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Effect of the Gamified Second Language Vocabulary Learning: A Meta-Analysis Study

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Abstract: In recent years, gamification in language learning has been a hot topic of study because of its presumed potential to improve language acquisition by providing a more natural, socially interactive, contextually relevant, and interesting learning setting. Many scholars all around the globe have been conducting trials on the pros and cons of using games to aid in the memory of foreign language vocabulary for some time now. Current studies on the best ways to learn new words find that gamified techniques, with their roots in motivational theories like goal setting and self-determination, are the most effective. As such, this meta-analysis aims to systematically synthesize data from quasi-experimental research conducted between 2012 and 2022 to determine whether or not gamified vocabulary acquisition is associated with the improved recall of L2 words. Fifteen main studies that met the eligibility criteria found that gamifying the process of learning L2 words had a significant favorable impact. Regarding remembering foreign-language words, the active gamified mode proved to be more effective than the passive one. Given the methodological weaknesses of the original studies and the comparably small sample sizes of several categories of moderators, the above findings should be seen as suggestive rather than conclusive.

1. Introduction

Gamification has received much attention from the workplace, marketing, and education over the last several decades. Many research studies show that using games in the classroom or learning boosts students' participation, motivation, and overall academic proficiency [1-4]. With more advanced technology like deep learning and electronic devices like augmented reality (AR) and virtual reality (VR), game-assisted learning has emerged as a promising new field for study and application. The influence of gamification on students' brains, motivations, and actions was analyzed in the frequently cited review paper [5] and found to be significant. It reveals that gamification, currently operationalized in empirical studies, is an effective instruction method [5]. However, due to the small sample size, essential classifications like participant characteristics and primary study quality were left out of the analysis. Since more classes have been moved online under the influence of Convid-19, the affordances of gamification for learning have been extensively explored in recent years. Many questions whether or not enough experimental or quasi-experimental studies have been conducted on developed gamified instruction to reveal its effects. In addition, previous research in the second

language acquisition category and research quality evaluation needs to be made up for. Therefore, this study aimed to investigate the use of gamification in Second Language Acquisition (SLA) throughout the last decade and to perform a meta-analysis to analyze the influence of gamification in SLA lexical learning based on research published between 2010 and 2022 using quasi-experimental methods and comparison analysis. The authors of this study also used meta-regression to look for underlying causes of the wide range of gamification effects observed.

1.1 Definitions, research, and previous meta-analyses on gamification

The term "gamification" refers to improving non-gaming contexts, systems, or activities by creating or adding digital game aspects that inspire and engage people in a manner comparable to playing games [6-7]. Unlike traditional passive lectures for distributing content, game-assisted learning engages them in a wider variety of engaging activities, which helps to alleviate their boredom and boost their interest. Elements of games are not standardized by any one category. A five-tiered system for categorizing game components was proposed, for instance, by Deterding et al.[8]. Minigames, Action, Adventure, Role-Playing, and Resource Management, Form the New Game Categories [9]. In 1999, Amory et al. [10] defined the interfaces of the visualization space components used in games (critical thinking, discovery, goal formation, goal completion, competition, and practice). Furthermore, Kim [11] emphasized mechanics, dynamics, and aesthetics. Only those aspects of the game that have been specifically mentioned in the primary research are mapped in this review. Badges, challenges, leaderboards/rank, levels/unlock, stories, characters, points, progress bars, and tech advancements are all staples of modern video games [12].

Studies on the effectiveness of gamification in education have increased in recent years [13-15] for a wide range of subjects, including but not limited to science, mathematics, and languages. While gamification has been shown to improve learning motivation, knowledge or skill gains, interaction, and collaboration in some research, this is not the case in all cases [16]. The results of other studies have not been so encouraging[17-18]. Problems with usability, technical difficulties, and resistance to new technologies are all obstacles to learning through games [18]. For example, some studies show that participants cannot concentrate in the gamified learning mode [19].

