

The Development and Effectiveness of Game-Based Learning Prototypes for Daily Life Words at B1 Level: A Case Study of Engineering Students in Thailand

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Abstract

In order to communicate effectively, it is undeniable that language learners should have rich vocabularies. In this study, online games are proposed to be an effective learning method in language teaching and learning. The study aimed at constructing game prototypes—online intermediate daily life lexicon (IDLL) games, assessing quality of online IDLL games, and investigating effectiveness of these games. This study comprised two stages: design and evaluation.

Quality of the online games was validated by four experts and 109 games players. Experts were asked to complete the IDLL evaluation form, whereas 109 game players were assigned to complete the learning experience questionnaire and learners' satisfaction questionnaire. Effectiveness of the online games in relation to English vocabulary knowledge at B1 level was measured by the IDLL mini pretest and posttest. Quantitative data were analyzed by descriptive statistics, arithmetic mean, t-test dependent sample, and the effect size (ES) on learners' gained scores. Qualitative data were investigated using content analysis of the IDLL evaluation form and learners' satisfaction questionnaire.

The findings revealed that the developed online games appear to be good learning material since both experts and learners view the games at the acceptable quality with some revision needed further, such as learning content, game design, website design, technical limitation, and human errors. The findings also suggested that the developed online games were effective since students' vocabulary knowledge had improved. Furthermore, students reported that they felt positive about the online games since they felt that they could learn in an enjoyable and interactive environment. Therefore, it was considered that this method can be used for teaching vocabulary within the Thai context. However, further development and revision were needed since the study was a trial process.

Keywords: game-based learning and evaluation, web-based learning and evaluation, daily life words, CEFR B1 vocabulary

1. Introduction

This study attempted to develop a prototype for game-based learning for daily life words and to evaluate effectiveness of the prototypes by engineering students. This study also aimed to ascertain learners' perceptions or satisfaction after having experience with the developed online games.

1.1 Background of the Study

This study was mainly developed and designed by synthesizing five important aspects: (1) English teaching and learning in Thailand, (2) the importance of vocabulary, (3) the game-based learning and evaluation, (4) web-based instruction and evaluation, and (5) whiteboard animation.

1.1.1 English Teaching and Learning in Thailand

In Thailand, English is widely recognized as an important foreign language both in academic and occupational fields (Foley, 2005). However, there are two studies indicating the very low language proficiency of Thai students (EF English Proficiency Index, 2023 and ONET-reports, 2018-2022). Thailand came in at 101st of 111 countries (that is in Asia, Thailand ranked 21st of 23), at a very low proficiency level according to the Educational First English Proficiency Index (EF English Proficiency Index, 2023). Thailand's English average scores (2018-2022) for the O-NET (Ordinary National Educational Test) were unsatisfactory; upper-secondary school students scored 31.41, 29.20, 29.94, 25.56, and 23.44 out of 100.

This indicates that English learning and teaching in Thailand are not as successful as they should be; most students lack knowledge and ability to communicate. There are several reasons for this, for example, lack of confidence in speaking, lack of understanding native culture, lack of motivation to learn English, and lack of opportunity to practice in the real world (Noom-ura, 2013; Sornkam et al., 2018; Wiriyachitra, 2010). Moreover, two studies have examined the causes of failure of English teaching and learning in Thailand (Chulalongkorn University Academic Service Centre in 2000 as cited in Wongsothorn et al., 2002; and Dhanasobhon, 2006), and the findings showed that the main factors that led to difficulties and unsatisfactory low English learning and teaching included unqualified and poorly-trained teachers, poorly-motivated students, large class sizes with mixed abilities of learners, inadequate preparation, overloaded teachers' responsibilities, inadequate materials and equipment, overuse of multiple-choice item tests, and lack of opportunities to use English outside the classroom. Therefore, Thai educators have tried to find ways to improve English proficiency of Thai students by using many methods, such as authentic tasks, technology integration, fun activities, roleplaying, and games.

1.1.2 Importance of Vocabulary

Learning vocabulary is an essential part of language teaching (Nation, 2003; Peterson, 2010; Schmitt, 2000; Yudintseva, 2015), and it is undeniable that a person's vocabulary is directly related to language development. Knowing and learning a limited range of grammar structures might help learners convey the target message, but knowing a smaller number of words prevents them from expressing themselves (Noori et al., 2011; Pan & Xu, 2011 as cited in Akramy et al., 2022). In other words, the richness of vocabulary enhances communication skills (Amiryousufi & Dastjerdi, 2010; Salavati & Salehi, 2016; Schmitt, 2000; Wu & Huang, 2017; Yudintseva, 2015).

This study focuses only on CEFR B1 (Note 1) vocabulary, which is used as the learning content. The reasons why the study focuses on the B1 level is as follows. First, at present, the Thai government has set a policy for universities to develop English language skills (the Office of the Higher Education Commission–OECD) by pushing universities to improve and assess English proficiency of the students. Moreover, Thailand's education system is moving towards using the Common European Framework of Reference (CEFR) to evaluate English language proficiency in schools, and the Thai Ministry of Education has announced a policy to reform teaching of English in primary education.

All sectors recognize the necessity to accelerate upgrading of education quality (Sornkam et al., 2018). The goal of English proficiency has been specified by the Ministry of Education in basic education at CEFR B2 level for those receiving a bachelor degree. However, in reality, many institutes have announced such language proficiency requirements, that is, undergraduates who are not in faculties of language or linguistics can have language results equivalent to the CEFR B1 level.

1.1.3 Game-based Learning (GBL) Method

A game is defined as 'an activity that you do for fun with some rules, and that you can win or lose' (Macmillan Dictionary, 2016). Many researchers have reported that games have potential to improve learning outcomes and motivation in education (Gee, 2007; Squire, 2008). Importantly, using games in the classroom can help improve foreign language education in terms of listening and speaking (Ngiwline & Haruansong, 2020), vocabulary (Rankin et al., 2009), and communicative language competence (Garcia-Carbonell et al., 2001; Namaziandost et al., 2020). Collaborative and interaction in a game environment help promote foreign language acquisition and motivation (Thorne & Reinhardt, 2008; Thorne et al., 2009).

Today, digital games are considered a tool to engage learners and encourage interaction in the target language (Reinders, 2012). Digital game-based learning can promote an active learning process and reduce anxiety among EFL learners (Chen & Law, 2016). A number of studies have explored the effect of digital games on developing EFL student's vocabulary (Lutfah, 2019; Salavati & Salehi, 2016). The study of Lutfah (2019) and Salavati and Salehi (2016) revealed that students felt more motivated to participate in classroom activities and confident with the games, and they were able to remember and retain new vocabulary easily. Moreover, it has been seen that

intrinsic motivation tends to increase when using digital games in a classroom, as well as increasing students' interests (Liu & Chu, 2010) with positive effects on language learning (Sari & Chairani, 2017).

In order to enrich students' repertoire in acquiring new vocabulary and retaining lexical items, language games used as an entertaining technique should be implemented (Darfilal, 2015). Educationists currently are attempting to find ways to improve target language learning by increasing students' enjoyment and engaging learning motivation as students including Thai students like fun activities (Fry & Bi, 2013; Meksophawannagul, 2015; Nguyen, n.d.). A more relaxed environment can help enhance students' learning engagement as well as lessen their fear of making mistakes or losing face.

There are three studies of evaluating effectiveness of the game quality (Connolly et al., 2009; Garris et al., 2002; Oguz, 2012). In the study of Oguz (2012), three indicators used to measure quality of the games are enjoyment, usability, and learning. An evaluation framework for game-based learning includes learner performance, learner/instructor motivation, learner/instructor perceptions, learner/instructor preferences, GBL environment, and collaboration among learners (Connolly et al., 2009). Garris et al. (2002) explained a generally acceptable input-process-outcome game model, where input is aimed at designing an instructional program that incorporates characteristics of the game and where the process comprises user judgment, user behavior and system feedback. Outcome refers to the achievement of learning objectives.

