

Reading, Writing, and Inclusion: Examining the Game “Words and Drawings” Through the Lens of Universal Design for Learning

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Abstract. *Digital games have been explored to support early literacy in inclusive contexts. This study analyzes a UDL-guided digitally mediated intervention using the game “Words and Drawings” in a first-grade classroom (N = 24). Writing-level progression was analyzed descriptively using psychogenetic classification, and word-level accuracy (0–10) was analyzed quantitatively in a quasi-experimental pre-test/post-test design. No student demonstrated performance decline. Quantitative operationalization of UDL dimensions indicated positive associations between engagement and action/expression indicators and writing gains. Results suggest that structured digital gameplay with teacher mediation may be associated with observable shifts in early writing development.*

1. Introduction

In recent years, digital games have been increasingly explored as tools to support early literacy development, particularly in the early school years, where interactive formats tend to foster children’s interest and active participation. In digitally mediated environments, these resources enable multimodal engagement, immediate feedback, and iterative hypothesis testing about written language. Digital technologies can transform teaching and learning processes by fostering students’ active participation, interaction, collaboration, and knowledge construction, provided they are integrated into pedagogical planning and intentionally mediated by the teacher [Valente 2018a]. Prior research highlights the pedagogical potential of digital technologies for fostering phonological awareness and consolidation of the alphabetic principle [Görge et al. 2020, Moura et al. 2024, Soares 2020]. Despite this potential, empirical studies conducted in real classroom contexts are still scarce in examining, in an articulated way, the use of digital games, teacher mediation, Universal Design for Learning, and the progression of writing hypotheses.

The educational impact of digital resources depends on intentional instructional design and teacher mediation [Moran et al. 2013, Freire 1996]. This is especially relevant in classrooms where students present different writing levels, making differentiated

and inclusive approaches necessary rather than optional. In literacy contexts, progression can be systematically analyzed through psychogenetic models that describe stages in the appropriation of the alphabetic writing system [Ferreiro and Teberosky 1999]. Although this framework allows structured observation of writing-level transitions, few studies examine how digitally mediated gameplay, guided instruction, and inclusive design jointly relate to empirically observable advancement.

From an inclusive education perspective, Universal Design for Learning (UDL) proposes organizing instruction through multiple means of engagement, representation, and action/expression [CAST 2018, Meyer et al. 2014]. While digital games are frequently described as compatible with UDL principles, these principles are seldom operationalized as measurable instructional dimensions linked to literacy outcomes. Consequently, UDL often remains a theoretical reference rather than an analytically examined component of classroom practice [Al-Azawei et al. 2016].

To address these gaps, this study investigates the pedagogically mediated use of the digital game *Words and Drawings* in a first-grade classroom through a structured UDL-guided intervention. We hypothesize that a digitally mediated literacy intervention informed by UDL is associated with positive progression trends in students' writing hypothesis levels, as measured through pre- and post-diagnostic assessment. By integrating digital gameplay, teacher mediation, psychogenetic analysis, and operationalized UDL dimensions within a mixed-method design, this research contributes classroom-based empirical evidence and proposes a replicable framework for inclusive digitally mediated literacy practices in Informatics in Education.

2. Background

2.1. Digital Games and Early Literacy

Digital Information and Communication Technologies have reshaped educational practices by expanding multimodal forms of communication and learning, requiring pedagogical intentionality rather than mere tool adoption [Kenski 2012, Valente 2018b]. In early literacy contexts, educational digital games may support active learning through interactivity, immediate feedback, and iterative problem-solving, allowing children to test hypotheses about phoneme–grapheme correspondence and refine their understanding of written language [Valente 2018b, Moran 2015, Silva et al. 2024].

From a pedagogical standpoint, the educational value of these resources depends on how they are integrated into instructional planning and mediated by teachers [Moran et al. 2013, Freire 1996]. When aligned with literacy objectives, digital games can complement early reading and writing practices by combining engagement with structured opportunities for language reflection [Soares 2020, Araújo 2018]. In this study, the game *Words and Drawings* is treated as a mediational artifact whose effects are examined in relation to instructional design and teacher mediation rather than to technological features alone.

