Designing a gamified e-learning environment for teaching undergraduate ERP course based on big five personality traits

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Abstract

The COVID-19 pandemic forced universities to push the use of distance learning, impacting an unprecedented number of students. New norms of social distancing and lockdown had been brought in as university measures, immediately modifying student and lecturer habits, changing from the traditional classroom to e-learning platforms. However, the lack of engagement of students throughout an e-learning system is a regular concern among lecturers when creating content on a system. This study presents an applied gamification concept to e-learning focusing on improving engagement of the various types of personalities of undergraduate students in ERP courses. The gamification design was developed by implementing the pros and cons of each game element to compromise the overall performance of students. Three evaluations were conducted: 1) to test whether the student has competently gained ERP knowledge; 2) web monitor to record the activity of students; 3) to evaluate the qualitative information of the game experience by interviews. According to the study, the selection of a game element based on personality traits does not necessarily improve knowledge but proves to allow better engagement in the course. In addition, our finding also provides the suggestions for designing game elements based on personality traits.

Keywords Big five factors · e-learning · Enterprise resource planning · Gamification · Undergraduate

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1 Introduction

Since covid-19 was confirmed to have reached Thailand on 13 January 2020, the government shut down universities and forced institutions to drastically change their schedules and implemented distance learning to teach students during the pandemic. However distance learning can be more or less effective in a number of ways for students depending on the right technology of pedagogy.

ERP (Enterprise Resource Planning) systems are the main course subjects in MMIT (Modern Management and Information Technology) to be implement for distance learning because the ERP course played an important role in contemporary business technology management to gaining advantage for modern management in business environment. ERP systems refer to a software that integrates the various functions such as planning, purchasing inventory, sales, marketing, finance, human resources, manufacturing, and procurement and are used to conduct business in companies' day-to-day activities (Kumar 2013; Nah 2002). As we mentioned before, teaching ERP systems in university programs on Modern Management and Information Technology is a core part of the program to prepare students for future employment in the industry (Lee et al. 2006; Venkatesh 2004). While universities were forced to teach in distance learning, the application of e-learning was a common approach to teach ERP systems in this situation. However, Leyh et al. (2011) only 64% of the teachers chose e-learning to teach students in ERP system because it was not practical to teach for distance learning and one of the most important problem was the students' lack of motivation and interest to follow until end of course.

During recent years “gamification” has been proven in academic research to positively affect behavior to enhance the overall performance of motivation to finish student's tasks and eventually improve experiences as games do (Huotari and Hamari 2017). Gamification refers to “the use of game design elements in non-game contexts” (Deterding et al. 2011). Several studies showed that gamification can enhance user engagement, motivation, and participation for learning and training (Monu and Ralph 2013; Procopie et al. 2015; Puritat 2019a, b).

Although the generally positive effect of gamification has been widely known, in educational context researchers have found that the personality of the learner is impacted by each game element differently (Hamari et al. 2014; Jia et al. 2016). Based on previous studies, personality is an important key to make gamification more effective. In addition, the big-five factor (Poropat 2009) was the model to describe the relationship between personality and academic behaviors. In this research, we studied the relationship of game elements between personality traits (extraversion, neuroticism, consciousness, agreeableness and imagination/openness) to understand the suitable effect for each character.

Thus, the research focuses on implementing a gamification concept into the ERP system course for distance learning based on the concept of big-five factor, in order to enhance the whole student characteristic for motivation and engagement in online courses. The gamification methodology employed the concept of game mechanics applied process entails in ERP systems to influence student behavior by educational psychology with intrinsic and extrinsic motivation. The method would go beyond the traditional classroom setting, design the LO (learning outcome) and selects the game elements to suit the objective.

This research is structured as follows: Some background on the principles of game design and how they apply to most gamification approaches is presented in Section 1 and 2. Section 3 presents research objectives related to the gamification concept to ERP online courses. Section 4 describes the research methodology and overview of the development of the platform including how to design gamification to support various types of student personalities. Section 5 and 6 is devoted to sum up the experiment result and discussion. Finally, section 7 contains the conclusion of this work and the research finding.

