TRIGGERING STUDENTS' LEARNING AUTONOMY USING THE COMBINATION OF M-LEARNING AND GAMIFICATION: A CASE STUDY AT NGUYEN TAT THANH UNIVERSITY

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Abstract

M-learning is usually thought of as based on videos, digital materials, and high technology. Nonetheless, it is not a complete perspective of this new educational trend. Mobile devices with many functions can be an effective tool to support learning. Furthermore, learners nowadays, who were born in the 4.0 movement, are more familiar with mobile devices than notebooks. They spend much time on their mobile phones interacting on social media and playing mobile games. Hence, if educators can integrate those interests into traditional lesson plans, added value would appear for learners' academic performance and learner autonomy.

This paper proposes the idea of combining m-learning, gamification, and other factors influencing learning motivation into a mobile application to reinforce students' learner autonomy. With a case study at Nguyen Tat Thanh University, we take a closer look at the effectiveness of the application on students' language acquisition and a detailed description of how to best use the application along with lessons at schools. Using experimental methods with surveys and tests, this paper draws a bonding connection between students' personal interest in the subject and their performance. The study provides thoughtful insights into utilizing m-learning and gamification to improve students' learner autonomy and modernize language learning classrooms in this technological context.

Keywords: gamification; m-learning; learner autonomy; language teaching

1. Introduction

In response to the rapid growth of smartphone users, from 1.06 billions in 2012 to 3.6 billions in 2020 (Statista, 2021), mobile learning has become a necessary trend for education nowadays.

The effects of mobile learning on students' motivation have been reassured by many studies around the world (Ciampa, 2014; Su & Cheng, 2015; Huang, Yang, Chiang & Su, 2016). To discover how and why mobile applications affect learners' motivation, Jeno, Adachi, Grytnes, Vandvik and Deci (2019) examined the effects under Self Determination Theory (SDT) perspectives. They found that compared to textbooks, students with mobile applications achieved higher levels of perceived competence, perceived autonomy and intrinsic motivation. However, the sample of the research was small and within a short period, which affects the generalization of the experiment. The 4.0 movement also introduces another trend of digital game-based learning. Though many believe that the games have a positive effect on students' motivation, the results were not consistent (Filsecker & Hickey, 2014). Proulx, Romero and Arnab (2016) built a framework to match motivation elements according to SDT with digital game aspects. The framework offered guidelines for educators to design appropriate digital game applications that help improve learners' intrinsic motivation.

Inspired by the growing trend of technology in education, the paper aims at introducing a combined application of mobile learning and gamification, as well as reinforce the findings of the existing studies. Firstly, the paper hopes to reinforce Jeno's (2019) findings using an experiment with a larger sample of 89 students and over a longer period of 3 months. Moreover, applying elements suggested by Proulx et al. (2016), the paper also focuses examining the framework of digital games in learning with an empirical experiment on Vietnamese students at tertiary levels. Finally, the research introduces a new approach to mobile learning with combined aspects of digital game-based learning to enhance students' competency and learner autonomy. Playing behaviours were analyzed to check if the application fits all groups of learners. Therefore, the following questions were explored:

1. What are the effects of the application of the combination of M-learning and gamification on the academic performance of the students in the experimental group?
2. Will the application be able to trigger the learner autonomy of students in the experimental group?
3. How do different groups of students react to the application?

Quantitative analysis was utilized to discover the effects of the application. Students were randomly divided into control and experimental groups with the same learning conditions to observe and measure the improvement over three months. Hence, the research would offer detailed insights into the actual effects of the application on students within a long period of three months when compared to students using textbooks only. After the course, test results along with learner autonomy levels were collected in both classes to analyze the performance and learner

autonomy. Moreover, enjoyment of the application was also assessed using EGameFlow scale by Fu, Su and Yu (2019) to check the appropriateness of the application to different groups of learners.

2. Literature review

2.1. M-learning in language teaching

The outburst of mobile phones' popularity has led to a new trend of applying mobile phones into teaching and learning, which is called m-learning or Mobile Assisted Language Learning (MALL) in languages education. Many researchers have been working on defining m-learning under various perspectives. M-learning was defined to be the use of small computing mobile devices, including mobile phones and small handheld devices, in learning (Mcconatha, Praul & Lynch, 2008). Also, Mirski and Abfalter (2004) referred to m-learning as a type of distant learning. On the other hand, Alzaza and Yaakub (2011) stated that m-learning is the development of e-learning that uses mobile technology. The effects of m-learning on learners have been proved by many studies. Crompton (2013) mentioned benefits of m-learning that could extend learning space and environment compared to the traditional classes, which means students can learn within both formal (classroom) and informal (social media, argumentation, etc.) contexts. Besides, Sarrab, Al-Shihi & Rehman (2013) also stated that m-learning brought many benefits to learners such as increasing the interactive dimension of learning, offering fast access to information and bridging the cultural gaps among the students. Meanwhile, Jeno, Grytnes and Vandvik (2017) focused on the psychological effects with a conclusion that m-learning enhanced learners' intrinsic motivation by engaging activities. Jeno et al. (2019) extended their studies and found out that mobile applications also enabled students in Biology class to identify species more quickly and accurately compared to traditional textbook, which represents their learning competency; and increased learners' well-being, too. Thus, they concluded that mobile applications should be incorporated into the classroom.

Many mobile applications have been developed to meet the requirements of all groups of learners, ranging from primary through secondary to tertiary levels. For primary learners, mobile applications developed to help them with pronunciation, basic English skills and vocabulary recognition are *Pogg-Spelling and Verbs*, *Speech with Milo* apps and *Mindsnacks*. Applications for secondary learners would focus more on English 4 skills, with typical examples like *Open Language, Duolingo* and *FluentU*. The tertiary learners require more opportunities to practice their language or to get exposed to authentic materials, which leads to the development of many

applications like *English Podcast for Learners*, *Voxy* and *Speech Tutor*. The majority of the applications were developed in the form of games, which require learners to complete tasks from the applications. Many others also provide real-life materials like *English Podcasts for Learners*; while others connect learners with native speakers to practice like *Voxy*. Thus, the applications are suitable for learners to self-improve their language level at home with a separated curriculum from what they studied at school.

In Vietnam, m-learning is getting more and more attention, especially for students in tertiary levels. When investigating m-learning in Vietnam, Vu (2016) stated that Vietnamese students are well-prepared for m-learning since the majority of them are equipped with mobile devices and the connections in universities are available. He also found out that Vietnamese students can quickly adapt to digital learning, however, they are still concerned about the lack of real-life interaction with teachers at school. Many universities in Vietnam are beginning to develop their *Moodle* system as the most common m-learning approach. The system allows students to get access to the study course, learn from a distance and keep track of the course. However, to best utilize the effects of m-learning, more forms of mobile applications should be developed to integrate it directly into the in-class and out-of-class activities.