Given the contradictory findings on the efficacy of gamification in education, a comprehensive review of the topic is warranted. More study is required to identify critical factors related to gamification's effects on second language learning, such as which technological features and instructional levels may be most useful for which age groups. Across the board, meta-analyses of gamification's effect on vocabulary acquisition and second language learning have found positive results, with a medium effect on students' overall learning outcomes [20-22]. However, it is understood that the results of different studies vary. Age of learners, L1 of learners, treatment duration, and treatment model are just some of the moderating variables that have been studied in relation to the varied effects of gamification on second language acquisition. Overall, the evidence is either mixed or less reliable from the meta-analyses across the studies suggesting that these factors may account for the heterogeneous effects of gamification in second vocabulary learning.

1.2 Theoretical frameworks for review of gamification impact

One of theories supported by gamification is the goal-setting theory. An individual's goals provide direction, concentration, and a means of defining success [23]. According to Edwin and Latham [24], Figure 1 depicts a simplified view of goal-setting theory. Specifically, the theory suggests that values and intentions are two cognitive determinants of behavior (goals). Many gamified techniques (such as emojis and music) offer participants emotions and desires need. And intentions and goals could be reflected as badges and instant feedback, allowing them to evaluate how well they are doing

concerning their objectives. In this manner, people may determine whether to make course corrections or switch to a different approach to achieve their objectives [25]. Thus, this study applied the categories of intention and emotion goals during the gamification classification.

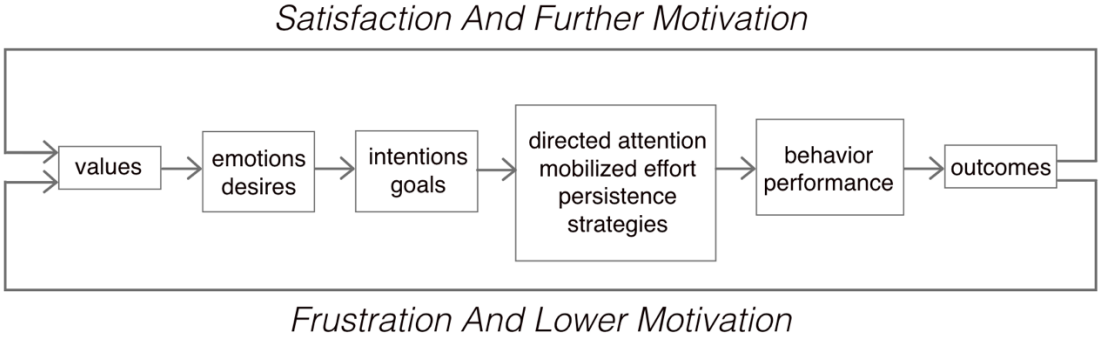

Figure 1 The model of goal-setting theory.

The study will apply the self-determination theory to analyzing learners' Motivation in gamification. According to proponents of the self-determination theory, people are driven to act based on their desire to satisfy their need for autonomy, relatedness, and competence [26]. Fortunately, this requirement may be met by gamified techniques that give players a say in their activities (e.g., by providing a range of task difficulties). When people feel like they have some control over their environment, they are more likely to be emotionally and behaviorally invested in the experience. "Relatedness" describes an individual's need for social interaction [27]. This demand is met by gamified activities that encourage individual competition or group cooperation. People have more fun and are likelier to keep at an activity when they have friends. Competence is the striving for mastery in one's chosen activities or fields of study. Users' confidence may be bolstered using gamified methods that provide signs of achievement (such as progress bars, levels, and badges) and rapid feedback (such as points and rankings) [27]. Figure 2, it shows the self-determination model and continuum.