2 Related work

Gamification in the education industry is related to a variety of benefits and is widely used in many universities, several case studies of applied game mechanics proved to be successful (Stott and Neustaedter 2013; De-Marcos et al. 2014; Urh et al. 2015). The concept of game mechanic allows the player to have a chance to play again even after several failures in the mission. From this attitude the students can experiment without fear and it increases student engagement (Kapp 2012). Many studies provide evidence that gamification improves performance such as decision making, problem- solving and critical thinking (Chang et al. 2016; Hussein et al. 2019).

The trend of research on gamification has focused on improving student performance of learning (Attali and Arieli-Attali 2015; Denny 2013), motivational affordances (Marcos et al. 2014), attitude (Glover 2013), and the technique of content gamification applied (Monu and Ralph 2013). Moreover, a very important topic is student behavior related to participation in the system (Alcivar and Abad 2016). However, there is few research to focus on the effect of gamification for various student personalities in e-learning systems.

3 Research objectives

The objective of this research is to apply the gamification concept to ERP online courses from traditional e-learning courses and with the aim of boosting learning through distance learning. Also, we investigate the effectiveness of the learning outcome and the students' retention to participate in the course. In this research, we define the learning outcome as the student's perception of ability to understand ERP systems based on each learning objective in the ERP online course. Retention to participate refers to the student's behavior to join and access the course in terms of data statistics. In addition, we would like to understand the pros and cons of various types of student personalities based on the Big Five Personality traits perception for gamification. A better understanding of the deep characteristics of game elements will help to design the system and promote the learning performance of the ERP course. We summarized three hypotheses for this approach:

- 1 Is there a significant effectiveness of students in gamified online learning ERP compared to non gamified online learning ERP (H1)?
- 2 Is there a significant effectiveness in the motivation of students in gamified online learning ERP compared to non gamified online learning ERP (H2)?

- 3 Applied gamification concept can enhance the students' whole learning experience based on personality traits and perceptions of participating in gamified online learning ERP and non gamified online learning ERP(H3)

To prove these hypotheses, the first hypothesis relates to the effects of applying the gamification concept to student learning during online courses. The second hypothesis claims that corresponds to the motivation and student behavior by collecting statistic data through the use of ERP web analytics traffic and other beneficial data to prove the hypothesis. The final hypothesis is based on data collected with a qualitative method by interviewing the students who were selected from each personality traits for learning and perceptions of participating in the system. To verify our hypotheses, we developed the gamified online learning ERP for university students. In order to investigate the effect, we also develop non gamified system to compare with the gamified system of online learning ERP.

4 Research methodology

In this research we decided to use a mixed-method design approach. The two major types of mixed methods designs were employed in this research. In the first session we gathered quantitative information (pre-post test and data statistic platform). The second session was qualitative data gathered by interviews with students to summarize the information. This mixed method design was adapted from previous research based on gamification (Chang and Hung 2016; Ding et al. 2018; Lo and Hew 2020; Zainuddin et al. 2020). In order to gather data, we developed traditional e-learning ERP and gamification e-learning ERP platform to compare the results and to keep statistic data for monitoring students' progress and collecting related data.

4.1 Overview of methodology

Our research is studied on a course of Financial Tracking in Digital Business based on module of ERP which is taught in the Modern Management and Information Technology major in the College of Art and Media Technology Chiang Mai University. The experimental design for this research was focusing on proving the hypothesis. The students on class were divided into two groups for the experiment in order to investigate the effect of gamified and non-gamified learning platforms. The overview of our methodology is shown in Figure 1.

4.2 Participants

Our participants were students with similar educational backgrounds of MMIT major in College of Arts Media and Technology, Chiangmai University between their second and third year of study who enrolled in the Financial Tracking in Digital Business course. According to (Creswell and Creswell 2017) which stated non-randomization design is one of the features of quasi-experimental research which focused to keep the experiment to natural environment setting. Seventy-two students, aged between 18 and 21 years, were recruited from the course and were asked to fill out the personal

Fig. 1 Overview of the methodology for hypothesis testing (H1, H2, H3)

information. The students received access to the learning platform login. It is important to note that the students didn't know who was in the group of the gamified or non-gamified learning platform, it was automatically generated by the platform. The platform can monitor how students are interacting and participating in the course. Thus, both of the e-learning platforms were gathering statistical information on their perceived level of learning outcome and assessment learning material. According to the interview session, ten students for each group (two students per each trait) were asked to be interviewed on their participation and learning experience in gamified online learning ERP and non-gamified online learning ERP.