1.1.4 Web-based Instruction and Evaluation

Khan (1997) defines web-based instruction (WBI) as 'a hypermedia-based instructional program which utilizes attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported'. Web-based instruction (WBI) offers easy accessibility and flexible storage and display options, relatively simple publishing formats, and multimedia capabilities (Khan, 1997). That is, WBI extends learning boundaries (Relan & Gillani, 1997), whereas computers and the Internet help encourage a learner-centered approach. In this study, WBI acts as a medium to convey learning content.

Educators have proposed many types of WBI evaluation criteria. Wilkinson et al. (1997) provided assessment criteria of a web-based course: for example, site access and user usability, resource identification and documentation, author identification, authority of author information structure and design relevance and scope of content, validity of content, accuracy and balance of content, navigation within the document, quality of links and aesthetic and affective aspects. Kapoun (1998) provided five criteria for a webpage: accuracy, authority, objectivity currency and coverage. Michigan Virtual University (2002) sets four standard factors: technology, usability, accessibility, and instructional design.

1.1.5 Whiteboard Animation

New tool used to enhance language learning and teaching is whiteboard animation. Whiteboard animation is a process where a story or a storyboard with pictures gets drawn on a whiteboard. Typically, the illustrations are accompanied by a story within the drawing. Although whiteboard animations are increasingly used in education, there is little evidence of their efficacy. There is lack of whiteboard creation in social sciences, especially in Thai contexts. One research by Bradford and Bharadwaj (2015) concluded that creative e-based dissemination approaches such as whiteboard animation can promote insights and new ways of co-producing knowledge that communicates traditional knowledge to wider audiences. Moreover, Wiseman (2014) studied whiteboard videos and investigated viewers' memory after watching video clips. He found that, overall, there was 15% rise in recall across memory questions for those that watched the script video. Turkey and Mouton (2016) measured the impact of whiteboard animations. Their studies showed the benefit of whiteboard animations in terms of enjoyment and engagement in the learning process.

Whiteboard animation is considered as a distinctive and professional tool to explain the concepts of simplicity with entertaining and eye-catching features. Retention of vocabulary is expected to be enhanced through interactive whiteboard animation. In this study, whiteboard animation is used as content preparation for students to learn B1 words.

In sum, in this study, B1 vocabulary functioned as learning content, WBI acted as learning distributions or channels, and GBL functioned as learning method. The evaluation procedure was conducted in three periods: before the implementation, during the implementation, and at the end of the course implementation. Quality of online games was assessed by investigating learners' vocabulary improvement and their attitudes towards the online games. Evaluation of the developed online game phototypes was conducted from the point of view of both experts and learners. Experts were asked to examine quality of the online game phototypes to be ready to be implemented in practical terms by learners. Learners were asked to evaluate effectiveness of the online games. If

the results demonstrated positive effects on English vocabulary knowledge or obtain positive attitudes on learning settings, further implementation in a large group with more categories of English vocabulary should be developed and implemented. The online games developed in this study are standalone activities, not related to any learning courses, and are designed as a prototype or trial instrument to enhance English vocabulary knowledge.

It is noted that the terms online IDLL games, WordWise4B1 games, developed online games, and online games are interchangeable.

2. Objectives of the Study

The purposes of this study are:

- (1) To construct the online IDLL games or WordWise4B1 games for engineering student
- (2) To evaluate the online IDLL games or WordWise4B1 games for engineering students
- (3) To evaluate effectiveness of the online IDLL games or WordWise4B1 games for engineering students

3. Research Questions

This study addresses the following research questions:

- (1) How can the online IDLL games for engineering students be evaluated?
- (2) What is the effectiveness of the online IDLL games for engineering students?

4. Hypothesis

Statement of Hypothesis: The means of learners' posttest scores are higher than those of the pretest scores after taking part in the online IDLL games.

Statistic Hypothesis:

$$H_0: \mu_{\text{posttest}} \leq \mu_{\text{pretest}}$$

$$H_1: \mu_{\text{posttest}} > \mu_{\text{pretest}}$$

5. Research Methodology

This study used a case study approach with a single group pretest/posttest design.

5.1 Participants or Evaluators

Participants were divided into two groups.

- (1) Two game-based instructional experts and two EFL teachers: They were asked to examine quality of the online games before implementing with learners, that is, they acted as learning materials evaluators or instrument examiners.
- (2) Learners: Volunteer learners were selected using the convenience sample method. At the beginning, there were 160 learners; however, only 122 players took a mini pretest, and 94 learners took both the mini pretest and posttest. 109 learners did all games, complete the information needed, and learned every process. Ninety-eight learners (90%) graduated with a high vocational certificate and will spend two to three years to complete their undergraduate degree. Sixty percent of the learners (65 learners) used to work after receiving their vocational certificate.

5.2 Settings

Learners were assigned to freely study WordWise4B1 games for two months. They were assigned into sixteen Avenger groups (e.g. Hulk, Ironman, and Thor) with 10 learners in each group. After two months, their names were changed to Learners 001-109.

The online IDLL games consisted of five themes or modules: appliances, city and countryside, food and drink, personal characteristics, and work and jobs. All of the vocabularies were summarized from CEFR vocabulary word lists (Cambridge CEFR B1 wordlists and Oxford CEFR wordlists).

Learners were asked to follow five learning steps of the online games: (1) pretest, (2) learn, (3) play, (4) module test, and (5) posttest (in Appendix A).

Step 1 (Pretest): Learners were assigned to take a mini pretest (the IDLL test) which focused on B1 vocabulary knowledge (see test specification in Appendix A) and were asked to complete the learning experience questionnaire.

Step 2 (Learn): The online games provide a user-friendly description, explanation, example, picture, symbol, or graphic representation of the terms. Game players learn the target language by VDO clips using the whiteboard animation tools program. In this study, a ready-made program, Doodle is used. Doodle is a user-friendly platform with simple implementation with attractive and interactive interface. Importantly, there is no need for subscription and computer language knowledge.

Step 3 (Play): Learners are asked to play games via a website: WordWise4B1.com. There are five modules and each module consists of two types of games: (1) seven custom-made games and (2) four ready-made games. In all, learners are assigned to play eleven games.

Seven custom-made games were constructed by the researcher using the program Construct-2. Four games were utilized from the ready-made program (WordWall.Net). WordWall.Net is a program that creates teaching resources easily. It helps create interactive games with audio and visual features and has many types of games, such as matchups, quizzes, word searches, maze chases and so on. It is a very user-friendly program. Importantly, the game design of WordWall.Net matches well with the online IDLL game design. Game creators' responsibilities are preparing the learning content and selecting pictures and game patterns that are suitable for learners.

In this study, each game had a user manual provided for players so that they could understand the way to play and limitations of the program.

Step 4 (Module test): After learners played each game, they were asked to test the vocabulary knowledge. All of the tests were designed as game-based testing formats and constructed by a ready-made program (WordWall.Net).

Step 5 (Posttest): This study employed the test-retest method. After learners played all games and did all activities in each module, they were asked to retest on B1 vocabulary knowledge (five themes). After that, learners were asked to give their opinion on the online games by using the learners' satisfaction questionnaire.

5.3 Validating Quality of the Online IDLL Games

Three main assessing procedures included: (1) validating quality of the online games by experts, (2) validating quality of the online games by learners, and (3) examining effectiveness of the online games on English vocabulary knowledge.

The first step was examining quality of the instrument or learning materials (the online IDLL games) and the last two steps were validating quality of the online games with two indicators: vocabulary knowledge (at B1 level) and learners' attitudes or perceptions on the online games.

5.3.1 Validating Quality of the Online Games by Experts

The principal objective of this study was to evaluate quality of the online games in order to ensure that the material used contained a specific behavior domain (i.e. identify and illustrate B1 terms).

