Digital gamification in memory recall of English vocabulary with lower-elementary students

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ABSTRACT

Vocabulary is key to English language learning; it is the basis of all languages. However, learning long lists of words and their meanings can be ineffective, tedious, and boring. This is especially true for lower elementary students as they navigate school life and development. Can digital gamification solve this problem?

The purpose of this positivist approach, quasi-experimental, individual action research, is to investigate the effects of using a digital gamification tool called Bamboozle on memory recall and to explore the effects of digital gamification as an instructional method on the motivation of lower elementary Thai ESL students to learn. It can also be used as a basis for schools to become more digitized and to have digital resources available for teachers and students. The experimental group consisted of 23 Grade 2 Thai ESL students with current CEFR A2 – B2 levels. This sample group was a convenience sample of grade 2 ESL students at a private school in Thailand.

The experimental period was four weeks, and 4x word lists of 10 new English vocabulary words per word list were used weekly over this period. This equates to 4x pretests, 4x posttests, and 4x delayed tests. Mean scores, a researcher's log, and a questionnaire were used to measure and analyze the results. The test scores were used to analyze the quantitative data. A researcher log and closed-ended questionnaire were used to collect qualitative data. Mean scores and analysis of quantitative data will be used to determine a pattern of higher test scores when using Bamboozle as an instructional method. Qualitative data analysis was used to determine students' motivation levels when using different instructional methods.

This was primary research, conducted in the field.

From the collected data, students were visibly motivated to learn when using Bamboozle as an instructional method. Students also noted that they preferred to use computers when learning as opposed to textbooks.

Most of this experimental group stated that they enjoyed learning English and that they did not find it difficult to do so, which could positively affect test scores, as they were already motivated to learn and confident.

In terms of positively impacting memory recall more than the traditional method of the present and repeat using a PPT, the data do not show Bamboozle as more effective as an instructional method. It could be deduced that students are forced to concentrate better when there is less hyperenergy in the classroom that is created when there is a ‘game’ involved.

However, there is little doubt that Bamboozle stimulated the desire to learn, which is evident from the atmosphere and motivation levels of the students observed before and during the Bamboozle lessons. This research implies that classrooms should have a degree of digitization that affects students’ motivation to learn, and digital gamification, as an instructional method, has value and will continue to develop.

Keywords: digital gamification, memory recall, Bamboozle, ESL, vocabulary learning

RATIONALE FOR RESEARCH

Vocabulary learning plays an important role in language teaching, especially in contexts where English is taught as a foreign language. This is because lexical competence is now seen as the heart of language learning and the goal of language teaching is to improve learners’ language competence (Saengpakdeejit, 2014).

While gamification has been a hot topic in education for some time, the pandemic has accelerated the digital development of various instructional tools in the educational space, with gamifying learning content being one of them. The gamification in education market size was valued at USD 742.01 Million in 2020 and is projected to reach USD 6550.3 Million by 2028. The effectiveness of this instructional method is still debated, and prior research in the field has been largely based and not specific to a singular gamification tool. Some researchers agree that active engagement in cognitive processes is necessary for effective and sustainable learning, as well as deep levels of understanding (Wouters et al. 2013) and that active learning in educational psychology is aligned with the (inter)active nature of games (Wouters et al. 2013). There is also much empirical evidence that illustrates that, as a rule, enactment encoding or ‘learning by doing’ leads to better memory for simple actions, compared to verbal learning (Steffens et al. 2015).

How to keep students motivated in learning vocabulary and the most effective method of learning vocabulary are two questions that are at the top of mind in the ESL teaching community. While there is a difference between ‘learning’ and ‘memorization,’ we will focus on memory recall and motivation to learn.

There are several digital gamification tools for vocabulary on the market, and this offering is still growing. One such tool has community members claiming that they learn ‘45 new words per day’ (Memrise Community, 2017), while others claim 10 – 15 (Study.com, 2022) commenting on the app Duolingo. Bamboozle, a user-customized digital gamification tool, states that ‘game-based learning is fun’ and ‘game-based learning improves memory’ (Bamboozle Blog, February 2022) however they do not quantify anything.