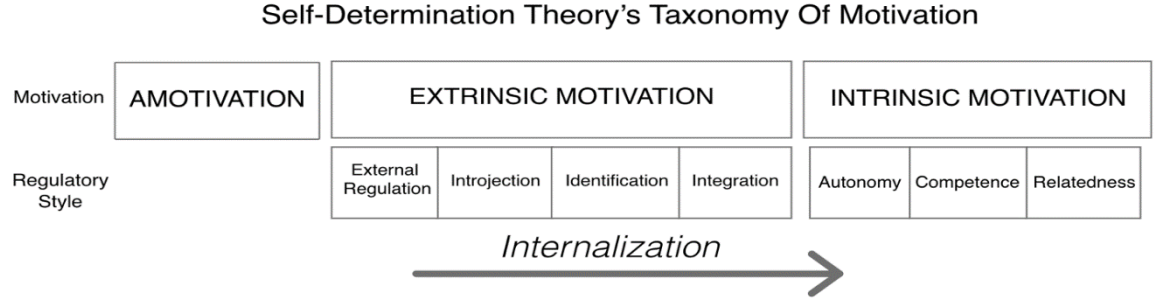

Figure 2 The self-determination model and continuum.

One common metaphor for this state of absorption is the concept of "flow" [28]. Figure 3 is the model of flowing and learning. Having specific objectives within reach, receiving feedback on how well you're doing and how far you've come, and facing a certain amount of difficulty are all factors that may lead to a state of flow [28]. The use of badges as feedback is one example of a gamified approach that has been shown to increase flow [29]. Having users choose their difficulty level is another method of facilitating flow.

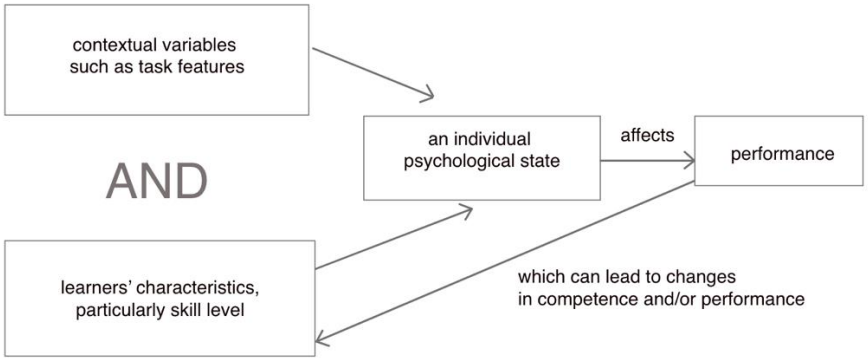

Figure 3 The model of flowing and learning.

1.3 The aim of the study

The primary goal of this research is to analyze how gamification has affected students' ability to acquire new words in a foreign language during the last ten years. In addition, the research features were defined and comprehended to analyze the effect of gamification in SLA. In addition to the e-learning framework's recommendations, this research performed meta-analyses on the impact of gamification training on various learning outcomes [30]. A meta-regression analysis might incorporate study characteristics, such as learner L1, educational background, and gamification design application factors. The following are some of the questions that will be investigated in this study:

RQ1: How consistent are the research findings on the effectiveness of gamification the second language vocabulary learning?

RQ2: What are gamification's effects on different learning stages (assessment, remembering, or applying)?

RQ3: Which research characteristics (such as learners' native language and educational background) and gamification design features (such as treatment length and technological tools) substantially corresponds to the range of effects shown in SLA vocabulary acquisition?

2. Methodology

Figure 4 depicts the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) methodology that was used to identify papers for this meta-analysis. This research project has been given a unique identifier (PROSPERO ID) in the International Prospective Register of Systematic Reviews (PROSPERO). As part of our meta-analysis, we utilized the "REVMAN" statistical software (version 5.4) made available to us by the Cochrane Collaboration over the internet. Rickinson and May define the five stages that make up a well-executed meta-analysis: problem definition; data collection, data assessment, analysis and interpretation and presentation of findings [31].