2.2. Gamification

Started around 2008, gamification was defined as "the use of game elements in non-game contexts" (Deterding, Dixon, Khaled & Nacke, 2011, p. 9). Since then, the term has been seen in many studies as a new approach to teaching, especially in this technological era. The impact of gamification was mostly reported to be positive, especially on students' learning motivation and in-class performance. Durin, Lee, Bade, On and Hamzad (2019) discovered the three main impacts of gamification were enhancing students' attitude toward learning, understanding of the subject and motivation. Game elements used in gamification as mentioned by Bedwell, Pavlas, Heyne, Lazzara, and Salas (2012, p. 737) are "action language, assessment, conflict/ challenge, control, environment, game fiction, human interaction, immersion, and rules/ goals". Durin et al. (2019) listed 33 game elements and concluded that the most popular ones used over time were rewards, feedback, challenge, mission, level, score, task, character, timing, narrative, leaderboards, progress bars, and badges. This is the guideline for educators to consider whenever employing gamification in teaching. Moreover, to make gamification impactful, Bunchball (2010) suggested a necessary components of game mechanic – base components of a game (points, levels, badges, virtual goods, leader boards and virtual presents) to match with game

dynamic's elements such as response to inputs (reward, status, achievement, self-expression, competition, and altruism).

In this research, all of the elements mentioned are included in the application to ensure the positive impact of gamification on learners. Moreover, cooperative or competitive forms of interaction between learners in gamification are also utilized in this research with the Area mode, which allows learners to compete with each other. The application was used as an out-of-class gamification strategy, which provided a game-based learning environment for students after the class.

2.3. Learner autonomy – motivation

The term 'autonomy' was first defined as the ability of students to take responsibility for their own study (Holec, 1981). Later, to clarify the psychological and methodological preparation, Little (1991) defined learner autonomy as "a capacity for detachment, critical reflection, decision making, and independent action" (p. 4). Since then, educators have been shifting their focus to improve learner autonomy in teaching practices. To improve learner autonomy, beside learners' independence, Morrison (2011) also emphasized the importance of interaction and support from teachers and other learners, as learner autonomy was "not a solitary experience but rather one in which the learner, in conjunction with relevant others, can make the decision necessary to meet the learner's needs" (p. 4).

On the other hand, motivation is also an essential element in learning. Dincer and Yesilyurt (2017) state that motivation plays a vital part that determines the success or failure of learning a language. Further examining the factors of motivation, Deci and Ryan (1985) mentioned the two common types of motivation, which were extrinsic and intrinsic. Later, Williams and Burden (1997) identified them as internal and external motivational factors. This division of intrinsic and extrinsic motivation was utilized by many researchers when investigating human motivation (Zarei & Elekaei, 2012; Sun & Hsieh, 2018; Locke & Schattke, 2019). Intrinsic motivation refers to students' personal desire to study for enjoyment, while extrinsic motivation comes from instrumental purposes like getting praise or avoiding punishment. Another division of motivation by Zhang, Su, and Liu (2013) distinguishes integrative motivation, which refers to the personal wishing of the students to be a part of the target culture, and instrumental motivation, studying for their academic and career purposes.

The relationship among motivation, learner autonomy and language proficiency has been of interest for many researchers. The two concepts have a positive relationship that has been proved by many studies. Ayan (2015) emphasized the influence of self-motivation on the

promotion of individual autonomy. On the other hand, Soodmand Afshar, Rahimi and Rahimi (2014) found out that learners with higher levels of learner autonomy show strong motivation in their foreign language acquisition. To check the relationship of motivation and autonomy, Wang and Xu (2015) conducted a study with 300 non-English students and found that intrinsic motivation and intermediate achievement had a strong relationship with learner autonomy. Jianfeng, Raj and Ai (2018) reinforced the relationship of the two elements with a study of 480 year-three undergraduates. They proved the correlation of the three variables: learning motivation, learner autonomy and language proficiency, in which the first two elements had a significantly positive relationship with the other one.

2.4. Self-Determination Theory about motivation

Self-Determination Theory (SDT) is a macro theory of motivation introduced by Deci and Ryan (1985). The model examines the influence of a person's internal and external factors on his/her motivation and autonomy. According to SDT, the three basic psychological needs of humans include autonomy, competence and relatedness. When satisfied, those three basic needs enhance the process of autonomy and motivation, which positively impacts learning. Besides, the degree to which the teacher can meet the basic needs also determines the quality of students' motivation. Ryan and Deci (2000, 2002) also found out that the autonomous learning environment can foster quality motivation, while controlling the environment undermines it. In addition, the SDT gives guidance to educators on students' level and types of motivation, as well as how to regulate their extrinsic motivation to become intrinsic motivation. The model suggested the process of motivation change from Amotivation to Extrinsic Motivation and Intrinsic Motivation with factors involved at each level. This means with appropriate influences educators can help transform students' motivation from amotivation to intrinsic motivation.

In this research, by providing an online environment satisfying factors mentioned in the model, the application aims at shifting students' motivation into intrinsic motivation, which also helps improve their learner autonomy.

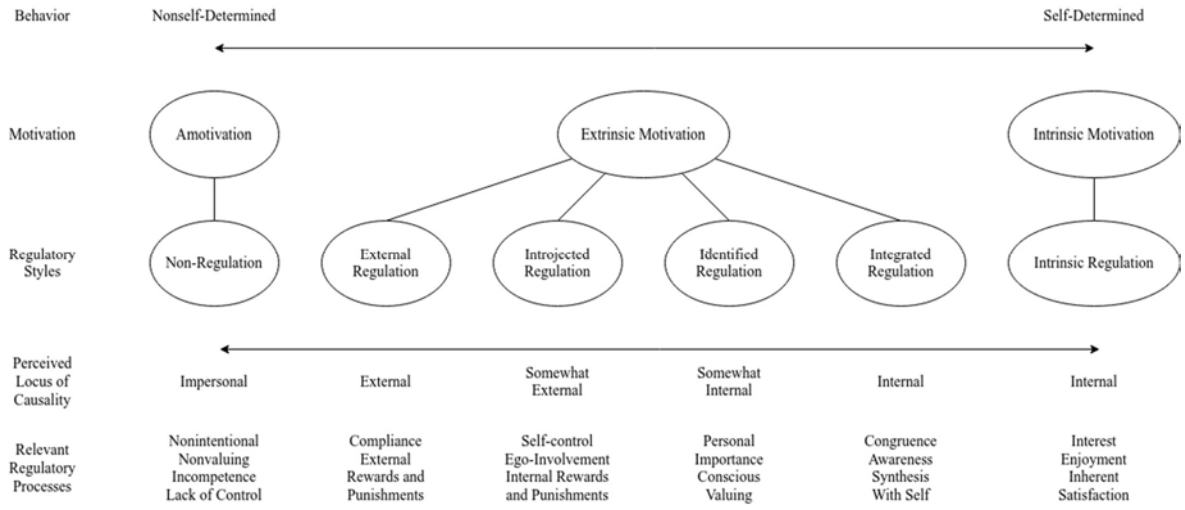

Figure 1. Self-Determination Theory (Ryan and Deci, 2000)

