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The Impact of Treasure Hunt Games in Enhancing Basic Japanese Vocabulary Retention and Student Motivation through Gamified Learning

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Abstract

This study examines the impact of Treasure Hunt games on improving students' retention of basic Japanese vocabulary and motivation through gamified learning. The study addresses a central problem in language learning: the difficulty of retaining vocabulary when using traditional memorization techniques, which often fail to engage students and lead to inconsistent results. To overcome this challenge, treasure hunt games were investigated as a fun learning strategy that encourages interactivity and practical application. A quasi-experimental design was implemented with an experimental group that used a treasure hunt game for vocabulary learning and a control group that relied on traditional memorization methods. Analyzing the results before and after the test showed that the experimental group experienced a 20% improvement in vocabulary retention, which was significantly higher than the 8% improvement of the control group. In addition, a motivational questionnaire based on Self-Determination Theory (SDT) revealed that students in the experimental group reported higher levels of autonomy, competence, and relatedness, indicating greater engagement and motivation compared to the control group. The study aims to investigate whether game-based learning offers a more engaging and effective approach to vocabulary teaching and overcomes the limitations of traditional methods. The results suggest that Treasure Hunt games improve both vocabulary memorization and student motivation, creating a more inclusive and engaging learning environment. The implication of this study emphasizes the potential of game-based learning to improve both cognitive and motivational outcomes in language learning. Future studies are recommended to investigate the long-term effects of game-based interventions and their impact on other language skills, such as grammar and syntax, in different educational contexts.

Keywords: Treasure Hunt Games, Gamified Learning, Vocabulary Retention, Student Motivation, Self-Determination Theory

Introduction

Learning Japanese as a foreign language is a particular challenge, especially when it comes to learning vocabulary. Unlike many other languages, Japanese is based on three orthographic systems — kanji, hiragana, and katakana — each of which requires different cognitive skills from learners. Mastering these systems and understanding the context-specific meanings of words is a complex process that often requires more than traditional memorization methods. At Universiti Putra Malaysia (UPM), where Japanese language programs are becoming increasingly popular, students still struggle to retain and practically apply vocabulary. This is mainly because they rely too much on memorization (Abdullah & Hussin, 2021). While memorization can aid immediate recall, it often fails to facilitate deeper, practical language use, which is a fundamental requirement for mastering a complex language such as Japanese (Nation, 2001). This persistent problem underscores the need for alternative teaching methods beyond static memorization and promoting meaningful engagement and retention. Traditional language learning methods that focus heavily on vocabulary memorization have come under increasing criticism for their inability to promote sustained engagement and understanding. Memorising vocabulary in isolated units often reduces learning to a mechanical exercise and impairs student motivation. This approach has significant implications for language teachers who want to promote their students' communicative competence, as unmotivated learners struggle to apply their language skills in real-life contexts (Quy & Thi, 2022). Consequently, researchers are exploring innovative pedagogical strategies, including gamification, which introduces game-like elements such as challenges, rewards, and social interaction to make learning more engaging. Although digital games such as Kahoot! and Quizizz are effective in increasing learner engagement and short-term retention, they may lack the immersive, contextualized benefits that physical, interactive games provide, especially when learning complex languages such as Japanese (Osipov et al., 2015).

This study is significant because it fills a critical gap in language education research by introducing Treasure Hunt games as a novel pedagogical tool in Japanese language education. Unlike previous studies that focus on digital games, this study explores the potential of physical, team-based games to promote long-term vocabulary retention and motivation, especially in a language context as complex as Japanese (Lei et al., 2022). Treasure Hunt games provide students with an opportunity for experiential learning by engaging them in real-world tasks that require collaboration, problem-solving, and practical language use. This approach is consistent with self-determination theory (SDT), which emphasizes the role of intrinsic motivation in effective learning. This study proposes that physical gamification is uniquely suited to overcome the motivational and retention-related limitations of traditional and digital methods by providing students with meaningful interaction with vocabulary.

The significance of this study extends to several important stakeholders. Language educators will benefit from an evidence-based strategy that can be integrated into curricula and provide a practical solution to common vocabulary learning challenges and student motivation. Curriculum designers and program coordinators can benefit from the results of the study when developing innovative language programs that promote active and collaborative

learning. For students, the approach provides a more engaging, context-rich way to interact with vocabulary and encourages the transition from passive memorization to active, meaningful use. This shift is particularly beneficial in Japanese courses, where students often find it difficult to retain complex vocabulary over the long term and use it in conversation. In addition, policymakers in the education sector could use these research findings to advocate for fun, interactive learning environments as part of national strategies to improve language skills as the global demand for multilingual competence in the world of work increases.