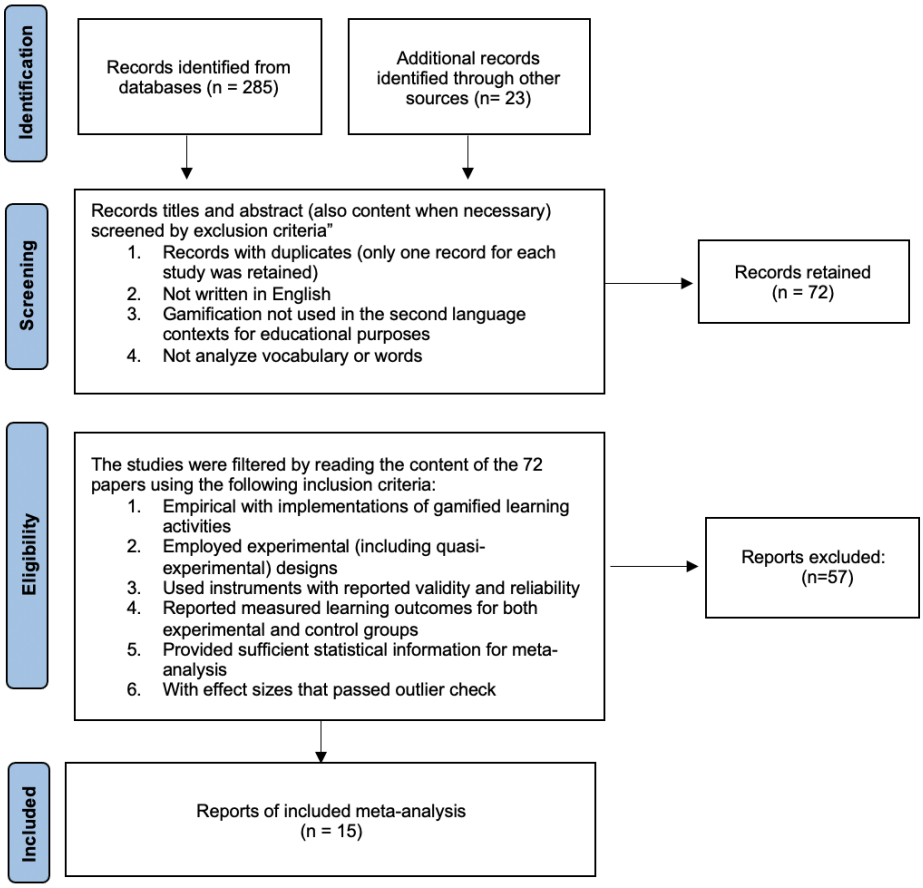

Figure 4 The PRISMA flowchart for including studies to review.

2.1 Selection of studies data collection

Locating applicable keywords is the initial step. The following is a list of the most common search terms used in conjunction with the Boolean 'OR' 'AND' operator to conduct preliminary database searches. 'gamification' OR 'gamified' OR 'game' OR 'DGBLL' OR 'app' OR 'language website' AND 'L2' 'second language' OR 'English' OR 'Foreign language' OR ' EFL ' AND 'vocabulary' OR 'words' OR 'phrases'.

In the second stage, you'll develop your membership and exclusion criteria. Prior studies on gamifying L2 vocabularies were chosen and analyzed here to determine which ones met the criteria for meta-analysis. Eligible primary studies in the Web of Science Core Collection were located using the search as mentioned above terms and permutations. Google Scholar, an academic search engine, was used to find additional applicable studies or unpublished papers using the identified keywords.

2.2 Inclusion and exclusion criteria

The primary literature search yielded 15 papers on the topic of gamification and second-language vocabulary acquisition. Studies were retrieved and assessed to determine their suitability for inclusion in the quantitative meta-analysis. Because the inclusion and exclusion criteria that had been specified for this inquiry were not satisfied by these studies, the analysis did not include them.

(1) There was a time constraint of 2012 to 2022 for either publication or completion of the research.

(2) The Eligible research used a game-based approach to teaching vocabulary. At least one independent condition, including gamification, or the "application of game design features in non-

gaming situations" [8], was required in all studies.

(3) The Eligible research may only be included if they evaluated at least one educational outcome. There were three distinct types of learning outcomes identified, including those related to cognition, motivation, and conduct. Consequences of learning that are motivated include (intrinsic) motivation, preferences, attitudes, engagement, and a sense of competence and mastery.