Memorizing long lists of vocabulary words tends to be ineffective in recalling them, and most researchers and educators now agree that the greater the depth of processing involved in lexical learning, the more secure and long-term the learning is likely to be (Barfield and Gyllstad 2009).

Although the effects of ‘digital gamification, ‘gamification,’ and ‘game-based learning’ have been explored, to date there is no specific research on Bamboozle as a tool. This tool is simple to use and easily customizable so that teachers can vary the content, and it is seemingly eye-catching and interactive for students. Vocabulary learning is a key focus area for schools in Thailand, with great emphasis placed on it. English is a compulsory subject in the Thai education system. Moreover, in basic education, English is the only foreign language taught in all grades. (Liping, H. & Sirinthor, S, 2010).

Due to the varying and complex nature of students’ development, with several factors impacting it (socioeconomic status, home environment, experience, school environment, etc.), as well as the ethical and limiting factors when studying the human brain and learning, it can be challenging to study and gain consensus on memory recall in students.

Lower elementary students need to recall new L2 vocabulary words, their meanings, and their applications in sentences effectively, both in the short and long term. However, memorizing a long vocabulary list may be ineffective.

Current English instructional methods are unsuccessful in helping learners have competence in learning English (Konkerd, 2013), since most classrooms are teacher-centered (Noytim, 2006).

In a study with Chinese elementary students, the results revealed that students who used digital flashcards statistically outperformed those who used paper flashcards on immediate post-tests of Chinese word reading and listening (Jui-Teng, Li, & Fuhui Tong, 2018).

Thai students are poorly motivated because of unchallenging English lessons and the lack of educational technology in classrooms (Tanaporn Kongprab, 2019). Motivation to study among lower elementary students can be particularly challenging, as various factors impact motivation, and they are not all within the educator's control.

RESEARCH QUESTIONS AND RESEARCH OBJECTIVES

1. Does digital gamification positively impact memory recall of English vocabulary in the working and long-term memory of lower elementary students?

2. Does using an instructional tool such as Bamboozle increase students' motivation to learn new English vocabulary?

Yousefi and Biria (2018) stated that there is a gap in the research on the effect of the context of L2 vocabulary instruction on the acquisition and retention of target words. Wilkins (1972) argued that without grammar, very little can be conveyed, and without vocabulary, nothing can be conveyed. Without learning an L2 vocabulary, no L2 language can be learned. There is currently no published research on the use of a specific digital gamification tool, Bamboozle, in vocabulary acquisition and retention in lower elementary students. This research is being conducted to ascertain the effect of digital gamification on motivation, acquisition, and retention of L2 vocabulary in lower elementary students, as it will benefit ESL teachers and students worldwide. The study aimed to observe a positive increase in test scores as well as learning motivation in the sample group.

The scope of the action research and focus of the study were 23 Grade 2 Thai students at a private school in Khon Kaen, Thailand. The sample group had current CEFR A2 – B2 English proficiency levels. When the group was asked whether they enjoyed learning new English vocabulary, there was a mixed response of yes and no, and some students said that it was difficult to learn new words and remember them for the test. In this study, we focused on positive memory recall, intending to positively increase students' test scores.

HYPOTHESIS

In an increasingly digitally connected and digitally native youth, a digital gamification tool improves memory recall and motivation levels in lower elementary ESL students.

LITERATURE REVIEW

Vocabulary is the building block of any language. Hunt and Belglar (2005) believed that "the heart of language comprehension and use is the lexicon since speakers cannot express themselves and understand others with inadequate vocabulary." Numerous technologies have been adopted to overcome this challenge (Huang et al., 2017), to increase engagement and simplify the learning of students with diverse proficiency levels in language learning.

Incorporating ICT into teaching and learning has proven to be a better teaching method, as learners are more inclined toward a more relaxing atmosphere of learning (Noureddine, 2017). Noureddine (2017) also stated that positive language learning can be achieved through the integration of technology. Online games can be used to promote learning among students. With adequate facilitation from the teacher, online tools can enhance learners' language (Krystalli et al., 2014).

Because students are familiar with technology and they will learn better within a technology-based environment, the issue of ICT integration in schools, specifically in the classroom, is vital (Ghavifekr & Rosdy, 2015, p. 175).