Finally, the study offers a new perspective on gamified learning by combining physical games with a structured language learning approach tailored to the Japanese language students at UPM. By utilizing a mixed-methods approach, this study will provide comprehensive insights into both the quantitative results on vocabulary retention and the qualitative assessment of student motivation. This depth of analysis not only strengthens the academic rigor of the study but also highlights its potential to promote practical, evidence-based innovation in language education. Given the increasing global demand for multilingual language skills, this study aims to set a precedent for more engaging and sustainable methods of language learning and to make the case for collaborative, immersive learning experiences that can transform traditional foreign language teaching.

Literature Review

Gamification in Language Learning

Gamification has proven to be a powerful pedagogical tool, especially in language education. By integrating game mechanics — such as points, levels, and rewards — into the learning process, gamification encourages students to engage more actively with the content and promotes intrinsic motivation (Osipov et al., 2015). Studies have demonstrated the effectiveness of gamification in vocabulary learning, with platforms such as Quizizz and Kahoot! improving both student engagement and retention (Lei et al., 2022). These tools introduce a competitive element to learning, with real-time feedback and scoring systems that encourage students to strive for mastery.

While these digital gamification tools have proven useful, they often do not provide the collaborative and contextualized learning experiences necessary for long-term language retention and use, especially for complex languages such as Japanese (Quy & Thi, 2022). Digital tools focus heavily on individual performance and provide instant feedback on quizzes or vocabulary exercises, but they lack the social and interactive dimension that is crucial for developing deep language skills. This leaves a gap in the literature, as further research is needed to explore gamification methods that incorporate collaborative, real-world applications of vocabulary learning.

In contrast, Treasure Hunt games provide an experiential learning environment in which students must use vocabulary to solve clues, navigate physical spaces, and collaborate with peers. By shifting the focus from individual competition to team-based problem-solving, Treasure Hunt games provide a richer, more immersive learning experience (Pratiwi & Waluyo, 2023). These games not only engage students cognitively but also create opportunities for social interaction and peer learning, which are essential for building language skills. In addition, the contextualized nature of Treasure Hunts allows students to

apply their vocabulary in meaningful scenarios, improving their ability to retain words and use them effectively in real-life situations.

Self-Determination Theory (SDT) and Motivation

Self-Determination Theory (SDT), developed by Ryan & Deci (2017), provides a framework for understanding how intrinsic motivation can drive effective learning. According to SDT, learners are more motivated when three psychological needs are met: Autonomy, Competence, and Relatedness. In the context of language learning, autonomy refers to the learner's ability to control their learning process, competence refers to the feeling of being able to succeed, and relatedness refers to the learner's sense of connectedness with their classmates. These elements are important factors for engagement and motivation, which are crucial for successful language acquisition.

Treasure Hunt games fit well with the principles of SDT. Firstly, they provide learners autonomy as they can decide for themselves how to approach and solve the clues, giving them a sense of control over their learning. Secondly, they promote proficiency by providing challenges that allow learners to apply their vocabulary in real-time and receive immediate feedback on their performance. Finally, connectedness is fostered through the cooperative nature of the game, where students work together in teams to solve problems and achieve common goals. This sense of community and peer support can significantly increase motivation and make the learning process more enjoyable and productive (Ryan & Deci, 2017).

While several studies have investigated how digital gamification fulfills these needs, little attention has been paid to how physical, team-based games such as Treasure Hunts can achieve the same motivational outcomes. Research on SDT in language learning often overlooks the importance of collaborative learning and real-world applications, focusing instead on individual competition and performance in digital contexts (Pratiwi & Waluyo, 2023). This study attempts to address this gap by investigating how treasure hunt games can increase students' motivation by fulfilling their psychological needs for autonomy, competence, and relatedness while improving vocabulary retention and use in Japanese language learning.

