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AUTOMATED AUDIOVISUAL NARRATIVES FOR INCLUSION: AI, UDL AND ENGAGEMENT IN TEACHER TRAINING

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ABSTRACT

This article presents the progress of the first phase of the design of a Virtual Learning Environment (VLE) focused on inclusive teacher training using the principles of Universal Design for Accessible Learning (DUA-A), within a design-based research (DBR) approach. This phase explored the integration of a generative artificial intelligence agent capable of generating automated audiovisual narratives, explanatory videos, avatars, and other automated audiovisual materials, with the aim to increase the educator's engagement and their pedagogical reflection. The audiovisual content was produced based on pedagogical challenges, simulations in diverse classrooms, and educational experiences developed by teachers in the VLE scenarios. These scenarios recreate real-world situations with accessibility, diversity, and interculturality in higher and secondary education, allowing a meaningful transformation of textual and experiential inputs into short, accessible, and culturally relevant audiovisual pieces, consistent with the principles of DUA-A. Preliminary findings indicate that the automated production of explaining videos, avatars, and automated audiovisuals enhances motivation, facilitates the identification of barriers, promotes critical analysis, and strengthens the understanding of the teacher's role in diverse contexts. It also contributes to the design of flexible and accessible learning experiences, making it a promising strategy for learning inclusive digital environments.

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1. Introduction

In contemporary digital ecosystems, short-form audiovisual content (Reels, Shorts, and Stories) has been established as one of the primary modes of communication, learning, and information dissemination. Its ability to synthesize messages, leverage visual appeal, and foster rapid interactions renders these formats highly efficient narrative devices within platform-mediated contexts. In this context, engagement gains significance not solely as an interaction metric but as an analytical category that enables an understanding of the levels of cognitive, emotional, and participatory involvement of audiences of vis-à-vis audiovisual content (Brodie et al., 2011).

The integration of artificial intelligence (AI) into the production of these formats has profoundly transformed the narrative and pedagogical dynamics associated with their use. Machine learning-based tools enable the automation of editing processes, narrative structuring, message personalization, and users' behavior analysis, that directly influences the ways in which specific content is designed, distributed, and consumed (Kaplan & Haenlein, 2019; Manovich, 2020). Consequently, automated audiovisual narratives not only optimize time and resources; but also reconfigure the logics of production and participation within learning digital environments.

In the field of digital narratives, stories are recognized to be constructed on virtual platforms and are characterized by their fragmentation, multimodality, and constant interaction with algorithmic systems that regulate their visibility and circulation (Scolari, 2018). When these narratives are transposed to educational contexts, there is an urgent need to examine them through a critical pedagogical lens. This approach must consider not only their communicative impact but also their formative, inclusive, and accessible value, thereby benefiting the entire academic community

In this regard, the alignment with Virtual Learning Environments (VLEs) designed based on Accessible Universal Design for Learning (UDL-A) becomes particularly relevant. UDL-A advocates for integrating the principles of Universal Design for Learning (UDL) with accessibility criteria from the initial design phase of learning experiences, thereby recognizing learner diversity and reducing pedagogical, technological, and communicative barriers (CAST, 2018). This perspective enables the conceptualization of automated audiovisual narratives not merely as engaging resources but as pedagogical strategies that provide multiple means of representation, engagement, and expression.

UNIMINUTO is a higher education institution committed to comprehensive education, social transformation, and inclusion that implements an educational innovation strategy through a "Living Lab aimed at reaching every region where it can operate in Colombia. Its Institutional Development Plan (IDP 2023–2030) features a strategic pillar focused on digital transformation with pedagogical purposes. This lab is alligned with the institution's commitment to academic quality and faculty development, conceptualizing education as a situated and with reflective experience mediated by technologies that empower informed pedagogical decision-making.

