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VISUAL GRAMMARS AND PLAYFUL INTERFACES IN THE REVITALIZATION OF INDIGENOUS LANGUAGES:
A Systematic Review on Gamification and Digital Semiotics

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ABSTRACT

Gamification has established itself as a promising strategy for fostering motivation in language teaching, although its application to endangered indigenous languages remains largely unexplored. Following the PRISMA 2020 protocol, this review analyzed 39 studies to examine the effectiveness of gamification and immersive technologies in the revitalization of indigenous languages, along with the visual and semiotic dimensions of interface design. The findings show consistent motivational benefits but mixed effects on performance, with immersive technologies proving to be the most effective. The need for culturally relevant and visually refined gamified experiences is highlighted.

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1. Introduction

The accelerated loss of indigenous languages constitutes a linguistic, semiotic, and cultural crisis. When a language disappears, the circulation of iconic systems, worldviews, and ways of representing the world—transmitted across generations—is interrupted. In a screen-dominated environment, language preservation is shifting toward digital visual culture. Within this framework, gamification and virtual environments are no longer merely educational resources: they function as multimodal cultural artifacts that reconfigure the memory and learning of Indigenous languages through graphic and hypertextual languages and playful narratives.

Gamification transfers the dynamics, mechanics, and aesthetic structures of games to non-recreational environments and acts as a catalyst for attention and affective motivation. Its application in global languages, such as English, has been extensively validated empirically and has seen significant aesthetic and technological development. In contrast, its adoption in indigenous languages remains an emerging and fragmented field. Although previous research shows that video games and mobile apps reduce communicative anxiety and foster engagement (Pai et al., 2024; Dehganzadeh, 2020), an analytical gap persists: it remains unclear how visual codes and gamified interfaces translate community knowledge into " " learning experiences without resorting to folkloric simplifications or superficial decolonialism.

The available evidence supports the strategy's potential, albeit unevenly. Núñez (2022) reports increases in motivation and participation among Ecuadorian teachers, although the study's non-experimental design precludes attributing causality. Dehganzadeh's (2020) review documents improvements in retention, performance, and peer interaction, but notes only marginal application in endangered languages. Pinto et al. (2021), for their part, associate virtual reality with advances in second-language acquisition, focusing on attitudinal variables. Taken together, these studies agree on the motivational benefit, but rarely examine whether that benefit translates into deep learning or how it is reflected in the specific design of the interface—a crucial issue for Indigenous languages.

From the perspective of visual culture, the conceptual distinction between gamification and Game-Based Learning (GBL) is crucial. While GBL immerses the user in autonomous virtual worlds structured by complex iconic and representational rules (Tobias et al., 2014), gamification superimposes layers of visual meaning (scores, badges, progress bars, avatars) onto traditional educational processes.

The objective of this systematic review, conducted in accordance with the PRISMA 2020 protocol (Page et al., 2021), is to critically examine the effectiveness of gamification and immersive technologies in the acquisition and revitalization of Indigenous languages. It seeks to unravel their cognitive and affective benefits, their technical limitations, and, fundamentally, the role that visual interface design plays in constructing culturally relevant educational experiences.

2. Theoretical Foundations

The digital transformation of educational environments has driven the incorporation of innovative methodologies aimed at improving the quality of learning, especially in contexts where not only the acquisition of knowledge but also cultural preservation is required. In this context, language teaching—both of foreign and indigenous languages—has undergone a significant evolution through the integration of digital technologies, playful strategies, and student-centered pedagogical models.

2.1. Gamification in Educational Contexts

Gamification has emerged as a pedagogical strategy that involves incorporating game-like elements into non-game contexts with the aim of improving motivation, engagement, and the user experience. According to Huotari and Hamari (2012), gamification is conceived as a process aimed at creating value through playful experiences, and it has been widely adopted in the field of education.

The evidence suggests that gamification promotes active participation, immediate feedback, and self-directed learning, and increases intrinsic motivation while reducing anxiety, particularly in oral expression (Pai et al., 2024). In online environments, it also strengthens interaction and collaborative work (Osipov et al., 2016). However, much of this evidence comes from contexts involving majority languages and brief interventions, so its transfer to Indigenous languages cannot be assumed without caution.

In terms of design, models such as the Octalysis framework have made it possible to structure gamified experiences geared toward specific educational objectives, optimizing student engagement and improving learning outcomes in formal and corporate contexts (Chen et al., 2023).

2.2. Game-Based Learning and Its Conceptual Distinction

Game-Based Learning (GBL) is a pedagogical approach that uses full-fledged games (digital or analog) as teaching tools. Unlike gamification, which incorporates game elements into educational activities, GBL is based on the direct use of game environments designed for educational purposes (Tobias et al., 2014).

Empirical evidence shows that GBL promotes complex cognitive processes, such as problem-solving, decision-making, and critical thinking. Recent studies have demonstrated that the use of educational video games improves reading comprehension, vocabulary retention, and the development of social-emotional skills (Manzano León et al., 2022). Furthermore, experimental research shows that digital games can optimize second-language vocabulary learning, in some cases outperforming traditional methods (Zhonggen, 2018; Janebi Enayat and Haghighatpasand, 2019).

