposed to gamification also significantly create more posts in online forums than students in the control group [7].

Thus, this study proposes hypotheses as follows.

H5a: There is a difference in game participants' game engagement intention before and after joining gamification in an introductory MIS class.

H5b: There is a difference in game conductors' game engagement intention before and after leading gamification in an introductory MIS class.

H6a: There is a difference in game participants' class attendance intention before and after joining gamification in an introductory MIS class.

H6b: There is a difference in game conductors' class attendance intention before and after leading gamification in an introductory MIS class.

H7a: There is a difference in game participants' class participation intention before and after joining gamification in an introductory MIS class.

H7b: There is a difference in game conductors' class participation intention before and after leading gamification in an introductory MIS class.

3. Research Methodology

3.1. Participants and Course Design

Participants were undergraduate students enrolled in the Management Information Systems course, selected by convenience sampling. Data were obtained from five course sections, opened in the first semester from 2014 to 2017. Two sections came from the course running in 2017. However, data from a section in 2015 were omitted from the analysis because of its higher dropout rates and very small sample sizes, leading to different game environments from other sections. Students were in their first, second, and third year. Most students were female.

Students in every section were taught and received the same instructions about group presentation and evaluation criteria from the same instructor. All students in each section were separated into eight groups. Each group was assigned to design, implement, and conduct one or more free-format games once related to a course topic, randomly assigned by the instructor. Teamwork and collaborated assignments were assigned because they were found to enjoy the Millennial generations in learning [18]. There are eight main topics for gamified activities in eight rounds, extracted from the similar content of MIS textbooks written by the same author. Each round took around one hour and fifteen minutes. Games were assigned to be aligned with the existing course assignment and content, to better control gaming processes and outcomes [9]. The games were run, totally eight rounds, after the assigned topics were taught. Students were given the prior knowledge about the topics by lectures. They could also find more information regarding the assigned topics from other reliable sources. During the game run, some group used information technology such as Kahoot, whereas others did not. Generally, many groups applied simple games such as guessing pictures and combined those simple games together, which required less time for game participants to understand and complete and could attract and motivate peers to play [9]. All presented games embraced some game mechanics linking to basic human desires such as reward, status, achievement, self-expression, competition, and altruism [7]. Gamification were indirectly tied to course grades to support self-directed learning [9].

When a group was game conductors, students in other groups became game participants. Game participants were voluntary to join games as game players or game observers. Normally, winners were rewarded with prizes or free snacks from game conductor groups. After the game ended in each round, game participants evaluated the games in five dimensions, which are game enjoyment, topic's content coverage, content correctness or reliability, the unity of the game conductor group, and overall satisfaction, together with other survey questions. The evaluation from game participants would be turned into an overall score (25 marks) for the group that was game makers. Game participants also received one mark for evaluating their peers. After the game finished, game conductors earned three marks after answering a survey regarding perceived usefulness and engagement intention. For the final class sessions, an instructor wrapped up again about the gamified activities and desired learning outcomes.

3.2. Data Collection and Analysis

An experimental study with repeated survey was conducted to introduce gamified modules in an introductory MIS course and to examine the effects of perceived usefulness and engagement intention that the students received from the gamified activities. One-group retrospective pre-

post research design were applied because it was less intrusive, took less time, and minimized pretest sensitivity and the response shift bias occurring in traditional pre-post design [48]. The short survey for game participants contained questions about a student's ID, name, group ID, participating role, game scores (from 0 to 5) in five dimensions, described above, and game evaluation in terms of his/ her perceived understanding, problem solving skills, creativity, topic interests, game engagement intention, class attendance intention, and class participation intention before and after playing games, using 6-point Likert scale. The first questionnaire was collected eight rounds for each section. The survey instrument for game conductors consisted of the questions about a student's ID, name, gender, group ID, and game evaluation before and after running games. The second questionnaire was gathered only once for each section at the end of the course. Students in all sections were informed about the collection of the data and the utilization of data in the overview analysis in the first period of study.

Finally, Demographic data were analyzed. Pre- and post-test data of game participants and game conductors from four sections were compared concerning their understanding, problem solving skills, creativity, topic interests, game engagement intention, class attendance intention, and class participation intention. Normality test using the Shapiro–Wilk test was applied first to check the normal distribution of data. If the data were normal, paired sample t-test would be applied to compare pre-post game evaluation. If not, differences in pre- and post-attitude scores would be examined by nonparametric statistics, the Wilcoxon signed-rank Test.

4. Results

Total students leading the game as game conductors were 181 students. There were 46 students from the first section (1/ 2014). Of the 46 students, 17 students are males, 29 students are females. All of them were in the first year. There were 41 students from the second section and 43 students from the third section in the same semester (1/ 2016). The second section had 20 males and 21 females, which 4 of them were freshmen, 34 of them were sophomores, and 3 of them were junior students. The third section had 14 males and 29 females. All of them were freshman students. The last section (1/ 2017) had 51 students. Twenty-two of them are males, 29 of them are females. Twenty-eight students were in the first year, 21 students were in the second year, and 2 of them were juniors. For game participants, the number of students participating in each round was slightly different. Although the sample size is small, the experiments were measured repeatedly in at least four sections under the same environments.

