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# EXPLORING THE ROLE OF INTERACTIVE GAMES IN IMPROVING SPANISH SPELLING SKILLS: A MOBILE APP STUDY

# EXPLORANDO EL PAPEL DE LOS JUEGOS INTERACTIVOS EN LA MEJORA DE LAS HABILIDADES ORTOGRÁFICAS EN ESPAÑOL: UN ESTUDIO BASADO EN UNA APLICACIÓN MÓVIL

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**Abstract:** This study aimed to investigate the impact of a specially designed mobile application, GAUBI, on Spanish spelling proficiency among primary school students. Utilizing a quasi-experimental design, we hypothesized that GAUBI would significantly improve spelling performance. Additionally, we examined the relationship between the type and duration of gameplay—specifically arcade, research, and fiction games—and improvements in spelling proficiency. The study involved 114 Spanish primary school students, who completed a pre-test to establish baseline spelling skills. Following a period of app usage, a post-test was administered to evaluate changes in performance. Pre-test and post-test assessments were aligned with the primary school curriculum in Spanish. Paired samples t-tests compared pre- and post-test scores, revealing statistically significant improvements in spelling performance, with a big effect size (Cohen's d = 0.80). Pearson correlation coefficients explored the association between game type and spelling outcomes, identifying significant positive correlations for "Research" and "Fiction" games, while "Arcade" games showed no clear relationship. These findings suggest that narrative-driven and research-based games are particularly effective in enhancing spelling skills. The results support the use of gamification, especially through collaborative and narrative-rich games, as a beneficial strategy for practising Spanish spelling.

**Resumen:** El principal objetivo de este artículo es investigar el impacto de una aplicación móvil, GAUBI, diseñada específicamente para la mejora de la competencia ortográfica en español de estudiantes de Educación Primaria. A través de un diseño cuasi-experimental, se planteó la hipótesis de que GAUBI mejoraría significativamente el desempeño ortográfico de los estudiantes. También, se analizó la relación entre el tipo y la duración del uso del juego—específicamente juegos de tipo arcade, investigación y ficción—y las posibles mejoras en la competencia ortográfica. La muestra estuvo compuesta por 114 estudiantes españoles de primaria, a los que se administró un pretest para establecer las habilidades ortográficas de partida. Tras un período de uso de la aplicación, se aplicó un postest para evaluar los cambios en el desempeño. Las evaluaciones de pretest y postest se alinearon

con el currículo de educación primaria en español. Mediante pruebas t para muestras relacionadas, se compararon las puntuaciones de los pretest y postest, revelándose mejoras estadísticamente significativas en el desempeño ortográfico, con un tamaño del efecto grande (*d* de Cohen = 0.80). Se utilizaron coeficientes de correlación de Pearson para explorar la asociación entre el tipo de juego y los resultados ortográficos, identificándose correlaciones positivas y significativas para los juegos de "Investigación" y "Ficción", mientras que los juegos de tipo "Arcade" no mostraron una relación clara. Estos hallazgos sugieren que los juegos basados en narrativas y en investigación son particularmente efectivos para mejorar las habilidades ortográficas. Los resultados respaldan el uso de la gamificación, especialmente mediante juegos colaborativos mediante narrativas virtuales gamificadas y enriquecidas, como una estrategia beneficiosa para la práctica de la ortografía del español.

**Résumé:** Cette étude visait à examiner l'impact d'une application mobile spécialement conçue, GAUBI, sur les compétences orthographiques en espagnol chez des élèves du primaire. En utilisant un design quasi-expérimental, nous avons émis l'hypothèse que GAUBI améliorerait de manière significative la performance en orthographe. De plus, nous avons analysé la relation entre le type et la durée du jeu—en particulier les jeux de type arcade, recherche et fiction—et les améliorations des compétences orthographiques. L'étude a impliqué 114 élèves de primaire espagnols, qui ont effectué un pré-test afin d'établir leurs compétences orthographiques de base. Après une période d'utilisation de l'application, un post-test a été administré pour évaluer les changements de performance. Les évaluations de pré-test et de post-test ont été alignées avec le programme scolaire primaire en espagnol. Des tests t pour échantillons appariés ont comparé les scores du pré-test et du post-test, révélant des améliorations statistiquement significatives des performances orthographiques, avec une taille d'effet importante (d de Cohen = 0,80). Des coefficients de corrélation de Pearson ont exploré l'association entre le type de jeu et les résultats en orthographe, identifiant des corrélations positives significatives pour les jeux de "Recherche" et de "Fiction", tandis que les jeux de type "Arcade" n'ont montré aucune relation claire. Ces résultats suggèrent que les jeux narratifs et axés sur la recherche sont particulièrement efficaces pour renforcer les compétences orthographiques. Les résultats soutiennent l'utilisation de la ludification, en particulier à travers des jeux collaboratifs et riches en contenu narratif, comme une stratégie bénéfique pour pratiquer l'orthographe en espagnol.

**Key words:** Gamification; Spelling Proficiency; Mobile Application; Primary Education; Spanish language.

**Palabras Clave:** Gamificación; Competencia ortográfica; Aplicación móvil; Educación primaria; Lengua española,

**Mots clés:** Ludification; Compétence orthographique; Application mobile; Éducation primaire; Langue espagnole.

## INTRODUCTION

Spelling proficiency is a fundamental component of communicative competence and its acquisition should be prioritized in early educational stages to ensure the development of robust linguistic skills. Despite the recognized importance of spelling, there remains a paucity of studies specifically focusing on the application of gamification strategies to Spanish orthography. Legislative recommendations have increasingly emphasized the need for continuous practice activities, such as spelling, to be contextualized within learning situations where students can apply their knowledge in simulated environments. This study addresses this gap by exploring the impact of the GAUBI mobile application on Spanish spelling proficiency among primary school students. This app is designed to enhance spelling skills through various game types, including arcade, research, and fiction games. Utilizing a

quasi-experimental design, this study hypothesizes that the use of GAUBI will significantly improve spelling performance. Moreover, it examines the relationship between the type and duration of gameplay and improvements in spelling proficiency. This research aims to provide empirical evidence analysing the possible effectiveness of gamification in spelling teaching and learning strategies.