3. Methodology

3.1. The aim of the study

This study uses a randomized experimental design to evaluate the effectiveness of blend of m-learning and gamification on student's academic improvement and autonomous learning in an authentic classroom setting. Thus, the following research questions were explored:

1. What are the effects of the application, which represents the combination of m-learning and gamification, on the academic performance of the students in the experimental group?
2. Will the application be able to enhance the learner autonomy of students in the experimental group?
3. How do different groups of students react to the application?

3.2. Participants and setting

The studies involved 114 sophomores from the Faculty of Foreign Languages, Nguyen Tat Thanh University. The students were randomly selected out of 3,000 students at the faculty and divided into two classes comprising the experimental group (including 59 students) and the control group (including 55 students). They were at the B1 level of the CEFR framework and had been learning for 4 semesters at Nguyen Tat Thanh University. During the course, Skilful level 3 by Macmillan was utilized as the main course book to develop students' listening skills.

The majority of the students were female, with the range of age from 20 to 24. 78.07% of the students completed all the required tests to assess their language proficiency. The other students, who missed 1-2 tests, were not counted to ensure the exactness of the data. Similarly,

78.07% of participants completed the survey with a valid result, together with empty papers, all-good-score responses were considered to be invalid.

Table 1. Participants

Variable	Subcategory	(*n* = 114)					
		Tested *n*	Tested %	Survey *n*	Survey %	Tested + Survey n	Tested + Survey %
Gender	Male	25	21.93	25	21.93	21	18.42
	Female	64	56.14	64	56.14	55	48.25
Age	20	76	66.67	80	70.18	68	59.65
	21 – 24	10	8.77	7	6.14	6	5.26
	25 and above	3	2.63	2	1.75	2	1.75
	Total	89	78.07	89	78.07	76	66.67

3.3. Instruments

3.3.1. Instructional model

In order to enhance the students' intrinsic motivation and learner autonomy, the game was designed to meet the three basic needs according to the SDT theory (Figure 2). The need for competence was demonstrated by letting the students choose the topic and the playing mode. The students would choose between the two playing modes: the game battle, which was to compete with other learners, and self-practice. The practice mode also allows players to choose the topics to play. In terms of the need for autonomy, the students were free to make choices, decisions, and the time to play, which was not limited compared to learning periods in class. They could also experience the need for relatedness through the interaction with other players, the interaction with their characters in the game and the ranking of their result compared to other learners.

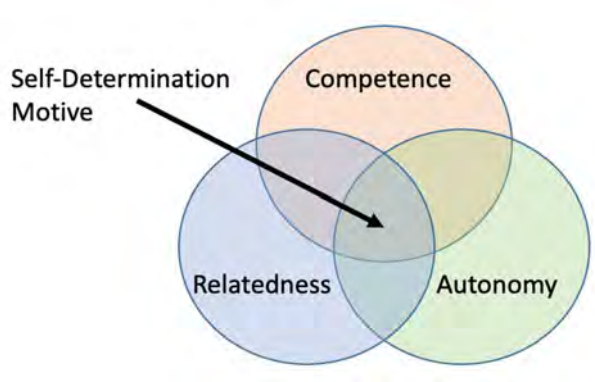

Figure 2. Self-Determination Theory (Ryan and Deci, 2000)

3.3.2. Academic performance tests

Three tests were applied to track the students' academic performance during the course and validate the impact of the game.

- Pre-instruction test included 40 selected-response questions. The test was divided into three main parts: listening, vocabulary and grammar.
- Post-instruction test followed the same format as the pre-instruction one. However, the content of the questions contained knowledge from 9 units in the coursebook. This test was supposed to reflect what students have learnt in the course.
- General listening test with 40 questions in total. The test involved a variety of exercises to check the students' listening skills in general, ranging from listening for specific information to comprehensive listening. The test included 19 selected-response questions and 21 constructed-response questions.

3.3.3. EGameFlow

The EGameFlow scale by Fu et al. (2009) was utilized to measure the students' involvement in the game. Fu et al. concluded that the students' enjoyment of a game would determine their involvement and commitment into the game as well as the learning process. The 7-point scale included 42 questions divided into 8 categories: (1) concentration (6 items); (2) goal clarity (4 items); (3) feedback (5 items); (4) challenge (6 items); (5) autonomy (3 items); (6) immersion (7 items); (7) social interaction (6 items); (8) knowledge improvement (5 items). Cronbach's alpha of 42 items was 0.942, which showed that the scale was highly reliable and consistent.

Table 2. Questionnaire based on EGameFlow scale (Fu et al., 2009)

Category	Questions
Concentration	1, 9,17, 25, 32, 38
Goal clarity	2, 10, 18, 26
Feedback	3, 11,19, 27, 33
Challenge	4, 12, 20, 28, 34, 39
Autonomy	5,13, 21
Immersion	6,14, 22, 29, 35, 40, 42
Social interaction	7,15, 23, 30, 36, 41
Knowledge improvement	8,16, 24, 31, 37

3.3.4. A measure of learner autonomy in university students

Macaskill and Taylor (2010) developed a brief measure of autonomous learning in university students. The scale was tested with two groups of students: the first group (N=214) including first-year students in the psychology department, and the second group (N=172) with a more diverse background, which reinforces the reliability of the test toward different types of students at tertiary level. In this paper, the 12 items of the survey were measured by a 5-point scale.

3.4. Procedure

A 3-stage process was applied during the project:

- Pre-instruction: the experimental group and the control group was selected randomly. Students in both classes took the pre-instruction test. The result of the test was used to determine the level of the students and to check their improvement over the course.
- While-instruction: Both classes were taught using the same methodology and course book. The experimental class students, beside the traditional instruction, were instructed to combine the game into the lesson at home. At home they competed with each other to gain more points as well as to revise the lesson. On the other hand, the control group was assigned paper homework to complete at home, instead. The exercises in the application were compiled in the forms of homework exercises. The teacher would correct the homework at the beginning of the following lesson. Therefore, the two groups were offered a chance to acquire the same amount of knowledge, but using different methods.

