

Gamification and Serious Games for Teaching Brazilian Sign Language: Partial Results of a Systematic Literature Review

Ricardo Silva¹, Flávio Moura², Waldemiro José Assis Gomes Negreiros²,
Renato Araujo Lima², Marcos César da Rocha Seruffo²,
Vanessa Andrade Pereira³, Paulo André Ignacio Pontes¹

¹Instituto Federal do Pará (IFPA)

²Universidade Federal do Pará (UFPA)

³Universidade Federal de São Paulo (UNIFESP)

{ricardo.silvmain, marcos.seruffo}@gmail.com,

{waldemiro.negreiros, paulo.pontes}@ifpa.edu.br,

{flavio.moura, renato.lima}@itec.ufpa.br, vapereira@unifesp.br

Abstract. Introduction: Brazilian Sign Language (Libras) is the primary means of communication of Brazil's deaf community, yet its teaching still faces significant accessibility barriers. Gamification and serious games have emerged as a promising avenue, but a comprehensive mapping of the evidence is lacking. **Objective:** This paper presents preliminary results of a Systematic Literature Review (SLR) on serious games and gamified applications for Libras teaching (2015–2025). **Methodology:** The review followed PRISMA 2020 guidelines and a PICO-based protocol. Searches were conducted across six databases (Scopus, SciELO, IEEE Xplore, ACM Digital Library, BDTD, and Google Scholar), yielding 280 studies. Abstract screening was supported by the LitReviewAI automated multi-agent tool. **Expected Results:** After screening, 71 records were selected for full-text reading. This report characterizes an illustrative sample of 10 of these studies, whose findings are exploratory rather than statistically representative: they indicate a predominance of vocabulary-focused games, limited longitudinal evidence, and gaps in accessibility and deaf-centered design. The full-corpus analysis has since been completed and will appear in an extended version, broadly corroborating these trends. **Keywords** Brazilian Sign Language. Serious Games. Gamification. Systematic Literature Review. Libras.

1. Introduction

Brazilian Sign Language (Libras), recognized by Law No. 10.436/2002 and Decree No. 5.626/2005, is the primary linguistic system of the Brazilian deaf community and a compulsory subject in teacher-education and speech-therapy programs. Yet access to Libras education remains restricted for much of the hearing population, and traditional methods still face limits in engagement, accessibility, and scalability [Quadros and Karnopp 2004].

In this context, serious games and gamified applications have emerged as strategies to mitigate these barriers, promoting language acquisition in a more engaging

and accessible way [Deterding et al. 2011, Michael and Chen 2005]. Although the international literature documents games for sign-language education, research focused specifically on Libras remains scarce and methodologically fragmented.

Given this gap, this paper presents the methodological protocol, search process, and study selection stage of an ongoing Systematic Literature Review (SLR). The scope of this investigation aims to provide an initial overview of the research domain between 2015 and 2025, outlining the mapped knowledge landscape without intending to exhaustively consolidate the state of the art. To this end, this work defines the review protocol, maps the bibliographic corpus, provides an illustrative characterization of a sample of studies, identifies emerging technological trends and research gaps, and evaluates the use of generative artificial intelligence as a methodological support tool to reduce manual effort during the screening process.

2. Theoretical Background

Teaching sign languages poses particular challenges, as it involves perceiving and producing complex visuospatial information—hand configurations, movement, facial expressions, and spatial positioning [Quadros and Karnopp 2004]. Digital technologies have been explored to mediate this process, from videos and animations to 3D avatars and interactive applications.

Gamification refers to applying game-design elements in non-game contexts to increase engagement and motivation [Deterding et al. 2011], whereas serious games are full games with an explicit educational purpose [Michael and Chen 2005]. Both can promote knowledge acquisition, though their effectiveness depends strongly on the underlying pedagogical design [Connolly et al. 2012].

3. Methodology

This section describes the method adopted for the SLR, designed according to the PRISMA 2020 guidelines [Page et al. 2021] and based on a previously defined protocol that ensures methodological rigor, transparency, and reproducibility [Kitchenham and Charters 2007].