4.3 Platform and instructor setting

Students were divided into two groups which were taught by the same instructor with the same material and content for two times per week. As regards the perspectives on Course Design, the outline of instructions is shown in Fig. 2.

However, we allowed students of both groups to join a video meeting through the zoom application once a week for surveying the student behavior, observing and supporting the students who had questions on how to use the system. For both groups,

Fig. 2 The outline of instructor setting for E-learning platform

it started with a video meeting on the zoom application in order to explain the course syllabus for the first meeting, then it was followed by a pre-test, material learning, post-test, and feedback respectively. However, in the session of the e-learning platform, students received a login to the e-learning with the implementation of the game-element concept. Note that we also developed both e-learning platforms because a common e-learning platform cannot evaluate and monitor the statistic of usage by students which we will explain in next session.

4.4 Gamification system design

The gamification system we designed was intended to be used in e-learning for ERP course in the module of financial analysis. However, every game has a game element and feature to keep students engaged towards the system. Some games have more while others have less design. To design a gamified system the core principle is that the design needs to deliberate. In order to initiate the platform, we adapted to use of a feasibility study using gamification for learning proposed by (Alcivar and Abad 2016; Werbach and Hunter 2012) (Table 1).

Instead of using the current platform of e-learning, we decided to develop our own e-learning platform which can be suitable for our students and for research objectives of comparing monitoring data of student behavior related to gamified and non-gamified e-learning. The development process is explained in this session.

In terms of learning material, the specific course in the module of financial tracking corresponds to the book of SAP ERP Financials: Configuration and Design (Arif and Tauseef 2008). The module is divided into five chapters. The first one is Introduction to Business Processes. The other chapters are about Process Integration, the Revenue Cycle, the Expenditure Cycle and the Production Cycle respectively. This module aims to make students understand and configure the SAP ERP Financials system. After learning the course, students will gain the knowledge about ERP Systems with specific knowledge of financial analysis for SAP modules. In order to develop a gamification system, we adapted the framework based on methods proposed by (Alcivar and Abad 2016; Cechetti et al. 2019) consisting of five stages.

- System requirement and learning objective.

Table 1 Feasibility study using gamification for learning

Criteria	Justification
Motivation	Students will learn the lesson and improve the knowledge if the system can make them feel motivated.
Significant choice	Students feel free to select their activities in the lesson. They can make their own to complete the lesson for creating a sense of autonomy and control.
Structure and progress map	Students can indicate the progress and performance of themselves in a certain activity to complete exercise and material learning.
Potential conflicts	Students who can complete and show improvement in their performance after the lesson could be rewarded in order to provide a sense of mastery.

In order to design a successful gamified e-learning system; in the studies of (Subhash and Cudney 2018) in the initial state it is very important to define the Goal activities, game mechanisms and learning objectives in the course. To clarify the objectives of the system, we listed the objectives for our gamified systems divided into the two types of objectives 1: system requirement objectives 2: learning outcome objectives.

System requirement objectives.

1. Engagement of the e-learning system to motivate the students to increase the use of the system on a daily basis.
2. Friendly and easy to understand platform of E-learning systems.
3. Increase the effective use of E-learning for the whole course, to reduce the time of learning of students with a tendency to learn in the last session of course before finishing.

Learning outcome objectives.

1. Analyze and describe financial transactions.
2. Explain the financial system in digital business.
3. Practice by using financial information for supporting digital business decisions.

System requirement objectives related to the first and second hypothesis aim to develop a flexible platform of e-learning with a gamified system and to be able to monitor the student behavior. The learning outcome objectives were focused on knowledge of students concur with the last hypothesis.