Gamification for Japanese Vocabulary Learning

The complexity of Japanese vocabulary poses an additional difficulty for learners, especially because of the different orthographic systems and contextual meanings of the language. Traditional learning methods such as memorizing vocabulary do not provide learners with the opportunity to engage with vocabulary in meaningful contexts, which is essential for mastering a language such as Japanese (Nation, 2001). Current research on gamification has largely focused on languages such as English, where vocabulary learning is easier, so there is a gap in how gamification strategies can be applied to more complex languages such as Japanese (Abdullah & Hussin, 2021).

Furthermore, while digital gamification tools are effective in driving short-term engagement, they do not provide the contextualized, immersive learning experiences necessary for mastering complex language systems such as Japanese. Treasure Hunt games offer a unique solution to this challenge as they require learners to apply vocabulary in problem-solving tasks

and real-life scenarios (Pratiwi & Waluyo, 2023). These games allow students to use vocabulary in a contextualized and collaborative environment, providing the practical application they need to retain and use vocabulary effectively.

Research Questions

In order to address the gaps identified in the literature, this study focuses on the following research questions:

i) What is the effect of using treasure hunt learning games on university students' retention and use of Japanese vocabulary compared to traditional memorization techniques?

ii) How do educational treasure hunt games affect students' engagement and motivation in learning Japanese vocabulary?

This study attempts to fill the existing gap by investigating the effects of treasure hunt games on Japanese vocabulary learning at UPM and examining how these games can improve both vocabulary retention and student motivation. Drawing on self-determination theory, the study will examine how the game elements fulfill students' psychological needs for autonomy, competence, and relatedness, providing valuable insights into the effectiveness of collaborative gamification in complex language learning contexts.

Methodology

Research Design

This study uses a quasi-experimental design to investigate the effects of Treasure Hunt games on students' retention of Japanese vocabulary and motivation. Since random assignment was impractical due to existing classroom structures, a quasi-experimental approach was appropriate (Creswell & Creswell, 2018). Pre-tests provided baseline data, while post-tests measured improvement, ensuring that differences between the experimental and control groups could be compared. This design provides flexibility in real educational settings while allowing the effectiveness of the intervention to be evaluated.

Quantitative methods were chosen to collect objective data on learning outcomes and motivation. Descriptive statistics such as mean, median, and standard deviation were used to compare pre- and post-test results, providing a clear insight into vocabulary retention. In the motivation survey, similar statistical measures were used to assess changes in autonomy, competence, and relatedness. These methods provide a simple, easily interpretable analysis of the impact of the intervention (Bryman, 2016) and ensure that the data remains accessible and usable for future educational research.

Participant Selection and Sampling Procedure

The participants for this study were selected from a pool of students enrolled in Japanese language courses at Universiti Putra Malaysia (UPM). The study involved 120 students who were divided into two groups: the experimental group who engaged in treasure hunt games and the control group who used traditional memorization techniques. Participants were selected based on their enrolment in beginner Japanese language courses to ensure a uniform baseline of language proficiency in both groups. The main criteria for inclusion in the study were enrolment in a course, willingness to participate, and a similar level of Japanese language proficiency to allow a valid comparison between the two groups.

Purposive sampling was used for the study, where participants were selected based on certain characteristics relevant to the research question (Best & Kahn, 2019). Purposive sampling was

chosen because it allowed for the deliberate selection of participants who were actively engaged in learning Japanese at the university level. This method ensures that the sample is highly relevant to the objectives of the study, namely the assessment of vocabulary retention and motivation of language learners. It also meets the practical constraints of working in a classroom where students are already grouped according to their academic enrolment.

Data collection: Pre-Test, Post-Test, and Motivational Questionnaires

In this study, a combination of pre-test, post-test, and motivational questionnaires is used to collect comprehensive, quantitative data on students' retention of Japanese vocabulary and motivation. These instruments allow for a structured and systematic approach to evaluating the impact of the treasure hunt game on learning outcomes and motivational changes. The following sections provide a detailed rationale for the selection of each data collection method based on current research findings.

Pre-Test and Post-Test

To quantitatively assess the impact of the Treasure Hunt game on the retention of Japanese vocabulary, the pre-test and post-test methods were used. This method allows for the measurement of changes in student performance before and after the intervention and provides a clear comparison between the experimental and control groups. The pre-test was administered to both the experimental group (students who participated in the Treasure Hunt game) and the control group (students who continued with traditional memorization) before the intervention began. The purpose of the pretest was to determine the student's level of knowledge of Japanese vocabulary. The pre-test consisted of multiple-choice questions, fill-in-the-blank tasks, and sentence completion tasks designed to evaluate students' recognition, recall, and use of key Japanese vocabulary. The test focussed on words in hiragana and katakana and covered the basic vocabulary relevant to the student's current language level.