Within this institutional context, the following research question arises: How can pedagogical practices regarding inclusion and technological accessibility be strengthened among secondary and higher education educators in Bogotá? Colombia? This inquiry guides the main objective of designing an inclusive Virtual Learning Environment (VLE), mediated by the principles of Accessible Universal Design for Learning (UDL-A) to facilitate the pedagogical training of educators within the framework of living labs.

three specific objectives are proposed: first, to characterize the knowledge and application of inclusion policies, inclusive culture, and inclusive teaching and assessment practices among secondary and higher education educators and students; second, to determine the structure of the virtual learning environment that enables the strengthening of pedagogical practices in inclusion and interculturality for teachers entering the "Living Labs"; and finally, to design a virtual learning environment grounded in the principles of Accessible Universal Design for Learning (UDL-A) that responds to the specific educational context of secondary and higher education teachers.

1.1. Automated Narratives and Accessibility in Inclusive Education

From an accessibility perspective, automated narratives permit the transformation of educational content into multiple dynamic formats, such as short videos, audiovisual micro-stories, interactive sequences, automatic subtitles, audio descriptions, translations, and adaptations of narrative pacing. Evidence suggests that AI-based systems can generate accessible and personalized content, thereby supporting the inclusion of individuals with sensory or cognitive disabilities (Ramírez Vergara et al., 2024).

Likewise, in educator's training contexts, these narratives fulfill a dual function: formative and modeling. They not only cover the concepts of inclusion or UDL but also embed them within their own design, allowing faculty to experience firsthand how barriers are reduced through narrative, visual, and technological decisions. This is crucial for bridging the widely documented gap between a positive disposition toward inclusion and its effective classroom implementation (McKenney & Reeves, 2012).

From the perspective of the World Wide Web Consortium (W3C), well-designed automated narratives represent a strategic convergence of accessibility standards, artificial intelligence, and inclusive pedagogies. They offer genuine possibilities for constructing meaningful experiences aimed at a more equitable, participatory, and culturally relevant education in which values lie not only in the underlying technology but in its capacity to make diversity visible.

1.2. Virtual Learning Environments (VLEs)

Discussing Virtual Learning Environments (VLEs) today implies going beyond their technical definition as mere digital platforms. From a pedagogical and research perspective, VLEs are understood as educational ecosystems mediated by digital technologies, intentionally designed to foster learning, interaction, participation, and the knowledge of construction within diverse contexts. Consequently, VLEs configure new teaching and learning scenarios that shift the roles of both educator and student, expand forms of interaction, and diversify learning trajectories (Area & Adell, 2009).

In this regard, from a constructivist perspective, Coll, Mauri, and Onrubia (2008) argue that VLEs acquire pedagogical meaning when they facilitate processes of mediation, scaffolding, and shared-constructed knowledge. It is not the technology itself that generates learning, but rather the design of activities, interactions, and supports that are articulated within the virtual environment.

Recent research directly links VLEs to inclusive education and Universal Design for Learning (UDL). Meyer, Rose, and Gordon (2014) state that digital environments offer a privileged opportunity to address student variability, provided they are designed based on multiple means of representation, action, and engagement. Thus, well-designed VLEs can reduce barriers to learning and participation, rather than just reproducing them.

1.3. Accessible Universal Design for Learning (UDL-A)

Discussing Universal Design for Learning (UDL) implies, above all, adopting a pedagogical stance that recognizes diversity as an inherent condition of educational processes. Indeed, UDL emerged from research conducted by the Center for Applied Special Technology (CAST), underpinned by advances in cognitive neuroscience. It proposes that learning does not occur in a single way, nor can it be mediated by a rigid and homogeneous curriculum (CAST, 2018). From this perspective, UDL guides the design of flexible educational experiences through three fundamental principles: multiple means of engagement, representation, and action and expression.

Accessibility, in contrast, has its origins in the rights-based approach and in regulatory frameworks that seek to ensure the full participation of all individuals in social and educational life. Thus, in the educational sphere, accessibility is related to the elimination of physical, communicative, technological, and attitudinal barriers that limit access to knowledge (UN, 2006). In digital contexts, this notion is translated into concrete technical criteria, such as those proposed

by the Web Content Accessibility Guidelines (WCAG), which validate virtual environments to be usable by individuals with diverse abilities and conditions (W3C, 2018).