The distinction between gamification and GBL is fundamental from a methodological standpoint, since both strategies, although complementary, are based on different pedagogical approaches. While gamification acts as a system of motivation and reinforcement, GBL constitutes a learning environment in and of itself.

2.3. Emerging Technologies in Language Learning

Advances in digital technologies have enabled the development of highly immersive learning environments, where artificial intelligence, virtual reality, and mobile applications play a key role. In the field of language learning, these technologies have proven to be highly effective in improving vocabulary acquisition, pronunciation, and contextual comprehension.

Virtual reality, for example, allows for the simulation of authentic communicative environments, facilitating linguistic immersion and improving knowledge retention (Alfadil, 2020; Lobanova et al., 2024). Similarly, the use of artificial intelligence and extended environments has made it possible to design adaptive systems capable of personalizing learning according to students' needs (Divekar et al., 2022).

Mobile apps have also gained prominence as accessible and flexible tools for language learning, enabling continuous practice and ubiquitous learning (Klimova, 2023; Kaur and Chen, 2021). These tools have proven particularly useful in contexts where access to traditional educational resources is limited.

2.4. Teaching and Revitalization of Indigenous Languages

Indigenous languages represent an essential component of the cultural heritage of Indigenous peoples, but they face an accelerated process of disappearance due to social, economic, and political factors. In this context, education plays a fundamental role in their preservation and revitalization.

Various studies have highlighted the importance of integrating digital technologies into indigenous language teaching processes. The use of mobile apps, interactive platforms, and multimedia resources has made it possible to expand access to learning and encourage the participation of new generations (Sanabria et al., 2019; Chachil et al., 2015).

Likewise, recent studies have shown that the incorporation of digital media contributes to the sustainability of indigenous knowledge systems, strengthening cultural identity and promoting the intergenerational transmission of language (Bastidas, Sánchez, (2025) and (Ajani et al., 2024). Similarly, the use of technologies such as NFC, video games, and interactive applications has yielded positive results in language revitalization, particularly in communities with limited access to formal education (Elmiligi et al., 2016; Ramírez et al., 2018).

2.5. Integration of Gamification and Technologies in Indigenous Languages

The convergence of gamification, game-based learning, and digital technologies has opened up new possibilities for teaching Indigenous languages. Recent studies have explored the use of serious games,

augmented reality, and interactive platforms for learning languages such as Quechua and Amazigh, demonstrating significant improvements in student motivation and engagement (Cardenas-Valdivia et al., 2023; Boulaknadel et al., 2019).

Furthermore, the design of gamified experiences has integrated cultural elements specific to indigenous communities, creating more contextualized environments (Nijdam, 2021; Zabecki, 2019) that promote both language learning and the preservation of ancestral knowledge. However, the literature tends to present these initiatives in a cumulative and celebratory manner, with little discussion of their limitations, scalability, or empirical validation. Recognizing this combination as a promising approach therefore requires accompanying it with a critical examination of the cultural, technical, and community conditions that make its implementation feasible.

2.6. Visual Culture, Digital Semiotics, and Gamified Interfaces

The convergence of digital technology and education has transformed language learning into a deeply visual and sensory practice. The theoretical framework of visual culture helps us understand that screen-based learning is not limited to phonetic or grammatical decoding but rather involves plurisemiotic literacy.

2.6.1. Gamification as a Visual and Interactive Artifact

According to the framework proposed by Huotari and Hamari (2012), gamification transcends the mere assignment of rewards to become the articulation of aesthetic and y experiences that create meaningful value for the user. In mobile and web environments, visual elements—such as the interface's color scheme, avatar design, and information architecture—act as emotional anchors that shape intrinsic motivation (Chen et al., 2023). The incorporation of design frameworks such as Octalysis demonstrates that the visual perception of progression and challenge directly influences the degree of immersion and the reduction of emotional barriers during language practice (Pai et al., 2024).

2.6.2. Immersive Technologies and the Semiotics of Virtual Space

The integration of Virtual Reality (VR), Augmented Reality (AR), and extended environments into language learning redefines the relationship between text and image (Alfadil, 2020; Lobanova et al., 2024). These technologies not only simulate communicative situations but also construct habitable virtual spaces where language is learned through contextualized interaction with 3D objects and symbolic representations of the environment (Divekar et al., 2022).

2.6.3. Ancestral Visuality and the Revitalization of Indigenous Languages

In the context of Indigenous languages, visual culture takes on paramount political and communal significance. As Nijdam (2021) and Zabecki (2019) point out, the incorporation of cosmologies, textile art, traditional iconography, and oral narratives into video games and interactive applications is not merely a graphical embellishment, but a strategy for epistemic and visual sustainability. The translation of languages such as Quechua, Kichwa, or Amazigh into digital interfaces (Cardenas-Valdivia et al., 2023; Sanabria et al., 2019) requires that typographic and graphic design respect the identity and semiosis of Indigenous peoples, avoiding the imposition of standardized Western aesthetics.