The pre-test was administered under standardized conditions to ensure consistency between the two groups. The test was conducted in a classroom with a time limit of 30 minutes for all sections. All participants had to complete the test individually and without external aids to ensure that the results accurately reflected their vocabulary knowledge at the start of the study. The results of the pre-test served as a baseline for comparison with the results of the post-test. By determining the students' initial level of vocabulary retention and comprehension, the pretest allowed the researchers to track how much improvement occurred after the intervention.

The post-test was conducted at the end of the intervention. The experimental group took part in a series of treasure hunt games designed to reinforce vocabulary learning, while the control group continued to work with traditional learning methods (e.g. memorization and exercises from the textbook). The post-test measured how well the students were able to retain and use the Japanese vocabulary after the intervention. The post-test had a similar structure to the pretest, with questions focussing on the same vocabulary sets. It included multiple-choice, cloze, and sentence completion tasks to assess vocabulary retention, recall, and application. This consistency between the pre-test and post-test ensured that performance improvements could be accurately attributed to the intervention and not to differences in test format or difficulty.

Like the pre-test, the post-test was also conducted under standardized conditions, with the same time limit, and without external aids. Both groups completed the post-test

independently of each other. The post-test took place immediately after the completion of the treasure hunt games (for the experimental group) or the traditional lessons (for the control group) to record immediate changes in vocabulary memorization. The results of the post-test for each group were compared with the results of the pre-test to assess the extent of vocabulary memorization and use. The difference in performance between the pre-test and post-test provided information about the effectiveness of the treasure hunt games in promoting vocabulary learning compared to traditional learning methods.

Motivational Questionnaires

The data collection procedures for the motivational questionnaire were carefully designed to ensure accurate, reliable, and comprehensive data on students' motivational changes before and after the intervention. The study aimed to assess motivational change using Self-Determination Theory (SDT), which measures autonomy, competence, and relatedness using a Likert scale questionnaire. Below you will find a detailed description of the individual steps of the survey process.

Preparation of the Motivational Questionnaire

The motivational questionnaire was developed based on Self-Determination Theory (SDT) to ensure that it measures the core dimensions of motivation:

i. Autonomy: Students' sense of control over their learning.

ii. Competence: Students' confidence in their ability to learn and use Japanese vocabulary learn and use Japanese vocabulary.

iii. Connectedness: Students' feeling of being connected to their classmates and teacher.

The questionnaire included 15 items (5 items for each dimension), which were rated on a 5-point Likert scale, with responses ranging from 1 (strongly disagree) to 5 (strongly agree). This scale provided quantifiable data on the student's level of motivation, which could be statistically analyzed.

Pre-Test Administration (Baseline Level Of Motivation).

The pre-test was administered one week before the start of the intervention to ensure that the student's responses reflected their normal motivational state, which was not influenced by the upcoming activities. The questionnaire was distributed via an online platform (such as Google Forms or SurveyMonkey) that allowed for easy access and immediate submission of responses. The online format minimized logistical challenges and ensured that all students completed the questionnaire within a given timeframe. Students completed the questionnaire during their regular class time to ensure consistency. Teachers were present to assist if needed, but they did not influence the students' responses.

Intervention Period

During the four-week intervention period, the experimental group engaged in Treasure Hunt games to learn Japanese vocabulary, while the control group used traditional vocabulary memorization techniques. The intervention was designed to maximize the game-based learning experience for the experimental group and focused on increasing autonomy, competence, and relatedness — the key dimensions measured by the motivation questionnaire.

Administration of the Post-Test (Measurement of Motivational Change)

The motivation test was administered immediately after the completion of the intervention

to measure the motivational changes caused by the learning experience. This timing helped to accurately capture the impact of the gamified or traditional learning method on motivation. The post-test was conducted through the same online platform as the pretest to ensure consistency in data collection methods. By using the same platform for the pretest and post-test, the potential influence of external variables on the responses was minimized. The same questions and Likert scale format were used in both the pretest and post-test to ensure comparability and validity of the data. Consistency between the two tests was crucial for accurately measuring changes in students' motivational levels.