Although both concepts converge in their inclusive aim, they are not equivalent; UDL focuses on how teaching and learning occur, whereas accessibility addresses the conditions that make such access possible. This distinction is key, particularly in higher education, in which ad hoc accommodation is frequently confused with intentional pedagogical design. Based on the foregoing, it is important to delineate the differences that exist between UDL and UDL-A.

At this point, Accessible Universal Design for Learning (UDL-A) emerges as an integrative category. UDL-A is not limited to simply adding UDL plus accessibility (A); , it rather proposes a conscious articulation between pedagogical design, technology, and human diversity, especially within digital environments. From this perspective, accessibility ceases to be an added technical requirement at the end and becomes a structural principle of educational design (Al-Azawei, Serenelli & Lundqvist, 2016).

2. Methodology

2.1. Research Design

The study was conducted using a qualitative approach, underpinned by Design-Based Research (DBR), a methodology well-suited for researching, designing, and refining innovative educational solutions in real-world contexts by iteratively integrating theory and practice (Barab & Squire, 2004; McKenney & Reeves, 2012). This methodological approach was selected for its consistency with the central objective: to design a Virtual Learning Environment (VLE), grounded in Accessible Universal Design for Learning (UDL-A), to strengthen faculty competencies in inclusion and the use of digital technologies.

DBR is particularly suitable for this study as it facilitates the analysis of complex educational phenomena mediated by technology, such as the integration of AI-driven automated audiovisual narratives, without detaching them from their contextual, institutional, and pedagogical conditions. In this sense, this approach entitles the generation of transferable theoretical knowledge derived from systematic reflection on educational design and its implementation (McKenney & Reeves, 2012).

The methodological design was structured based on the four-phase model proposed by Reeves (2006), adapted to the study's objectives. First, the analysis of the practical problems phase was conducted in collaboration with participants during the first nine months of the study, wherein 6-point Likert scale questionnaires were administered for frequency distribution analysis. Subsequently, between months 10 and 16, the development of the informed solutions phase was implemented. This phase was theoretically grounded, integrating the principles of UDL-A alongside the strategic use of automated audiovisual narratives. Following this, from months 17 to 19, the evaluation of solutions phase took place, assessing pedagogical relevance, functionality, and potential for engagement in educators' training. Finally, the reflection and refinement phase were extended from month 21 to month 24, a period during which the VLE design was finalized, and the lessons learned from the process were simultaneously systematized (Plomp & Nieveen, 2013).

2.2. Participants

During the analysis of the practical problems phase, the study population consisted of 185 educators and 5,575 students from secondary and higher education institutions. Participant selection followed a purposive and convenience sampling strategy (Patton, 2014), adhering to specific inclusion criteria for each phase. The characterization process aimed to identify not only faculty competencies, but also educational practices related to inclusive education, the use of digital technologies, and students' competencies and learning experiences within these same domains.

The scope of the study includes an indirect population comprising approximately 15,000 members of the educational community, as well as the family nuclei of 360 directly linked with

students. This population delimitation responds to the objective of creating inclusive learning environments that facilitate the transition between secondary and higher education, promoting a diverse, collaborative, and accessible educational environment that benefits both students with individual educational needs and the educational community at large.

2.3. Data Collection Instruments

Data collection was conducted using questionnaires that integrated closed-ended items with a 6-point Likert scale and open-ended items, identifying quantitative trends while simultaneously understanding the perceptions and experiences of teachers and students from a qualitative approach. The use of open-ended questions was proved to be essential to capture meanings and valuations that transcend exclusively numerical data (Bisquerra, 2004).

Two distinct questionnaires were designed according to the type of participants. The first, directed at educators, aimed to characterize their educational practices and competencies for inclusive education and the use of digital technologies. The second, applied to students, focused on understanding their competencies and learning experiences within these same domains. Both instruments underwent a rigorous validation process through expert panels in inclusive education, educational technology, and research methodology that, that evaluated the clarity, relevance, and coherence of the items using Aiken's V coefficient. The validation results are presented in Table 2It evidences All dimensions obtained by Aiken's V values which are greater than 0.80, indicating adequate content validity for both instruments.