- Post-instruction: after 9 weeks, the two classes took the post-instruction test – the listening skill test to measure their academic improvement over the course. They were also required to take the EGameFlow and the Autonomy survey to compare the opinions among the two groups.

3.5. Description of the game

The game was designed with two playing modes, dashboard and the library.

1. Arena mode: Students were randomly paired to compete with each other. Each completed challenges in the game, the faster one and with more correct answers would be the winner. The winner gained more points to upgrade their ranking as well as their character in the game. The identification of the students was hidden as they used nicknames during the game. Each battle game consisted of 3 rounds representing 4 skills: vocabulary, grammar, listening for specific information and comprehensive listening.
2. Practice mode: In order to combat well in the Battle mode, students could practice by playing themselves in the practice mode. They were allowed to choose the unit and the types of game to practice. Each time they finished a practice game, they would also gain some points for their ranking.
3. Dashboard: The dashboard was the first theme to be displayed when the app was activated. Students' performance was demonstrated by a triangle chart based on their scores in both battle and practice modes. Besides, the dashboards also included other necessary functions namely settings, nickname, ranking, and avatar.
4. Library: This display offered the students useful sources of information for self-study. They could access the library for new words listed, which were categorized into units. The grammatical points of each unit were also displayed here with forms, structures, examples and practice exercises.

4. Results

4.1. Academic performance

To evaluate the influence of the application on students' academic performance, t scores collected in the three tests were analyzed and compared between the two groups. The data collected served to verify the proposed hypothesis.

The pre-instruction test was used to check the students' current level of English in order to ensure the equality between the two groups. Moreover, the results collected from this test would be the foundation to measure the students' improvement during the course.

Table 3. Scoring of pre-instruction test, post-instruction test and listening skills test

Group	Pre-instruction test mean score	Post-instruction test mean score	Improvement (*p = 000)	Listening skills test mean score	Improvement (*p = 000)
Experimental	3.79	6.84	3.05*	6.38	2.51*
Control	3.64	5.66	2.02*	4.27	0.70
Difference (*p = 000)	0.15	1.18*		2.11*	

There were 95 students taking the test, 50 from experimental class and 45 from control class. As can be seen from the table above, two groups were at the same level of English at the beginning of the course (MD = 0.15, sig. = 0.582).

After 3 months of the listening course, both groups showed a considerable improvement in the two tests.

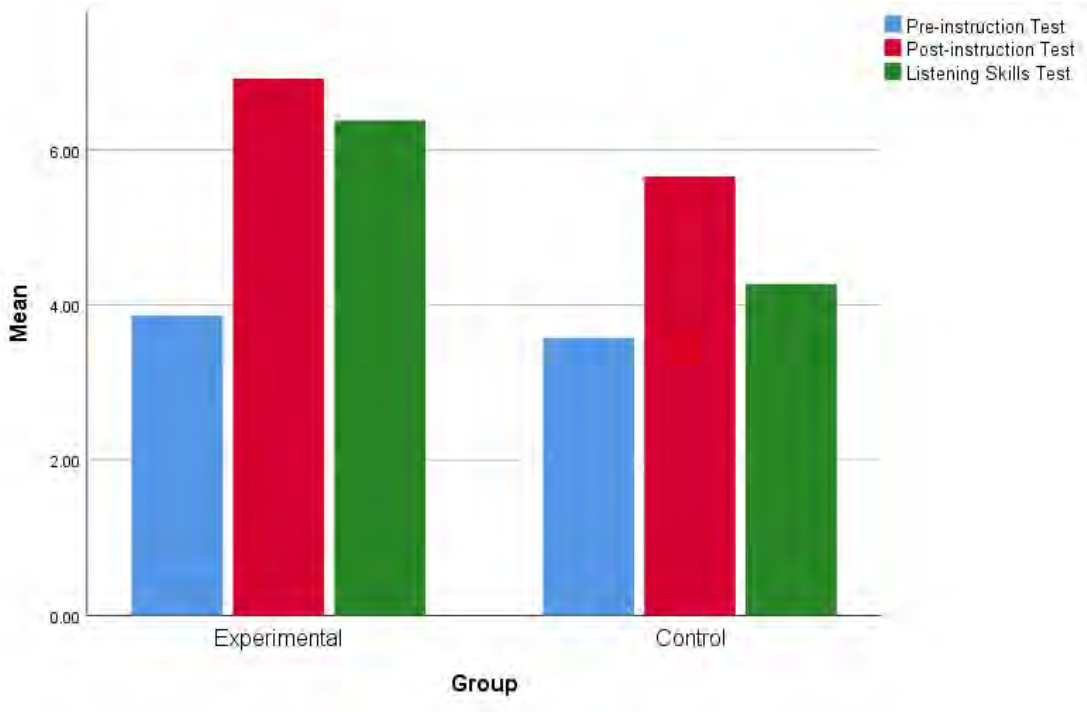

Figure 3. Mean score of pre-instruction, post-instruction and listening skills test of experimental and control group

However, the experimental group witnessed a much more significant increase in both post-instruction and general listening tests. This shows that the experimental class improved much more considerably in terms of the knowledge they learnt and their listening skills in general.

The improvement of the experimental group in the post-instruction and general listening skills tests were 3.02 and 2.51 respectively, compared to those of the control class, which were 2.02 and 0.07.

Moreover, as Table 3 indicates, the difference between the increment of the two groups was significant. Besides, there were strong correlations between each pair of the pre-instruction – post-instruction and pre-instruction – general listening skills test (sig. < 0.001)

Table 4. Correlation between pre-instruction, post-instruction and listening skills test

Correlation (*p = 0.01)	Post-instruction test	Listening skills test	Post-instruction score increment
Pre-instruction test	0.572*	0.636*	-0.334
Post-instruction test	-	0.729*	-

Another interesting finding of the study was the negative correlation between the pre-instruction test and the score increment in the post-instruction test (sig. = 0.001). This means that good students retained their performance while there was a dramatic improvement for students with lower scores in the pre-instruction test.

In short, as Table 4 implies, although starting from the same level of English with the same teacher and the same teaching methodology, the students in the experimental class improved much more significantly compared to the control group in terms of the knowledge learnt and the listening skills in general.

4.2. Autonomous learning scale

On the other hand, beside academic performance, learner autonomy was also factor to measure the effect of the application. The students' learner autonomy was measured on a 5-point Likert scale with all constructs having good internal consistency (Cronbach's Alpha range: 0.932-0.937). The questions in the scale were divided into two factors: Factor 1 labelled as Independence of Learning containing all key components of autonomous learning, and Factor 2 related to the study habits.