## The teaching of spelling through gamification

From an international perspective, gamification has recently been employed to foster active and engaging learning environments. Specifically, in language education and the enhancement of spelling-related processes, gamification has demonstrated beneficial effects on learning outcomes. Research indicates that gamification positively impacts spelling proficiency across various educational contexts. Digital tools with gamified features have been found effective in augmenting reading and writing skills, even among children with Special Educational Needs (SEN) (Anderle et al., 2022). Moreover, puzzle games that emphasize blending skills have proven effective in boosting reading abilities in preschool children, thereby enhancing learning outcomes and increasing interest in the educational process (Ungau et al., 2023). Additionally, an innovative educational application incorporating Augmented Reality (AR) and gamification has been investigated for students with reading difficulties, yielding promising results in literacy skill advancement and motivation for both teachers and students, despite certain implementation challenges (Tiede et al., 2022; Fodor & Varga, 2020). Overall, gamification—whether through digital tools, puzzle games, or AR-enhanced applications—has shown considerable potential to improve spelling learning and motivation in diverse educational settings.

Empirical studies have revealed that gamified spelling applications lead to superior test scores and heightened interest in spelling compared to traditional methods (Dymora & Niemiec, 2019). For instance, Tshering et al. (2018) examined the experience of Bhutanese children learning English spelling via "EDUBUZZ kids," a gamified English spelling app. The findings demonstrated that gamifying English spelling education enhances interest, facilitates learning, and improves long-term memory retention compared to conventional classroom methods.

The incorporation of gamification strategies significantly enhances student engagement and motivation by transforming the learning experience into a more dynamic and pleasurable activity. This approach utilizes various components such as real-time feedback, scoring systems, quizzes, digital accolades, leaderboards, incentives, progress tracking mechanisms, narrative techniques, challenges, multimedia content, and time constraints. These elements foster a sense of competition and promote personal development among students. In a

related study, Zhang and Hasim (2023) revealed that gamification in EFL/ESL instruction enhances students' English language skills, attitudes, and overall competence. Lee and Baek (2023) further confirmed this by analyzing 11 cases with 610 participants, showing a medium effect size (g = 0.517) and indicating that gamification significantly improves English language learning outcomes, particularly in vocabulary, listening, and writing skills. Gamification also positively influences students' attitudes towards learning and reduces anxiety, making them more receptive to engaging with educational materials. For example, Hong et al. (2020) found that gamifying English grammar questions could predict students' learning progress, enhancing the overall learning experience. Their study showed that the TipOn platform positively impacts students' attitudes towards gamification and their learning progress, with deprivation-type epistemic curiosity significantly influencing their attitudes.

Moreover, research conducted by Ridhon and Daulay (2023) demonstrates that gamification significantly enhances students' oral proficiency in English, making the learning process more captivating and pleasurable. This dynamic and motivational pedagogical approach not only increases engagement but also facilitates learning and improves long-term memory retention compared to conventional English teaching methods. Gamified learning techniques, therefore, ensure longer retention of information than traditional classroom methods due to the interactive and repetitive characteristics of gamified activities, which reinforce learning. Additionally, gamification fosters the development of self-regulated learning strategies, enabling students to effectively manage their own learning processes, a benefit particularly notable in e-learning environments (Li et al., 2022). Consequently, incorporating gamification into spelling education has been shown to enhance learning outcomes, student engagement, and motivation, positively influencing emotional responses and supporting long-term retention and self-regulated learning. These findings indicate that gamification is a valuable educational tool, especially for improving spelling skills. Gamification has also proven effective in nearly all languages, not just English.

Although the impact is not always positive, for instance, within the context of the French language, the study by Brazo Millán et al. (2018) analyzed the impact of the video game "Scribblenauts" on the teaching of French as a second language, and no improvements in academic performance were identified. On the other hand, the study by Anderle et al. (2022) in Italy investigated primary school students, encompassing those with Special Educational Needs and Learning Disorders. The study revealed statistically significant improvements in reading and writing abilities among all participant groups, both before and after the intervention. Similarly, in Spain, López-Bouzas and Del Moral Pérez (2023) investigated how gamified environments utilizing augmented reality can enhance communication skills in

students with Autism Spectrum Disorder. In the subject of mathematics, González Calleros et al. (2019) also successfully employed gamification for the resolution of mathematical problems with children diagnosed with ADHD.

In the context of Spanish spelling, the scientific literature on the efficacy of gamification is not yet well-established. Recent studies (Méndez & Arias, 2020) advocate for the visual and auditory stimulation of students through videos and audio clips, emphasizing that this strategy significantly improves correct writing skills in Spanish text production. This multisensory impact not only aids knowledge consolidation but also generates longer-lasting memories, achieving around 50% of the expected objectives.

Although gamification's introduction is not yet widespread enough to validate its effectiveness in Spanish, various studies have analyzed its impact on Spanish spelling education and learning. For instance, a study by Diuk et al. (2014) on the impact of gamification through worksheets among third-grade primary students in Argentina showed positive effects on learning. Additionally, Guamán and Álvarez (2022) demonstrated that using Genially with presentations and creative games enhanced spelling learning in sixth-grade students. A study contextualized in eighth-grade education in Ecuador (Cantos Orellana et al., 2024) using various types of games showed improved spelling performance among students. Furthermore, Maquilon-León et al. (2024) observed higher participation and motivation levels in gamified spelling activities compared to traditional methods, with a clear increase in student motivation for learning spelling when gamification was implemented. Game elements like challenges, rewards, and competitions were particularly effective in maintaining student interest and commitment.