From a sociocultural perspective, learning occurs through mediated interaction [Vygotsky 1991]. Therefore, the educational effectiveness of digital games depends not solely on their technological affordances, but on how they are embedded in structured pedagogical activities and classroom routines.

2.2. Writing Hypothesis Development

The psychogenesis of written language framework provides a structured model for analyzing early writing development [Ferreiro and Teberosky 1999]. According to this perspective, children progress through identifiable stages—pre-syllabic, syllabic, syllabic-alphabetic, and alphabetic—reflecting increasing understanding of the alphabetic writing system.

This classification enables systematic observation of qualitative shifts in writing hypotheses and supports the evaluation of literacy progression in authentic learning contexts. In this study, writing level transitions constitute the primary learning outcome used to examine the effects associated with the pedagogically mediated intervention.

This structured classification model provides the analytical basis for examining writing-level progression as an ordinal outcome variable in the present study.

2.3. Universal Design for Learning as Analytical Framework

Universal Design for Learning (UDL) proposes organizing instruction through multiple means of engagement, representation, and action/expression to reduce barriers and address learner variability [CAST 2018, Meyer et al. 2014]. This perspective is particularly relevant in heterogeneous early-grade classrooms, where inclusive literacy practices must support diverse developmental profiles [Freitas et al. 2024].

Rather than functioning solely as a philosophical orientation, UDL can be operationalized as an analytical framework for examining instructional design. In digitally mediated contexts, UDL principles can be observed through: (1) engagement mechanisms that sustain participation; (2) multimodal representation of content; and (3) diversified forms of learner expression [Roski et al. 2024, CAST 2018, Meyer et al. 2014]. In this study, these dimensions are operationalized as observable instructional design features used to analyze patterns of student engagement and writing progression, consistent with mediated learning perspectives [Vygotsky 1991].

2.4. Gamification and Early Literacy in Inclusive Contexts

Gamification refers to the deliberate application of game-design elements, such as challenges, progressive difficulty, immediate feedback, and reward mechanisms, to non-game contexts with the aim of increasing motivation and sustained engagement [Deterding et al. 2011, Kapp 2013]. In educational settings, these elements have been associated with increased task persistence, repetition of target behaviors, and learner investment in structured activities [Dichev and Dicheva 2017, Landers 2014]. In early literacy contexts specifically, gamified features may support the iterative practice necessary for consolidating phoneme-grapheme correspondences and internalizing the logic of the alphabetic writing system.

However, gamification does not inherently produce learning outcomes. Its educational effectiveness depends on how game-design elements are aligned with pedagogical objectives and how the teacher mediates students' interaction with those elements [Moran et al. 2013, Deterding et al. 2011]. Without intentional instructional framing, gamified activities risk prioritizing performance indicators, such as points or progression levels, over the underlying cognitive processes they are meant to support

[Kapp 2013, Dichev and Dicheva 2017]. This distinction is particularly consequential in early-grade classrooms, where students present highly variable developmental profiles and where undifferentiated engagement strategies may inadvertently exclude learners who do not yet meet the implicit prerequisites embedded in game mechanics.

In this context, the articulation between gamification and Universal Design for Learning becomes analytically relevant. UDL principles offer a framework for ensuring that gamified activities remain accessible and meaningful across different learner profiles by expanding the means through which content is presented, participation is sustained, and knowledge is expressed [CAST 2018, Meyer et al. 2014]. When gamification is deliberately designed in alignment with UDL, the motivational affordances of game-design elements can be distributed more equitably, reducing barriers to participation rather than concentrating engagement among students who already command the skills being practiced. In inclusive early-grade classrooms, this convergence may be especially productive for supporting literacy development among students at varying stages of writing hypothesis formation.

3. Related Work

Research in Informatics in Education has consistently examined how digital technologies and game-based environments can support early literacy by enabling interaction, immediate feedback, and repeated practice opportunities [Moura et al. 2024, Valente 2018b, Silva et al. 2024]. At the same time, this literature also indicates that educational effects are not produced by technology alone; they depend on pedagogical integration and teacher mediation in classroom practice [Araújo 2018]. Thus, although digital games are frequently associated with higher engagement, the strength and meaning of learning gains remain contingent on instructional design.