(4) The Eligible studies that experimentally investigate the efficacy of a specific mode of gamified L2 vocabulary treatment were eligible to contribute statistical data for calculating the effect sizes, so only experimental and quasi-experimental studies met the inclusion criteria for the quantitative meta-analysis; the independent variables consisted of an adequately defined and reported gamified L2 vocabulary treat.

(5) Participants had to be in the process of learning a second language.

(6) The full text of the article was available.

(7) Only research published in English was considered.

Studies that have any of the following characteristics were not considered:

a. There have been a number of qualitative studies and descriptive studies conducted on the topic of gamified L2 vocabulary learning, with a particular emphasis on the following: the attitudes or perceptions of L2 learners towards gamified L2 vocabulary learning; pedagogical recommendations for using gamified learning for L2 vocabulary learning; the creation of materials; and the development of theoretical frameworks or discussions.

b. Questionnaire-only surveys evaluating the impact of gamified tools on second language vocabulary acquisition and narrative-synthesis studies

c. Studies that don't provide enough quantitative information to make use of meta-analysis.

2.3 Coding Procedure

Table 1 The code system for the moderators and their subgroups

Types	Subgroups
Game type	• Practice type • Task-based type
Educational level	• Primary (Preschool and primary school students) • Middle (Junior and senior school students) • High (University students)
L2 proficiency	• Beginning • Middle (Pre-, lower-level, intermediate-level) • Advanced
Intervention setting	• formal • informal
Vocabulary learning	• active • passive
Game source	• Offline • System • Software
Intervention duration	/days

Table 1 shows the produced, debated, and specified categories and subcategories for the coding system, which were informed by the theoretical frameworks and the existing data (i.e., the reviewed studies). Studies were characterized by their categories, authors' names, publication year, publishing kind, level of education, game type, L2 competency, vocabulary learning type, intervention setting, and treatment length. We break down the subgroup criteria and explore the moderator factors in more detail below.

Similar to the taxonomy used in prior meta-analysis studies [22], the different kinds of games were divided into practice and task-based subgroups. Wordle, a word guessing game, is just one of the

practice games that allow students of the L2 vocabulary to repeatedly practice the words in a variety of contexts. All the bells and whistles of scores, challenges, multimedia, etc., but no actual work to do. The opposite of this is a task-based game, defined as "an activity with a clear purpose in which students use language to accomplish a meaningful goal." [32]. The only way for a player to win is if they do everything they're supposed to. Role-playing, strategy, and adventure games are just a few examples of games that encourage players to think critically and solve problems based on context rather than rote memorization [33-35]. Given the small number of studies, the study merged students from different grade levels into three categories: primary (preschool and elementary school), middle (junior high and high school), and high (postsecondary education and beyond) [36]. Based on the aforementioned descriptions, this research classified learners' L2 competence into three levels: beginning, intermediate, and mixed. Participants in studies with no prior knowledge of the target language or just a basic degree of proficiency were classified as the "starting" group. Studies that included students with low- to intermediate-level second language skills were classified as advanced. The studies in the advanced level category included pretests as a covariate but did not specify the students' L2 competence degree [37]. Two distinct types of vocabulary knowledge have been identified in students: passive/receptive (knowledge of a word's meaning) and active/productive (knowledge of employing words in context) [38]. Since the topic is education and the people involved are students, formal classroom settings typically involve mandated learning under the watchful eye of teachers, while less structured, more relaxed environments like those found at home, outside of school, or in after-school programs speak volumes about students' ability to learn on their own terms. A game was classified as offline if there is no gamification computer-assisted in language learning. If the game were taken from a system that allows anybody to access it, then its owners would claim ownership. Games obtained through commercially available software or compact disc were classified as software. Treatment duration refers to the total duration of learning in hours in the treatment condition involving gamification.

2.4 Publication bias

Publication bias is a risk to any research strategy that uses published studies' results as its primary information source. Meta-analysis could help estimate and quantify its effects, however[39]. Researchers used a funnel plot and a selection model to examine the possibility of publication bias, finding that it was not present in the primary papers included in this meta-analysis. So, we assumed that the papers with solid research designs were included in these sub-analyses.