To systematically delimit the scope of the investigation, the established protocol includes the PICO model, information sources, and search strategies. The PICO model is a standard framework derived from Evidence-Based Practice (EBP), widely used to structure research questions in a clear and objective manner by decomposing them into four dimensions: Population, Intervention, Comparison, and Outcomes. Based on this structure, the review was guided by the following research questions:

- **RQ1:** Which serious games and gamified applications have been developed for teaching Libras between 2015 and 2025?
- **RQ2:** Which pedagogical approaches and gamification elements are employed in these tools?
- **RQ3:** What evidence of effectiveness exists in terms of learning, engagement, and usability?

Within this framework, the Population comprises deaf and hearing-impaired individuals, hearing learners of Libras, and educators; the Intervention, serious and

educational games and gamified applications for teaching Libras; the Comparison, traditional teaching, non-gamified technologies, or no explicit comparison; and the Outcomes, language and vocabulary acquisition, engagement, motivation, and usability.

Searches were conducted across national and international databases selected for their relevance to education, educational technology, and computing, covering both indexed academic production and Brazilian gray literature. The consulted databases were: Scopus, SciELO, IEEE Xplore, ACM Digital Library, the Brazilian Digital Library of Theses and Dissertations (BDTD), and Google Scholar (a complementary source for gray literature, restricted to the first 50 results ordered by relevance). This pragmatic cap reflects Google Scholar's limited Boolean precision and noisy long tail; systematic coverage is ensured by the five indexed databases, and we treat the cap as a limitation to exhaustiveness in this complementary source. The searches returned 280 studies across the six consulted databases. A total of 23 results were identified in Scopus, 3 in SciELO, 8 in IEEE Xplore, 55 in the ACM Digital Library, 141 in BDTD, and 50 in Google Scholar. These records were subsequently submitted to the systematic review selection process.

The exported metadata were consolidated into a single BibTeX corpus. The screening of titles and abstracts was supported by the LitReviewAI tool¹, a multi-agent orchestration of Large Language Models (LLMs) that simulates the peer-review process [Pantoja et al. 2025]. After manual auditing of the 280 processed records, 71 studies were selected.

Eligibility criteria were applied through the system's parametric interface, aligned with the PICO model. An Analyst agent evaluated each abstract, extracting only evidence directly grounded in the text, to identify empirical and design studies on serious games, educational games, and gamification for Libras teaching, published between 2015 and 2025 in Portuguese or English.

A Reviewer agent cross-validated the extracted evidence and issued provisional decisions, mitigating hallucination. Under a conservative heuristic, the system excluded studies on other sign languages without adaptability to Libras, work centered solely on automatic translation or computer vision without gamified components, and studies lacking empirical validation. Practical criteria—duplicates or inaccessible full texts—were then applied manually during full-text reading.

Despite these safeguards, generative AI screening carries methodological risks: LLM-based agents may introduce selection bias and remain prone to hallucination—fabricating or misattributing evidence. The tool was therefore used strictly as a Decision Support System, with every inclusion and exclusion decision audited and ratified by the authors; no study entered or left the corpus on an automated judgment alone. This Human-in-the-Loop design mitigates, but does not eliminate, such risks, and a formal assessment of the tool's precision and recall remains as future work.

4. Results and Discussion

The temporal distribution of the selected studies shows a relatively stable number of publications between 2016 and 2022, with values ranging from 2 to 6 studies per year. From 2023 onward, there is a significant increase in publication volume, reaching

¹<https://litreviewai.siaparsec.com/>

9 studies in 2023, 14 in 2024, and a peak of 17 studies in 2025. This growth indicates a recent expansion of research interest in the area, possibly associated with the increasing adoption of mobile technologies in Brazilian education [CGI.br 2024] and recent advances in generative AI tools that facilitate the development of interactive educational applications [Arruda 2024].

To illustrate emerging patterns, we examined a purposive sample of 10 selected studies (Table 1). Given its small size, the proportions below are illustrative rather than statistically representative and are stated primarily as absolute counts. Serious games (4 of 10) and gamified applications (2 of 10) predominate, followed by theses/dissertations (2) and secondary studies (2). Among the eight development studies, desktop solutions (4 of 8) outnumber web (2) and mobile (1) (Table 2). Even as a tentative signal, this limited mobile presence contrasts with Brazil’s smartphone penetration [CGI.br 2024], suggesting a possible gap in accessible, ubiquitous tools that the full review can confirm.