Empirical evidence from game-based literacy interventions has shown promising results, especially for early reading outcomes. In a cluster randomized controlled trial with first-grade students, Glatz et al. [Glatz et al. 2023] reported improvements in letter-sound knowledge and initial reading fluency after training with GraphoGame-NL. Similarly, Görgen et al. [Görgen et al. 2020] found positive effects of a digital game-based program for children with reading disorder, particularly in specific reading-related skills. These studies provide important evidence of effectiveness, but their analytical focus is primarily on reading performance rather than on the developmental progression of writing hypotheses in early literacy classrooms.

At a broader level, Connolly et al. [Connolly et al. 2012], in a systematic review of empirical research on computer and serious games, concluded that such resources can benefit learning across domains, while also emphasizing methodological variability and the need for more robust classroom-based evidence. This observation remains relevant in literacy research, where studies often differ substantially in intervention structure, assessment criteria, and ecological validity, making cross-study comparison difficult.

In inclusive education, UDL has become a central framework for addressing learner variability through multiple means of engagement, representation, and action/expression [Meyer et al. 2014, CAST 2018]. Cunningham and Murphy [Cunningham and Murphy 2018] discuss the alignment between UDL and digital game-based learning, arguing that UDL-informed design can expand accessibility and partic-

ipation. However, in much of this literature, UDL remains predominantly a theoretical or design-oriented reference, and is less often operationalized as observable pedagogical dimensions examined empirically in relation to literacy outcomes.

Taken together, prior studies establish the relevance of digital games, teacher mediation, and inclusive design, but they are rarely integrated within a single empirical classroom investigation. In particular, there is still limited evidence combining a specific digital game, systematic pedagogical mediation, UDL-informed instructional organization, pre/post diagnostic assessment, and qualitative–quantitative analysis of writing-hypothesis progression. The present study addresses this gap by articulating these elements in an authentic first-grade literacy context through the use of *Words and Drawings*.

4. Methodology

4.1. Research Design

This classroom-based quasi-experimental study adopted a mixed-method approach with a single-group pre-test/post-test structure to examine changes in students' writing hypothesis levels following a structured digital game intervention.

Writing-level classification was treated as the primary ordinal outcome, whereas word-level accuracy (0–10) was the paired quantitative outcome used for inferential testing. Quantitative comparison of diagnostic measures was combined with qualitative classroom observation to strengthen analytical rigor through triangulation. Given the single-group structure, findings are interpreted as associational rather than causal due to the absence of a comparison group.

4.2. Participants and Context

The study involved 24 first-grade students (aged 6–7) from a public elementary school in northeastern Brazil. Writing development levels were heterogeneous according to the psychogenesis framework [Ferreiro and Teberosky 1999]. Inclusion criteria required regular enrollment, minimum 75% attendance, and parental consent. Only students completing both diagnostic assessments were included in statistical analysis.

4.3. Intervention Design

The intervention comprised eight 45-minute sessions over four weeks: (1) pre-intervention diagnostic assessment; (2) five digitally mediated literacy sessions using the game *Words and Drawings*¹; and (3) post-intervention assessment.

Teacher mediation was a central and continuous component throughout all sessions, rather than a peripheral or optional support. The teacher's role extended beyond managing students' interaction with the game to encompass active pedagogical accompaniment: posing questions, prompting metacognitive reflection about written language, and encouraging students to verbalize their reasoning. Students were systematically invited to explain the connections they were drawing between sounds and letters, fostering more deliberate and explicit engagement with phoneme-grapheme correspondence. This mediational stance is consistent with sociocultural perspectives on learning, in which the

¹Game available at: <https://www.escolagames.com.br/jogos/palavras-e-desenhos>. Accessed: July, 15, 2026.

teacher functions as a more knowledgeable other who scaffolds the learner's zone of proximal development [Vygotsky 1991].