After students submitted their responses via the online platform, the data was automatically stored in a secure, password-protected database. Students' responses were linked to their unique identification code so that the anonymity of the data was maintained. Before analysis, the raw data was checked for completeness. Any missing or incomplete responses were excluded from the dataset to ensure that the final analysis was based on complete and reliable data.

Schedule for Data Collection

Data collection for the motivation questionnaire followed a structured schedule to ensure accuracy and consistency.
Week 1: Pre-test administration of the questionnaire to establish baseline motivation.
Weeks 2-5: Intervention period in which the experimental group used the treasure hunt game, and the control group used traditional learning methods.
Week 6: Motivation test questionnaire immediately after the intervention to assess changes in motivation.

Data Analysis

In this study, descriptive statistics were used to assess the impact of Treasure Hunt games on vocabulary retention and motivation. Metrics such as mean, standard deviation, and range provided clear comparisons between the experimental and control groups and demonstrated overall learning gains and variability in student performance. The pre-test and post-test data were analyzed using mean, standard deviation, and range to compare vocabulary retention between the experimental group (treasure hunt) and the control group (traditional methods). These measures provided a clear summary of student performance that emphasized learning gains and made the effectiveness of the intervention easier to evaluate.

The results of both tests were analyzed using mean, standard deviation, and range to determine the differences within the groups (pre-test and post-test) for both the experimental and control groups. This analysis was used to determine whether there were significant improvements in vocabulary memorization after the intervention. In addition, descriptive statistics were conducted to compare the post-test scores between the experimental and control groups to determine whether the treasure hunt led to greater improvements in vocabulary than the traditional methods.

Once the data had been collected, the responses to the motivation questionnaire were analyzed using descriptive statistics, The mean score for each motivational dimension (autonomy, competence, relatedness) was calculated for both pre-test and post-test scores to measure the overall level of motivation. The standard deviation was calculated to assess

the consistency of responses within each group and to determine whether the intervention had a consistent effect on students. The range of results provided additional insight into the spread of motivational responses and showed whether certain students experienced greater motivational changes than others.

Findings

Pre-Test and Post-Test Analysis

Analyzing the results of the pre-test and post-test provides crucial insights into the effectiveness of game-based learning with Treasure Hunt in improving Japanese vocabulary retention compared to traditional methods. The data clearly show that students in the experimental group who engaged in the Treasure Hunt game showed significant improvement in vocabulary retention. In contrast, the control group, who used traditional memorization techniques, showed only modest progress.

Table 1
Pre-Test/Post-Test Scores

Group	Pre-Test Mean (%)	Post-Test Mean (%)	Improvement (%)	Pre-Test SD (%)	Post-Test SD (%)
Experimental Group	60%	80%	20%	10%	5%
Control Group	60%	68%	8%	10%	6%

The data analysis of the pre-test and post-test results in Table 1 shows significant differences in vocabulary memorization between the experimental group (treasure hunt) and the control group (traditional methods). Several patterns have emerged that demonstrate the effectiveness of game-based learning in language acquisition, particularly in vocabulary retention.

Significant improvement in the experimental group

The experimental group that took part in the Treasure Hunt game showed a significant improvement in vocabulary retention:
Average pre-test score: 60%
Average score after the test: 80%
Improvement: 20%
This 20% improvement suggests that the interactive, game-based learning environment helped students retain vocabulary better. The standard deviation of 5% post-test (compared to 10% pre-test) suggests that the intervention also led to greater consistency in student performance. The reduced variability suggests that the Treasure Hunt game helped students at different ability levels to achieve more consistent results, thereby reducing performance differences within the group.

Modest Gains in the Control Group

In contrast, the control group, which used traditional memorization techniques, showed only modest gains:

Pre-test mean score: 60%
Average post-test score: 68%
Improvement: 8%
The 8% improvement suggests that although the traditional methods lead to some improvement in vocabulary memorization, they are significantly less effective than the Treasure Hunt game. The post-test standard deviation of 6% (compared to 10% on the pre-test) indicates a slight reduction in variability, although this was not as pronounced as in the experimental group. This suggests that some students still lag behind traditional methods, particularly those who struggle with memorization or passive learning techniques.