– Mapping student characteristics

To design the platform, we considered to use the model of personality based on studies of (Smiderle et al. 2020), the big-five factor describes the characteristics by psychology and human interaction, the factors being: Extraversion, Neuroticism, Conscientiousness, Agreeableness and Imagination/Openness (Jia et al. 2016) study addressed the design of personality traits for different experiences of mapping characteristics of student in gamification environment system—the task is shown in Table 2.

– Identification of game mechanic and activities cycle.

Table 2 Student Characteristics based on personality traits

Big-five factor	Personality traits.
Extraversion	Seek out new opportunities and excitement.
Neuroticism	Be fearful, sad, embarrassed, distrustful, and have difficulty managing stress.
Conscientiousness	Actively plan, organize and carry out tasks.
Agreeableness	Help others and expect help in return.
Imagination/Openness	Devise novel ideas, hold unconventional values, and willingly question authority.

This stage identifies the game mechanic to mapping whole tasks related to students in order to provide the activities cycle loop of the gamified system. However, the most important part is defining the activities list to reveal when and how the game element can be designed to the system. Based on our experience, the key of the design in these activities is to motivate the students to engage and participate during working from home; the students can access learning material and feel free to select to read every chapter without limit.

To get engaged with the lecturer, students could get a reminder short lecture via the zoom application once a week. The key factors to be gamified by using a use-Case diagram from Fig. 3, we mapped the key points to be gamified in the gamified e-learning. These key points are as follows: the activities diagram cycle related to the student activity flow in the system, login to the system, participating in using the learning material, calculating the system score, visualization of the competition on the leaderboard, overview of self-progress, as well as the scheduling of progress and related activities.

- Selection of game elements.

This process specifies to selection of game elements to fit the game requirements. However, several studies (Gallego-Durán et al. 2019) suggest designing truly effective games is a very difficult task with a great component. It is important to note that the selection of game elements needs to be carefully considered because every game element cannot be adjusted to every context and each element needs time to be consumed and effort to be implemented. Based on the characteristics of students and report studied by (Jia et al. 2016) to map personality traits and motivational affordances in order to be effective and suitable for every factor of personal factors, we studied the literature relevant regarding game elements and summarized the common game elements used in our prototype as shown below and in Table 3.

- Points: are virtual numerical feedback provided when the learner make a certain action (Borges et al. 2016; Taspinar et al. 2016; Tondello et al. 2017)

Fig. 3 The outline of instructor setting for E-learning platform

- Levels: virtual numerical measurement of learner performance and progression through the system's purpose to lead the player continuously toward a specific goal (Lavoue et al. 2019; Roosta et al. 2016)
 - Leaderboard: allows learners to know the ranking and shows how the player is performing compared to others which enables learner comparison (Jia et al. 2017; Codish and Ravid 2014; Puritat 2019a, b)
 - Exp progress bar: visualization to support learners to track their progression to complete their activity progress (Roosta et al. 2016; Mohammad 2014).
 - Avatar: representing the character of learner that boosts the learner esteem (Mert and Samur 2018).
 - Challenge: any kind of action which requires an effort from the learner to complete a certain task (Aldemir et al. 2018).
- Building a prototype of the system.

In order to build a prototype of the gamified e-learning system, we decided to develop our own e-learning platform because it is suitable for research objectives as we mentioned in section 4.4. The e-learning system architecture consisted of Frontend and Backend side. Backend side was developed with php version 7.2 and Mysql 5.0 to store the information and record activities in the database which was deployed by the server in the Information technology server center, Chiang Mai University. The Fronted side was developed by Bootstrap 5.0 using responsive design to automatically adjust to different screen sizes of all learner devices.