Students worked in alternating homogeneous and heterogeneous pairs to encourage autonomy and peer mediation. Pair work was not merely organizational but functioned as a pedagogical structure that promoted collaborative hypothesis construction: students negotiated responses, challenged each other's reasoning, and co-elaborated phonological correspondences, thereby expanding the possibilities for conceptual advancement beyond what individual interaction with the game alone would afford [Vygotsky 1991, Freire 1996]. Complementary written and verbal activities reinforced phoneme-grapheme mapping and literacy reflection, ensuring that the game was embedded within a coherent instructional sequence rather than used as an isolated resource.

4.4. Operationalization of UDL Principles

UDL principles were operationalized as analytical dimensions:

- **Engagement:** sustained participation and response to feedback;
- **Representation:** multimodal word–image interaction;
- **Action/Expression:** written production and verbalized hypotheses.

An observation protocol documented instances of engagement, multimodal interaction, and hypothesis verbalization during sessions.

4.4.1. UDL Measurement Procedure

To move beyond conceptual alignment and enable empirical analysis, UDL dimensions were operationalized as observable indicators recorded during each session. Engagement was assessed using a 3-point ordinal scale (0 = passive/non-participatory; 1 = participation with mediation; 2 = autonomous and sustained engagement), applied per session to capture variation in student involvement [Henrie et al. 2015].

Representation was measured by counting instances of multimodal word–image association and feedback-based correction per student. Action/Expression was evaluated through recorded verbalized phoneme–grapheme hypotheses and observable self-corrections in writing tasks. Scores across dimensions were aggregated to generate individual UDL indices, which were subsequently used for exploratory correlational analysis with writing progression. Because indicators were coded through classroom observation, this measurement is exploratory and may be sensitive to observer bias; future studies should include double-coding procedures and inter-rater agreement.

4.5. Data Collection

Data sources included: (1) pre- and post-diagnostic writing tasks; (2) classroom observation records; and (3) student written productions.

The writing diagnostic instrument was developed by the researchers based on the assumptions of the Psychogenesis of Written Language framework [Ferreiro and Teberosky 1999], with the aim of identifying students' writing hypotheses before and after the pedagogical intervention. For instrument design, words from children's lexical universe were selected according to lexical familiarity, varying lengths,

and different syllabic structures, enabling observation of the strategies children used to represent written language and establish phoneme–grapheme correspondences. The selection sought to include different levels of linguistic complexity to support identification of the writing hypotheses formulated by students.

The instrument was administered individually through dictation in both pre- and post-intervention moments. Written productions were analyzed as a whole for each student, allowing classification into four developmental levels (pre-syllabic, syllabic, syllabic-alphabetic, alphabetic), following [Ferreiro and Teberosky 1999]. In addition to qualitative classification, a quantitative analysis was conducted by assigning one point to each correctly written word, resulting in a score ranging from 0 to 10, used for pre/post comparison.

The pre- and post-diagnostic tasks employed distinct word sets selected to elicit phoneme–grapheme correspondence. Although both instruments targeted alphabetic principle consolidation, differences in lexical familiarity, syllabic complexity, or phonological transparency between word sets cannot be fully ruled out.

4.6. Data Analysis

Pre- and post-intervention scores were compared using the Wilcoxon signed-rank test, appropriate for ordinal paired data, with significance set at $\alpha = 0.05$. Effect size (r) was calculated to estimate magnitude of change.

Qualitative data were analyzed using Content Analysis procedures [Bardin 2016], focusing on shifts in phoneme–grapheme correspondence, writing stability, and observable engagement patterns. Integration of quantitative and qualitative findings enhanced internal validity.

4.7. Ethical Considerations

The study followed Brazilian ethical guidelines (Resolution No. 510/2016) and was approved by the Research Ethics Committee of local university (Protocol No. anonymized). Parental consent was obtained, and all data were anonymized.