Evaluators: Two instructional experts who are specialized in the game-based design and two EFL teachers who have taught English for five years were asked to evaluate quality of the online games.

Research instruments: In order to assess quality of the online games, this study used the framework developed by Connolly et al. (2009), Garris et al. (2002), and Oguz (2012)

The IDLL evaluation form consisted of four parts: general information, overall quality of the online games, quality of each game in each module, and game-based testing design. The last two parts were developed by the researcher.

In the first part, experts were asked to provide general information such as age, gender, and level of education.

The second part included four main attributes for assessing overall quality of the online games: (1) learning content, (2) game design, (3) website design, and (4) usability. All extra opinions and suggestions were given in an open-ended format.

Nine indicators of learning content such as content accuracy, content difficulty, interesting presentation were synthesized from material development and evaluation in language teaching adapted from Tomlinson (1988) and Richards (2001).

Ten indicators of game design such as quality of the picture, audio, visual, and menus were synthesized from the characteristics or attributes of the game-based learning framework based on Connolly et al., (2009), Fang et al. (2010), Fu et al. (2008), Garris et al. (2010), Kiili (2004), Tan et al. (2007), and Oguz (2012).

Eight indicators of website design such as layout, color, background, menu, and navigator were synthesized from the web-based instruction key features proposed by the American Council of Education (1997), Khan (1997), and the Michigan Virtual University (2002).

Five indicators of usability such as user-friendly features, self-learning settings, applicable ways to use knowledge, and user manuals or guidelines were synthesized from Alessi and Trollip (2001), the Michigan Virtual University (2002), and Squires and Preece (1999).

The third part was designed to validate quality of each game. There were six indicators consisting of learning content appropriateness, levels of difficulty, multimedia quality, appropriate length of playing time, interesting game format, and ease of the game.

The last part was designed to assess quality of the game-based test format. Quality of the test was validated by seven indicators including ease of the test, relevant testing content, interesting test format, test content suitability, correct language usage, appropriate number of test items, and appropriate length of test taking time.

Quality of the online games assessed by experts was graded on three-point Likert scales (3 = Agree/Good, 2 = Neutral/Average, and 1 = Disagree/Poor). Quality of the online game was measured by arithmetic mean. The acceptable quality of the online games was equal to or greater than 2.25.

5.3.2 Validating Quality of the Online IDLL Games by Learners

Evaluators: 109 learners were asked to evaluate quality of the online games.

Research Instruments: There were two questionnaires which were developed by the researcher.

(1) Learning experience questionnaire: This was a pre-course questionnaire on English learning experience and game experience. The questionnaire comprised two parts.

In the first part, learners were asked to provide general information, their mastered English skills, and obstacles to their language learning based on the study of Meksophawannagul (2015).

In the second part, learners were asked about their experience with playing games (their feeling about playing games, average playing time, usefulness of playing games, their game platform preference, and their favorite games). Moreover, learners were asked to share their English learning experience with games.

(2) Learners' satisfaction questionnaire was a post-course questionnaire on learners' satisfaction towards the online games. The questionnaire synthesized knowledge of many studies and researches on material development and evaluation, game-based learning and evaluation, web-based design and evaluation, vocabulary teaching and assessing, and whiteboard animation. The questionnaires were delivered online to two experts—one language expert and one instructional design expert—in order to validate their quality.

The questionnaire consisted of four parts: personal information, online games design, learners' game preferences, and learners' satisfaction with test formats. The following information illustrates the post-course questionnaire for learners.

In part one, learners were asked for their personal information. Part two is similar to the second part of the IDLL evaluation form validated by experts. There were four main elements in assessing quality of the online games: learning content, game design, website design, and usability. In part three, learners were asked about their preferred online games with reasons as well as the games they did not care for with reasons. In part four, learners were asked to provide feedback on the game-based testing format. The indicators included ease of the test format, test content, test enjoyment, how interesting the test format was, suitability of language use, and overall satisfaction. The researcher reviewed the questionnaire according to experts' comments and suggestions and resubmitted the revised version to the experts.

Data analysis: Quality of the online games validated by learners was measured by arithmetic mean. It was graded on five-point Likert scales. The acceptable quality of the online games was equal to or greater than 3.50. The issues with arithmetic mean below 3.50 were eliminated, and those with an arithmetic mean equal to or greater than 3.50 were incorporated.

5.3.3 Examining Effectiveness of the Online IDLL Games on English Vocabulary Knowledge

Evaluators: 122 students were asked to take the mini pretest English vocabulary performance at B1 level. However, only 94 students did the mini posttest, which was an online test via Google Forms.

Research Instruments: Intermediate daily life lexicon (IDLL) mini test (see test specifications in Appendix A) was used to assess English vocabulary performance at B1 level. It was validated by two English language experts that have taught English for more than five years.

Data analysis: In order to assess whether learners actually learned the content of the online games, a t-test for dependent samples and effect size with standardized gained scores (ES) were reported.

In order to identify the statistical difference between the pretest and posttest scores in terms of English words at B1 level, t-test dependent sample was used. The significance level was set at $\alpha = 0.05$.

In order to identify the practical differences of the effect size (ES) between the pretest and posttest scores, the effect size of the paired sample t-test dependent sample known as Cohen's d (effect size) was used. The effect size (1988) for the dependent sample t-test was computed by using the following equation:

$$d = \frac{\mu_1 - \mu_2}{\sigma} \quad (1)$$

The t-test dependent sample's criteria to reject or accept the hypothesis (the t-value is higher than the t-critical or the p-value is less than significance level) was set at 0.05.

This study also employed the criteria provided by Cohen (1988) as they were globally accepted. Cohen (1988) defined effect size (ES) as 'small, $d = 0.2$, medium, $d = 0.5$ and large, $d = 0.8$ ', stating that 'there is a certain risk in inherent in offering conventional operational definition for those terms for use in power analysis as diverse a field of inquiry as behavior science (p.25)'. Thus, the acceptable ES value should be greater than 0.25 (medium). The values of 0.25 indicates that one-quarter standard deviation separates the two means.

In conclusion, quality and effectiveness of the online games were analyzed using both descriptive statistics and open-ended information which was grouped and qualitatively analyzed.

6. Results

6.1 Assessing Quality of the Online IDLL Games

The quantitative and qualitative analysis consisted of two parts: experts' views and learners' views.

6.1.1 Experts' Views

The findings were reported in three parts: (1) overall quality of the online games, (2) quality of each game in each module, and (3) quality of the game-based testing formats.

(1) Overall quality of the online games: Table 1 showed arithmetic mean of overall quality of the online games assessed by experts.

Table 1. Arithmetic mean of overall quality of the online games assessed by experts

	Statements	Mean
1	Learning content	
	1.1 Accuracy of content	3.0
	1.2 Difficulty of content	3.0
	1.3 Using appropriate vocabularies for learners	3.0
	1.4 Using correct language	3.0
	1.5 Clear pictures and sound	2.5
	1.6 Interesting presentation	2.5
	1.7 Using appropriate tests that suit learners' performance	2.75
	1.8 The test is easy to understand.	2.75
	1.9 The test content is designed to correspond with learning content.	2.75
2	Game design (Game interface)	
	2.1 Quality of multimedia, suitable image size with colorful pictures	2.75
	2.2 Fonts are easy to read and colorful.	3.0
	2.3 Interesting game format	2.75
	2.4 Clear sound	2.5
	2.5 English pronunciation is correct.	3.0
	2.6 Game format corresponds to learning contents.	2.5
	2.7 The layout and menu are easy to use (user-friendly).	2.5
	2.8 Games convey learning content that enhances understandable and memorable language learning.	2.5
	2.9 Learners gain learning benefits after playing the games.	3.0
	2.10 Overall, what level of satisfaction do you have with this online game design?	2.75
	Website design (Web interface)	
	3.1 Homepage is well-designed and interesting.	3.0
	3.2 Website layout is well-organized, and is easy to navigate and logical. The quality of texts, animation, graphics, audio and VDO are well-designed.	2.5
	3.3 Color of the website is harmonious.	3.0
3	3.4 Menu design is easy to use.	2.75
	3.5 Design of the background color and font color are appropriate for reading and are easy to read clearly.	3.0
	3.6 Font size and font style are easy to read and are consistent.	3.0
	3.7 The website contains meaningful and consistent images and learning content.	3.0
	3.8 Overall, what level of satisfaction do you have with this website design?	2.75
4	Usability	
	4.1 The games have the features of usability—they are easy to use.	2.75
	4.2 The website design is usable.	2.50
	4.3 Learners can study by themselves.	2.75
	4.4 Learning content can be used in daily life.	3.0
	4.5 There is a manual for the game playing.	2.50
	Overall quality	2.78**