González-Ríos (2012) in Costa Rica explored how recurring errors in specific letters can be minimized using playful strategies based on game theory to improve spelling. In Mexico, Rodríguez Arce et al. (2023) compared different vocabulary representation formats in gamified activities, finding significant improvements in vocabulary acquisition. Meanwhile, Machuca Pogo et al. (2022) analyzed the impact of a pilot role-playing video game on teaching spelling to sixth graders in Ecuador, finding that role-based gamification helped reduce spelling errors.

Recent studies have shown that primary school students frequently use video games in various formats and devices, suggesting that incorporating gamification through these video games can be an effective educational strategy both inside and outside the classroom (Vázquez-Cano et al., 2023a; Saez-Lopez et al., 2023). For this to be effective, game design must meet pedagogical and didactic requirements directly linked to the competencies and evaluation criteria outlined in the official curriculum, ensuring that their use aligns with the

educational goals students must achieve at this stage (Vázquez-Cano et al., 2022). Moreover, the use of gamification mediated by digital devices and various game types must adhere to sustainable proposals that protect student data and ensure ethical use without storing sensitive information on servers, while allowing teachers and families full knowledge, access, and opposition to game requirements (Vázquez-Cano et al., 2023b).

## The Typology of Games and Their Educational Impact

One critical aspect of leveraging gamification for educational enhancement is identifying the most effective types of games for fostering meaningful learning. Effective serious games in education include various genres such as arcade, research-based, and interactive fiction games. Studies have shown that serious games, whether 2D or 3D, positively influence learning outcomes, with 2D games perceived as more effective than 3D games, particularly among females with specific scientific backgrounds and ICT skills (Arosquipa López et al., 2023). Furthermore, serious games have been found to improve cognition, motivation, and academic achievement among primary school students, though competition and improper methodologies can sometimes lead to adverse effects (Toda et al., 2018).

In this regard, scientific literature has identified specific dimensions and variables that should be adopted in creating gamified and playful spaces for educational purposes. A crucial category that serious games must fulfil is multimodality and interactivity. Both multimodality, which involves using multiple communication modes, and interactivity significantly enhance the educational effectiveness of serious games (Ritterfeld et al., 2009). Another critical factor contributing to the efficacy of serious games in education is the inclusion of simulation and role-playing elements (Bellotti et al., 2010). The beneficial effects of simulation are heightened when it fosters the cultivation of soft skills and actively promotes learning through cooperative exercises (Echeverría et al., 2011). Moreover, the structure of the game plays a crucial role in enhancing students' visual and cognitive perceptual abilities (van der Ven et al., 2017), which may result in improved concentration and learning outcomes (Chen et al., 2019). Consequently, activities that align with students' interests, especially those based on real-life experiences organized into narratives to solve contextual problems, are highly effective (Rocha & Dondio, 2021). Additionally, serious games are more effective when they contribute to developing 21st-century skills such as critical thinking, problem-solving, and collaboration (Romero et al., 2015). This approach has been proven to enhance primary school students' logical-mathematical, naturalistic, and linguistic abilities (Pérez et al., 2018).

In general, a well-crafted serious game, regarding its typology, is defined by two main functionalities: (1) Adaptive challenges, where effective games adjust difficulty levels to align with the users' abilities. The most impactful games and instructional methods do not surpass

the users' capacity for interactive problem-solving, and (2) Sensory stimuli, which involve the incorporation of visual elements, sounds, and/or narratives that engage the senses, without necessitating "professional" quality graphics or audio to be compelling (Shute & Ke, 2012). Games that foster "situated learning" tend to enhance motivation and academic performance (Ben Rebah & Ben Slama, 2019). As noted by Frété (2015), games embed learning within real or fictional contexts, allowing learners to participate in problem-solving activities that capture their interest from the outset. These problem-solving actions, planned by the learner, are interconnected through a playful metaphor and are enriched by the game's objectives, setting, and challenges.

Moreover, serious games should be designed to enhance logical thinking and problem-solving through adequate positive feedback, enabling students to learn from mistakes and overcome challenges (Mielgo-Conde et al., 2022; Sanchez et al., 2011). Based on these principles, games should also be sufficiently complex to increase difficulty as obstacles are overcome, thus adhering to a core aspect of flow theory, which states that the challenge should continually match the learner's ability (Abuhamdeh & Csikszentmihalyi, 2012; Nebel et al., 2020). Additionally, formal requirements such as visual aesthetic design and auditory design must be met. Studies have shown that rounded shapes and warm colors induce positive emotions (Um et al., 2012), and music related to scoring impacts motivation and enjoyment (Lipscomb & Zehnder, 2004). Another aspect that enhances the gaming experience and relates to higher academic performance is the inclusion of a narrative that allows students to progress through an engaging story viewed as a challenge (Clark et al., 2016; Echeverria et al., 2012).

## Intervention for practising Spanish spelling with a gamified App

The GAUBI application is founded on the principle of Game-Based Learning (GBL), which is regarded as a form of educational activity utilizing digital educational games. This approach can also be referred to as Digital Game-Based Learning (DGBL) (Chen et al., 2020). The mobile app was tailored to provide interactive exercises and games focused on Spanish spelling rules and vocabulary. The app was developed with the collaboration of researchers from the project "Gamificación y aprendizaje ubicuo en Educación Primaria. Elaboración de un mapa de competencias y recursos docentes, discentes y parentales (GAUBI)" and is currently undergoing analysis in a proof of concept (PDC2022-133185-I00). The application is accessible on the Android PlayStore at the following link: GAUBI App.