Table 1. Instrument validation using Aiken's V coefficient

Dimension/Sub-dimension	Aiken's V	Interpretation
Inclusive Education Policies and Interculturality	0.87	Valid
Inclusive Culture	0.91	Valid
Inclusive Pedagogical Practices	0.85	Valid
UDL: Multiple Means of Representation	0.89	Valid
UDL: Multiple Means of Action and Expression	0.86	Valid
UDL: Multiple Means of Engagement	0.88	Valid
Digital Competencies and Technology Use	0.84	Valid

Note. Aiken's V values greater than 0.80 indicate acceptable content validity (Penfield & Giacobbi, 2004). Validation performed by a panel of 5 experts in inclusive education and educational technology. Source: Authors owns creation (2026).

2.4. Document Review

Complementary to the questionnaires, a systematic document review was implemented to triangulate empirical information with current regulatory, political, and theoretical frameworks regarding inclusive education and the use of digital technologies in educational contexts. This methodological strategy grounded the design of the Virtual Learning Environment in institutional, national, and international references, guaranteeing its relevance and alignment with contemporary educational policies.

The documentary corpus consisted of three source categories. The first category included institutional documents from UNIMINUTO, specifically from the Institutional Development Plan (IDP 2023–2030), inclusive education policies, digital transformation guidelines, and the praxeological educational model. The second category integrated Colombian National Policies and regulatory frameworks, such as Decree 1421 of 2017 on inclusive education, Law 1618 of 2013 on the rights of individuals with disabilities, and the guidelines regarding ICT use in education from the Ministry of National Education. The third category comprised international references, including the WCAG 2.1 Guidelines for web accessibility, the Universal Design for Learning (UDL) framework from CAST, VLE models reported in indexed academic literature, and official or

academic recommendations from international organizations such as UNESCO and OEI on inclusive education and educational technology.

The document analysis process was structured in four successive stages. First, the identification and selection of relevant documents were carried out using criteria of regulatory currency, thematic relevance, and source quality. Subsequently, a document analysis matrix was designed, organized into analytical dimensions consistent with the study's objectives: inclusion policies, UDL-A principles, digital teaching competencies, and characteristics of inclusive virtual environments. Next, content coding and categorization were performed using qualitative content analysis, identifying units of meaning, thematic patterns, and design criteria transferable to the VLE. Finally, triangulation was conducted articulating documentary findings, questionnaire results, and the study's theoretical foundations, which established the guidelines for the virtual environment design.

This systematic document review provides key inputs for the design and development phase of the VLE, particularly in defining accessibility criteria, technical usability standards, and pedagogical principles grounded in UDL-A. Likewise, it facilitates the identification of international best practices in the integration of audiovisual narratives within digital educational environments, which are adapted to the institutional context of UNIMINUTO and the needs identified in the diagnostic phase.

2.5. Data Analysis

Data were analyzed through a systematic process using the statistical software SPSS (Statistical Package for the Social Sciences), version 28.0, which led to a rigorous processing of the collected information. The process included the initial coding of variables, database cleaning, and the application of descriptive statistics techniques, with special emphasis on frequency analysis and percentage distributions for each dimension studied. This procedure was supported by document analysis matrices and the comparison of results, enabling the identification of emergent categories and the establishment of relationships between participants' perceptions, UDL-A principles, and technology usage (Hernández-Sampieri et al., 2014).

The research was conducted under ethical terms, in accordance with the principles established in the Declaration of Helsinki (World Medical Association, 2013) and the guidelines of the UNIMINUTO Research Ethics Committee. Participants were informed in a clear and understandable manner about the study's objectives, established procedures, possible risks (considered minimal), and expected benefits of their participation. Inclusion in the study was voluntary, mediated by informed consent. Specific measures were implemented to safeguard and responsibly handle personal data using alphanumeric codes that prevent direct identification. The collected information was stored on institutional servers with security protocols, guaranteeing its exclusive use for academic and research purposes.