The results showed that experts rated the online games as of good quality as evidenced by the mean (M=2.78 out of 3.0). The arithmetic mean of all the indicators was higher than 2.25, indicating that the online games were quite good. That is, this instrument was acceptable to be implemented by other users (learners or game players).

The arithmetic means of the four attributes—learning content, game interface, website interface, and usability—were 2.81, 2.73, 2.88, and 2.70, respectively. The highest mean was website interface, indicating that human-computer interaction and communication items such as homepage, link, website layout, menu design, font size, font color, picture, display screen, and background were of acceptable and practical quality.

(2) Quality of each game in each module: As shown in Table 2, the arithmetic mean of quality of each game was 2.78 out of 3.0 (M=2.78). All of the mean was more than 2.25 out of 3.0. In other words, quality of each game in each module was quite exceptional. The highest mean (M=2.96) was Hangman game, whereas the lowest mean (M=2.46) was Balloon pop game.

In Table 2, the top-three indicators with high mean were learning content appropriateness (M=2.89), multimedia quality (M=2.86), and interesting game format (M=2.84). The lowest mean was appropriate length of playing time (M=2.43), therefore, the game developer needed to extend the gaming speeding time.

Table 2. Arithmetic mean of quality of each game assessed by experts

Module	Game name	learning content appropriateness	levels of difficulty	multimedia quality	appropriate length of playing time	interesting game format	the ease of game.	
Appliances	Zombie**	3.0	3.0	3.0	1.75*	3.0	2.5	2.71
	Matching definitions	3.0	2.75	2.75	3.0	2.75	3.0	2.88
City and countryside	Matching places**	2.5	2.75	3.0	3.0	3.0	3.0	2.88
	Hangman	2.75	3.0	3.0	3.0	3.0	3.0	2.96*
Food and drink	Spelling-Vegetables**	3.0	2.25	3.0	2.75	3.0	2.75	2.79
	Spelling-Fruits**	2.75	3.0	3.0	2.5	3.0	3.0	2.88
	Hangman	2.75	3.0	3.0	3.0	3.0	3.0	2.96*
Personal characteristics	Spelling adjectives**	3.0	2.25	3.0	2.25	2.75	2.75	2.67
	Balloon pop	3.0	2.25*	2.25*	2.25*	2.5	2.5	2.46*
Work and jobs	Dear lady spelling/Orc hoa spelling**	3.0	2.75	3.0	2.5	2.25	2.75	2.74
	Two players quiz games (Spaceship game) **	3.0	2.5	2.5	2.5	3.0	2.5	2.67
		2.89*	2.68	2.86*	2.43	2.84*	2.80	2.78

Note: ** = custom-made games

As shown in Table 2, one indicator—appropriate length of playing time in Zombie game—needed to be revised since the mean was 1.75. It was clear that Zombie game problem was the speed of the game. Thus, the game timing needed to be adjusted. The mean of three indicators (i.e., levels of difficulty, multimedia quality, and appropriate length of playing time) of Balloon pop game was equal to 2.25 (M=2.25). Even though it was of acceptable quality, this game needed to be revised as well.

(3) Quality of game-based test platforms: Table 3 showed quality of the game-based test format. As shown in Table 3, the results indicated that the game-based testing format was fairly good (M=2.80). The highest mean of the game-based format was Maze chase game (M=2.96). According to Table 3, the mean of seven indications was higher than 2.25, indicating that the quality of each game-based test format was quite good. The highest indicator was testing content (M=3.0), revealing that the testing content corresponded well with the learning content.

Table 3. Arithmetic mean of quality of the game-based test format assessed by experts

	Game name	ease of the test	relevant testing content	interesting test format	test content suitability	correct language usage	appropriate number of test items	appropriate length of test taking time	
Appliances	Matching pictures	2.75	3.0	2.75	2.75	2.75	2.75	2.75	2.79
City and countryside	Matching pictures	2.75	3.0	2.75	2.75	3.0	2.75	2.50	2.79
Food and drink	Matching pictures	2.75	3.0	2.75	2.75	2.75	2.75	2.75	2.79
	Airplanes	2.50	3.0	2.75	3.0	3.0	3.0	2.75	2.75
Personal characteristics	Maze chase	3.0	3.0	3.0	3.0	2.75	2.75	2.75	2.96*
	Win or lose quiz	2.75	3.0	2.75	2.75	2.75	2.75	2.75	2.79
Work and jobs	True or false	2.75	3.0	2.75	2.75	2.75	2.75	2.75	2.75
	Crossword	2.50	3.0	2.75	2.75	2.75	2.75	2.75	2.75
		2.72	3.0*	2.78	2.78	2.81	2.78	2.74	2.80*

The experts expressed that the games were fun and interesting even though there were some technical limitations in the custom-made games; for example, the players could not access the games via mobile phone, the screen of some games was frozen if the players made a mistake. Moreover, there were some human errors; for example, one picture did not match the word (Module: food and drink). Even though gaming manuals were provided, some players who were not familiar with the game setting might not understand. The experts provided comments and made some recommendations for further improvement. The following is an example of expert's comments and suggestions.

Quality of the online games

'The sound of the teaching VDO clips was slightly quiet. The speed of some games was quite fast. It might be better if the web developer constructed log-in systems and kept all learning and testing records, especially playing game records. The embedded page should be employed.' (Instructional expert 1)

'Sometimes, there was no interaction – frozen screen or hanged system. Players needed to refresh the game. Mobile phone settings should be a better choice to learn language. It might be better to keep learning and testing the records of each module. The game developer needs to increase the font size.' (Instructional expert 2)

'Players might feel confused since some games use capital letters and some use lowercase letters. Sometimes, I pressed the button but there was no interaction. The game developer should extend the time of playing the game.' (Language expert 1)

Quality of each game in each module

'The Balloon pop game is so fast. Error in one picture in a Food and drink word. Check audio and visuals.' (Instructional expert 1)

'The screen was frozen in the Zombie game if the players lost. Playing speed time is very fast.' (Instructional expert 2)

'Two players game (Spaceship) is fun but it would be better if players could choose to play individually or in pairs. Matching Places games could not be played via mobile phone.' (Language expert 2)

Quality of the game-based format

‘Game-based testing design was OK. Check about time. Some tests are too fast.’ (Instructional expert 1)

‘The tests of each module look good but please check the speed of the testing time. I like ‘True or false’. It is clear. Win or lose quiz is very exciting. Airplane test has a problem. I pressed the button but it did not work properly. If game players spell incorrectly, they cannot rewrite or go back in the Crossword game. The pictures in the Maze chase game should be bigger.’ (Language expert 1)

After receiving all of comments and suggestions, the online games were adjusted, for example, speed of playing and testing time, size of pictures, human errors-typos, font size, and pictures. Two recommendations could not be met: (1) the technical limitation factor and (2) the log-in page. There were two main reasons for this. First, the researcher tried to hire a specialist in the Construct-2 program but no one was interested; thus, the researcher had to learn how to construct the games via the Construct-2 program. Surely, there were some limitation, bugs, and computer coding problems that the researcher could not find solutions for. Secondly, since the log-in page for website development was quite difficult, professional web creators needed to be employed. However, the project had a limited budget; thus, the researcher had to develop it. In fact, the games in this study were in a trial process in order to examine effectiveness of the developed online games when implemented in a small group. More revision and more technical or game-design expert teams are needed in order to improve the game quality in the future.