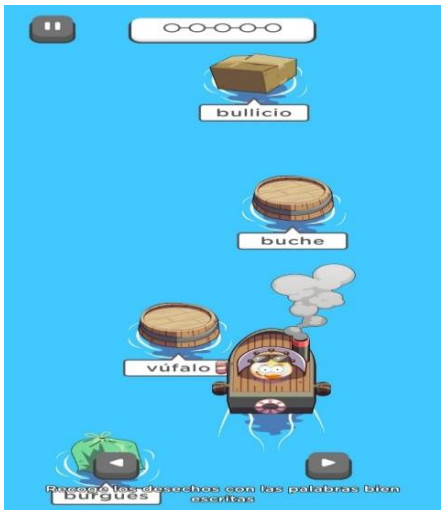
This application is non-commercial and strictly adheres to user data protection regulations, ensuring no personal data is stored on servers. Additionally, it contains no advertisements or promotions, thereby maintaining an ethical and sustainable operation (Figure 1).

**Figure 1. T Presentation of the GAUBI app**


The app includes pedagogical guides, which introduce the content to families and educators upon launching the app. Emphasis has been placed on usability, the duration of app usage, and student self-assessment through various in-game achievements. It is essential to analyze these achievements within the classroom context. Consequently, a final report feature has been incorporated, enabling players to submit their performance data to their teachers upon completion. This report includes the following information: game level, orthographic rule practiced according to the curriculum, level score, time spent on each level, and the student's name.

The design included features aimed at engaging students through gamification elements such as challenges, rewards, and feedback mechanisms. The app incorporated three main game types: arcade, research-based activities that encouraged exploration and learning through inquiry, and fiction-based activities that immersed students in narrative-driven scenarios (Figures 2, 3 and 4).

**Figure 2. Description of Arcade games**




**ARCADE**

This genre of game epitomizes the most mechanical form of gameplay, specifically designed to engage and exercise fundamental cognitive functions such as element recognition and identification, attention, and memory. This is achieved through arcade-style game mechanics, wherein an automatism is developed that is intrinsically linked to the game's core mechanics. In each mini-game, students are tasked with discerning correctly spelled words from those that are incorrectly spelled, thereby reinforcing their cognitive skills in a structured yet dynamic environment.

**Figure 3. Description of Research games**


**RESEARCH**

Research-based games aim to foster an exploratory phase of decision-making regarding the sequencing of elements and the completion of challenges. In this context, cognitive functions are extended to include the association and connection of ideas, as well as the application of learned concepts through various game mechanics, such as selection and deletion. In this phase, the orthographic rule is presented within a contextual framework, establishing relationships with other words in the learning scenario and allowing the rule to be linked to specific situations.

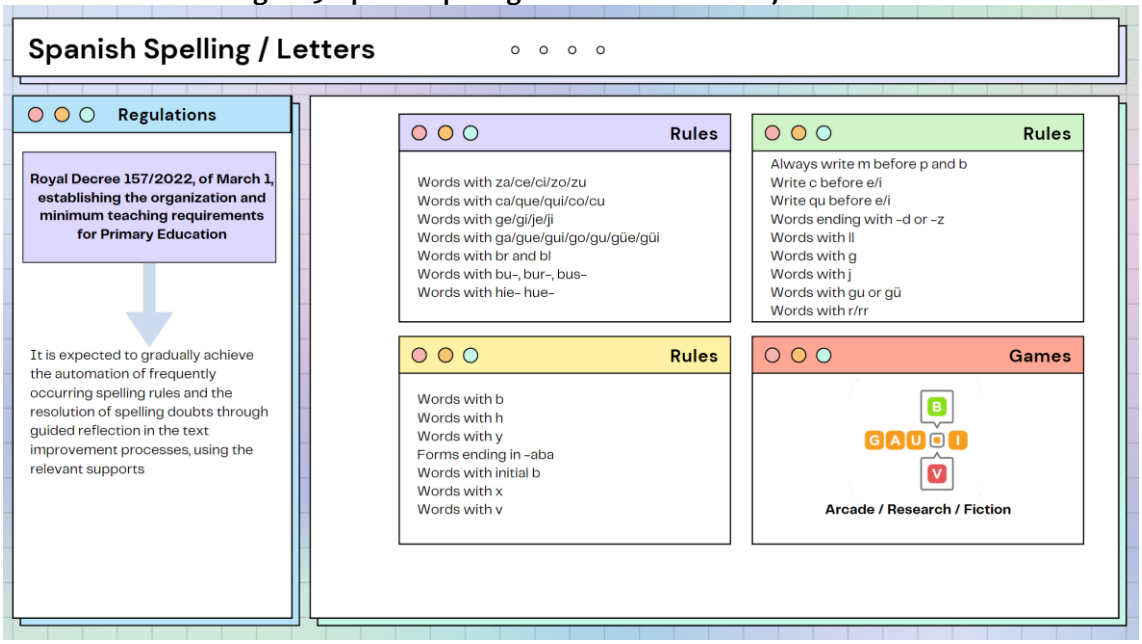
**Figure 4. Description of Research games**


**FICTION**

Games based on fiction and interaction rely on a metacognitive processing framework that aims to enable students to apply and create content. This involves making decisions within an interactive fiction that allows them to complete the story themselves. The virtual narrative, which is centered on mental health (SDG), progressively contextualizes the orthographic rule within its thematic dynamics. This approach ensures that the orthographic rules are embedded within a meaningful and engaging storyline, facilitating deeper cognitive engagement and understanding among students.