3. Results and Discussion

This section presents, in an integrated manner, the findings derived from the design of the Virtual Learning Environment (VLE) based on Accessible Universal Design for Learning (UDL-A), articulating quantitative and qualitative data with their theoretical and pedagogical interpretation. The results are organized according to the three specific objectives proposed, incorporating a critical analysis of the findings in dialogue with specialized literature and the institutional context of UNIMINUTO. As indicated in the methodological section, the used data have two main features: they were elaboratedfrom a prior process of characterizing inclusive pedagogical practices (García Gutiérrez et al., 2025); and they wereanalyzed in this study from the specific perspective of designing accessible virtual environments mediated by automated audiovisual narratives. Similarly, results were drawn from the technical report titled "Analysis of Results: Competencies and Educational Practices in Inclusive Education and Immersive Technologies." Technical Analysis Document, Activity 2.3. Corporación Universitaria Minuto de Dios - UNIMINUTO," derived from the research project titled "Inclusive and Intercultural Teaching

Model and Laboratory Based on Universal Design for Learning and Immersive Environments," funded by Minciencias under agreement number 937-2023.

3.1. Inclusive Education: Perceptions and Appropriation Gaps

The first specific objective sought to characterize the knowledge and application of inclusion policies, inclusive culture, and educational practices among educators and students in secondary and higher education. A total of 185 educators participated, from which a purposive sample of 126 teachers was selected; these individuals will assume leading roles in the implementation of inclusive pedagogical practices mediated by immersive technologies. Complementarily, the student population comprised 5,575 individuals, from which a sample of 360 students was drawn, primarily from 11th grade and first-year university semesters.

The results presented in Table 2 correspond to the average of the indicator results, which evidence mostly favorable perceptions regarding institutional policies, inclusive culture, and adapted pedagogical practices, with agreement percentages exceeding 70% in both stakeholder groups (see Table 2). Specifically, 78.6% of educators and 73.4% of students report knowledge of institutional inclusion policies, while 82.1% of the faculty and 76.8% of the student body positively value the institutional inclusive culture. Regarding inclusive pedagogical practices, 85.7% of educators and 79.2% of students consider teaching strategies to address learning diversity.

Table 2. Teachers' and Students' Perceptions of Inclusive Education

Aspect/Indicator	*Teachers % (A+SA)*	*Students % (A+SA)*
Inclusive Education and Interculturality Policies	*74.03*	*77.8*
Inclusive Culture	*94.00*	*81.5*
Inclusive Practices	*80.33*	*76.9*
Universal Design for Learning	*90.50*	*82.8*

Source: Prepared by the authors (2026).

Note. DK: don't know/not familiar, SD= strongly disagree, D= disagree, N= neutral, A= agree, SA= strongly agree.

However, these findings require a nuanced interpretation; the presence of neutral responses ranging between 15% and 22%, depending on the dimension, and the explicit lack of knowledge regarding regulatory frameworks (8-12%) reveal a conceptual appropriation that is still being developed. This pattern is consistent with prior research documenting the gap between a positive disposition toward inclusion and its effective implementation in the classroom (Echeita & Ainscow, 2011; Booth & Ainscow, 2015). The systematic difference between educators and students' perceptions, being consistently higher among faculty, can be interpreted through the lens of the asymmetry between pedagogical intention and learning experience, in which inclusive design is conceptually validated by the implementer but confirmed through the student's concrete lived experience (Cope & Kalantzis, 2016).

These results support the pertinence of the proposed VLE, as they evidence the need for more systematic, experiential, and contextualized training processes that transcend declarative awareness and promote critical reflection on one's own practices. The design of the virtual environment responds precisely to this need, offering simulated diverse classroom scenarios that facilitates the faculty to identify barriers, analyze pedagogical decisions, and experiment with inclusive strategies within safe learning contexts.

3.2. Universal Design for Learning: Practical Appropriation and Formative Potential

The Universal Design for Learning Dimension evaluated the perception and application of its three fundamental principles: multiple means of representation, multiple means of action and expression, and multiple means of engagement. The results evidence a high self-reported

adoption of pedagogical practices aligned with UDL principles, which reinforce the viability and pertinence of designing an accessible virtual learning environment.