Table 5. Autonomous learning scale result

Content	Experimental group		Control group	
	Mean	SD	Mean	SD
Factor 1				
I enjoy new learning experiences.	4.27	0.676	3.96	0.878
Even when tasks are difficult, I try to stick with them.	3.90	0.714	2.98	0.753
I enjoy finding information about new topics on my own.	4.22	0.685	3.16	1.043
I am open to new ways of doing familiar things.	4.00	0.945	2.39	0.920
I take responsibility for my learning experiences.	4.37	0.698	4.23	0.677
I enjoy being set a challenge.	3.96	0.798	2.64	1.069
I tend to be motivated to work by assessment deadlines.	3.96	0.935	3.11	1.481
Factor 2				
I frequently find excuses for not getting down to work.	3.20	1.060	2.96	1.127
I plan my time for study effectively.	3.92	0.871	2.95	1.011
I am good at meeting deadlines.	3.51	0.845	4.20	0.968
My time management is good.	3.67	0.851	3.02	0.917
I am happy working on my own.	4.27	0.785	3.71	0.968

Table 5 shows the results of the two groups for each question. Generally, except for time management skill, the mean score of the experimental group was higher than that of the control group.

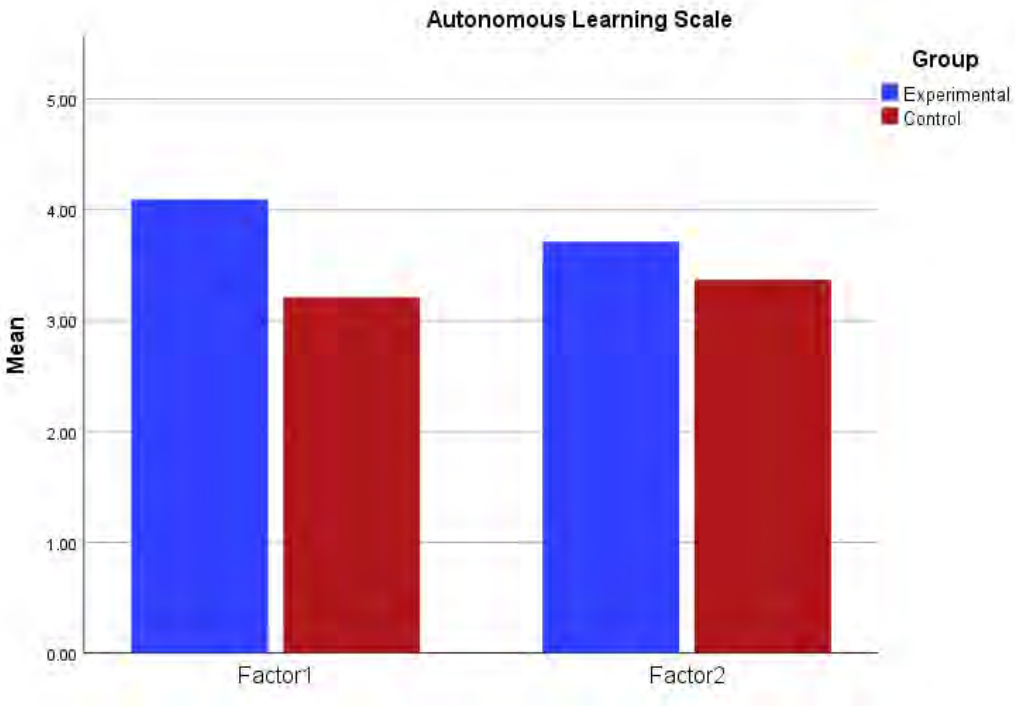

Figure 4. Mean score of each factor in autonomous learning scale of experimental and control group

The experimental group got higher mean for both factors. More importantly, the figures of the experimental group for Factor 1 were significantly higher than those of the control group (Experimental group: M = 4.094, SD = 0.494; Control group: M = 3.211, SD = 0.560, MD = 0.882, SD = 0.109, sig. < 001). It is also noticeable that Factor 1 contains elements of intrinsic motivation which we were aiming for. The figure for Factor 2 was (Experimental group: M = 3.713, SD = 0.511; Control group: M = 3.369, SD = 0.508, MD = 0.344, SD = 0.105, sig. = 002).

After the course, the students in the experimental group showed higher levels of autonomous learning than their peers in the control group, especially behaviours demonstrated in Factor 1.

4.3. EGameFlow

To make a closer investigation of the students' enjoyment of the application, their enjoyment in the game was rated on a 7-point Likert scale and all constructs had pretty good internal consistency (Cronbach' s Alpha range: 0.755-0.821). We collected 49 forms with the generally high average scores. The most striking figure was the knowledge improvement with the smallest SD and the highest average while the immersion factor got the lowest score and the highest SD.

Table 6. EGameFlow scale result

Content	Experimental group	
	Mean	SD
Concentration	5.97	0.659
Goal Clarity	5.86	0.687
Feedback	6.07	0.685
Challenge	6.06	0.685
Autonomy	5.85	0.855
Immersion	5.32	0.944
Social Interaction	5.50	0.934
Knowledge Improvement	6.27	0.610