6.1.2 Learners’ Views

109 game players consisted of 104 learners (96%) and five teachers (4%). Of these, 101 (92.6%) were male and eight (7.4%) were female. The average age was 22.22 years. One hundred and seven were engineering students and two teachers had a master degree and a doctoral degree.

English learning information: For language competency, learners ranked reading skills (74 out of 109 learners = 67.89%) as the highest language competency, followed by listening (18 learners = 16.51%), writing (13 learners = 11.93%), and speaking (4 learners = 3.67%). Learners were asked to rank the top-three causes obstructing English learning. The top obstacle was insufficient English knowledge as they learned and did not understand what the teachers taught in primary school or secondary school or higher vocational institution (44 learners = 40.40%). The second obstacle was that learners felt embarrassed to make mistake (47 learners = 43.52%). The third place was terrible English learning experience (39 learners = 35.80%), followed by complicated learning contents (38 learners = 34.90%).

Gaming information: Seventy-five learners really liked playing games, whereas 6 learners disliked playing games. Twenty-eight learners felt indifferent about playing games. On average, learners spent 2.45 hours playing games per day. The top-four game platforms were PC (89 learners = 82%), mobile phone (57 learners = 52%), PlayStation (6 learners = 5.5%), and iPad (4 learners = 3.37%). Fifty-nine percent of learners (64 learners) played games on more than one platform. Most importantly, learners were asked to inform about their experience on English learning through game format. It was interesting that 61 learners (56.48%) had never learned English language via online games. Forty-eight learners (44.44%) gave a list of games that they used to play to improve their English abilities: Duolingo, Kahoot, Echo English, Hangman, Wordsearch, Wordle, Word spelling, and Word puzzles.

Furthermore, learners were asked to rank the three benefits they gain when playing games. The top benefit was relieving stress (49 students = 45%), followed by enhancing enjoyment (40 students = 36.7%), and improving memory (39 students = 35.8%). The popular or favorite game genre perceived by learners was asked in order to ascertain the top-three games that the learners enjoyed the most. The top-three games were action games (40.4%), role playing games (30.3%), and strategy games (27.5%). The most popular PC game was DOTA (37 learners = 24.8%), followed by Minecraft game (24 learners = 22%), and Valorant game (23 learners = 21.1%).

In order to examine effectiveness of the online games assessed by learners, the findings are reported in three aspects: (1) overall quality of the online games, (2) learners’ satisfaction with each game, and (c) quality of the game-based test format.

(1) Overall quality of the online games: Table 4 demonstrated learners’ view on overall quality of the online games after they played for two months. As shown in the table, there were four main attributes in assessing quality of the online games—learning content, game design, website design, and usability. Overall, learners rated the online games as good ($M = 4.12$) since the average mean of the four attributes was greater than 3.50.

Table 4. Quality of the online games calculated by mean and standard deviation

Statements	Mean	SD
Learning content		
1.1 Accuracy of content	4.14	.755
1.2 Difficulty of content	3.95*	.681
1.3 Using appropriate vocabulary for learners	4.09	.708
1.4 Using correct language	4.13	.716
1.5 Clear pictures and sound	4.04	.835
1.6 Interesting presentation	4.04	.872
1.7 Using appropriate tests that suit learners' performance	4.03	.755
1.8 The test is easy to understand.	4.01	.779
1.9 The test content is designed to correspond with learning content.	4.19*	.763
	4.07	
Game design (Game interface)		
2.1 Quality of multimedia, suitable image size with colorful pictures	4.06	.795
2.2 Fonts are easy to read and colorful.	4.05	.754
2.3 Interesting game format	4.09	.792
2.4 Clear sound	4.07	.817
2.5 English pronunciation is correct.	4.27*	.744
2.6 Game format corresponds to learning contents.	4.15	.783
2.7 Layout and menu are easy to use (user-friendly)	3.90*	.864
2.8 Games convey learning content that enhances understandable and memorable language learning.	4.13	.786
2.9 Learners gain learning benefits after playing games.	4.17	.791
2.10 Overall, what level of satisfaction do you have with this online game design?	4.16	.763
	4.11	
Website design (Web interface)		
3.1 Homepage is well-designed and interesting.	4.20*	.758
3.2 Website layout is well-organized, easy to navigate and is logical. The quality of texts, animation, graphics, audio, and VDO are well-designed.	4.07	.758
3.3 Color of the website is harmonious.	4.14	.755
3.4 Menu design is easy to use.	4.01*	.881
3.5 Design of background color and font color is appropriate for reading and is easy to read	4.20*	.758
3.6 Font size and font style are easy to read and are consistent.	4.19	.699
3.7 The website contains meaningful and consistent images and learning content	4.18	.803
3.8 Overall, what level of satisfaction do you have with this website design?	4.18	.734
	4.15	
Usability		
4.1 Games have the features of usability—they are easy to use.	4.12	.862
4.2 Website design is usable.	3.98*	.875
4.3 Learners can study by themselves.	4.21	.786
4.4 Learning content can be used in daily life.	4.32	.721
4.5 There is a manual for the game playing.	4.15	.841
	4.16 *	
Overall quality	4.12	

The highest mean was usability ($M=4.16$), indicating that learners viewed that the *online games* had easy user interfaces. In other words, capacity of the online games could provide conditions for users to perform the tasks safely, enjoyably, and effectively while learning.

Moreover, the mean for all indicators was more than 3.50, indicating that the learners felt pleasant when playing the online games. That is, the online games were of acceptable quality or fairly good. When investigating the four attributes closely (Table 4), the findings could be concluded.

Regarding learning content attributes, there was a correspondence between learning content and test content (item 1.9), with the highest mean of ($M = 4.19$), suggesting that there was a correlation between the online games and the game-based test format. The lowest mean was content difficulty ($M = 3.95$), suggesting that the learning content did not appear to be difficult.

Pronunciation (item 2.5) was positioned at the highest mean of game design or game interface attributes ($M=4.27$). The lowest mean was ease of use of the layout and menu ($M=3.90$), revealing that some learners felt that the design of layout and menu might create an uncomfortable condition.

Regarding website design or interface, the appropriate background color and font color (item 3.5) and well-designed and interesting homepage (item 3.1) were ranked as the most satisfying indicator ($M= 4.20$).

In terms of usability, learners rated 'learning content can be used in daily life' (item 4.4) as the favorite feature of the online games ($M=4.32$). The lowest means ($M=3.98$) was the usability of the website design (item 4.2).

The mean of three indicators (items 1.2, 2.7, and 4.2) was less than 4.0 but within acceptable quality. This revealed that some issues or features needed to be improved in the future.

(2) Learners' satisfaction with each game: Table 5 illustrates learners' satisfaction or perception on each game.

Table 5. Learners' satisfaction or perception on each game calculated by mean and standard deviation

	Mean	SD
Module 1: Appliances		
Zombie game **	3.82*	1.021
Matching definitions	4.16	.738
Module 2: City and countryside		
Matching place 1/2/3 **	4.11	.813
Hangman	4.17*	.791
Module 3: Food and drink		
Spelling-Vegetables**	4.05	.836
Spelling- Fruits**	4.06	.789
Hangman	4.21*	.684
Module 4: Personal characteristics		
Spelling adjectives**	4.11	.813
Balloon pop	4.13	.775
Module 5: Work and jobs		
Dear lady spelling (Orchao spelling) **	4.06	.823
Two players quiz (Spaceship game) **	4.06	.789

Note: ** = custom-made games

Overall, learners liked the online games as the average mean was greater than 3.50. The top-two most enjoyable games were Hangman game from food and drink module ($M=4.21$) and from the city and countryside module ($M=4.17$). The least enjoyable game was Zombie game from appliances module ($M=3.82$).