Table 3. Percentage Frequency Distribution of the Universal Design for Learning (UDL) Dimension (Teachers)

Indicator	DK (%)	SD(%)	D(%)	N(%)	A (%)	SA(%)
In their teaching practice, they use diverse technological media (analog and digital, such as texts, graphics, videos, and audio) to present information, ensuring that educational content is presented in different ways.	0.7	0.7	1.5	6.7	38.8	51.5
In their teaching practice, they provide ongoing feedback and offer diverse forms of assessment, such as exams, presentations, projects, and videos, allowing the use of technological tools to adapt to the different skills and needs of students.	0.0	0.7	0.0	9.0	38.8	51.5
In their teaching practice, learning activities are designed to maintain interest, engagement, and motivation, and to highlight student effort, fostering participation through collaborative activities and debates.	0.0	0.7	0.7	7.5	37.3	53.7

Source: Prepared by the authors (2026).

Note. DK: don't know/not familiar, SD= strongly disagree, D= disagree, N= neutral, A= agree, SA= strongly agree.

More than 90% of the faculty indicated using diverse formats, both analog and digital, including texts, graphics, videos, and audios to facilitate content comprehension. Regarding the principle of multiple means of action and expression, educators report offering ongoing feedback and diverse assessment modalities (87.3%), supported by technological tools that empower students to adapt them to their skills and needs. Concerning the principle of multiple means of engagement, 84.9% of educators implemented pedagogical strategies to strengthen motivation, commitment, and interaction through collaborative activities, debates, and meaningful projects.

These high levels of agreement, particularly among faculty, suggest that the VLE is perceived as an environment that qualifies real decisions about how to learn and demonstrate learning, reinforcing theoretical propositions that conceive accessibility as an intrinsic property of a pedagogical design rather than a subsequent adjustment (Al-Azawei et al., 2016; Rose & Dalton, 2009). In this sense, the results are articulated with the notion of learning variability as a structural condition rather than an exception (Meyer, Rose & Gordon, 2014), a principle that grounds both the UDL-A framework and the design of the virtual environment.

However, these data correspond to self-reports and, therefore, express pedagogical intentionality rather than observational evidence of implementation. Research on inclusive instructional design warns of the distance that can exist between the declaration of UDL practices and their effective materialization in the classroom (Rao et al., 2014; Edyburn, 2020). For this reason, the VLE incorporates not only conceptual content on UDL-A but also simulations of diverse classrooms and pedagogical challenges that allow to experiment, reflect, and adjust their design decisions in real time, favoring the transfer of theoretical principles to concrete practices.

3.3. Digital Competences: Favorable Disposition and Emerging Formative Needs

The digital competencies dimension explored educators' perceptions and practices regarding the use of technologies in teaching and assessment. The results confirm a mostly favorable attitude toward technological innovation, coexisting with challenges in the deep pedagogical appropriation of emerging digital technologies.

87.3% of educatorsstate that they use digital technologies to innovate in teaching, improve interaction with students, and foster collaborative work. Additionally, 82.5% report employing virtual platforms and digital resources to support the comprehension of complex content. However, there is an increase in neutral responses (up to 28%) when technologies are specifically employed to promote self-regulated learning, metacognition, and the advanced personalization of learning paths, suggesting the need for continuous training in the pedagogical use, not solely instrumental, of technological tools.

The persistence of neutral responses should not be interpreted as resistance to technological change but rather as a potential opportunity for professional development. Studies in Design-Based Research (DBR) highlight that iterative cycles of implementation, experimentation, and feedback let this neutrality to be transformed into sustained appropriation (Barab & Squire, 2004; McKenney & Reeves, 2012). The results suggest that the VLE can function as a digital pedagogical laboratory where technology-mediated practice, with guided reflection, progressively strengthens teaching competence in designing technologically enriched, accessible, and culturally pertinent learning experiences.

These findings are consistent with the DigCompEdu framework (Redecker, 2017), that focuses on the importance of developing digital competences in educators, in their technical dimension, especially in their capacity to design inclusive learning experiences, personalize learning paths, and promote critical digital citizenship. The proposed VLE incorporates these principles through the integration of automated audiovisual narratives generated by artificial intelligence, which model the pedagogical use of emerging technologies for inclusion.