5. Results and Discussion

5.1. Initial Profile and Writing Levels

The study included 24 students aged between six and seven years, enrolled in the first grade of Elementary Education. The initial diagnostic assessment revealed a heterogeneous profile, characteristic of this stage of schooling, with a predominance of records compatible with the pre-syllabic and syllabic levels, according to the classification proposed by [Ferreiro and Teberosky 1999]. These records indicated instability in phoneme–grapheme correspondence and an incipient understanding of the functioning of the alphabetic writing system.

5.2. Initial Diagnosis: Writing Hypotheses

The initial written productions showed low correspondence between sounds and graphemes, with records such as “AEOU,” “AGA,” “CLT,” “PAOE,” “ORSA,” and

“CAVIO.” A predominance of omissions, substitutions, and non-conventional use of letters was observed, indicating that students were still in the process of constructing the alphabetic principle.

These productions reflect early hypotheses about how writing functions, in which students demonstrate attempts at graphic representation that still lack systematic correspondence with the phonological structure of words. These findings highlight the need for pedagogical interventions that promote reflection on the relationship between speech and writing, expanding opportunities for knowledge construction.

5.3. Final Diagnosis: Evidence of Development of the Alphabetic Principle

After the pedagogical intervention, greater stability in written productions and advancement in phoneme–grapheme correspondence were observed. Post-intervention productions exhibited increased stability and more conventional spellings (e.g., “SOFÁ”, “CANETA”), indicating improved phoneme–grapheme correspondence.

A significant reduction in random records and an increase in more structured productions were verified, indicating progressive reorganization of writing hypotheses. These results suggest that the intervention was accompanied by increased stability in students’ written productions within this classroom context.

5.4. Comparison Between Initial and Final Diagnosis

To quantify changes in word-level writing accuracy, each student received a score from 0 to 10, corresponding to the number of target words written correctly. Scoring required correspondence with the intended lexical form, using a case-insensitive criterion and disregarding diacritics (e.g., *SOFA* vs. *SOFÁ*), consistent with the focus on alphabetic principle consolidation rather than orthographic accentuation at this stage.

Across the 24 participants, the pre-test totaled 134 correctly written words ($M = 5.58$), whereas the post-test totaled 155 correctly written words ($M = 6.46$), representing an average gain of 0.88 correctly written words per student. Figure 1 illustrates the mean performance in both assessments.

To examine whether the observed gain exceeded what might be expected by random fluctuation under paired measurement, a Wilcoxon signed-rank test was conducted, as specified in the methodology. The Wilcoxon signed-rank test indicated that the median paired difference was not statistically different from zero at $\alpha = 0.05$ ($W = 37.5$, $Z = 0.94$, $p = 0.346$, two-tailed). The associated effect size was small ($r = 0.25$), suggesting modest magnitude of change. This magnitude is consistent with modest classroom-level shifts observed in short interventions with heterogeneous baseline profiles.

In terms of sign distribution, 14 students improved, 10 remained stable, and none declined across assessments. This distribution indicates a non-negative performance trend, accompanied by substantial inter-individual variability, which likely reduced statistical power under the single-group quasi-experimental design.

5.5. Distribution of Writing Development Levels

The data show an overall positive shift in students’ distribution across writing development levels.

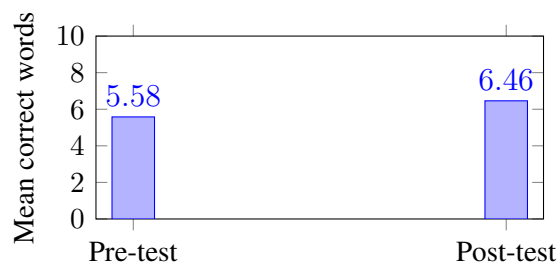


Figure 1. Mean correct words in pre- and post-tests (N=24).