Games are popular among ESL teachers and are beneficial for education. The main reason for a game to be a successful tool in aiding learning is that it provides a competitive platform that

motivates learners to fully engage in the activity (Bullard & Anderson, 2016; Bullard & Anderson, 2014). This means that many educators today prefer to use a more stimulating method to deliver their lessons, rather than the talk-and-chalk method (Hashim et al., 2019). Concepts and experience in the real world can be fostered through games, which prove to be an effective tool for learning (Hashim 2018; Santhanam et al. 2015). As an educator in 21st-century learning, integrating digital elements into the classroom and instructional methods is crucial.

Teachers, administrators, and schools should adhere to the ever-changing field of education to ensure that learners achieve their maximum learning experience. Concerning the evolution of technology, a firm belief is that learning can be enhanced by using games is ignited. Online language games can cater to independent learning and enhance learners' language skills (Krystalli et al., 2014; Wiggins, 2016). Language learning technology can boost variety and increase the diversity of learning environments and opportunities and enhance the quality of the learning experience by making class content more varied and accessible to almost every individual learner, thus ensuring more participation and engagement among learners (Pennington, 1996).

Today, pedagogy is interlinked with technology, automation, digitalization, and entertainment, leading to more forms and means of education. Additionally, learning is enhanced through exposure to English media, intercultural and global knowledge, and meaningful language-learning activities (Anak Yunus & Hua, 2021; Maasum et al., 2015). Teachers are encouraged to be creative (Mee et al.,2020). They are also encouraged to exploit the advantages of technology and maximize the use of digital materials in lessons. Along with rapid advancements in education, teaching and learning are modernized and supported by technology (Anak Yunus & Hua, 2021; Welbers, K et al., 2019; Hashim, Y et al., 2019). Chambers and Yunus (2017) described the significance of different approaches and classroom activities are significant in catering to students' different needs for effective learning. It attracts students' attention and interest in learning complex English (Pazilah, Hashim, & Yunus, 2019; Sanchez-Mena & Marti-Parreno, 2017). In any case, English is often considered dull and challenging to acquire but could be exciting when fun approaches are implemented (Rahmani, 2020; Rafiq, P et al. 2019).

Looking at a simple, summarized overview of current research on gamification, the consensus is that it positively impacts students' motivational levels to learn and that it positively affects vocabulary gain and retention. It was found that there was more consensus that gamification and digital gamification positively affected students' motivation to learn and enjoyment of classes; however, there were limitations and more unknown variables when they had a positive impact on learning, memory recall, and/or retention, and understanding of learning material. This is understandable because of the complex nature of human beings and how they learn and the emerging body of research on digitization in students' lives and in the classroom.

While there is current research on gamification versus game-based learning, as well as other digital gamification tools such as Kahoot, Quizizz, Google Forms, and others, nothing has been found that is specific to using Bamboozle as an instructional tool.

Playing games helps to promote a degree of enjoyment. Additionally, games can arouse intrinsic motivation (Malone, 1981). The design and use of a diverse array of digital games to learn or teach a second or foreign language (L2), broadly referred to as digital game-based language learning (DGBLL), has also significantly expanded (Cornillie et al. (2012), which speaks to the interest of both students and teachers in using this medium.

In a Thai context, Chaiyo and Nokham (2017) conducted a study with 121 undergraduate students attending a gerontological nursing course four hours a week for one full semester. They investigated the use of Kahoot! Quizizz and Google Forms affected the students' concentration, engagement, enjoyment, perception, motivation, and satisfaction." The results revealed that students learned better from doing the quiz via these learning technologies, and there was a statistical difference in concentration, engagement, enjoyment, motivation, and satisfaction. Kahoot! and Quizizz showed more positives than Google Forms when applied in the classroom.

Wichadee and Pattanapichet (2018) also investigated the impact of Kahoot! with Thai students from a private university. After the study, they found that students in the experimental group obtained higher scores than those in the control group did. This is because they had more fun playing Kahoot! while learning grammar and vocabulary. Moreover, they had positive perceptions regarding the application of digital games in English classes. The researchers

supported that Kahoot! can be used to stimulate learning, particularly language improvement, which can occur in a pleasurable learning environment.