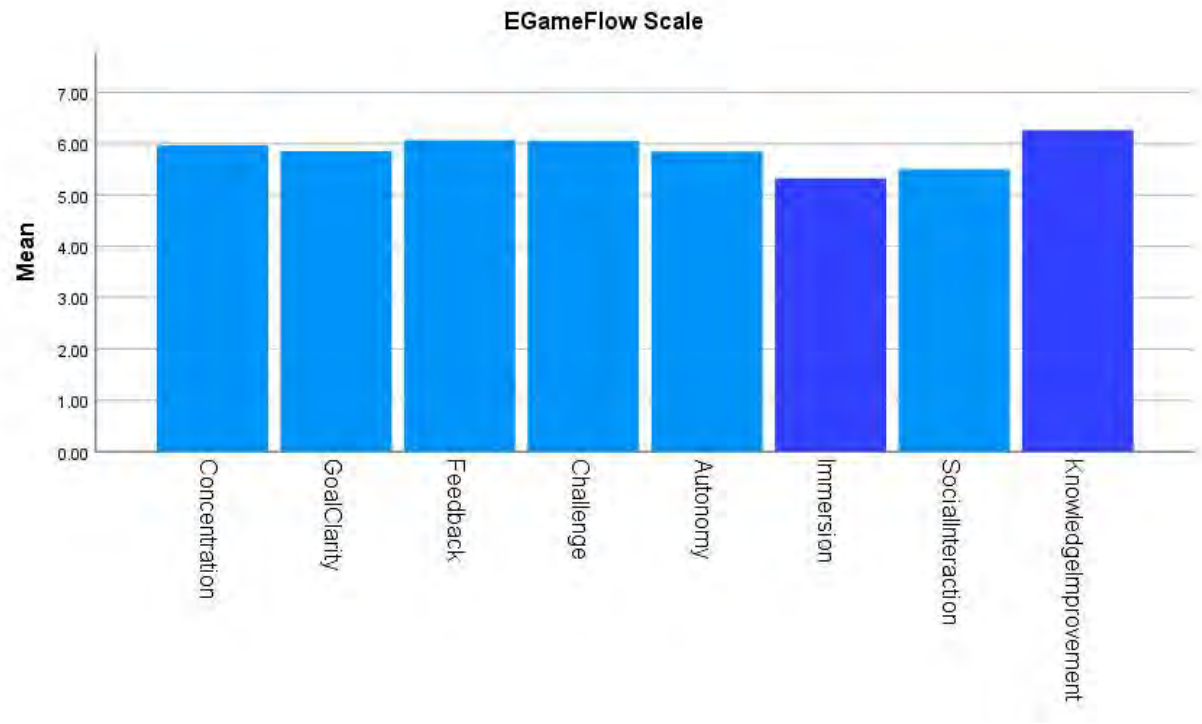

Figure 5. Mean score of each category in EGameFlow scale of the experimental group

The results of the survey corroborated the proposed hypothesis. Students can utilize the application to a moderate extent so that they can improve their competency but not become addicted to the games.

Table 7. Correlation between autonomous learning scale result and each category in EGameFlow scale result

Correlation (*p = 0.05) (**p = 0.01)	Concentration	Goal Clarity	Feedback	Challenge	Autonomy	Immersion	Social Interaction	Knowledge Improvement
Autonomous Scale Mean	0.379*	0.300*	0.428**	0.439**	0.260	0.596**	0.373*	0.445**

Moreover, students with high autonomous results gave higher scores to every factor in EGameFlow Scale with the correlations shown in the table above. This can be understood that enjoying and playing the game can be a factor that helps trigger and improve the students' learner autonomy level.

4.4. Learners' playing behavior

The students' playing behaviors were also observed and analyzed to gain insights into further development.

Firstly, the students were divided by their playing mode. There were 23 students mostly playing in the Practice mode and 19 students playing in the Arena mode. The other 8 students who did not practice frequently were not involved in the results for better analysis. The percentage of students playing in the two modes was demonstrated in Figure 6.

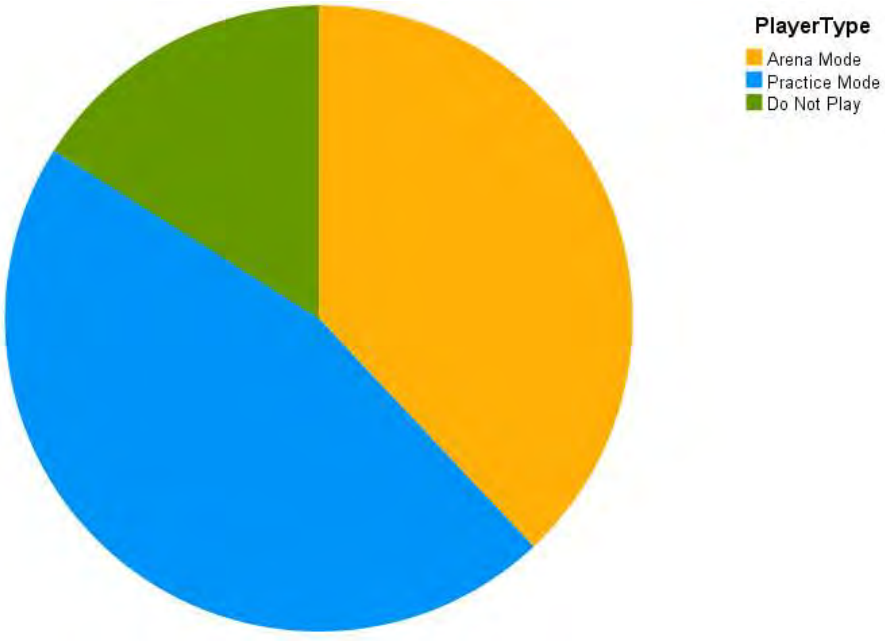

Figure 6. Engagement of students with *Powerlish*

The correlations between the two groups with the results of the tests were analysed as follows.

Table 8. Correlation between number of practice times and pre-instruction, post-instruction, listening skills test

Correlation (*p = 0.05)	Pre-instruction test	Post-instruction test	Listening skills test	Post-instruction score increment
Practice times	-0.418*	-0.502*	-0.262	0.175

Practice players had a tendency to gain lower scores in the pre-instruction test and the general listening test (sig.=0.047 and 0.034 respectively); however, this was not the case for the post-instruction test. We can imply that the students with lower scores had tried to improve their knowledge of the course by practicing the games many times; however, the content of the application was mainly from the syllabus at school so they got higher scores for the post-instruction test, while the overall skill improvement was not significant.

Table 9. Correlation between the number of Arena times and the pre-instruction and the listening skills test scores

Correlation (*p = 0.05)	Pre-instruction test	Listening skills test
Arena times	0.517*	0.509*

On the other hand, the students that liked playing in the Arena mode gained higher scores in both the pre-instruction and the general listening test, which means the students with a strong base of knowledge are more confident to compete with other players.

Secondly, gender-based analysis was also applied to examine whether their playing behaviours were determined by gender.

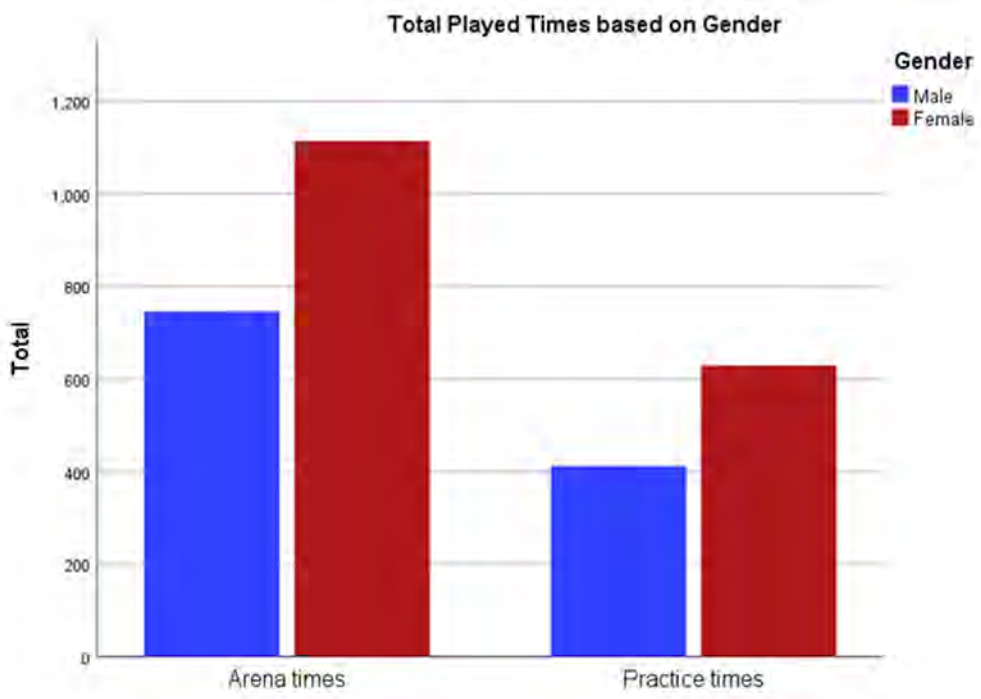

Figure 7. Numbers of Arena times and Practice times of each gender

In total, the male students played 746 games in the Arena mode and 412 in the Practice mode, while the figures for female students were 1114 and 629 respectively.