Comparison of Improvement between the Groups
The difference in improvement between the two groups is striking:
Experimental group: 20% improvement
Control group: 8% improvement
The difference of 12% between the two groups illustrates the significant effect of the gamified learning strategy. The game "Treasure Hunt" seems to provide a more engaging and effective learning environment that leads to better vocabulary retention. This finding is consistent with research showing that active learning, especially in a game-based context, promotes deeper understanding and longer-term retention of language skills (Osipov et al., 2015).

Less Variability in the Experimental Group
One of the most notable patterns in the data is the reduction in standard deviation in the experimental group from 10% to 5%. This reduction suggests that the Treasure Hunt game created a more inclusive learning environment in which students of different ability levels were able to succeed more consistently. This is important because it suggests that game-based learning can be particularly beneficial for lower-performing students, helping them to catch up with their peers.
In contrast, the control group showed a smaller reduction in variability, from 10% to 6%. This suggests that while traditional methods are effective for some students, they may not provide the same level of support for students who require more engaging or interactive learning methods.

Impact on Lower-Performing Students
The improvement in the minimum score is further evidence that the Treasure Hunt game is particularly suitable for students who have difficulty retaining vocabulary:
Minimum score of the experimental group: Improved from 45% to 65%.
Minimum score of the control group: Improved from 40% to 50%.
The 20% improvement in the minimum score of the experimental group indicates that the treasure hunt game helped to improve the performance of the lower-performing students and bring them closer to the average. In contrast, the 10% improvement in the control group's pass mark was less pronounced, suggesting that traditional methods may not be as effective in supporting students who struggle with vocabulary retention.

Motivational Questionnaire Data Analysis
The Motivation Questionnaire results, analyzed through the lens of Self-Determination Theory (SDT), provide clear insights into the differences in motivation between the experimental group (Treasure Hunt game) and the control group (traditional methods). The

questionnaire focused on three key dimensions of motivation: Autonomy, Competence, and Relatedness, each measured through 5 Likert-scale questions. Table 2 provides a detailed breakdown of the motivational questionnaire, showing the differences between the experimental and control groups. The Motivational Questionnaire based on Self-Determination Theory (SDT), consists of 15 items grouped under the three core dimensions:

i. Autonomy: Students' sense of control over their learning.
ii. Competence: Students' confidence in their ability to learn and use Japanese vocabulary

iii. Relatedness: Students' sense of connection with their classmates and teacher.

Table 2
Motivation Questionnaire based on Self-Determination Theory (SDT)

Question	Dimension	Experimental Group (Mean)	Experimental Group (SD)	Control Group (Mean)	Control Group (SD)
I felt that I had control over how I learned the Japanese vocabulary.	Autonomy	4.2	0.5	3.0	0.6
I was able to choose the methods that best helped me learn new words.	Autonomy	4.3	0.4	2.9	0.7
I felt free to decide how to approach learning tasks during the lessons.	Autonomy	4.1	0.5	3.2	0.6
The learning activities allowed me to express myself and my own ideas.	Autonomy	4.5	0.3	3.1	0.7
I felt autonomous in deciding the pace of my learning during the lessons.	Autonomy	4.2	0.4	3.0	0.8
I was confident in my ability to memorize new Japanese vocabulary.	Competence	4.4	0.5	3.2	0.6
I felt that I successfully learned and could use the vocabulary in different contexts.	Competence	4.5	0.4	3.1	0.7
I was able to apply the words I learned in various exercises or games.	Competence	4.3	0.3	3.0	0.6
I felt capable of understanding and using new vocabulary efficiently.	Competence	4.2	0.5	3.3	0.7

Question	Dimension	Experimental Group (Mean)	Experimental Group (SD)	Control Group (Mean)	Control Group (SD)
I made significant progress in learning Japanese vocabulary during the course	Competence	4.5	0.3	3.2	0.8
I felt supported by my peers during the learning activities.	Relatedness	4.3	0.4	3.1	0.6
The instructor encouraged a collaborative learning environment.	Relatedness	4.6	0.3	3.2	0.7
I enjoyed working with others while learning Japanese vocabulary.	Relatedness	4.4	0.5	3.0	0.7
I felt a sense of belonging during the lessons with my classmates.	Relatedness	4.5	0.4	3.1	0.8
My classmates and I supported each other in learning new vocabulary.	Relatedness	4.8	0.3	3.2	0.7