METHODOLOGY

This action research is a theoretical, quasi-experimental, quantitative, and qualitative research model that uses a one-group pretest-posttest research design, an inductive research method, and a cross-sectional study. The research was a one-group pre-test post-test, as it attempted to test the cause-and-effect relationship between instructional methods and effective memory recall in a class of grade 2 ESL learners. I am attempting to prove the causation between instructional methods, test scores, and students' motivation to learn. It is a one-group pre-test post-test in nature because there is one experimental group. The independent variable was the instructional method, and the dependent variables were the students' test scores and the outcome of the motivation to learn questionnaire. It is theoretical in nature as it attempts to explore an assumption.

Description of participants

The experimental group was my current grade 2 class and was chosen because it is my responsibility to teach them L2 vocabulary that the school tests on as part of their formative assessments. A major question for myself and other ESL teachers is how best to do this and what is the most effective way to achieve good test scores.

The experimental group for this study included 23 grade 2 ESL students with current CEFR A2 – B2 levels. Their native language is Thai.

Description of intervention (treatment) and/or data collection tools/ materials

The current instructional method that the school advocates for this learning outcome is the 'present and repeat' or 'chalk and talk' method where the teacher presents the new word and its meaning, and the students are asked to repeat the word, spell the word verbally and are then given the meaning on the board.

The digital gamification tool used was Bamboozle, a digital user-customized teaching game platform.

The study will take place at a private school in Khon Kaen, Thailand, on Tuesdays during the same periods, 9.20 – 10.10 for the pretest, teaching, and posttest and Wednesdays 12.50 – 13.05 for the delayed tests in the homeroom classroom using the TV monitor and computer in the classroom.

Students will be exposed to two instructional methods. The first is the traditional 'present and repeat verbal memorization method, and the second is interactive digital gamification using the Bamboozle tool. Students will not be given access to words to perform additional studies and practice at home.

The study will be conducted over four weeks with four sets of 10 new vocabulary words and their meanings from the second-semester grade 2 vocabulary book. Students have not yet been exposed to these words through their textbooks; however, it is unknown whether they have been exposed to them through other avenues.

Independent variable: Instructional method
Instructional methods tested: Present and repeat & Bamboozle digital gamification
Dependant variable: Test scores & motivation to learn questionnaire
Experimental group: 23 grade 2 Thai native students learning English as a second language

Testing Schedule

Week 1:	Word list 1	Instructional method: PPT	Tues: 9.20 Pretest – teach – posttest	Wed: 12.50 Delayed Test
Week 2:	Word list 2	Instructional method: Bamboozle	Tues: 9.20 Pretest – teach – posttest	Wed: 12.50 Delayed Test
Week 3:	Word list 3	Instructional method: PPT	Tues: 9.20 Pretest – teach – posttest	Wed: 12.50 Delayed Test
Week 4:	Word list 4	Instructional method: Bamboozle	Tues: 9.20 Pretest – teach – posttest	Wed: 12.50 Delayed Test

Detailed and descriptive data collection procedure

The researcher for this study is me; I am a qualified ESL teacher with a Bachelor's degree and TEFL and has been teaching grade 2 Thai students for the past two years. I used quantitative data to measure the first research question and qualitative data to measure the second research question. An inferential analysis will then be used inductively to generalize the findings from the sample group to the population and draw conclusions.

Testing will take place via paper tests, 10x multiple choice, and 10x gap-fill questions to test students' recall and knowledge of the meaning of each of the 10x new vocabulary words. Students will be given 15 minutes to complete each test.

The test scores were tabulated and analyzed. Post-test and delayed test scores were compared to infer whether a positive recall had taken place. The mean scores of the posttests and delayed tests from each instructional method were then compared to infer which instructional method produced better test results. This is primary research, as I am conducting research in the field. The test scores and motivation to learn the questionnaire were used to measure the effectiveness of the instructional methods. Inferential statistics were used to apply the sample findings to the population.

DATA ANALYSIS & PRESENTATION OF RESULTS OF FINDINGS

Data Analysis

Seven data sources were used in this action research. The pre-, post-, and delayed tests of students in a 2-part test format were used to test the recall of newly learned English vocabulary words. The initial testing format gave Part 1 multiple choice, and Part 2 write the word of the given definition. This was to test the recall of the correct word relative to the meaning given and the correct recall of the spelling of the newly learned vocabulary word. This test format was used for the first two datasets.