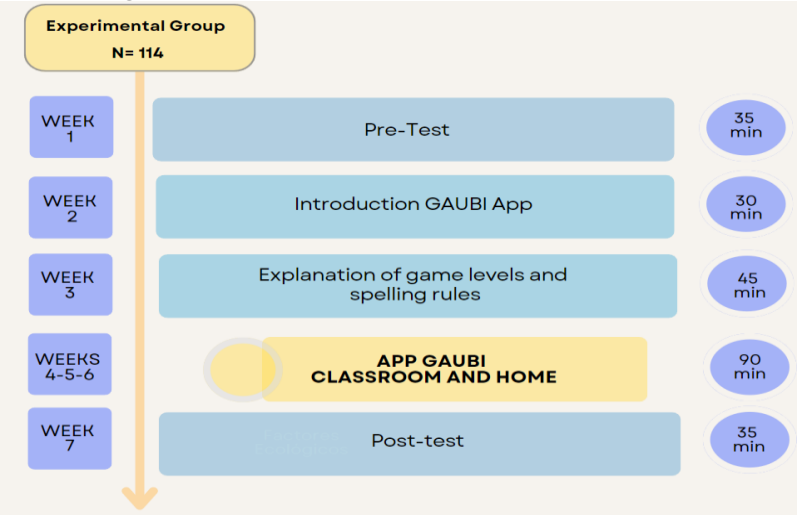
The app has been designed in consideration of the Royal Decree on Primary Education for the Spanish State (Royal Decree 157/2022), incorporating all the rules governing Spanish orthography with respect to the variability of letters and phonemes. (Figure 5).

**Figure 5. Spanish spelling letters and curricular justification**




The implementation to evaluate the app's functionality was conducted in various scenarios. One of these scenarios involved experimenting with the app's use for spelling practice in an experimental group. The primary objective was to apply the app in diverse socio-educational contexts and with different student typologies to test the potential effectiveness of the application regardless of the context. Consequently, the experimental group comprised six primary education groups from fourth and fifth grades in three Spanish schools—small, medium, and large—in both urban and rural settings. The experiment extended over seven weeks during the 2023/24 academic year and followed the procedure outlined in Figure 6.

**Figure 6. Phases in the development of the research**



In the first week, students were required to complete a spelling knowledge test involving Spanish letters, using words and rules similar to those they would encounter in the app's minigames. In the second week, an introductory session was held to explain the app's primary functionalities from a dual perspective for both students and families. The third week featured a 45-minute session to delve deeper into the app's operation and objectives. This session covered the installation process, challenges, minigames, evaluation and reward systems, and result reporting, addressing both classroom use and home practice. During the following three weeks, the app was used for spelling practice both in the classroom and at home, with three sessions each week. Classroom sessions were limited to 20 minutes, while home sessions were restricted to 15 minutes. Finally, in the seventh week, a post-test was administered to assess potential improvements in the spelling performance of the students who participated in the experience.

## METHOD

This study aimed to investigate the impact of a specially designed mobile application on Spanish spelling proficiency among primary school students (GAUBI). The primary hypothesis posited that using this app would lead to a significant improvement in spelling performance. Additionally, a secondary hypothesis was formulated to investigate whether there is a relationship between the type and duration of gameplay—such as arcade, exploration, fiction games—and potential improvements in spelling performance.

This study is approached using a quasi-experimental design. Prior to the intervention, participants completed a pre-test assessment to establish baseline spelling proficiency. Following a specified period of app usage, a post-test assessment was administered to evaluate changes in spelling performance. These assessments were carefully constructed to encompass a broad spectrum of spelling skills relevant to the primary school curriculum in Spanish. This pre-test and post-test design enabled within-subject comparisons, minimizing potential confounding variables and enhancing the reliability of observed effects. The normality of the sample distribution was assessed to ensure appropriateness for parametric analyses. Following this, paired samples t-tests were conducted to compare pre-test and post-test scores, evaluating the statistical significance of improvements in spelling performance.

Effect sizes for these comparisons were calculated using Cohen's d to quantify the magnitude of changes observed. Additionally, correlations between the frequency and type of game usage (arcade, research and fiction) within the app and spelling performance outcomes were explored using Pearson correlation coefficients. These analyses aimed to

elucidate the strength and direction of associations between specific app features and spelling proficiency. Ethical approval was obtained from UNED review board prior to the commencement of data collection. Informed consent was obtained from participants and their guardians, ensuring voluntary participation and confidentiality of collected data throughout the study.

## Participants

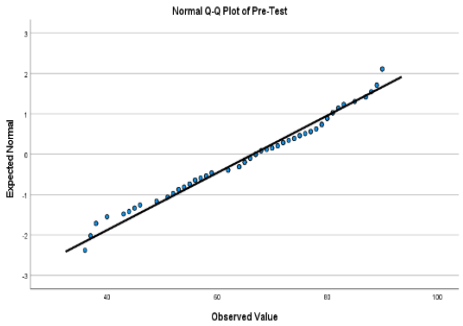
The study recruited a sample of 114 primary school students from three different schools who used the mobile app for practising spelling during the academic year 2023/24.

## Results

First, the normality of the sample is calculated, and the results are presented in Table 1.

**Table 1. Tests of Normality.**

| | Kolmogorov-Smirnov[a] | | |
|---|---|---|---|
| | Statistic | df | Sig. |
| Post_Test | 0,086 | 114 | 0,036 |
| Pre_Test | 0,070 | 114 | ,200* |




The Kolmogorov-Smirnov statistic is 0.070, with 114 degrees of freedom and a significance value of 0.200, which is a lower bound of the true significance. This suggests that the Pre_Test data does not deviate significantly from a normal distribution. Subsequently, given that the pre-test sample follows a normal distribution, a paired samples test was conducted.