Two versions of the e-learning were used to develop courses of Financial Tracking in Digital Business in order to evaluate student performance and activity behavior of the Gamification e-learning platform: the first one is an e-learning implemented with game elements and the other one without game element features. For the non-gamified system, the students were allowed to participate only in the material and pre-post test as shown in Fig. 2. For the gamified system version, Fig. 4 shows a screenshot of the system show, the students observe the overall system with profile including an avatar and a rank which consists of features like Common, Sword, Knight and King with

Table 3 Mapping game element for positive effect for each personality

	Positive effect	Suggest for complicate gamification design.
Extraversion	Points, Levels, and Leaderboards	Leaderboard may have high engagement for higher levels but custom Leaderboard for average students should be implemented, for example friend circle or similar score.
Neuroticism	No effective	Gamification may not be effective for neuroticism.
Conscientiousness	Levels, progress	Personality traits may not have a high effect on higher levels preference for gamification designers.
Agreeableness	Challenges	Personality traits may not have a high effect on higher levels preference for gamification designers.
Imagination/Openness	Avatars	To appeal to student with higher levels of imagination, applying Avatar in a conventional way should be avoided.

Fig. 4 Screenshot of the system A) Avatar, point, level B) Leaderboard C) Challenge respectively

obtaining ranks by level up, in addition to this information, student performance indicators are visualized through an exp. progress bar and the level of student with the use to promote to rank student earned. The students can also check the score of other students in the classroom by clicking in the profile of the leaderboard (Fig. 4) which consists of two types of leaderboards: top five player and all players in the classroom (Figs. 5 and 6).

5 Experiment results

5.1 Tools for measurement

We used the following tools to measure our variables.

5.1.1 Tool for collecting quantitative data

Pre-test/Post-test This test was part of the e-learning system for both groups. The questions for this test were multiple choice and quiz questions. The students were able to do it on a system before/after the end of each chapter. This test consisted of twenty

Fig. 5 Leaderboard (left) and Learning material (right)

Fig. 6 Player ranks (left) and Learning materials (right)

multiple choice and five quiz questions per module and students could take it only once.

Web monitoring This tool was developed for both groups in order to collect every student activity into a log file while using the system. The log file is able to track how long students are using the system for each time.

5.1.2 Tool for collecting qualitative data

Feedback/ system evaluation This test was designed to assess satisfaction and to measure how students feel about all the aspects of this system. Students can fill this feedback/evaluation anytime they use the system.

Interview The objective of this tool is to particularly collect data for uncovering the story behind a participant's experience and to pursue in-depth information while using the system. We interviewed only the gamified group for each personality trait after using the system.

5.2 Research procedure

The both groups followed a research procedure during the ERP course of 5 weeks in total. The following steps were taken:

1. Instructor's step to explain how to use the system (Give the account name) for both groups of experimental students.
2. Both groups take the pre-test before starting to learn for each week
3. Access to the system to complete the learning material separated into two systems
 - ERP learning system without implementing a game element for the non-gamified group
 - ERP learning system with a game element implemented for the gamified group
 - Reading material of the module.
 - exercises for each module.
 - module quiz.
4. Taking the final test (paper test) of the course for both groups.

5.3 Quantitative information

5.3.1 The quantitative data were collected in two ways

1. Pre-Post test

Pre-post test was collected from the system during the beginning and the end of these weeks. As mentioned before, we added material for new chapters every week until chapter five. Table 1 shows the results of the pre-test and post-test arranged by week one to five compared between non-gamified and gamified groups where D is the data for difference between the Pre-test and Post-test for each group.

2. Web monitoring of student activity

In order to record student activity, García-Iruela et al. (2020) information of student activity has been collected by a log file in the our platform. Puritat (2019a, b) collect the activity of click per action has been collected to compare the two groups. We designed our web monitoring to record every activity such as: clicking on the material, accessing the resources, attempting a test, participating in questionnaires, time duration of the system. Activity logs were collected into a database for activity analysis for the effect of gamification. The database of activity provides information about each student's last activity. However, our data cannot analyze whether the student really paid attention to the content or only opened it without focusing on it.

We observed the student activity for 5 weeks until the end of the course. To compare the two groups in the graph, we generated the data by averaging the usage time in the system of students per week as shown in Fig. 7. From the first 2 weeks, the activity of the gamified group was greater than that of the non-gamified, but from the third and fourth weeks student activity started to drop in both groups, with the gamified group's student activity decreasing sharper. The fourth week is almost equal for both groups. Based on data activity and our viewpoint, in this case, gamification can improve activity in the short term but not in the long term.