The testing format was slightly amended for the following two datasets because it was observed that students were rushing to finish, and this was where the spelling errors came from, which

affected their total test scores in the post and delayed tests. The testing format was altered to include multiple choices in Part 1 and using the vocabulary word in a sentence correctly in Part 2, removing the test for spelling and giving a second opportunity to test correct recall in the form of correct usage of the meaning of the new vocabulary word.

Four-word lists of 10 new vocabulary words were used, which equated to 4x pretests, 4x posttests, and 4x delayed tests.

Mean scores were generated for each dataset using pre-, post-, and delayed test scores from the experimental group.

Two qualitative questionnaires were used to gather data on students' motivation to learn English vocabulary and their perceived preferences regarding how they learned English. The final data source was my observations as a researcher, which I detailed and reflected on at each delayed test data collection point. My research logs were analyzed with the research questions. Questionnaires and researchers' logs were used to identify trends and themes in learning behavior and attitudes.

Findings and Results

At the close of this study, the results from the pre, post, and delayed assessments were compared. First, across both instructional methods, there was an increase in test scores from pretest to post-test. This is expected, as students recall words once they have been exposed to them. This will not be mentioned again, as the analysis will only be conducted across post and delayed test scores.

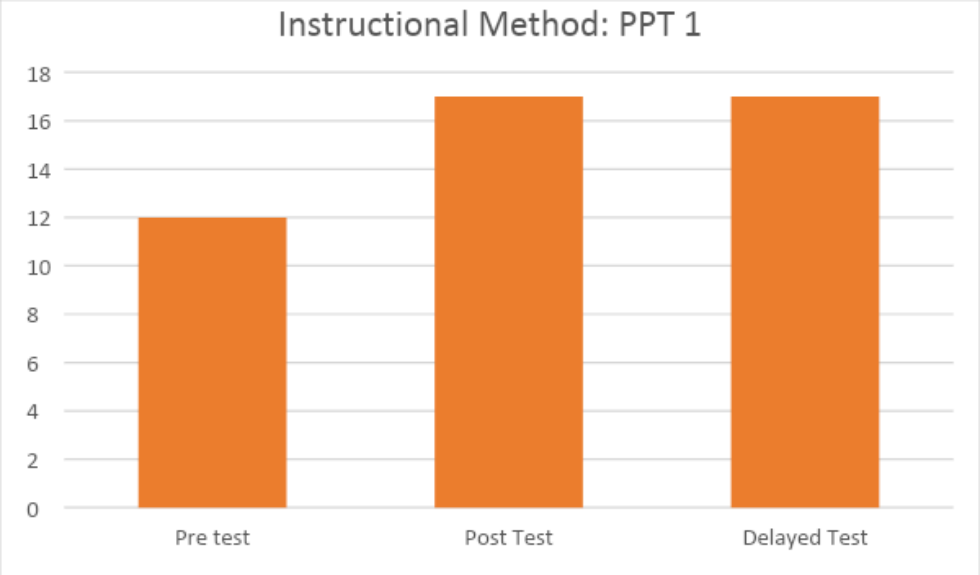

***Figure 1*: Mean scores of pre, post, and delayed test scores out of 20 using the PPT instructional method with word list 1**

The mean scores across the post-test and delayed test for the instructional method PPT remained the same, and no change was observed.