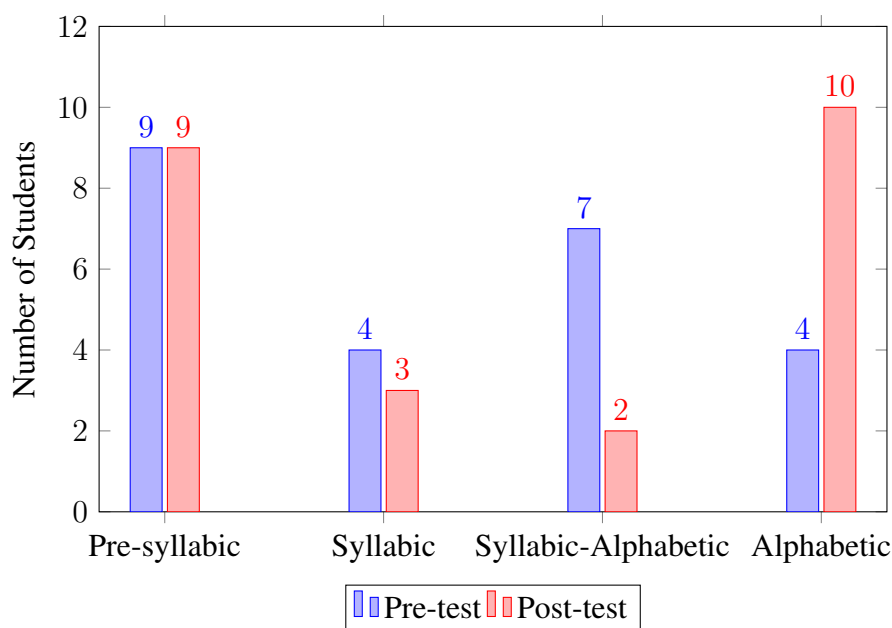


Figure 2. Distribution of students across writing development levels in pre- and post-diagnostic assessments (valid $n = 24$).

Figure 2 presents the distribution of students across the different writing development levels, allowing visualization of the shifts that occurred throughout the pedagogical intervention.

A reduction in the syllabic and syllabic-alphabetic levels and an increase in the alphabetic level were observed, while the pre-syllabic group remained stable. This shift suggests progressive reorganization of writing hypotheses and greater appropriation of the alphabetic writing system.

Specifically, the increase in the number of students classified at the alphabetic level after the intervention indicates greater stability in phoneme-grapheme correspondence and improved understanding of the structural functioning of written language. At the same time, the reduction in intermediate levels suggests qualitative advancement rather than mere quantitative improvement in isolated tasks.

These distributional shifts are consistent with the quantitative trend observed in word-level accuracy, suggesting that structured digital gameplay, when combined with teacher mediation, may be associated with progression in writing hypothesis development within this classroom context.

5.6. Participant Observation: Engagement, Interaction, and Mediation

Classroom observation indicated sustained engagement, peer interaction, and active participation during gameplay. Teacher mediation supported reflection on phoneme–grapheme correspondence and strategy exchange. These elements were associated with expanded participation opportunities aligned with UDL principles.

5.7. Quantitative Analysis of UDL Dimensions

Engagement scores ranged from 0.8 to 1.9 ($M = 1.45$). Spearman analysis suggested a moderate positive association between engagement and writing gain ($\rho = 0.42$, $p = 0.041$), indicating that students who participated more actively tended to show greater pre/post improvement.

Representation showed a weaker, non-significant association with writing gain ($\rho = 0.28$, $p = 0.18$). This pattern may indicate that representational supports alone were insufficient to produce measurable short-term differences in this sample, particularly given the brief intervention period.

Action/Expression presented the strongest association with writing progression ($\rho = 0.51$, $p = 0.012$), suggesting that opportunities to respond, test hypotheses, and externalize reasoning were more closely related to gains in word-level writing performance.

These results should be interpreted with caution. Correlations were estimated in a small sample ($N = 24$), without correction for multiple comparisons, and therefore are vulnerable to sampling variability and inflated Type I error. Accordingly, they should be treated as exploratory signals of potentially relevant instructional mechanisms, not as confirmatory evidence of causal effects.

5.8. Synthesis and Discussion

The findings should be interpreted as *exploratory evidence of learning trends*, rather than as definitive proof of intervention effectiveness. Given the single-group quasi-experimental design, absence of a control group, reduced sample size ($N=24$), short intervention period, and the non-significant pre/post Wilcoxon result ($p = 0.346$), causal claims are not warranted in this study context.