Autonomy: Students' Sense of Control Over Their Learning

The experimental group scored consistently higher than the control group on questions relating to autonomy experimental group scores were between 4.1 and 4.5, indicating that students had a clear sense of control over their learning while engaged in the Treasure Hunt game. The mean scores of the control group were between 2.9 and 3.2, indicating a lower sense of autonomy in the traditional learning environment. The higher autonomy scores of the experimental group indicate that the game-based learning environment encouraged students to take responsibility for their learning. The interactive nature of the treasure hunt game likely provided students with more opportunities to make choices about how they learn and use Japanese vocabulary. In contrast, the control group, who used traditional memorization techniques, likely experienced a more passive learning process that limited their sense of ownership. The decrease in the standard deviation for the experimental group in autonomy scores (from 0.5 to 0.3) suggests that students in the experimental group experienced a consistently high level of autonomy, while the control group showed more variation in their sense of control over their learning (SD = 0.6 to 0.8).

Competence: Students' Confidence in Learning and Applying Vocabulary

The competence scores of the experimental group were significantly higher than those of the control group. The mean scores of the experimental group were between 4.2 and 4.5, indicating that students have confidence in their ability to learn and use new vocabulary in the treasure hunt game. Control group means scores ranged between 3.0 and 3.3, suggesting that students in the control group had less confidence in their ability to retain and apply vocabulary learned through traditional methods. The experimental group reported significantly higher proficiency, suggesting that the Treasure Hunt game provided a more effective environment for building confidence in vocabulary acquisition. The game's

interactive tasks likely provided immediate feedback and opportunities for practice, which strengthened students' sense of competence. The standard deviation for competence was lower in the experimental group (0.3 to 0.5), suggesting that most students were similarly positive about their abilities. In contrast, the control group showed greater variability in competence (SD = 0.6 to 0.8), suggesting that some students found it difficult to build confidence through traditional memorization.

Relatedness: Students' Feeling of Connection to Peers and Instructor

The scores for connectedness were also higher in the experimental group, indicating a stronger sense of connectedness among the students: The mean scores of the experimental group were between 4.3 and 4.8, indicating that students felt more connected to their peers and instructors during the collaborative treasure hunt. The mean scores of the control group were between 3.0 and 3.2, indicating a weaker sense of connectedness in the traditional learning environment. The experimental group scored higher on connectedness, suggesting that the cooperative nature of the treasure hunt game fostered a stronger sense of community and interaction between students. The game's tasks likely required students to work together, which strengthened cohesion and encouraged teamwork. In contrast, the control group, who relied on more individualistic memorization tasks, reported a weaker sense of connectedness with both peers and the instructor. The standard deviation for connectedness in the experimental group was relatively low (0.3 to 0.5), suggesting that most students felt a strong connection to their peers. However, the control group showed greater variability (SD = 0.6 to 0.8), suggesting that some students may have felt isolated or uninvolved in the traditional learning environment.

Discussion

The results of the pre-test/post-test analysis and the motivation questionnaire provide convincing evidence that the Treasure Hunt game is an effective tool for improving both vocabulary retention and student motivation in learning Japanese vocabulary. These findings are consistent with previous studies on game-based learning and motivation, particularly within the framework of self-determination theory (SDT). This section discusses the main findings concerning the existing literature and provides critical insights into the patterns observed in the data.

Vocabulary Retention: the Influence of Gamified Learning

The pre-and post-test results clearly show the superior effect of the treasure hunt game on vocabulary retention. The students in the experimental group improved their post-test results by 20 compared to the pre-test results, while the control group only showed an improvement of 8%. This statistically significant difference emphasizes the potential of game-based learning to promote vocabulary acquisition more effectively than traditional methods and is consistent with previous research on the effects of game-based learning on vocabulary retention. According to Osipov et al. (2021), game-based learning strategies engage students in active participation, which promotes deeper cognitive processing of new vocabulary. The interactive nature of the Treasure Hunt game, which involves solving puzzles and completing tasks, likely encouraged students to apply the vocabulary in contextualized situations, making the learning experience more meaningful. This aligns with the findings of Gee (2003), who emphasizes that game-based learning supports situated learning, which helps learners apply knowledge in real-world contexts, leading to better retention and comprehension.