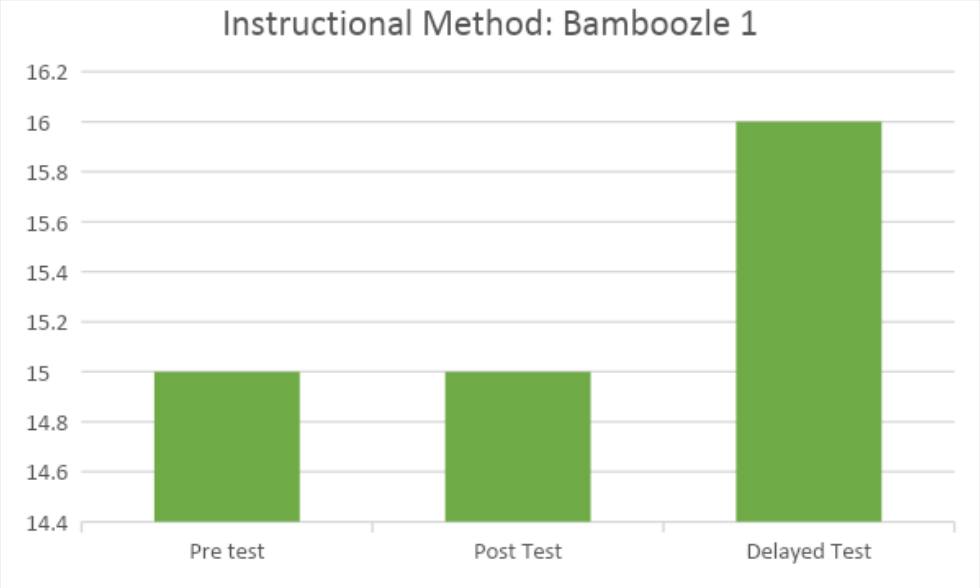

***Figure 2*: Mean scores of pre, post, and delayed test scores out of 20 using the Bamboozle instructional method with word list 2**

Mean scores across the post-test and delayed test for the instructional method Bamboozle significantly increased by one mean score point.

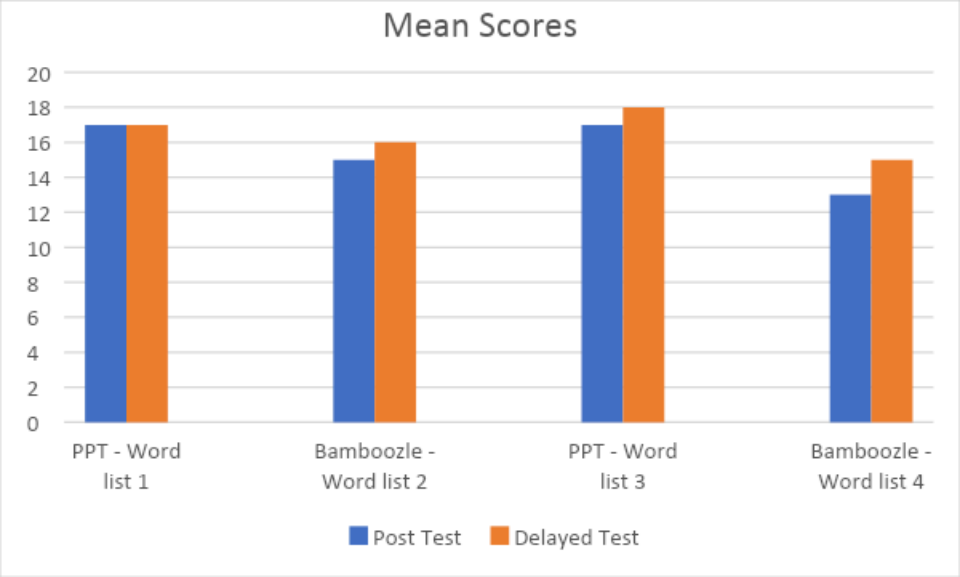

***Figure 3*: Mean scores of post and delayed test scores out of 20 per word list and instructional method**

Aside from the initial word list test, where scores remained the same, all other datasets showed an increase in test scores from post-test to delayed test, regardless of the instructional method.