**Table 2. Paired Samples Statistics.**

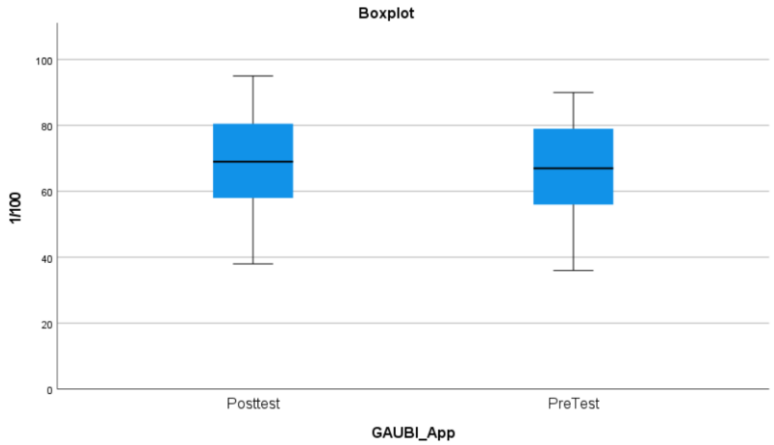
| | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| Pre-Test | 66,50 | 114 | 14,107 | 1,321 |
| Post_Test | 68,51 | 114 | 14,461 | 1,354 |

**Table 3. Paired Samples Test.**

| | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | | | | Lower | Upper | | | |
| Pre-Test - Post_Test | -2,009 | 2,462 | 0,231 | -2,466 | -1,552 | -8,711 | 113 | 0,000 |

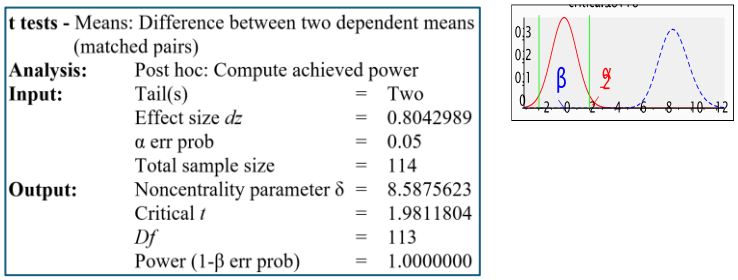
The boxplot in Figure 7 below shows the differences between the control and experimental groups.

**Figure 7. Boxplot of the differences between the pretest and posttest.**



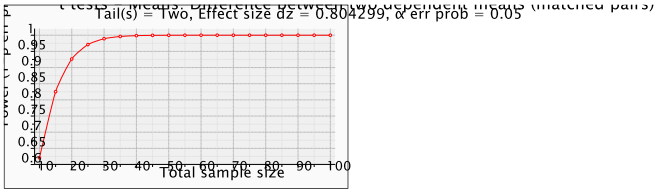

To determine the impact, the effect size is calculated using the G*Power software.

**Figure 8. Effect size results.**



| | | | |
|---|---|---|---|
| **t tests -** Means: Difference between two dependent means (matched pairs) | | | |
| **Analysis:** | Post hoc: Compute achieved power | | |
| **Input:** | Tail(s) | = | Two |
| | Effect size *dz* | = | 0.8042989 |
| | α err prob | = | 0.05 |
| | Total sample size | = | 114 |
| **Output:** | Noncentrality parameter δ | = | 8.5875623 |
| | Critical *t* | = | 1.9811804 |
| | *Df* | = | 113 |
| | Power (1-β err prob) | = | 1.0000000 |




As depicted in Figure 8, the effect size of 0.8 is substantial, signifying a considerable difference between the paired means. In practical terms, this indicates that the treatment or condition under investigation has a markedly impactful effect. Power (1-β err prob): 1.0000000. Statistical power is the probability of correctly rejecting a false null hypothesis. A power of 1.0000000 indicates 100% power, suggesting that the test is extremely robust in detecting an effect if one exists. The frequency of use for each type of game during the educational experience is presented below.

**Table 4. Frequency of usage of each type of game.**

| *Frequency* | *Arcade %* | *Research %* | *Fiction %* |
|---|---|---|---|
| 2 | | 12.3 | 28.1 |
| 3 | 2.6 | 47.4 | 35.1 |
| 4 | 19.3 | 30.7 | 28.1 |
| 5 | 30.7 | 7.9 | 7.0 |
| 6 | 16.7 | 1.8 | 1.8 |
| 7 | 30.7 | | |
| Total | 100.0 | 100.0 | 100.0 |

The frequency distribution for "Arcade games" shows a significant concentration at the frequency levels of 5 and 7, each with a 30.7% share of the total responses. The cumulative percentage reaches 100% at frequency level 7, indicating a substantial and consistent engagement pattern among the respondents. The frequency distribution for "Research games" peaks at frequency level 3, with 47.4% of the total responses. The cumulative percentage of 100% is reached at frequency level 6, with a notable drop in higher engagement frequencies compared to Arcade games. The frequency distribution for "Fiction games" is highest at frequency level 3, with 35.1% of the total responses, followed by a significant proportion at frequency levels 2 and 4 (each around 28%). The cumulative percentage reaches 100% at frequency level 6, showing a slightly more varied engagement pattern compared to the other two categories. A correlation is conducted between the frequency of use of "Arcade," "Research," and "Fiction" games and their impact on post-test outcomes to determine their respective influences on spelling proficiency (Table 5).