3. Methodology

This research was conducted as a systematic literature review aimed at analyzing the effectiveness of gamification in the learning of indigenous languages, as well as its main challenges and limitations. It also explored existing evidence in comparison with other teaching strategies to determine its impact on the language acquisition process. Thus, the study was structured according to the guidelines of the PRISMA 2020 protocol, proposed by Matthew J. Page et al. (2021), ensuring transparency, traceability, and replicability in the study selection process.

The systematic search was conducted in three high-impact academic databases—Scopus, ScienceDirect, and the ACM Digital Library—selected for their broad interdisciplinary coverage and the quality of their indexed publications.

Scopus is known for its extensive coverage of peer-reviewed scientific literature and its bibliometric analysis tools. ScienceDirect provides access to high-quality research across multiple disciplines, particularly in education and technology. For its part, the ACM Digital Library excels in the fields of computing, human-computer interaction, and educational technologies—areas closely linked to gamification and digital learning.

Rigorous criteria were established to ensure the relevance and quality of the selected studies. Accordingly, the inclusion criteria considered studies that met the following conditions:

Publications indexed in Scopus, ScienceDirect, or the ACM Digital Library
Articles in English or Spanish
Studies published since 2015
Research focused on language learning (especially indigenous or minority languages)
Studies with an educational focus within the field of social sciences
Publications such as scientific articles, conference papers, or book chapters
Studies with empirical evidence or systematic analysis

Meanwhile, the following were considered as exclusion criteria:

Those presenting incomplete or insufficient information for analysis
Were not related to gamification or language learning
Did not include the relevant population (students or language learners)
Duplicates across databases

The search strategy was designed using the Boolean operators AND and OR, with the aim of maximizing the retrieval of relevant studies while maintaining thematic specificity. The search string used was as follows:

("gamification" OR "game-based learning" OR "serious games") AND ("indigenous languages" OR "native languages") AND ("language learning" OR "language acquisition")

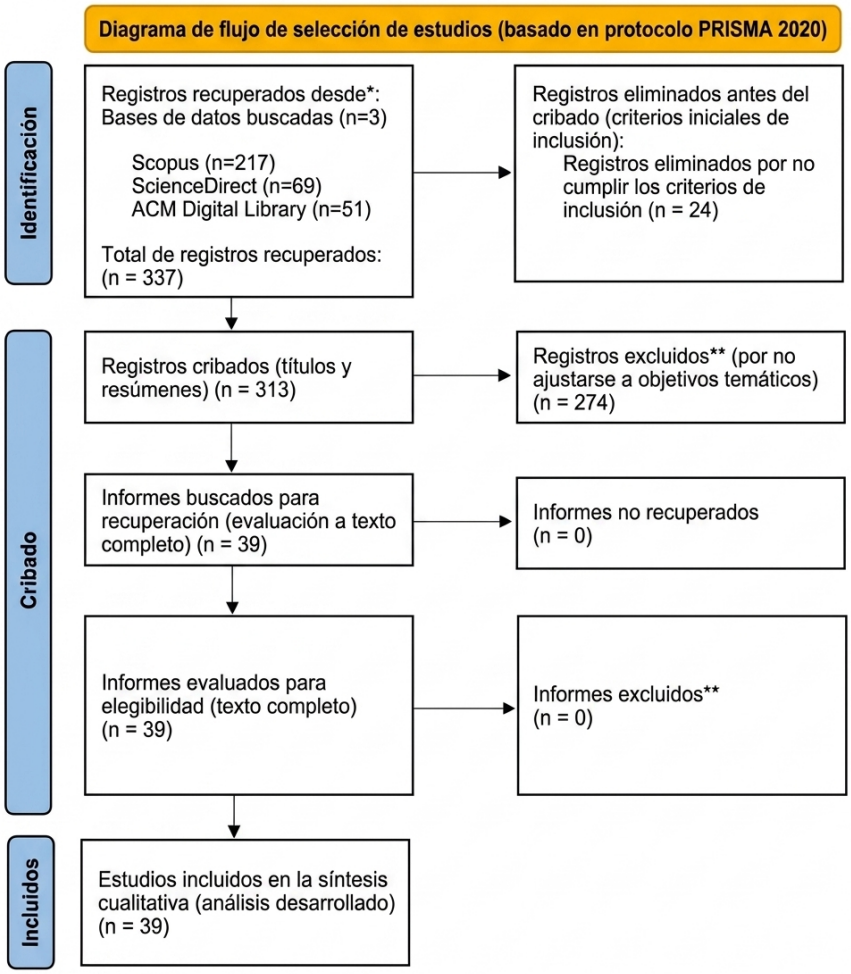
This search string identified research related to both gamification and game-based learning, ensuring broad coverage of the phenomenon under study. It should be noted that the search deliberately encompassed gamification in language learning in general—including major foreign languages—and not exclusively indigenous languages, with the aim of conducting a comparative analysis between the progress achieved in global languages and the gaps identified in minority/indigenous languages.

The study selection process was conducted in accordance with the PRISMA 2020 guidelines, thereby ensuring the transparency, traceability, and replicability of the systematic review. During the identification phase, a total of 337 records were retrieved from the Scopus (n = 217), ScienceDirect (n = 69), and ACM Digital Library (n = 51) databases. Subsequently, 24 records were excluded prior to the screening process because they did not meet the initial inclusion criteria, resulting in a total of 313 studies for the preliminary evaluation phase.