4.1. Understanding, Problem Solving Skills, Creativity, and Topic Interests

Normality test of data from all sections, using the Shapiro–Wilk test, indicated non-normal distribution. Thus, nonparametric statistics (the Wilcoxon Signed-Rank test), which were robust against skewed data, were applied to compare pre- and post-test attitudinal scores. In terms of understanding, a Wilcoxon Signed-Rank test indicated that the post-test scores were significantly higher than pre-test scores. The Ranks table also shows that the majority of students in almost all cases gives a higher score to understanding in the post-test more than in the pre-test. Therefore, hypotheses *H1a* and *H1b* were supported.

In terms of problem solving skills, a Wilcoxon Signed-Rank test revealed that the post-test scores were significantly greater than pre-test scores. The Ranks table also shows that the majority of students in almost all cases gives a higher score to problem solving in the post-test more than in the pre-test. So, hypotheses *H2a* and *H2b* were supported.

In terms of creativity, a Wilcoxon Signed-Rank test pointed that the post-test scores were significantly more than pre-test scores. The Ranks table also shows that the majority of students in almost all cases gives a higher score to creativity in the post-test more than in the pre-test. Hence, hypotheses *H3a* and *H3b* were supported.

In terms of topic interests, a Wilcoxon Signed-Rank test showed that the post-test scores were significantly above pre-test scores. The Ranks table also shows that the majority of students in almost all cases gives a higher topic interests to understanding in the post-test more than in the pre-test. However, one presented gamification of game conductor group# 2 in the

last section (1/ 2017) gained the insignificant increase of post-test scores. Thus, the hypothesis *H4a* was partially supported and the hypothesis *H4b* was supported.

4.2. Students' Game Engagement Intention, Class Attendance Intention, and Class Participation Intention

In terms of game engagement intention, a Wilcoxon Signed-Rank test indicated that the post-test scores were significantly higher than pre-test scores excepts in the games of group# 2 and group# 5 in the last section (1/ 2017). The Ranks table also shows that the majority of students in almost all cases gives a higher score to game engagement intention in the post-test more than in the pre-test. So, hypothesis *H5a* was partially supported and *H5b* were supported.

In terms of class attendance intention, a Wilcoxon Signed-Rank test revealed the significantly higher post-test scores than pre-test scores. The Ranks table also shows that the majority of students in almost all cases gives a higher score to class attendance intention in the post-test more than in the pre-test. Hence, hypotheses *H6a* and *H6b* were supported.

In terms of class participation intention, a Wilcoxon Signed-Rank test showed that the post-test scores were above the pre-test scores. The Ranks table also shows that the majority of students in almost all cases gives a higher score to class participation intention in the post-test more than in the pre-test. So, hypotheses *H7a* and *H7b* were supported.

5. Discussion and Implications

The majority of hypotheses is supported, conforming to studies in the literature. Only two hypotheses are partially supported that are *H4a* and *H5a*. Games conducted by group number 2 of the last section (1/ 2017) insignificantly raise the post-game evaluation in terms of topic interests. This could be explained by the fact that group#2 gets the lowest overall scores, compared to other game-conductor groups. The rejection of hypothesis also in line with the study of Smith that gamifying an introductory statistics course shifted students' interest in an unexpected direction, a small decrease in interest [6]. The insignificant increase of the game engagement intention of games conducted by group number 2 and group number 5 of the last section could be explained by the support from literature that some students thought carefully about a course with gamification more than felt motivated by gamification [15]. In addition, group#2 and group#5 are in the bottom two ranking by overall scores (25 marks). They also receive the lowest game enjoyment scores, 3.3/5 for group#2 and 3.5/5 for group#5 respectively.

A theoretical contribution of this study is an experimental research exploring perceived usefulness and students' engagement factors. Other researchers could replicate this study to introduce gameful experiences for participants and examine their consequences in other aspects. For practical implications, this study shows the promising effects of gamifying an introductory MIS course from the repeated experimental study, which could increase understanding, problem solving skills, creativity, and topic interests in the views of both game participants and game conductors. Applying games to some sessions of the MIS class also enhance students' intention to engage game, attend classes, and participate in-class activities in the opinions of both game participants and game conductors. To reduce the time overhead required from an instructor and the complicatedness of implementing games solely by an instructor, this study guides an instructor to assign the design and implementation of games as group projects. Enabling students to work together as teams also matches the young generation students' needs. Evaluating the games by peers with the standard criteria is the use of social powers to assess game outcomes fairly.

6. Conclusion and Future Research

To our knowledge, this is the first time perceived usefulness and student engagement intention have been studied repeatedly under gamified MIS classroom environments. This study explores perceived usefulness in the aspects of understanding, problem solving skills, creativity, and

topic interests and examines the engagement intention in terms of game engagement intention, class attendance intention, and class participation intention, using students-led gamification. Findings show the significant differences in students' pre- and post-test attitudinal scores, which indicates that gamifying an introductory MIS course could improve students' perceived usefulness of games and their engagement intention.

Small numbers of students who participate in each round limits this study. Therefore, results should be applied with caution. Future studies should replicate the study with other courses with larger class sizes. Not only positive impacts, but also negative consequences of gamification should be examined. Gamification should also be compared with other active learning methods such as a flipped classroom to guide instructors about the teaching method selection. More game types and specific game elements such as badges that are applied to each game type should be explored in their effectiveness. Different viewpoints of game conductors and game participants in gamification should be investigated.

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