**Table 5. Correlation between Post_Test and type of games.**

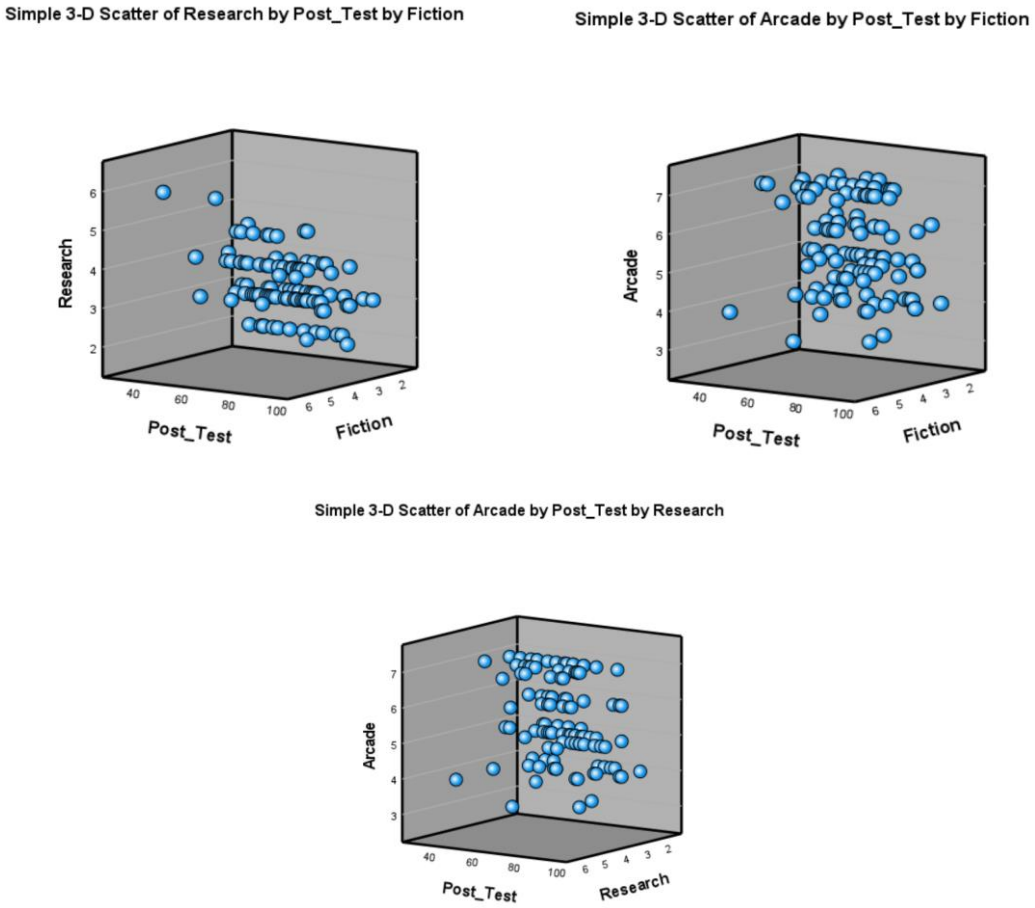
| | | Post_Test | Arcade | Research | Fiction |
|---|---|---|---|---|---|
| Post_Test | Pearson Correlation | 1 | ,009 | ,190* | ,213* |
| | Sig. (2-tailed) | | ,922 | ,043 | ,023 |
| | N | 114 | 114 | 114 | 114 |
| Arcade | Pearson Correlation | ,009 | 1 | ,333** | ,273** |
| | Sig. (2-tailed) | ,922 | | ,000 | ,003 |
| | N | 114 | 114 | 114 | 114 |
| Research | Pearson Correlation | ,190* | ,333** | 1 | ,820** |
| | Sig. (2-tailed) | ,043 | ,000 | | ,000 |
| | N | 114 | 114 | 114 | 114 |
| Fiction | Pearson Correlation | ,213* | ,273** | ,820** | 1 |
| | Sig. (2-tailed) | ,023 | ,003 | ,000 | |
| | N | 114 | 114 | 114 | 114 |

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

The correlation results between Post_Test and the games (Table XXX) indicate that for "Arcade" games, the Pearson correlation between the frequency of Arcade game usage and spelling performance (Post_Test) is 0.009, indicating a very weak and non-significant correlation (p = 0.922). This suggests that the frequency of Arcade game usage is not

significantly related to students' spelling performance. Regarding "Research" games, the correlation is significant at the $p < 0.05$ level (0.190*). Finally, for "Fiction" games, the correlation is also significant (0.213*). When analyzing the combination of games, we observe that the correlation between Arcade and Research is 0.333** (significant at the $p < 0.01$ level), and the correlation between Arcade and Fiction is 0.273** (significant at the $p < 0.01$ level), indicating a moderate relationship. In contrast, the correlation between "Research" and "Fiction" is 0.820** (highly significant at the $p < 0.01$ level), suggesting a strong and positive relationship between the usage of "Research" and "Fiction" games.We can observe these correlations in Figure 9, comparing the frequency of gameplay for each game and their impact on post-test scores.

**Figure 9. Scatter plot of the impact of games and their combination.**




As observed in Figure 9, the correlation between "Fiction" and "Research" is notably stronger, with a tighter clustering of data points towards the lower end. This suggests that fewer plays of "Research" and "Fiction" have a greater impact on post-test outcomes compared to "Arcade", evident in the broader scatter of points on the graph. Based on these findings, it can be concluded that both "Research" and "Fiction" games exhibit significant and positive associations with students' spelling performance, whereas Arcade games show

no clear relationship in this specific context. The high correlation between "Research" and "Fiction" also suggests that using both games in combination could be particularly advantageous for enhancing spelling skills in primary school students.

## DISCUSSION

The findings of this research have demonstrated, firstly, that the use of the GAUBI app significantly enhances students' orthographic performance, with a large effect size of 0.80. Additionally, it has been established that the typology of the game influences students' orthographic performance. Games based on "Research" and "Fiction" exhibit significant and positive associations with students' orthographic outcomes, whereas "Arcade" games do not show a clear relationship in this specific context. The high correlation between "Research" and "Fiction" also suggests that the combination of these games could be particularly beneficial in improving primary school students' orthographic skills.