During the screening stage, the titles and abstracts of the 313 records were reviewed, and 274 studies were excluded because they did not align with the research objectives or did not meet the established thematic criteria. As a result, 39 studies were considered potentially relevant and proceeded to the full-text evaluation phase.

During the eligibility phase, the 39 studies were analyzed in depth to verify their methodological relevance, thematic coherence, and contribution to the review's objective. All evaluated studies met the established inclusion criteria, so no additional exclusions were recorded at this stage. Finally, 39 studies were included in the qualitative synthesis, which form the basis of the analysis presented in this paper.

Figure 1.



Source(s): Prepared by the authors, based on the PRISMA protocol (Page et al., 2021).

To ensure the validity of the results, an assessment of the methodological quality of the included studies was conducted. To this end, criteria were established based on:

Clarity of research objectives

Appropriateness of the methodological design

Sample size and representativeness

Consistency between results and conclusions

Presence of empirical evidence

Each study was classified into three levels—high, medium, and low methodological rigor—which allowed us to identify potential biases and assess the strength of the analyzed evidence. These criteria were developed as an ad hoc rubric inspired by the evaluation domains of the Mixed Methods Appraisal Tool (MMAT), adapted to the heterogeneity of designs (quantitative, qualitative, mixed-methods, and technology development) present in the analyzed corpus. This process helped reduce the risk of bias in the review, strengthening the reliability of the conclusions drawn.

A qualitative synthesis based on thematic analysis was used to analyze the selected studies, following the six phases proposed by Braun and Clarke (2006): familiarization with the data, generation of initial codes, identification of themes, review of themes, definition and naming of themes, and report writing. Coding was performed using a standardized extraction matrix, in which each study was recorded according to authorship, year, type of technology, pedagogical strategy, language addressed, methodological design, impact variables, and treatment of the interface's visual design. From this open coding, the following analytical categories were derived inductively and through constant comparison:

Type of technology used (virtual reality, mobile apps, digital games)

Pedagogical strategy (gamification, game-based learning)

Type of language (foreign vs. native)Results obtained (motivation, performance, knowledge retention)

3.1. Identified limitations and challenges

Aesthetic-Visual Dimension and Interface Design (UI/UX, use of indigenous iconography, representation of cultural symbols)

This process allowed us to identify patterns, trends, and gaps in the literature, facilitating a structured and comparative interpretation of the findings.

The categorization was carried out in two coding cycles performed by the reviewers. In the first cycle, each study was coded independently; in the second, the codes were cross-checked to eliminate overlaps, merge redundant categories, and consolidate the final dimensions. Discrepancies were resolved through discussion until consensus was reached, and persistent disagreements were settled with the intervention of a third reviewer. To reduce interpretive bias, a documentary record of the coding decisions was maintained, and category saturation was verified iteratively to ensure that no study remained unassigned to a thematic category. This procedure ensured transparency in the interpretive process and allowed the synthesis to be grounded in explicit and replicable criteria.

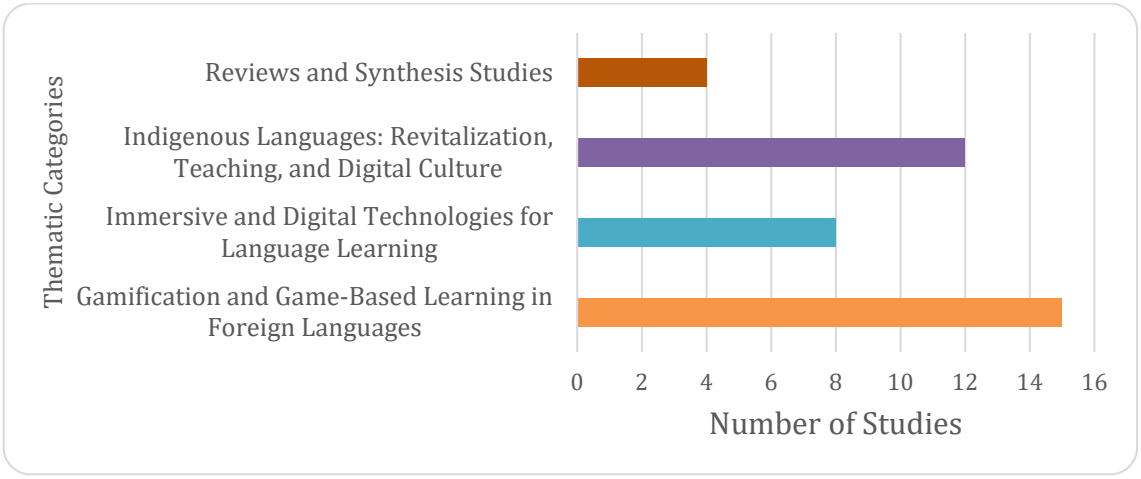
4. Results

The thematic distribution of the studies reveals a clear concentration of scholarly output on approaches focused on gamification and game-based learning applied to foreign languages (Figure 2), suggesting that much of the available knowledge has been developed in contexts that are more established from a pedagogical and technological standpoint. This predominance demonstrates that foreign languages have served as an initial testing ground for validating game-based strategies, pushing their application to Indigenous languages into the background.