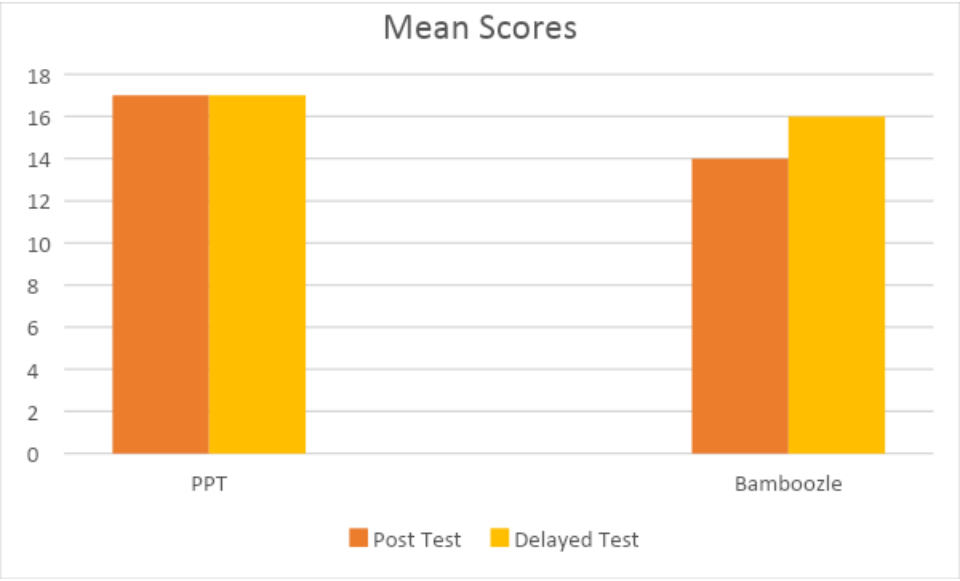

Figure 4: **Posttest and delayed test mean scores rounded up**

The mean scores across the word lists were rounded up. The PPT instructional method across both word lists tested in the post and delayed tests showed a mean score of 17 each. The Bamboozle instructional method across both word lists tested in the post-and delayed tests showed mean scores of 14 and 16. The PPT instructional method showed a higher average test score of three and one base points.

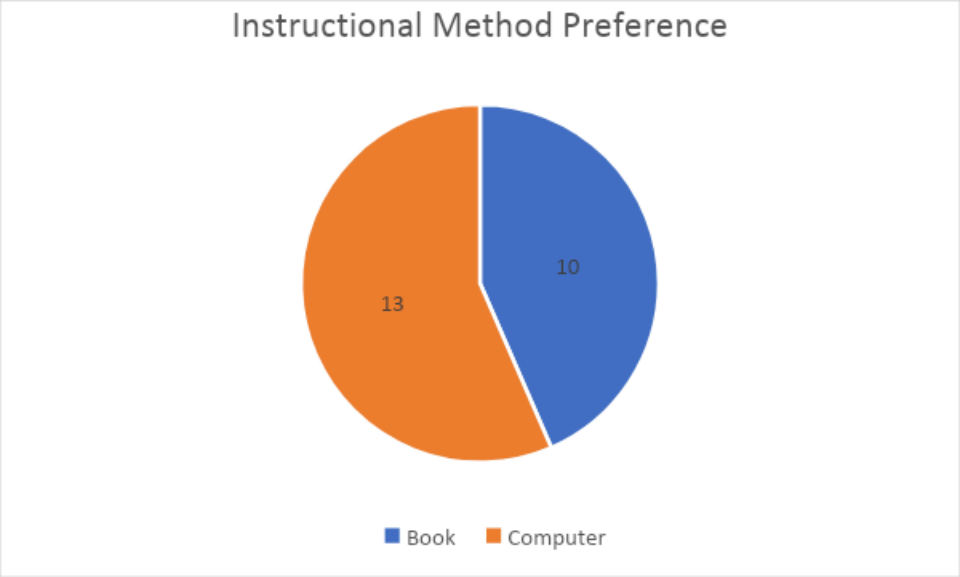

Figure 5: **Student answers to their preference of learning vocabulary**

The computer, as a mode of learning, had three base points above the book as a mode of learning based on students' answers in the questionnaire.