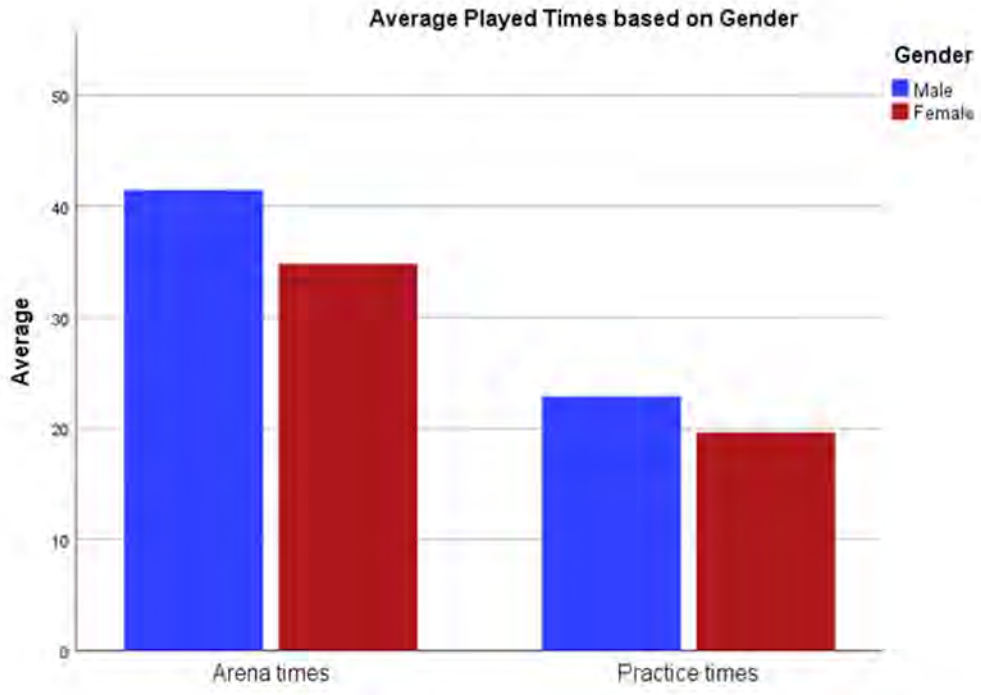

Figure 8. Average of Arena games and Practice games of each gender

On average, each male student played 41 Arena games and 23 Practice games; whereas each female student played 35 and 20 games for each mode respectively.

It can be seen from the figures that the male students played slightly more than the female ones, especially in the Arena mode. However, the difference was not significant, which proves that the platform was user-friendly for both groups of students.

Finally, based on the results of the pre-instruction test, the students in the experimental group were divided into three groups: Group 1 comprised the students with the score below 3.0 (N=19), Group 2 had those with score from 3.0 to 4.25 (N=15) and the remaining ones went to Group 3 (N=16).

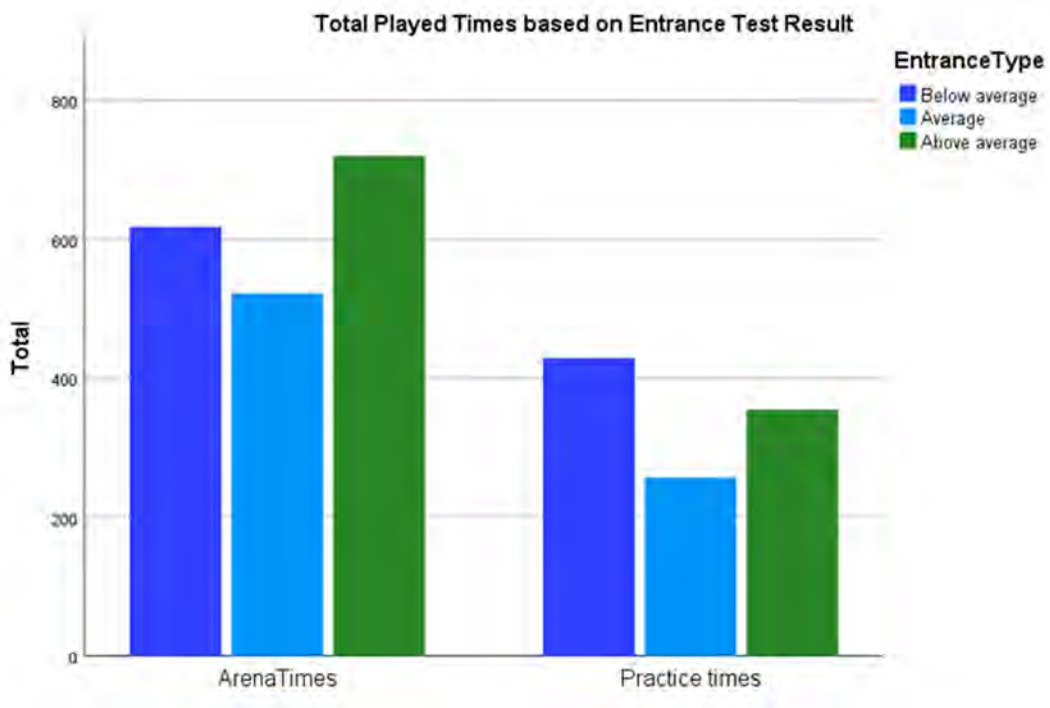

Figure 9. Numbers of Arena times and Practice times of each group based on the pre-instruction test score