In contrast, although there is a significant body of research focused on the revitalization, teaching, and digital culture of indigenous languages, its relatively smaller proportion highlights a gap in scientific development in this field. This imbalance suggests that, while there is growing interest in language preservation, a level of maturity comparable to that observed in the teaching of global languages has not yet been achieved.

On the other hand, the category related to immersive and digital technologies reveals an emerging trend that serves as a connecting thread between the two fields, indicating that technological innovation is positioning itself as a key catalyst in the evolution of language teaching methodologies. Finally, the limited number of reviews and synthesis studies reflects an expanding field that is still in the process of theoretical consolidation, which reinforces the relevance of this research as an integrative contribution.

Figure 2. Thematic Classification of the Studies Included in the Systematic Review



Source(s): Prepared by the authors, based on the qualitative synthesis of the 39 included studies.

The thematic classification of the studies (Table 1) allows us to identify not only the main lines of research regarding gamification applied to language learning but also the relative maturity of each one. In this regard, the predominance of research focused on gamification and game-based learning in foreign languages demonstrates that this field has reached a higher level of empirical consolidation, serving as an initial validation environment for this type of pedagogical strategy. This trend suggests

that methodological advances have primarily developed in more standardized educational contexts, where the availability of resources and curricular stability facilitate experimentation.

In contrast, the category associated with indigenous languages, while having a significant presence, reflects a development that is still in its early stages in terms of systematization and analytical depth. This situation highlights a gap between interest in language preservation and established scientific research, which could be influenced by structural factors such as the limited availability of technological resources, cultural diversity, and the specific contextual characteristics of these communities.

Furthermore, the presence of studies focused on immersive and digital technologies indicates a transition toward more integrated approaches, where gamification does not operate in isolation but rather as part of more complex educational ecosystems. This trend suggests that the future of the field will be shaped by the convergence of technological innovation and active pedagogical strategies.

Table 1. Summary of Thematic Categories

Thematic Category	Number of Studies	References	Contributions
Gamification and GBL in Foreign Languages	15	Núñez (2022); Manzano León et al. (2022); Zhonggen (2018); Janebi Enayat and Haghighatpasand (2019); Pai et al. (2024)	Further empirical development and methodological validation
Immersive and digital technologies	8	Alfadil (2020); Divekar et al. (2022); Lobanova et al. (2024); Klimova (2023); Kaur and Chen (2021)	Emerging area driven by technological innovation
Indigenous languages: revitalization and teaching	12	Ajani et al. (2024); Sanabria et al. (2019); Chachil et al. (2015); Elmiligi et al. (2016); Ramírez et al. (2018)	A growing field with less consolidation
Reviews and synthesis studies	4	Dehganzadeh (2020); Pinto et al. (2021); Cardenas-Valdivia et al. (2023); Criollo-C et al. (2021)	Limited theoretical maturity in the field

Source(s): Author's own work, based on a qualitative synthesis of the 39 included studies.

Table 2 shows the distribution of methodological approaches, revealing a clear orientation of the field toward the empirical validation of gamification, with a predominance of quantitative studies that seek to measure its impact on specific learning variables. This trend suggests that research has prioritized demonstrating effectiveness through measurable indicators, which strengthens the evidence base but may simultaneously limit a deep understanding of the underlying educational processes.

In contrast, the limited presence of qualitative studies reveals a gap in contextual and cultural analysis, which is particularly relevant in the field of Indigenous languages, where learning processes are closely linked to sociocultural and community factors. This methodological limitation highlights the need for more interpretive approaches that allow us to understand not only "what works," but also the "how" and "why" of implementing gamified strategies in diverse contexts.

Meanwhile, mixed-methods studies emerge as a relevant methodological alternative by integrating quantitative impact measurement with qualitative analysis of the user experience. This combination allows for a more holistic view of the phenomenon, although such studies are not yet prevalent in the literature.

Table 2. Methodological Classification of Studies

Methodological Approach	Number of studies	References	Contribution
Quantitative (experimental/non-experimental)	16	Núñez (2022); Pai et al. (2024); Zhonggen (2018); Alfadil (2020); Chen et al. (2023)	Predominance of impact measurement on educational variables
Qualitative	7	Nijdam (2021); Zabecki (2019); Ramírez et al. (2018)	Focus on cultural and contextual aspects
Mixed	8	Janebi Enayat and Haghighatpasand (2019); Criollo-C et al. (2021); Rodríguez-Ferrer et al. (2024)	Integration of empirical evidence and user perception
Systematic reviews	4	Dehganzadeh (2020); Pinto et al. (2021); Cardenas-Valdivia et al. (2023)	Theoretical consolidation still limited

Methodological Approach	Number of studies	References	Contribution
Technological development (apps, systems)	4	Sanabria et al. (2019); Kaur and Chen (2021); Murad et al. (2018)	Applied focus with an emphasis on tool design

Source(s): Author's own work, based on the qualitative synthesis of the 39 included studies.