Moreover, learners were asked to identify their favorite game in an open-ended format, the game they wanted to be revised or the game that they were not satisfied with, as well as suggestions for improvement.

Favorite game: Overall, 12 of 109 learners (11.01%) (Ls 21,38, 50, 82, 90, 91, 92, 98,99, 100, 101, and 108) noted that they liked all of the games because they were fun and easy. They felt excited while playing the games, the

words in the games were everyday life words, and the answers were provided in the website. The most satisfying game was Hangman (16 learners = 14.68%), followed by Matching definitions (14 learners = 12.84%) and Balloon pop (13 learners = 11.93%).

The following is an example of learners' viewpoints on their favorite games.

Hangman:

'I enjoy play Hangman games. It is fun game.' (Ls 20, 36, 44, 84, 93, 109)

'The game is easy to understand.' (Ls 47, 103, 107)

'It helps me remember the words and write it correctly. I like it.' (Ls 51, 58, 104)

'It is easy to play' (Ls 70, 81)

'I feel so excited. I think I have to survive.' (Ls 94)

'I really like the effect sound. It is so exciting.' (Ls 97)

Matching definitions:

'The game helps me remember the English words easily.' (Ls 4)

'It is very fun.' (Ls 1, 13, 37, 28, 29)

'The game is very easy. I like it.' (Ls 42, 85, 95)

'I can remember the words easily because they are not difficult with illustrations. I really like it. Fun.' (Ls 46)

'It is fun and they are everyday life words.' (Ls 62)

'There is correspondence between learning content (words) and pictures. The pictures are clear and beautiful.' (Ls 26, 64)

Balloon pop:

'The game is not complicated but you need to read fast.' (Ls 5, 17, 55)

'The score of the game is very high. I like it. I feel happy when I get high score.' (Ls 6)

'The game is very fun.' (Ls 35, 41, 49, 54, 57, 59, 86, 88)

'I need to work on game because playing time is fast.' (Ls 60)

The qualitative results were in line with the quantitative results. That is, the top-three favorite games validated by learners were Hangman, Matching definitions, and Balloon pop. Note that, four learners (3.67%) did not give their opinions (Ls 27, 32, 85, and 96).

To sum up, most learners 'gave fun, easy, and exciting games'; 'employed everyday life words'; and 'contained visual and sound effect' as the main reasons for their satisfaction.

Unsatisfying games: Learners were asked to identify the game they felt uncomfortable with. Twenty-one learners (19.27%) (Ls 11, 20, 21, 22, 23, 25, 30, 37, 50, 52, 53, 61, 78, 90, 91, 92, 97, 98, 100, 101, and 103) pointed out that there was no game that they disliked. Twenty-three learners (21.10%) rated the Zombie game as the most unfavorable game, followed by Dear lady spelling (17 learners: 15.60%). The main reason why players did not like the Zombie game was fast speed of the game. The main reason why they did not like Dear lady spelling game was the word difficulty. Seven learners (6.42%) did not give any reasons (Ls 12, 27, 32, 85, 96, and 108).

The following is an example of learners' viewpoint on their unsatisfying games or the games that need to be revised.

Zombie game:

'The speed of game is so fast.' (Ls 4, 13, 18, 19, 28, 41, 42, 56, 57, 60, 75, 85, 94)

'If you have no ideas about the answer, you will die from Zombie.' (Ls 14)

'The game has bug' It was frozen if I couldn't answer. I need to refresh it but sometimes it is hanged.' (Ls 59, 104)

'This game couldn't play via mobile phone.' (Ls 64)

'I am afraid of ghost.' (Ls 58, 84)

Dear lady spelling:

'I am the one who types very slowly so it is timeout. I feel so sad.' (Ls 5)

'It is difficult. I don't know how to play it.' (Ls 35)

'The game is so fast.' (Ls 9, 24, 38, 44, 54, 77, 80, 81, 83, 89, 106)

'I don't like the pictures. I feel confused.' (Ls 70)

'The spelling words are very difficult.' (Ls 68, 69, 79, 82)

(3) Quality of the game-based test format: Overall, learners preferred the game-based testing format since the arithmetic mean was greater than 3.50 (Table 6). As seen in Table 6, the highest pleasant attribute was 'the test content suitability for the test takers' (item 5: $M = 4.26$). The second ranking was 'correspondence between the test content and the learning contents' ($M=4.19$). Item 1 'The test design is easy to understand and practice' was ranked third ($M=4.17$). In general, learners were satisfied with the game-based test format ($M=4.17$).

Table 6. Learners' satisfaction with the game-based test format calculated by mean and standard deviation

Statements	Mean	SD
1. The test design is easy to understand and practice.	4.17*	.803
2. The test contents correspond well with the learning contents.	4.19*	.742
3. I enjoy the game test format.	4.12	.862
4. I think the test format is interesting.	4.14	.814
5. The test content is suitable for English language learners.	4.26*	.753
6. Overall, at what level are you satisfied with the game test design?	4.18	.771
	4.17	

Learners were asked to point out the game-based testing module they liked the most. 42 learners (38.53%) really liked the Matching pictures and Airplane games from food and drink module. The main reasons were 'daily life words, easy to understand, and fun'. The three modules (appliances, city and countryside and work and jobs) were equal in terms of learner's satisfaction (20 learners = 18.35%). Only seven learners (6.42%) liked the game-based testing format in personal characteristic module.

The following is an example of reasons of learners' preferences on the game-based testing format.

Food and drink module:

'There are everyday-life words, vegetables and fruits. It is very easy.' (Ls 16, 47, 70, 83, 107, 109)

'I feel hungry. the picture looks so nice.' (Ls 24)

'Easy words. They are used for cooking.' (Ls 33, 68, 69)

'Easy to understand and easy to play.' (Ls 39, 49, 51, 54, 57, 65, 66)

'I like it. It is fun and knowledgeable.' (Ls 43, 45, 75, 87)

'There are many words and menu. I like eating.' (Ls 108)

Appliance module:

'The pictures are beautiful.' (Ls 8)

'I can apply what I learn to my work.' (Ls 19)

'It is fun. I feel happy to play games or do the tests.' (Ls 20, 32)

'It is fun. I acquire more words.' (Ls 35, 60, 79, 80)

'It seems that I travel to many places and learns new words.' (Ls 38, 97)

'I learn city and countryside words and some words I don't know them.' (Ls 55)

Work and Jobs module:

'There contain frequency words. Every day words.' (Ls 1, 58)

'Easy to understand.' (Ls 15, 40)

'I have chance to learn new words. It is fun.' (Ls 22, 23, 48)

'I am good at this category because I have learned in the classroom.' (Ls 73, 76, 100, 102, 105)

Learners were asked to provide suggestions and recommendations for further development. Twelve learners provided some suggestions. Eighty-one learners did not give any comments or suggestions.

Comments and suggestions from twelve learners are as follows.