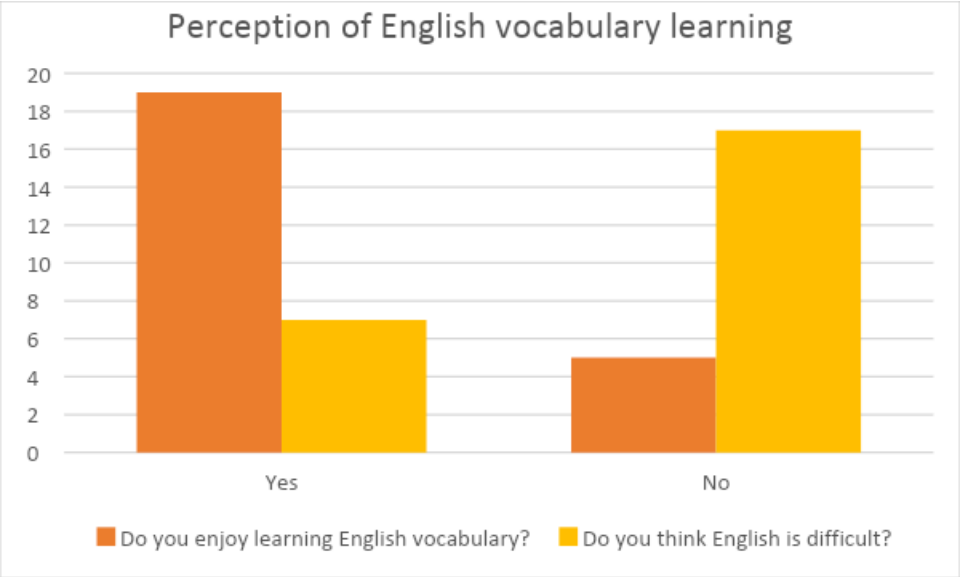

Figure 6: **The mean scores rounded up showing students' perceptions of English vocabulary learning**

Most of the participants in the experimental group enjoyed learning English and did not think that learning English vocabulary was difficult.

Researchers log results and findings

Date	**Observations**	**Analysis & Notes**
8/11/2022	1. Students rush to test and make spelling mistakes. The current testing format tests recall based on the definition in part one and spelling recall in part two. Students know which words to use, but spell them incorrectly.	1. This does not necessarily mean that students cannot recall the correct vocabulary word but could mean that they misspelled due to rushing. This affects test scores.

15/11/2022	1. Students cheered and were jovial when I brought Bamboozle up onto the TV screen. 2. The instructions for using Bamboozle were quite uncontrolled. Certainly, it is less controlled than when using PPT and Present and Repeat.	1. There was more visible motivation to learn among the students than when the Present and Repeat instructional methods were used. 2. The environment must be changed so that there is more control over the flow of the lesson, as is done when the PPT instructional method is used.
22/11/2022	1. During this experiment, the students were first told to take time to complete the test. The students were told that they would need to wait until the full testing time was up before they could move onto doing something else. The clock was then removed from the wall. The students took more time and appeared to be more diligent in completing the test.	1. The environments of both the Bamboozle instructional method and the Present and Repeat (PPT) instructional methods are now more similar in terms of pace and flow.
28/11/2022	1. Students were told to stay seated and have their eyes on the TV as Bamboozle was being played. It was far more controlled than the first	1. It appeared that more students were engaged and exposed to the new

	lesson, and students appeared to be more engaged with the questions and answers displayed.	vocabulary and their meanings and usage when the experiment was performed for the first time.

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

This action research study paper sought to prove the hypothesis that a digital gamification tool would improve memory recall and motivation levels in lower elementary ESL students.

From the above data, students were visibly motivated to learn when using Bamboozle as an instructional method. Students also noted that they preferred to use computers when learning as opposed to textbooks.

I believe that most of this experimental group stated that they enjoyed learning English and that they did not find it difficult to do so, which could positively affect test scores, as they were already motivated to learn and confident.

In terms of positively impacting memory recall more than the traditional method of the present and repeat using a PPT, the data do not show Bamboozle is more effective as an instructional method. It could be deduced that students are forced to concentrate better when there is less hyperenergy in the classroom that is created when there is a ‘game’ involved.

However, there is little doubt in my mind that Bamboozle stimulated the desire to learn, which is evident from the atmosphere and motivation levels of the students that I observed before and during the Bamboozle lessons. This research implies that classrooms should have a degree of digitization that affects students’ motivation to learn, and digital gamification, as an instructional method, has value and will continue to develop.

I recommend that the research be replicated across different grades and across grade two classes from multiple schools. It is impossible to determine whether students have prior knowledge and understanding of the vocabulary words tested, which would positively affect their recall. With

more quantitative data across grades and schools, we can generalize the results more effectively. It is also recommended that more than one researcher record their observations in the observation log to achieve a less biased perspective.

Limitations

This study has some limitations that need to be noted. The experiment was conducted in only one class, grade, and school. The experimental group was my homeroom class, which could have led to selection bias. As I was the only researcher in the study and my observation logs were used, the report could contain observer bias.

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