The distribution of the impact variables (Table 3) shows that gamification acts primarily as a catalyst for motivational processes rather than as a direct mechanism for improving academic performance. The high frequency of studies reporting increases in motivation suggests that the core value of these strategies lies in their ability to change students' attitudes toward learning, creating more engaging and participatory environments. However, the fact that variables such as performance and retention are less prevalent and more heterogeneous indicates that the effect of gamification is not automatically transferable to sustained cognitive outcomes.

This pattern highlights a nonlinear relationship between motivation and effective learning, implying that increased student engagement does not, by itself, guarantee a significant improvement in academic performance. In this regard, the effectiveness of gamification appears to depend on additional factors, such as instructional design, curricular integration, and the type of technology used.

On the other hand, the observed impact on language skills and the reduction in anxiety suggests that gamification has significant potential in the affective and communicative dimensions of learning, especially in contexts where language use involves exposure, error, and active participation. This characteristic is particularly valuable in language learning, where emotional barriers can significantly limit progress.

Table 3. Impact of Gamification on Learning Variables

Impact variable	Frequency	References	Contributions
Motivation	18	Núñez (2022); Pinto et al. (2021); Pai et al. (2024)	Variable most consistently affected
Academic performance	12	Zhonggen (2018); Alfadil (2020); Chen et al. (2023)	Positive, though not uniform, evidence
Knowledge retention	10	Janebi Enayat and Haghighatpasand (2019); Rosalin et al. (2021)	Improvement associated with ongoing interaction
Language skills	14	Al-Jamili et al. (2024); Divekar et al. (2022)	Significant impact on expression and vocabulary
Anxiety / engagement	9	Pai et al. (2024); Ibrahim et al. (2021)	Reduction of emotional barriers
Interaction and collaboration	11	Osipov et al. (2016); Manzano León et al. (2022)	Improvement in social learning

Source(s): Author's own analysis, based on the qualitative synthesis of the 39 included studies.

The matrix presented in Table 4 shows that the impact of gamification is not distributed uniformly across technologies and learning variables, but rather follows distinct patterns depending on the level of immersion and complexity of the environments used. In particular, immersive technologies, such as virtual reality, show a high and consistent impact across all analyzed dimensions, suggesting that multisensory and contextualized interaction promotes both cognitive and affective processes.

In contrast, web-based platforms have a more limited impact, especially in reducing anxiety, indicating that less interactive environments tend to generate less emotional engagement. Meanwhile, mobile apps and artificial intelligence-based systems show an intermediate-to-high level of impact, standing out in motivation and skill development, although with variations in more complex variables such as retention.

These results suggest that the effectiveness of gamification does not depend solely on its implementation as a pedagogical strategy, but rather on its integration with technologies capable of generating meaningful learning experiences. In this regard, the matrix allows us to identify not only levels of impact but also structural relationships between technology type and educational outcomes, providing a foundation for the design of more precise and context-specific interventions.

A cross-cutting finding, which has so far received little attention in the literature, pertains to the aesthetic-visual dimension and interface design. The analyzed corpus reveals that most studies on foreign languages treat visual elements—such as avatars, badges, progress bars, and color schemes—as

generic motivational resources, disconnected from cultural content. In contrast, studies focused on Indigenous languages (Nijdam, 2021; Zabecki, 2019; Sanabria et al., 2019; Cardenas-Valdivia et al., 2023) incorporate iconography, textile art, and their own cosmological references as an integral part of the interface. However, this incorporation is rarely subjected to systematic empirical evaluation: it is documented as a design decision, but its effect on motivation, retention, or perceived cultural relevance is seldom measured. Thus, a gap is identified between the semiotic richness of the proposed design and the available evidence regarding its effectiveness, which constitutes one of the most significant gaps in the field.

Table 4. Matrix of relationships between educational technologies and variables affecting language learning.

Type of Technology / Variables Affecting Learning	Motivation	Performance	Retention	Skills	Anxiety
Mobile apps	3	2	2	3	2
Virtual Reality	3	3	3	3	3
Digital Games	3	2	3	2	2
Web platforms	2	2	2	2	1
AI / adaptive	3	3	3	3	2

Source(s): Compiled by the author.
Note: Ratings: 1 = Low, 2 = Medium, 3 = High.

Table 5 presents the assessment of methodological quality and risk of bias for the included studies, revealing a heterogeneous empirical basis in which highly rigorous research coexists with applied studies and conceptual contributions. This diversity does not compromise the validity of the analysis, but it does guide the interpretation of the results toward a critical reading, taking into account both the methodological soundness and the context of each study's production.