‘I think overall is very good. But some games, they are difficult to drag and drop the English letters.’ (Ls 3)

‘Pictures of rice cooker and water boiler are similar. I cannot identify it.’ (Ls 15)

‘The games are fun and gain vocabulary knowledge. I would like to add more player-name when I finish play games.’ (Ls 31)

‘I would like to have ‘clues’ to help me. Also, if I can talk and pronounce the words, it will be perfect.’ (Ls 44)

‘They are good games. I can play without feeling boring.’ (Ls 55)

‘Learning clip should use the authentic pictures. Sometime drawing pictures are not real and should provide more time to watch it.’ (Ls 69)

‘I think I have problem with accessing the games because of layout and menu. I would like to have more interactive features.’ (Ls 70)

‘Sometimes games are frozen and I need to refresh it.’ (Ls 97)

‘I would like to play game both PC and mobile phone. It might be better to play only on PC.’ (Ls 103)

‘Some games, the pictures are quite small.’ (Ls 105)

‘I hope to have more varieties of games.’ (Ls 107)

To sum up, these findings reported that the online games were quite good. That is, learners had positive’ attitudes towards the online games. In fact, they liked the online games as shown from learners’ views on the online games both quantitatively and qualitatively. However, learners pointed out that the games might be better if some problems were fixed and more interactive features were added on.

6.2 Examining Effectiveness of the Online IDLL Games Regarding English Vocabulary Knowledge at B1 Level

One hundred and twenty-two learners did the pretest, whereas 94 took the posttest, as shown in Table 7 (mean, standard deviation, standard error mean, and the number of observations). The results indicated that the average test score before training with the games was 81.62 (SD=15.76), and the average test score after training was 88.13 (SD = 9.17).

Table 7. Descriptive statistics of the variables (mean, standard deviation, standard error mean, and the number of observations)

	N	Minimum	Maximum	Mean	SD	Variance
Posttest	94	56.0	100.0	88.127	6.461	9.171
Pretest	122	20.0	100.0	81.623	13.936	15.759
Valid N (listwise)	94					

Tables 8 and 9 showed correlations between pretest scores and posttest scores after online training. The correlation coefficient showed that there was a significant positive relationship between the test score before training and after training [r (94) = .283, p = .000].

Table 8. Paired Sample Statistics

		Mean	N	SD	Std. Error Mean
Pair 1	Posttest	88.127	94	9.171	0.946
	Pretest	80.680	94	16.587	1.711

Table 9. Paired Correlations

		N	Correlation	Sig
Pair 1	Posttest & Pretest	94	0.283	.000

Table 10 showed the paired sample t-test results. In this study, $p = .000$. indicated that there were significant differences between pretest score and posttest score after playing the online games.

Table 10. Paired Sample Test

Pair	Posttest-Pretest	Paired Differences		Std. Error Mean	95% confidence Interval of the Difference		t	df	Sig
		Mean	SD		Lower	Upper			
		7.447	16.525		4.062	10.831			

In this study, an effect size (ES) Cohen's d was 0.505, indicating a 'medium' effect'. That is, learners performed significantly different on the B1 vocabulary after playing the online games.

The results of the t-test dependent sample [$t(94) = 4.37$] together with a 'medium' effect size (ES = 0.505) indicated that learners' English vocabulary knowledge at the B1 level slightly improved after playing the online games. Therefore, we can reject the null hypothesis is that posttest scores are less than pretest scores. In other words, there is 'positive' effect of the online games on English vocabulary knowledge and research hypothesis 'the means of students' posttest scores is higher than that of pre-test scores after studying the online IDLL games', was accepted.

A 'medium' effect size also confirmed that learners had learned and performed differently after playing the online games.

To sum up, these findings suggested that the online games effectively improved learners' performance (vocabulary knowledge), with a medium effect size.

7. Discussion

This study aimed at constructing online game prototypes in order to enrich English vocabulary knowledge. Findings of the study were systematically discussed in two parts according to the research questions.

7.1 Assessing Quality of the Online IDLL Games

Two parties—experts and learners—were involved in this process. The results revealed that experts and learners viewed the online games as good activities, though the games needed to be revised in some parts. The findings also reported that learners had positive attitudes toward the digital games.

The findings were quantitatively and qualitatively concluded in three aspects: overall quality of the online IDLL games, learners' game preferences, and game-based testing.

Overall quality of the online games: Experts expressed that the games were fun and interesting, whereas learners articulated that the games made them enjoy language learning and that they felt excited, the games contained daily life words and helped them remember words easily with visual and audio effects. Experts rated the website interface as the highest feature ($M=2.88$), whereas learners positioned usability as the best feature ($M=4.16$).

Qualitative information also confirmed that learners felt pleased and excited when playing the games and that the games helped them remember and understand B1 words easily. They liked the pictures, which helped them remember the words comfortably. They realized that each game had different difficulty level. Most importantly, they mentioned that what they learned in the game-based learning matched with what they were tested on and what they faced in daily life.

Learners' game preferences: Both experts ($M=2.96$) and learners ($M=4.21$) liked 'Hangman' game. The design of Hangman game was simple, while the game provided learners with opportunities to practice their vocabulary by spelling, pronouncing, and guessing letter by letter (Munikasari et al., 2021).

The unsatisfying games assessed by experts and learners were Ballon pop game ($M=2.46$) and Zombie game ($M=3.82$), respectively. For experts, three main attributes that caused unfavorable preferences were high level of difficulty, short length of playing time and quality of the multimedia. The small font size was the main reason for dissatisfaction with Ballon pop game. As players needed to read definitions and match them with the correct B1 words, if the definition of each word was too detailed, it would cause a small font size on the screen, and then it was difficult to read. For learners, a fast game like Zombie might cause pressure and; thus, was the main reason for their dissatisfaction. Also, the game players were lost or frozen when they made mistakes.

Game-based testing: The highest mean of the game-based testing format viewed by experts was testing content, indicating that the test content corresponded well with the learning content ($M=3.0$). On the other hand, learners rated suitability of the test content for test takers ($M=4.26$) as the first rank, followed by ‘correspondence between the learning content and test content’ ($M = 4.19$). Experts liked Maze chase game ($M =2.96$), whereas learners liked Matching pictures and Airplane games (42 learners = 38.53%). The qualitative information indicated that learners liked the game-based testing as each word was used in daily life and was easy to understand. Learners had fun with the test format.

In sum, game-based learning proves to be a useful method for educators to enrich language performance. Learners prefer an enjoyable environment and a playful spirit (Ni Chiarain & Ni Chasaide, 2017) as it enhances interactive learning experiences and bolsters independent learning (Lin et al., 2018, and Lin and Lan, 2015), and enhances vocabulary knowledge and motivation (Fithriani, 2021). That is, learners’ vocabulary knowledge is easily acquired and directly influences or has an impact on language development.

Moreover, from the findings, as learners spent 2.45 hours playing games per day, it might be an intellectual curiosity for educators to use it as a learning method to help learners enhance language knowledge. The more playing time spent, the greater the language knowledge can be acquired. In other words, the long-playing game time with a well-designed and enjoyable environment will enhance learner’s language performance.

There were many types of games used in this study, for example, ‘diversion features and fantasy’ settings’: flying, driving a space ship, fighting with Zombies. Undeniably, there were some problems regarding learning content, game design issues, website design, technical limitation, and human errors in the online games.

Regarding learning content issues, the B1 vocabulary used in this study was suitable for learners and was not too difficult.

In terms of game design issues, the design was generally at an acceptable level; however, the ‘layout and menu’ needed to be adjusted in order to enhance accessibility. At the same time, learners might feel confused with capital and lower-case letters of two games: the lower-case letters in Spelling-vegetable game and capital letters in Dear lady spelling game. Importantly, the fast game time could cause negative emotions because of losing competition, and later losing the learning content. Psychologists concluded that humans are truly competitive and do not like losing; thus, too much competitiveness in the game time might cause unfavorable issues. In order to minimize the negative feelings, extending the playing time is needed in the future. The researcher also hopes that high learning outcomes (analyzing and evaluating) proposed by Bloom’s taxonomy (1956) might be acquired if game players think about why they lose and learn to solve the problems. This process is called constructing a productive failure (Anderson et al., 2018).

With reference to website design issues, a significant problem might be difficulty of the menu attributes, making users feel uncomfortable while playing the games. Moreover, both experts and learners recommended inclusion of learning and testing records in order to mark their improvement.