The improvement in the orthographic and lexical performance of primary school students through gamification has been corroborated in various languages. For example, Belet Boyacı and Genç Ersoy (2021) found that gamification significantly improves vocabulary acquisition, awareness, and skills within the experimental group. Furthermore, it enhances participants' willingness and motivation to learn new vocabulary and incorporate previously unfamiliar words into their usage. In a study of South Korean students, a medium effect size of 0.517 was reported when gamification was employed for English language learning (Lee & Baek, 2023). Another study with primary school students in Indonesia (Wedhanti et al., 2021) created games to improve vocabulary and spelling acquisition through a game called “bee game,” which helps students remember words better, is enjoyable, and makes students more active. Dixon et al. (2022) also found that gamification had a medium effect size of 0.50 for second language learning.

The results of this research for the Spanish language have corroborated findings from other studies that employed gamification as a didactic strategy for teaching orthography (Méndez & Arias, 2020; Diuk et al., 2014; Guamán & Álvarez, 2022; Cantos Orellana et al., 2024; Maquilon-León et al., 2024).

Moreover, the results have shown that when games are based on narratives requiring critical and investigative thinking from the student, they produce better academic outcomes. The scientific literature has indicated that when a game is designed considering its interactivity, narrative, and visual characteristics, its effectiveness for learning is significantly higher (Clark et al., 2016; Sadera et al., 2014).

Conversely, simpler games tend to become boring and excessively mechanical, thus less satisfactory (Villalta et al., 2011; Halloran & Minaeva, 2019). In this sense, "Arcade Games," typically fast-paced and requiring quick reflexes, can enhance cognitive skills such as reaction time, hand-eye coordination, and spatial awareness. However, their potential for teaching complex or abstract concepts is limited. As Bediou et al. (2018) established in their meta-analysis, action video games, which include many arcade games, improve cognitive abilities, particularly visuospatial skills and attentional control, but have a limited impact on learning outcomes. Clark et al. (2016) also noted in their study that more mechanical games like "shooter games" can improve certain visual cognitive tasks but are more limited for the development of situated and contextualized learning.

In contrast, Barab and Dede (2007) found that narrative-driven games create immersive learning experiences, aiding in the understanding and retention of complex content by situating learning within a meaningful context. Similarly, Gee (2008) emphasizes how story-based games promote literacy and critical thinking through narrative-driven problem-solving. In this line of research, Ruggiero and Watson (2014) discuss how digital narrative games can foster empathy and ethical thinking, particularly through immersive storytelling and character-driven plots. Numerous studies have evidenced that incorporating a narrative context linked with a learning context is essential for serious games to have a multiplier effect on learning (Bransford et al., 2000; Dickey, 2006; Echeverria et al., 2012).

Besides the typology of "mechanics" games, these games must adhere to dynamics that generate attention, status, or reflection and combine with the "Aesthetics" component (Manzano-León et al., 2021, p. 1), "desirable emotional responses evoked in players when interacting with the game system." The games based on "Research" and "Fiction" used in the analyzed application can be played in groups or pairs, and this collaborative and shared play can enhance the effectiveness of orthographic learning. This aspect has also been corroborated in other studies that link collaborative play with better academic performance compared to solitary play (van der Meij et al., 2011; Wouters et al., 2013). In this sense, the meta-analysis by Clark et al. (2016, p. 100) evidenced that "Games with collaborative team competition, however, produced significantly larger effects than those using single/competitive players ($b = 0.40$, $p = .001$, 95% CI [0.17, 0.63])." This research has shown that the amount of gameplay time is not a significant variable for improving outcomes; rather, it is the type of game related to the orthographic rule being addressed from a more integral and collaborative perspective. These results were also confirmed by Clark et al. (2016, p. 99), who found no association between total gameplay time and effect size ($b = 0.00$, $p = .99$, 95% CI [−0.0005, 0.001]).

In addition, it is crucial to highlight that the gameplay in GAUBI is aligned with the Sustainable Development Goals (SDGs), specifically SDG 6: Clean Water and Sanitation, SDG 7: Affordable and Clean Energy, SDG 14: Life Below Water, and SDG 3: Good Health and Well-being. This alignment is achieved through game dynamics contextualized within these themes to address students' spelling competence. The integration of games with empathy and ethical values is a fundamental aspect for their educational application (Carnicero Pérez et al., 2023). Finally, it is imperative that educators engage in the ethical and secure utilization of applications employed in their instructional strategies (Vázquez-Cano et al., 2023)

**CONCLUSION**

The findings of this study have demonstrated, firstly, that the use of the GAUBI app significantly enhances students' orthographic performance, exhibiting a large effect size (Cohen's d = 0.80). Furthermore, the typology of the game has been shown to influence students' orthographic performance. Specifically, games based on "Research" and "Fiction" display significant and positive associations with students' orthographic outcomes, while "Arcade" games do not present a clear relationship in this specific context. The strong correlation between "Research" and "Fiction" suggests that the combined use of both game types could be particularly advantageous for improving spelling skills in primary school students. These results underline the importance of narrative-driven and research-based games in educational settings, highlighting their potential to foster significant improvements in spelling proficiency. The absence of a clear relationship between "Arcade" games and orthographic performance further emphasizes the necessity of integrating more complex and contextually rich game designs to achieve optimal educational outcomes. These findings contribute to the growing body of evidence supporting the use of gamification as a didactic strategy, particularly through collaborative and narrative-rich games, to enhance spelling proficiency in primary education.

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***Contribución de los autores***

Esteban Vázquez-Cano: Responsable de la financiación e investigación; conceptualización, curación de datos, metodología; análisis formal; redacción del borrador original, revisión y edición. César Bernal-Bravo: Metodología; conceptualización, redacción del borrador original, revisión y edición. Cristóbal Ballesteros-Regaña: Metodología; análisis formal; redacción del borrador original, revisión y edición. Eloy López-Meneses: Investigación; metodología; conceptualización; análisis formal; redacción del borrador original, revisión y edición.

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***Conflicto de intereses***

Los autores declaran no tener ningún conflicto de intereses.

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