Table 5. Quality and Bias Assessment

ID	Study	Methodological Rigor	Risk of Bias	Rationale
1	Ajani et al. (2024)	Medium	Moderate	Relevant applied approach, with limited experimental validation
2	Alfadil (2020)	High	Medium-low	Empirical study with a clear learning variable
3	Al-Jamili et al. (2024)	High	Medium-low	Intervention with oral performance assessment
4	Arias et al. (2021)	Medium	Medium-high	Development of a framework with limited validation
5	Boulaknadel et al. (2019)	Medium	Medium	Relevant design with limited empirical evidence
6	Bräuer and Mazarakis (2024)	High	Medium-low	Field experiment with a robust design
7	Cardenas-Valdivia et al. (2023)	High	Low	Well-structured systematic review
8	Chachil et al. (2015)	Medium	Medium	Applied study with less evaluative depth
9	Chen et al. (2023)	High	Medium-low	Structured use of a gamified model
10	Criollo-C et al. (2021)	High	Medium	Good support for technology adoption
11	Dehganzadeh (2020)	High	Low	Consistent systematic review
12	Divekar et al. (2022)	High	Medium-low	Integration of AI and XR with evaluation
13	Elmiligi et al. (2016)	Medium	Medium	Innovative application with limited scope
14	Ibrahim et al. (2021)	Medium-high	Medium	Perceptual study without direct intervention
15	Janebi Enayat and Haghighatpasand (2019)	High	Medium	Mixed-methods study with cognitive analysis
16	Kaur and Chen (2021)	Medium	Medium-high	Technology development with partial validation
17	Klimova (2023)	Medium-high	Medium	Application in a specific population
18	Lobanova et al. (2024)	High	Medium-low	Strong evidence in VR settings
19	Luo and Zou (2024)	Medium	Medium	Focus on teacher preparation rather than impact

ID	Study	Methodological Rigor	Risk of Bias	Rationale
20	Lyu and Lai (2024)	Medium	Medium	Contextual contribution with limited empirical validation
21	Manzano León et al. (2022)	High	Medium-low	Well-structured pedagogical comparison
22	Murad et al. (2018)	Medium	Medium	Applied development with limited scope
23	Nijdam (2021)	Medium	Medium	Cultural analysis without impact measurement
24	Núñez (2022)	Medium-high	Medium	Evidence based on teacher perceptions
25	Osipov et al. (2016)	Medium-high	Medium	Web-based system with a gamified approach
26	Osipov et al. (2016)	Medium	Medium	E-learning approach with less experimental control
27	Pai et al. (2024)	High	Medium-low	Well-defined affective variable
28	Pinto et al. (2021)	High	Low	Empirical systematic review
29	Pulla (2017)	Medium	Medium	Conceptual synthesis with lower causal rigor
30	Ramírez et al. (2018)	Medium-high	Medium	Relevant comparison in an indigenous context
31	Rivera-Trigueros and Sánchez-Pérez (2020)	Medium-high	Medium	Well-contextualized practical implementation
32	Rodríguez-Ferrer et al. (2024)	High	Medium	Mixed-methods study with a social-emotional focus
33	Rosalin et al. (2021)	Upper-middle	Medium	Web application with evidence on vocabulary
34	Sanabria et al. (2019)	Medium	Medium	Educational software development
35	Sánchez-Acevedo (2021)	Intermediate	Medium	Theoretical and Applied Contribution
36	Soclo et al. (2022)	High	Medium	Applied study on mobile learning
37	Tianyi (2025)	Upper-intermediate	Medium	Innovation in Digital Learning
38	Zabecki (2019)	Medium	Medium	Cultural approach without experimental validation
39	Zhonggen (2018)	High	Medium-low	Direct comparison with traditional method

Source(s): Author's own analysis, based on criteria adapted from the Mixed Methods Appraisal Tool (MMAT).
Note: The quality assessment was conducted using an ad hoc matrix of five criteria (clarity of objectives, methodological coherence, thematic relevance, empirical evidence, and descriptive adequacy), developed based on the assessment domains proposed by the Mixed Methods Appraisal Tool (MMAT), given the heterogeneity of methodological designs present in the corpus.

5. Discussion

The results show that gamification has established itself as a pedagogical strategy with high potential in language learning, although its impact is neither uniform nor universally transferable to all contexts. In line with previous studies, it is confirmed that the main strength of gamification lies in its ability to increase student motivation, which has been extensively documented in empirical research and systematic reviews (Núñez, 2022; Dehganzadeh, 2020; Pinto et al., 2021). However, the findings of this study suggest that this increase in motivation does not necessarily translate directly into sustained improvements in academic performance, which is consistent with evidence pointing to heterogeneous results in cognitive variables (Zhonggen, 2018; Alfadil, 2020).

From a deeper perspective, the results call into question the idea of gamification as a universal pedagogical solution. In particular, the integrative matrix shows that the impact depends significantly on the type of technology used, with immersive technologies—such as virtual reality—demonstrating the most consistent effects across multiple dimensions of learning. This pattern reinforces the findings of Divekar et al. (2022) and Lobanova et al. (2024), who highlight the role of immersive environments in enhancing the learning experience and knowledge retention. In contrast, less interactive technologies, such as traditional web platforms, have a more limited impact, suggesting that the effectiveness of gamification is closely linked to the level of interaction and contextualization offered by digital tools.

In the case of Indigenous languages, the results reveal a significant gap compared to foreign language learning. Although there are relevant initiatives aimed at linguistic revitalization through digital technologies (Ajani et al., 2024; Sanabria et al., 2019; Elmiligi et al., 2016), these have not yet reached the level of systematization or empirical validation observed in other contexts. This difference can be explained not only by technological limitations but also by the sociocultural complexity inherent in indigenous languages, where learning extends beyond the classroom and is linked to processes of identity, community, and intergenerational transmission.