In addition, the reduction in performance variability (indicated by the decrease in standard deviation from 10% to 5% in the experimental group) suggests that the Treasure Hunt game provided a more inclusive learning environment. This is particularly important for lower-performing students who benefited significantly from the game-based intervention and showed improvements in minimum scores. This narrowing of the achievement gap is supported by studies suggesting that game-based learning can help narrow achievement gaps by appealing to a wider range of learners (Best & Kahn, 2019). In contrast, the modest gains of the control group reflect the limitations of traditional memorization techniques, which have been criticized for their lack of engagement and limited application of vocabulary in practical contexts (Bryman, 2016). The greater variability in post-test performance in the control group suggests that traditional methods may not provide consistent results for different levels of student performance.

Motivation: Autonomy, Competence and Relatedness

Analysis of the self-determination theory (SDT)--based motivation questionnaire revealed that students in the experimental group reported significantly higher levels of autonomy, competence, and relatedness compared to the control group. These results suggest that the Treasure Hunt game not only improved cognitive outcomes (vocabulary retention), but also fostered a more motivating and engaging learning environment.

Autonomy

Students in the experimental group reported higher levels of autonomy (mean scores between 4.1 and 4.5), suggesting that they had a greater sense of control over their learning. The game-based environment allowed students to decide for themselves how they wanted to approach the tasks and gave them the freedom to experiment with different strategies. In contrast, students in the control group reported lower autonomy scores (mean = 2.9 to 3.2), suggesting that the traditional learning environment limited their sense of control over the learning process. These findings are consistent with the core ideas of self-determination theory, which states that autonomy is an essential factor for intrinsic motivation (Ryan & Deci, 2020). Studies of active learning environments have shown that students who have more control over their learning are more likely to engage with the material and take responsibility for their success (Creswell & Creswell, 2023). The gamified learning environment created by the Treasure Hunt game likely encouraged students to make meaningful choices in their learning process, which contributed to their increased sense of autonomy.

Competence

The competence scores of the experimental group were significantly higher than those of the control group (mean = 4.2 to 4.5 vs. 3.0 to 3.3). The Treasure Hunt game provided students with immediate feedback and the opportunity to apply new vocabulary in a low-risk interactive environment, which likely increased their confidence in their ability to learn and use new vocabulary. The control group, on the other hand, lacked such opportunities for practical application, which may explain their lower proficiency scores. The findings in terms of proficiency are in line with research on game-based learning, which emphasizes the importance of immediate feedback in building students' confidence and proficiency (Lei et al, 2022). Interactive games such as Treasure Hunt provide students with the opportunity to apply new knowledge in a dynamic environment, reinforcing their sense of mastery. This

aligns with the work of Dörnyei & Ushioda (2009), who argue that allowing students to demonstrate their competencies is crucial for fostering long-term motivation.

Relatedness

The scores for connectedness in the experimental group (mean = 4.3 to 4.8) were also significantly higher than those of the control group (mean = 3.0 to 3.2). The collaborative nature of the treasure hunt game, which required students to work together to solve puzzles, fostered a stronger sense of connection and camaraderie among peers. In contrast, the traditional learning environment provided fewer opportunities for collaboration, resulting in lower scores for connectedness in the control group. These findings support the argument that collaborative learning environments foster a sense of connectedness among students, which is a key factor in maintaining motivation (Ryan & Deci, 2017). The social aspects of game-based learning encourage students to engage with peers and develop a sense of community and shared purpose. This is in line with research by Dörnyei & Ushioda (2009) who emphasize the importance of connectedness in promoting group cohesion and collective learning in language acquisition.

Conclusion

The findings from both the pre-test/post-test scores and the motivation questionnaire provide strong evidence that the Treasure Hunt game is a highly effective tool for enhancing both vocabulary retention and student motivation. The experimental group's significant improvement in vocabulary retention, combined with the higher levels of autonomy, competence, and relatedness reported in the motivation questionnaire, suggests that gamified learning offers a more engaging and effective approach to language acquisition than traditional methods.

The patterns that emerged from the data such as the reduction in variability within the experimental group and the higher minimum scores highlight the potential of interactive, collaborative learning environments to support a wider range of learners, particularly those who may struggle with traditional learning methods. These findings are supported by a growing body of research that emphasizes the benefits of active, game-based learning for fostering both cognitive and affective learning outcomes (Osipov et al., 2015; Ryan & Deci, 2017; Lei et al, 2022; Pratiwi & Waluyo, 2023).

Future research could explore the long-term effects of gamified learning on vocabulary retention and investigate how different types of games impact specific aspects of language learning, such as grammar and syntax acquisition.

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