3. Results

The eligibility of a total of 15 full-text articles was examined, and those articles were read. A meta-analysis of comparative studies that were eligible for inclusion included 300 subjects who were exposed to gamified vocabulary learning and 395 subjects who were exposed to traditional learning without gamification. As can be seen in Figure 5, it demonstrated a statistically significant effect in favor of the gamified vocabulary approach for those working in the health professions. The existence of heterogeneity was indicated by the presence of a significant Q statistic (p 0.001) Test for overall effect Z = 4.14.

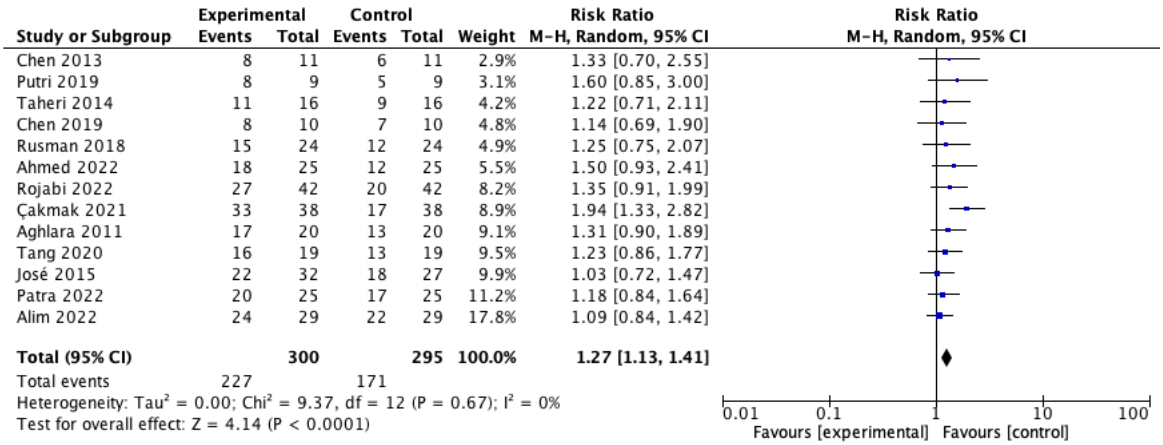

Figure 5: Forest plot of effect sizes using random effect model.

We carried out a number of moderator analyses utilizing the random-effects mode in order to investigate the factors that might have contributed to the observable significant heterogeneity. Table 2 provides a concise summary of the findings from the analyses.

Table 2 results of Moderator analyses

Types	Subgroups	No. percent (%)
Game type	• Practice type	338 (56.80)
	• Task-based type	257 (43.20)
Educational level	• Primary	267 (44.87)
	• Middle	68 (11.43)
	• High	260 (43.70)
L2 proficiency	• Beginning	346 (58.15)
	• Middle	181 (30.42)
	• Advanced	68 (11.43)
Intervention setting	• Formal	346 (58.15)
	• Informal	249 (41.85)
Vocabulary learning	• Active	260 (43.70)
	• Passive	335 (56.30)
Game source	• Offline	50 (8.4)
	• System	288 (48.40)
	• Software	257 (43.19)

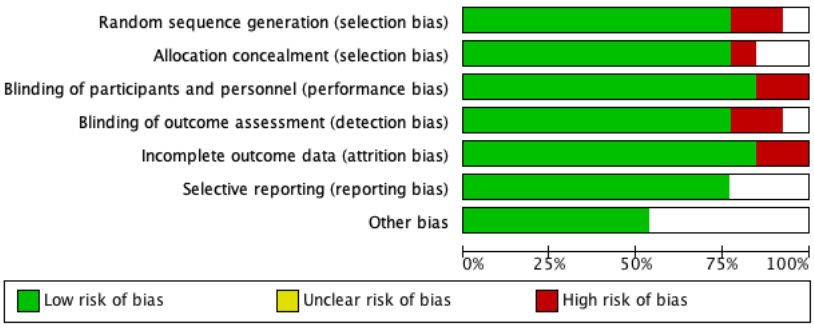

Figure 6 Publication bias

A cursory examination of Figure 6 gave the impression that there was some publication bias present. According to the results of the computation of Duval and Tweedie's trim and fill method with the random effects model, no studies were trimmed using the random effects model. In addition to

this, we carried out the time-honored fail-safe N test in Figure 7 in order to ascertain the number of studies of the null effect that would be required to push the p-value associated with the mean effect above some arbitrary alpha threshold. We believe that the overall mean effect size is not inflated by publication bias based on the visual inspection of the funnel plot, the statistical analyses, and the class fail-safe N.