Furthermore, the results reveal a methodological tension in the analyzed literature. The predominance of quantitative studies aimed at measuring specific variables contrasts with the need to understand more complex and contextualized processes, especially in intercultural settings. In this regard, mixed-methods approaches emerge as a promising alternative, as they integrate impact measurement with the interpretation of the user experience, as observed in recent studies (Janebi Enayat and Haghighatpasand, 2019; Criollo-C et al., 2021).

Another relevant aspect is the role of emerging technologies as catalysts for learning. The use of mobile apps, artificial intelligence, and adaptive systems has expanded the possibilities for access to and personalization of learning, making it possible to overcome some of the traditional barriers in language teaching (Klimova, 2023; Kaur and Chen, 2021). However, these advances also pose challenges related to accessibility, the digital divide, and the cultural appropriateness of content, especially in indigenous communities.

These findings call for a critical reexamination of the role of visual interface design—a central aspect of this review that has, however, been under-theorized in the literature. The evidence suggests that the effectiveness of a gamified experience lies not solely in its playful mechanics, but in the semiotic coherence between visual signs and the worldview of the language community. When ancestral iconography is reduced to an ornament superimposed on Western design templates, gamification runs the risk of folklorizing the language rather than revitalizing it. Given the trend observed in the corpus—an accumulation of studies that document motivational benefits without critically examining their conditions—it is necessary to shift the question from "Does gamification work?" to "Under what visual grammars and on what cultural terms does it work?" This perspective positions interface design not as an aesthetic wrapper, but as an epistemic and political decision with direct effects on the sustainability of Indigenous languages.

The findings suggest that the effectiveness of gamification does not depend solely on its implementation as a teaching strategy, but rather on its integration with technological, pedagogical, and contextual factors. This implies that its application in the learning of Indigenous languages requires more comprehensive approaches, capable of combining technological innovation with cultural sensitivity and educational relevance.

This study has some limitations that must be considered for a proper interpretation of the results. First, the review was restricted to three databases (Scopus, ScienceDirect, and ACM Digital Library), which, while ensuring the quality of the sources, may have excluded relevant research indexed on other platforms or in gray literature, thereby limiting the scope of the analysis.

Likewise, the established inclusion criteria—particularly the time frame starting in 2015 and the selection of languages (English and Spanish)—may have affected the representativeness of the studies analyzed, excluding earlier contributions or research conducted in other linguistic contexts.

From a methodological standpoint, although a quality assessment of the studies was conducted, it was based on general criteria of rigor, which may introduce a certain degree of subjectivity in the classification of methodological quality. In this regard, the absence of more specific standardized tools for assessing the risk of bias could influence the comparative interpretation of the results.

Furthermore, the heterogeneity of the included studies—in terms of methodological approaches, technologies used, educational contexts, and types of languages—makes it difficult to draw direct comparisons and limits the ability to make robust generalizations. While this diversity enriches the analysis, it also introduces variability in the reported results.

Finally, the analysis focused on a qualitative synthesis; therefore, quantitative techniques such as meta-analysis were not incorporated, which prevents a precise estimation of the effect size of gamification on learning variables. Consequently, the findings should be interpreted as trends identified in the literature rather than as definitive causal relationships.

6. Conclusions

This study confirmed that gamification is a pedagogical strategy with high potential for the learning of indigenous languages, particularly due to its ability to influence the motivational and affective dimensions of the educational process. The evidence analyzed shows that the incorporation of playful elements fosters engagement, active participation, and a willingness to learn—aspects that are particularly relevant in contexts where the language is at risk and its use is conditioned by sociocultural factors.

Its effectiveness is not limited to facilitating language learning but extends to its role as a tool for cultural revitalization, especially when combined with contextualized pedagogical approaches and appropriate technologies. In this regard, the use of mobile apps, digital games, and interactive environments has proven to be an effective way to integrate linguistic content with meaningful experiences, strengthening both communicative skills and students' connection to their cultural identity.

However, the impact of gamification is not uniform and depends on its integration with instructional design and the type of technology used. More immersive technologies tend to generate more consistent effects across multiple dimensions of learning, while less interactive approaches yield more limited results, highlighting the need for strategic—rather than merely instrumental—implementation.

Furthermore, structural challenges persist that limit its application, notably the availability of technological resources, digital accessibility, and teacher training in the design of gamified experiences. Added to this is the need to develop rigorous linguistic and cultural content that avoids oversimplification and addresses the complexity of Indigenous languages.

A comprehensive analysis of the evidence suggests that gamification should not be viewed as an isolated solution, but rather as part of a comprehensive approach that combines technological innovation, cultural relevance, and pedagogical soundness. Consistent with the objective that guided this review, we conclude that the design of the visual interface and the semiotic dimension are determining factors—not merely incidental ones—in this integration: revitalization through digital environments depends on visual grammars respecting the identity and semiosis of Indigenous peoples. Consequently, its application to indigenous languages represents a significant opportunity, although it still requires further empirical validation, greater methodological diversity—particularly qualitative and mixed-methods studies that shed light on the how and why of these processes—and explicit attention to the culturally relevant design of interfaces.

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Conflict of Interest:

There is no conflict of interest.

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