Table 1. Studies included in the preliminary sample.

Study	Year	Type	Main contribution
[Ferreira et al. 2016]	2016	Serious Game	Terra Libras: game-based environment to support Libras learning.
[Rocha 2018]	2018	Gamified Tool	Computational tool using gamification elements for Libras learning.
[Wessling et al. 2021]	2021	Mobile App	Development and validation of a gamified application for Libras learning.
[Moreira et al. 2024]	2024	Systematic Review	Mapping of gamified technologies applied to deaf education.
[Casarin 2024]	2024	Interactive Game	Digital sign dictionary supporting mathematics education in Libras.
[JESUS 2025]	2025	Gamification	Gamified practices in Letras–Libras distance education.
[de Lima 2025]	2025	Educational Game	Kahoot-based activities for teaching Libras verbs.
[Souza et al. 2025]	2025	Serious Game	RogueLibras: game focused on vocabulary acquisition in Brazilian Sign Language.
[Silva and de Souza 2025]	2025	Serious Game	CAMLIBRAS: accessible educational tool for Libras teaching and inclusion.
[Silva 2025]	2025	Scoping Review	Review of active methodologies for Libras teaching.

Table 2. Characterization of the preliminary sample by solution type and target platform.

Solution Type (n = 10)			Target Platform (n = 8)*		
Characteristic	n	%	Platform	n	%
Serious Game	4	40.0	Desktop (PC/computer)	4	50.0
Gamified Application	2	20.0	Web (online platform)	2	25.0
Thesis/Dissertation (game as product)	2	20.0	Mobile (Android)	1	12.5
Systematic Review/Mapping	1	10.0	Multiplatform/Not specified	1	12.5
Scoping Review	1	10.0			

*Considers only primary development studies.

Finally, Table 3 points to a methodological gap in user-centered design, showing that, within this sample, only 3 of 8 development studies (37.5%) report active involvement of the deaf community or interpreters in design or validation stages.

Although based on few studies, this signal is consistent with a broader concern: excluding end users from the design process tends to result in solutions that reproduce hearing-centric perspectives and neglect the communicative and identity practices intrinsic to the deaf community [Quadros and Karnopp 2004].

Table 3. Participation of the deaf community in the design process.

Participation of Deaf Individuals/Interpreters	n	%
Yes — involvement in design or validation	3	37.5
Partial — as participants/users	3	37.5
Not reported	2	25.0
Total	8	100

Taken together, these signals point to a coherent tension. The prevalence of desktop-bound solutions sits uneasily with the visuospatial nature of Libras and with learners’ access conditions, raising the barrier to the sustained practice that language acquisition requires; meanwhile, limited deaf involvement in design risks embedding hearing-centric assumptions and increasing learners’ extraneous cognitive load. Both connect to the accessibility limits of traditional instruction (Section 1) and to the dependence of effectiveness on pedagogical design (Section 2) [Connolly et al. 2012]. Though from a small sample, they motivate the full-corpus analysis summarized next.

5. Final Considerations

This paper presented preliminary results of a Systematic Literature Review on gamification and serious games for teaching Libras. The search and selection stages yielded 71 records for full-text reading, of which an illustrative sample of 10 was characterized here.

Since this report, the full-corpus analysis has been completed: after deduplication and eligibility assessment, 56 studies were read in full and 31 composed the final corpus (30 artefacts in six technological families). The consolidated synthesis—detailed in an extended version—corroborates and sharpens these trends: a field vigorous in producing artefacts but limited in demonstrating efficacy, with no controlled trials, inferential statistics in only two studies, and weak ethics and availability reporting. Its maturation depends less on new technologies than on stronger research practices.

Practically, effort should shift from the low-cost repertoire toward signed production and connected discourse, narrative anchored in deaf culture, and open artefact availability, while authors and reviewers adopt controlled designs, validated instruments, and explicit ethics reporting. Future work will apply a formal quality assessment (MMAT, CASP, or JBI) and evaluate the screening’s precision and recall. **Acknowledgments.** The authors thank IFPA and UFPA for their support.

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