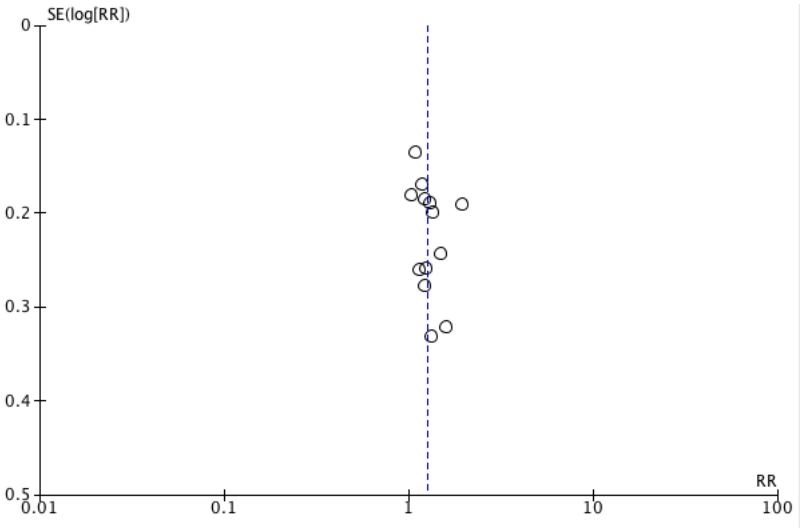

Figure 7 Funnel Plot

4. Conclusion and discussion

The findings of this research demonstrate that using a gamified method to learning second language results in improved performance for a greater number of pupils. In addition, the gamification of teaching second language was shown to be a more engaging and motivating strategy for improving student learning engagement than the standard teaching method. The fact that having a competition and challenge environment [7] encourages students to participate and contact with others may be one reason for the more favorable student perspective, as well as the larger influence of gamification. Another possible reason is that students have access to more active learning time, which helps to boost the degree to which pupils comprehend the content being studied. A gamified vocabulary learning system encourages students to practice the material several times while immersed in an interesting environment and using an avatar. On the other hand, we discovered that the use of simple gamified quizzes in the classroom would make it far less successful. Traditional gamified quizzes and flashcards do less well in terms of word retention when compared to the gamified active system. This might be because learners' comprehension of language cannot be furthered via repeated learning, even when it is facilitated through gamification.

This study synthesis also highlighted characteristics that may impact the effect of gamified learning on the acquisition of L2 vocabulary. These factors include game settings, treatment durations, and the level of competency in the L2 language. To be more explicit, gamified technologies used both in and outside of class scored better on L2 word recall than those used in either formal or informal settings on their own. This was the case regardless of whether the technology was utilized in a formal or casual environment. It is hypothesized that the implicit or explicit vocabulary acquisition strategies that are included in gamified technologies for formal or informal learning settings might be a factor that influences the outcomes of the learning. In addition, the medium length produced significantly improved results in terms of the efficacy of word retention.

This quantitative meta-analysis showed how efficient game-based learning is for long-term foreign-language vocabulary retention. Potential variables and design features that might affect

gamified L2 vocabulary acquisition were also examined.In the future, research might be carried out to investigate the possibility of the impact that certain kinds of gamified instructional strategies may have on various levels of schooling. In further study, game genres should also be investigated for their potential influence on the learning process. In spite of the fact that gamified lectures are becoming more and more common, we still know very little about how the various kinds of games may influence the learning of students. Additionally, longitudinal research has to be carried out to investigate whether or not gamification might help learners retain information over an extended period of time.

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