Technical limitation issues included no accessibility in the mobile platform for some games, especially the custom-made games. Note that all games were constructed by the researcher since no one accepted the hiring agreement. It is hoped that in the next development and implementation, there should have more game-based instructional designers and specialized computer programmers to join the team. More varieties of custom-made games are required in the future. Finally, the online games had some typos; however, human errors can be solved quite easily.

Online games mostly concentrated on spelling since objectives of the game activities are to remember and understand English vocabulary at B1 level. However, the game genres preferred by learners were action games, role playing games, and strategy games. It is a challenge to design a digital game for EFL learners as an action game, role playing games, and strategy games. There are significant differences between the world of PC games and that of educational games. If the world of games meets the world of educational games, English language learning and teaching can be improved dramatically.

From the researcher’s experience, English-speaking ability of gamers is quite ‘good’ in terms of gaming orientation. Learners feel confident in communicating about their preferred games. If learners want to win the game, they need to have some assistance from their game partners. As a result, they communicate in English with their partners or enemies. If language educators and game technicians work closely together, EFL learners’ performance might be significantly improved because of interactive, authentic, challenging, fantasy, curious, mysterious and diversified game-based settings. One caution is that educators need to beware of violent games used in educational contexts.

Note that, in this study, the games acted as ‘standalone activities’ that were not related to the learning course. In fact, some vocabulary learned in the games was in the textbooks as well. EFL teachers need to recognize the roles of digital games in the classroom; digital games can be the main teaching method, supplementary materials, or extra activities. Each role has different ways to be implemented. For example, if EFL teachers use digital games as the main teaching method for an entire course, there might be difficult utilization and a need for more methodical, systematic, and pedagogical design. The standalone extra activities in this study might help learners feel less anxious because there was clearly no effect on their grade.

7.2 Assessing Effectiveness of the Online IDLL Games

The t-test dependent sample [$t(94) = 4.37$] together with a ‘medium’ effect size ($ES = 0.505$) indicated that the learners’ English vocabulary knowledge at B1 level slightly improved after studying the online games. Although the number of test items might be ‘small’, the medium effect size proved the enhancement of English vocabulary knowledge at B1 level. At least, evidence on ‘what works was found’ in this study.

The online games are currently positioned as ‘phototype’ games; they need further development to include more innovative games as well as more themes. It is suggested that all issues need to be revised, professionally reconstructed, more themes need to be incorporated, and with a variety of games as well as learning and testing records in order to ensure that learners are placed in a safe entertainment with educational settings.

Moreover, future studies on identifying teacher’s perceptions of game-based learning in the EFL classroom might be studied as well. Digital games are not easy to implement as teachers have to take many responsibilities, for example, connecting the games with the course content, creating enjoyment and educational games and minimizing learners’ stress. This might cause overloaded responsibilities. As a result, positive attitudes towards games are a key success factor in implementing digital games.

One surprising finding was that EFL learners lack English game-based learning experience. Digital game engagement in the EFL classroom in the Thai context should be increasingly implemented both inside and outside classroom because of effectiveness of their quality. Both the advantages and disadvantages of implementing games in the language learning and teaching process need to be systematically researched as well.

Most importantly, it is a challenge to design games or digital games to reach the six learning outcomes on Bloom’s taxonomy. Design of the online games focused on helping learners acquire only two levels of learning outcomes (Bloom’s taxonomy): remembering and understanding (Bloom, 1956). The other four learning outcomes were not included. The higher learning outcomes to acquire, the harder learning activities or material design will be. Due to complicated activities, materials, learning process, and learning assessment, language educators need to put more energy into designing digital games as well as having a professional team to support each process of the game development. Thus, it is quite challenging and worthwhile to examine the effectiveness of digital games.

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Notes

Note 1. The Common European Framework of Reference for Languages (CEFR) is an international standard for describing language ability. It describes language ability on a six-point scale, from A1 for beginners, up to C2 for those who have mastered a language. The CEFR B1 level means learners or someone can (1) understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure, etc.; (2) deal with most situations likely to arise whilst travelling in an area where the language is spoken; (3) produce simple connected text on topics, which are familiar, or of personal interest; and (4) describe experiences and events, dreams, hopes & ambitions and briefly give reasons and explanations for opinions and plans.

Appendix A

Activity Packages

Online intermediate daily life lexicon (IDLL) games: The online games or WordWise4B1 games consist of five modules: appliances, city and countryside, food and drink, personal characteristics, and work and jobs.

There is no need to study sequentially; for instance, learners can begin at Module 5, 3, 1, 2, and 4. After volunteer learners apply for playing the games, they will receive game player numbers, Line ID, and website links. Most importantly, in order to increase learners' comprehension of participating of the online games, the Q&A VDO clip or talks, together with the website developer clip, were provided, and learners were asked to watch them before playing games.

I. Learning Activities: Five main activities of the online games were (1) pretest, (2) learn, (3) play (game-based activities), (4) module test, and (5) posttest. Both pretest and posttest were used for assessing effectiveness of the developed online games only.

Activity 1: Pretest. The learners were assigned to take a mini pretest and complete the learning experience questionnaire.

Activity 2: Learn.

Step 1: Learning Objectives. Learning objectives were provided on the website in VDO clip PowerPoint presentation.

Step 2: Learn. Some words were presented in whiteboard animation together with visual and audio features. Visual features included each word illustration, whereas audio features include word pronunciation (Doodle program).

Step 3: Worksheet. The whole word sets of each theme were equipped via VDO clip PowerPoint presentation. Definitions of each word and visual and audio features were provided as well.

Activity 3: Play.

Step 1: Game manual. A manual for the games was included in a VDO clip PowerPoint presentation.

Step 2: Play. Learners played the games. They could play them as often as they like. Duration of the online games was two months.

Activity 4: Module Test.

Step 1: Exam manual. A manual for the game-based testing format was provided in a VDO clip PowerPoint presentation.

Step 2: Test. Learners were asked to take module tests in a game-based format.

Activity 5: Posttest. Learners were asked to retest on B1 vocabulary knowledge and completed learners' satisfaction questionnaire.

II. Learning Materials and Evaluation

2.1 Learn (Game-based learning): There were two types of learning games, namely, seven custom-made games and four ready-made games.

2.2 Formative test/Module test (Game-based testing): Eight game-based testing formats were ready-made games. The following table listed the game-based learning and game-based testing.

Module	Game-based learning		Game-based testing
	Custom-made games	Ready-made games	(Ready-made games)
Appliances	Zombie	Matching definitions	Matching pictures
City and countryside	Matching place 1, 2, 3	Hangman	Matching pictures
Food and drink	Spelling-Vegetables	Hangman	1. Matching pictures
	Spelling-Fruits		2. Airplane
Personal characteristics	Spelling adjectives	Balloon pop	1. Maze chase
	Dear lady spelling/Orchoa spelling		2. Win or lose quiz
Work and jobs	Two players quiz games (Spaceship game)	–	1. True or false
			2. Crossword

2.3 Summative Test (Pretest and Posttest): The mini pretest and posttest consisted of 25 items. Each theme had five words with total scores of 100 points. The mini pretest and posttest have five parts. The test specification is presented in the following table.

Part	Test Specification
1. Appliances	Pictures of appliance words are shown in the online test. Test takers need to type letters or characters into the blanks. The first character or the first two characters are provided.
2. City and countryside	Pictures of city and countryside words are shown in the online test. Test takers need to type letters into the blanks. The first character or the first two characters are provided.
3. Food and drink	Pictures of food and drink words are shown in the online test. Test takers need to type letters into the blanks. The first character or the first two characters are provided.
4. Personal characteristics	Test takers need to complete the sentences with correct words. The test includes pictures and there are three multiple choices.
5. Work and jobs	Definitions and pictures are shown in the online test. Test takers need to choose the correct answer from three multiple choices.

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