Another activity generated data is based on the average usage time per day. Figure 8 shows the activity of both groups. Note that we added new material for new chapters every Monday at 08.00 pm every week. Another interesting data reveals that in the first day there were significant differences in the activity of the gamified group where students were curious to access the system and continued to drop out the rate until Thursday. However, on Saturday and Sunday, the activity of the non-gamified group increased. We believe that it is possible for the non-gamified groups to finish the chapter before the end of the week. Similar to the previous graph, the gamification can motivate students to access the system early more than the non-gamified group in the short term.

5.3.2 Verification of data of pre-post test and web monitoring

With verification of data, we considered to use the t-test method with unpaired samples, assuming normality and equal variances as shown in Table 4. For the pre-post test showing data in Table 5, with p-value of 0.167, there was no sufficient statistical evidence to support the differences in learning between non-gamified and gamified

student activity(hour) per week

Fig. 7 Graph show average usage time per week

groups at the significance level of 0.05. Therefore, applying the concept of gamification to the ERP course cannot contribute enough to better results of student learning (H1).

For web monitoring, as the data show of Table 5 shows, with a p value of 0.047, there was sufficient statistical evidence to support the motivation between Group1 and Group2 at a significance level of 0.05. Thus, contrary to the pre-post test, applying the concept of gamification to the ERP course can improve the results in student motivation (H2).

student activity(hour) per day

Fig. 8 Graph show average usage time per day

5.4 Qualitative information

We collected the qualitative information in order to answer the three hypotheses of students' learning experiences based on personality traits for each student characteristic. The research findings were categorized according to the types of big-five factors personality traits described by the characteristics of psychology. Before we interviewing for each characteristic, students were used self-report test measures (Goldberg 1992) to identify their personalities. The three themes for interviews are how they experienced learning, feelings of fun, motivation to attend during the usage of the system the result describe in section 6.3.

6 Discussion and comparative results

Finally in this section, we finalize the research findings and try to answer the question of how to apply game elements to the gamified e-learning environment for the highest benefit to undergraduate students based on their personality types. We discussed our research taking three perspectives into account.

6.1 Gamification improves the performance of knowledge

The finding suggests that gamified e-learning implements the game element of points, levels, progress, challenges, Avatars and leaderboard based on the suggestion of Jia et al. (2016) and it cannot improve the performance of knowledge of every personality type in general. Although some personality types of Extraversion and Imagination/Openness show higher scores than non-gamified groups because they feel competition to win their friend from seeing the leaderboard but this situation relates to only a few top students in the classroom. In addition, extraverted students report the negative effect on the perceived playfulness from competition. Our findings align with existing literature on (García-Iruela et al. 2020; Puritat 2019a, b). In summary, as far as knowledge is concerned, gamification cannot improve the overall knowledge for all personality types because each game element has both positive and negative impacts on each personality type.

Table 4 Tests results for Non-gamified group and gamified group

Observation	Non-gamified group			gamified group		
	Pre-test	Post-test	D	Pre-test	Post-test	D
week1 (ch1)	19.03	26.36	7.33	17.00	25.92	8.92
week2(ch2)	22.71	25.93	3.22	22.28	26.83	4.55
week3(ch3)	15.02	24.09	9.07	17.92	25.71	7.79
week4(ch4)	17.30	26.55	9.25	15.55	26.03	10.48
week5(ch5)	12.40	23.02	10.62	14.30	27.00	12.70

Table 5 Verification of t-test assumptions

	Non-Gamified	Gamified	p-value
Pre-post (D)	7.89	8.88	0.167
Web monitor (activity)	48.8860	51.7880	0.047

6.2 Gamification engages students

Our data record from the web monitor showed a significant difference in higher engagement of gamified e-learning than non-gamified e-learning. Regarding the methodology, the gamified e-learning group was higher engaged only in the first two weeks, after that a drop rate of the gamified group activity record was detected due to dropouts that occurred as well as a decrease in student activity until equalling the non-gamified group in the end of the experiment. Our interviews with students report that the fun and curiousness related to gamification are short-lived. It could become a boring task very fast especially for an extravert student which finding is consistent with other researchers (Koivisto and Hamari 2014; Mollick and Rothbard 2014). In terms of personality traits, the game element may make students feel excited for the first time and they could repeat the task to get high score points but this might lose its appeal even faster. From this point, to keep higher engagement, we suggest to add new small tasks of game elements every two-three weeks until the end of the course.