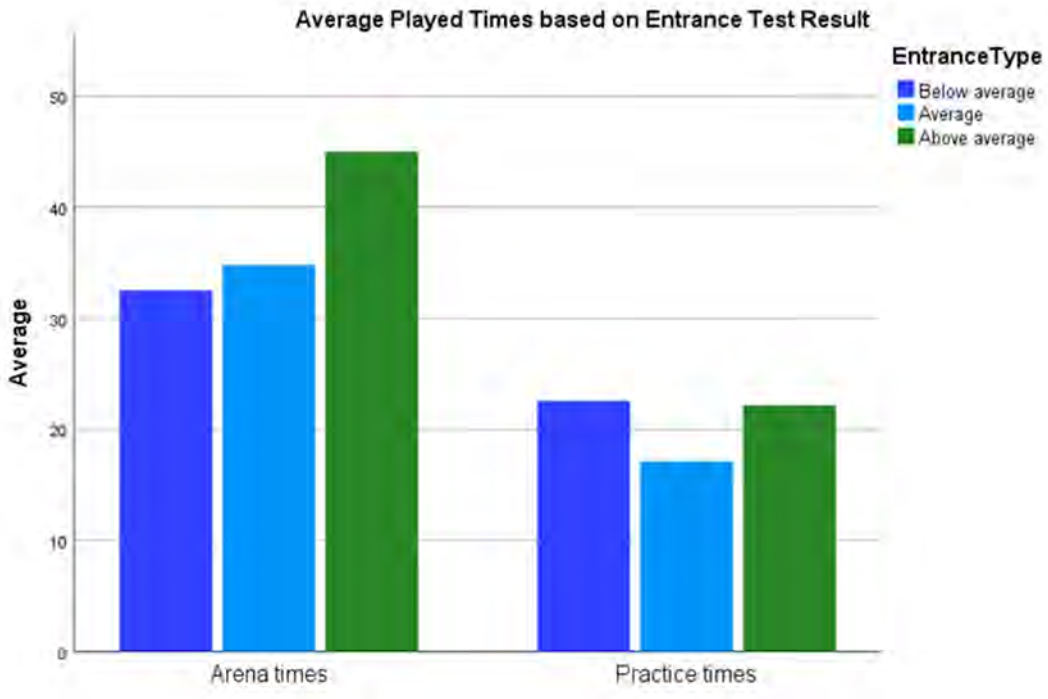

Figure 10. Average of Arena times and Practice times of each group based on the pre-instruction test score

The most striking was the Arena playing times of the high-score students with the figure of nearly 45; while the students with lowest scores tended to play Practice games the most. This strengthens the conclusion that good students prefer competitiveness whereas the others like practicing alone first then compete with each other later to check their knowledge and skills.

It is also noticeable that all students played in the Arena mode more frequently than the in the Practice mode. Therefore, competitiveness with other players can be a good selling point for students when designing applications for study.

5. Discussion

After learning with the application integrated into the program, the students' both academic performance and learner autonomy witnessed a remarkable improvement compared to those in the traditional class. The increase in the post-instruction test proves that the students improved the knowledge required in the program, while the general listening test results mean their listening skills in general were also enhanced owing to the utilization of the application. More importantly, the significantly higher autonomy level in the experimental class implies that the application successfully brought about positive effects on making students autonomous learners, which was also the final aim of the application. The utilization of the application received enthusiastic responses from students with the enjoyable scale results over average. Teachers' concerns relating to games addiction were also clarified when the students reported that they

were not too immersed into the games, while the majority of them said that the application helped them improve their knowledge. Moreover, the application was designed to suit almost every group of learners in the class regardless of gender or favour. Most students found the competitive games intriguing, and the resources in the application were useful for them. Students with better scores enjoyed interacting and combating with other learners to revise the lessons, while the others chose the Practice mode to improve their skills first.

The paper also reassures the five factors influencing learner autonomy generalized from previous studies by Kemala (2016), which are motivation, teacher, environment, material and task. By influencing the five factors with the application, students' autonomy improved significantly. The interaction in the game created an engaging environment with social interaction, while the resources in the application made materials accessible to every student. Furthermore, the various games representing different types of tasks were designed to make students more intrigued in their study and the encouragement from the teacher was another factor utilized in this project to affect learner autonomy.

The findings of the paper paved the way for a new approach to English study blending m-learning and gamification, which benefits various stakeholders. The application offers the students with an intriguing platform for studying English where they can play games, interact with other learners, track their progress, practice their skills and self-study at the same time. On the other hand, the paper suggests an m-learning instructional model for teachers to manage their class more effectively while still developing the students' learner autonomy. The application enables teachers to track the students' performance weekly and observe their playing behaviours to develop teaching strategies accordingly. And, most importantly, educators are recommended to adopt new perspectives to m-learning where user-orientation is of the highest order. Instead of simply delivering lessons and being a communication channel, m-learning can be adapted to be a perfect tool to develop learners' autonomy by considering such factors as competitive games, practice games, progress tracker and learning resources.

However, there still exist some limitations to improve in order for the application to make positive effects on many other learners. Firstly, the application was developed for listening, hence, the other 3 skills (speaking, writing and reading) were not focused on yet. Moreover, the application was not equipped with a teacher platform, which requires a program developer when the teacher needs to add more exercises into the application. Regarding the paper, the findings mostly depend on quantitative analysis of surveys and tests without any qualitative consideration to examine the students' personal opinions about the application. Last but not least, the sample

of the paper was drawn only from Nguyen Tat Thanh University, which is not enough to generalize the results for the students at tertiary level in general.

The paper can form the foundation for further development into m-learning and gamification for students at the tertiary level. Research can be conducted to examine the impact of this application model on many other groups of students ranging from freshman to senior students, as well as students from other universities or departments. After that, developers working in the education segment can base on the findings and the model presented in the paper to invent many other applications that can be integrated into the teaching program to improve learner autonomy of students studying English as well as other subjects using the model suggested in the paper.

6. Conclusion

The effectiveness of m-learning and gamification on students' knowledge improvement and learner autonomy was examined by an empirical study with quantitative data analysis. The students in experimental class, who were taught with the application, showed significant improvement in their knowledge and listening skills in general. This increase can be attributed to the application as the control class received the same teaching environment with one curriculum and teacher. Moreover, the application also succeeded in enhancing students' learner autonomy with the figures significantly higher than those in the control class. Most of the students enjoyed the games and considered them as a useful tool to improve their knowledge without getting addicted to the game. Their playing behaviours also varied according to their ability and purposes. Overall, the students with higher levels of English preferred the battle mode to compete with others while the others spent more time in the practice mode before competing.

The paper suggests a new approach to m-learning in teaching English, which is about utilizing gamification and integrating it into learning both inside and outside the classroom. Instead of being the platform for distance learning, m-learning can be used to engage the students into the lesson and connect them together. Following the model suggested, researchers can also emphasize their works on finding out more impacts of the m-learning and gamification on the students' learner autonomy to modernize teaching methodologies in this 4.0 era with the support of Artificial Intelligence (AI) technology.

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