Even under these constraints, the combined qualitative and quantitative analyses identified consistent signals of progression. Post-intervention productions showed greater organizational stability and closer phoneme–grapheme correspondence, indicating ongoing reorganization of students' writing hypotheses. The sign distribution (14 improved, 10 stable, 0 declined) also indicates a non-negative trajectory across participants, although with substantial inter-individual variability.

These patterns reinforce the pedagogical argument that digital gameplay alone should not be expected to produce learning gains. In this study, observable advances emerged in association with intentional instructional mediation and structured classroom use of the game [Moran et al. 2013, Vygotsky 1991]. From a psychogenetic perspective, the intervention context appeared to support iterative hypothesis testing about written language [Ferreiro and Teberosky 1999].

Student engagement was a particularly relevant dimension. Classroom observations indicated sustained participation, peer interaction, and greater willingness to at-

tempt, revise, and verbalize reasoning during activities. Exploratory correlations suggested stronger associations between writing gains and Action/Expression indicators ($\rho = 0.51$, $p = 0.012$), with moderate association for Engagement ($\rho = 0.42$, $p = 0.041$), while Representation was weaker and non-significant ($\rho = 0.28$, $p = 0.18$). As these analyses are exploratory and uncorrected for multiple comparisons, they should be interpreted cautiously as directional signals.

Overall, the study provides contextualized classroom-based evidence that the articulation of digital gameplay, teacher mediation, and UDL-informed instructional organization may support promising trends in early writing development. These findings should be further tested in future research with larger samples, longer intervention periods, control/comparison groups, and more robust experimental designs.

6. Conclusion

This study examined the contributions of the digital game *Words and Drawings*, pedagogically mediated and guided by Universal Design for Learning (UDL) principles, to early literacy development in a first-grade classroom. Results indicate descriptive qualitative progression in students' writing hypotheses, reflected in greater phoneme-grapheme stability and shifts toward more advanced writing levels, consistent with the psychogenesis framework [Ferreiro and Teberosky 1999].

Although the Wilcoxon signed-rank test did not reach statistical significance at $\alpha = 0.05$, the overall trajectory was non-negative, with most students demonstrating stability or improvement in word-level accuracy. Moreover, the operationalization of UDL dimensions showed positive associations between engagement and action/expression indicators and writing gains, suggesting that structured multimodal mediation may contribute to early literacy progression.

The findings reinforce that the educational value of digital games lies not in technological features alone, but in intentional pedagogical integration and teacher mediation [Moran et al. 2013, Moran 2015]. From a UDL perspective, the intervention expanded the forms through which students could participate, respecting individual differences and promoting broader and more equitable involvement in literacy activities. This alignment between digitally mediated practices and inclusive instructional design supported learner variability across developmental profiles [CAST 2018, Meyer et al. 2014].

This study has limitations. The single-group quasi-experimental design restricts causal inference, and the small sample size ($N = 24$) reduces statistical power. A further limitation concerns measurement equivalence: pre- and post-tests employed different word sets, which may vary in lexical or phonological difficulty and therefore affect strict comparability of accuracy scores. The single-school context limits generalizability, and observational UDL indicators may involve interpretive bias.

As a contribution to the field of Informatics in Education, this study points to possibilities for integrating digital resources, inclusive pedagogical practices, and early writing development within real classroom contexts. At the same time, it highlights the need for further investigations that extend intervention duration, explore diverse educational settings, and deepen understanding of the pedagogical use of digital games in literacy instruction. Future research should incorporate controlled designs, larger and more diverse

samples, longitudinal follow-up, and refined measurement of engagement and hypothesis verbalization, contributing to an empirically grounded and inclusive framework for digitally mediated literacy within Brazilian Basic Education.

Statement on the Use of Generative AI

Generative Artificial Intelligence (AI) tools were used only to support text organization and translation from Portuguese to English. All research design, data collection, analysis, interpretation of results, and final approval of the manuscript were conducted by the authors, who take full responsibility for the content presented.

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