6.3 Gamification based on personality traits

6.3.1 Extraversion and imagination/openness

Our interviews with extraverted and Imagination/Openness students, the results are similar, they enjoy gamified courses. They love to compete for the score point on the leaderboard compared with other students in the system. They still love the login more frequently into the system only to get the point for showing off their score to close friends. However, from the statistical data of dropdown of activity, they reported that after 2 weeks they don't feel as curious as for the first time, activities such as point and login can turn to be boring quickly on repetitive tasks that the learning process includes.

The previous study of Extraversion is consistent with our result which showed positive perceptions of leaderboards (Jia et al. 2017; Nov and Arazy 2013; Jia et al. 2016). They described that extraverted learners prefer leaderboards because it reflects the social landscape constituted of the system's participants. Based on the findings from our study, we suggest that for Extraversion and Imagination/Openness the gamification designer should consider prioritizing the implementation of leaderboard over points and levels in the gamification application.

6.3.2 Conscientiousness and agreeableness

Similar to the previous result, our interviews show that they enjoy some game elements on gamified courses. Avatar can increase motivation for logging in to the system and

show them on the leaderboard. Results show that point, rank and exp. progress bar with Conscientiousness and Agreeableness felt bored. In terms of learning experience, the implementation of game elements cannot support them in focusing on reading material and complete the point in the leaderboard.

Previous results of (Jia et al. 2016) show that game elements may not affect preference positively or negatively. These results are inconsistent with our work. Denden et al. (2018) resulted that players of high Conscientiousness prefer points and challenges as game elements. Thus, we suggest for Conscientiousness and Agreeableness to consider implementing avatar to change the behavior of learners and engage them with the gamification system. However, the designer can consider implementing point, rank and exp. progress bar for the short-term in the proposed system and then providing the challenge game element for the long term in the gamification application.

6.3.3 Neuroticism

For neuroticism, our interviews revealed that students with Neuroticism are not likely to be motivated by or interested in any game element implemented in a gamified system. They directly do the test and read the material. Moreover, some students reported that Leaderboards had made them feel negative in connection with the perceived playfulness from other students with their score.

These results are consistent with the prior work by (Orji et al. 2017) reporting that game element is not an effective approach for motivating behavior change. Jia et al. (2016) also showed results correlating negatively with all motivational affordances. We suggest not to implement any game elements for Neuroticism as it is not an effective way to enhance engagement.

7 Conclusions

This paper studied the application of gamification to e-learning design game elements based upon to improve engagement in the theory of the big five personality traits of undergraduate students in the ERP course. By teaching two groups we showed that gamification has a positive effect to engage students on e-learning. One of the groups was using a gamified e-learning system, and the other group was using a non-gamified e-learning system. However, the gamified e-learning system cannot show better results with respect to student learning performance. Thus, we conclude that gamification of e-learning alone serves as a tool to engage students in distance learning but to enhance learning, the presence of a lecturer is also necessary during the teaching.

7.1 Limitation of the study

This study focuses on analysing the effect of gamification to improve knowledge and engagement of the various types of personalities of undergraduate students. However, the limitation of only one subject (Enterprise Resource Planning) and the limited number of participants per group may have an effect on engagement and motivation, for example if the lecturer or the subject is a personal favorite for a certain participant. Although motivation and collaboration among participants are interesting, we want to

study whether a personal favorite lecturer or subject doesn't affect the use of game elements of gamification and the participant's activity.

7.2 Future work

In our future work, first we plan to study the other game elements related to Big Five personality traits. Second, we intend to perform new tests with a more significant number of participants and extend the time duration for each trait to verify the stability of the results. Third, we designed the practical prototype gamified system for the dynamic adjustment of game elements suitable for learner personality traits. We believe this could be an area for future research that will help to serve as guidelines for designing the improvement of engagement in gamified applications in the context of education and it can potentially provide an opportunity to carry out a design based on this guideline for other types of applications.

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