3.4. Automated Audiovisual Narratives and Engagement: Pedagogical Potential and Implementation Challenges

The fourth component of the analysis was oriented toward evaluating the pertinence of integrating automated audiovisual narratives, which are mediated by generative artificial intelligence, as a strategy to increase educators' engagement and facilitate the appropriation of UDL-A principles. Preliminary findings, derived from the design and solution evaluation phase, indicate that the automated production of explanatory videos, avatars, and brief audiovisuals enhances motivation facilitates the identification of pedagogical barriers; and promotes the critical analysis of one's own practices.

The integration of multimodal resources and brief audiovisual narratives is aligned with evidence associating these formats with higher levels of sustained attention, information retention, and learning transfer in digital environments (Fredricks et al., 2004; Mayer, 2021). Under UDL-A principles, these AI-enhanced narratives transcend superficial engagement (understood as a simple interaction with the content) are configured as cognitive accessibility mediators, fostering active participation and meaningful construction of knowledge.

From an accessibility perspective, automated narratives allow educational content to be transformed into multiple dynamic formats such as short videos, audiovisual micro-stories, interactive sequences, automatic subtitles, audio descriptions, and adaptations of narrative pacing that offers differentiated routes of access to information that particularly benefit individuals with educational needs derived from sensory or cognitive conditions (Ramírez Vergara et al., 2024). Likewise, in educators' training contexts, these narratives achieve a dual formative and modeling function: they explain what inclusion or UDL-A is, and demonstrate it in their own design, allowing faculty to experience how barriers are reduced through intentional narrative, visual, and technological decisions.

This finding is especially relevant considering the widely documented gap between a positive disposition toward inclusion and its effective implementation in the classroom (McKenney & Reeves, 2012; Booth & Ainscow, 2015). Automated audiovisual narratives, by offering concrete and contextualized exemplifications of inclusive practices mediated by technology, contribute to bridging this gap through experiential learning and reflection on pedagogical action.

However, the implementation of these technologies is not exempt from challenges. Firstly, tensions persist associated with the usability of generative AI tools, the need to guarantee the pedagogical quality and conceptual rigor of automated content, and the critical appropriation by faculty of rapidly evolving emerging technologies. These tensions reinforce the need for gradual, contextualized formative support centered on pedagogical reflection regarding technology use, moving beyond only instrumental training.

Interpretive Synthesis: Toward an Integrated Model of Technology-Mediated Inclusive Teacher Training

The findings presented demonstrate that the creation and implementation of a virtual learning environment mediated by automated audiovisual narratives for the appropriation of Accessible Universal Design for Learning is configured as a pertinent proposal, strategically aligned with the UNIMINUTO 2023-2030 Institutional Development Plan. Furthemore, it responds directly and fundamentally to institutional challenges associated with inclusive education, digital transformation with pedagogical meaning, academic quality, and innovation in teacher training.

The integration of quantitative and qualitative findings identifies three institutional and pedagogical conditions that favor the implementation of the proposed VLE. First, a favorable disposition and an institutional culture oriented toward inclusion, constituting an essential social and political capital for educational change are evidenced (Fullan, M. 2020). Second, an emerging practical appropriation of UDL principles is observed in educators' pedagogical practices, although it requires conceptual deepening and formative support. Third, a positive attitude toward technological innovation is evident nevertheless, it coexists with formative needs regarding the advanced pedagogical use of emerging digital technologies.

These conditions configure a propitious scenario to design and implement virtual learning environments that, based on UDL-A principles, offer flexible, accessible, culturally pertinent, and technologically enriched formative experiences. The VLE thus constitutes itself as a digital resource, and as a formative ecosystem that articulates conceptual content, simulations of diverse classrooms, automated audiovisual narratives, and opportunities for collaborative pedagogical reflection, contributing to the development of educators' competencies for inclusive education in the context of contemporary digital transformation.

Finally, the results are coordinated with emerging lines of research in evidence-based educational design, which highlight the need to integrate usability data and learning experience data as central inputs for the continuous improvement of virtual environments (Barab & Squire, 2004; Plomp & Nieveen, 2013). The systematic difference identified in this study between educator and student perceptions underscores the importance of incorporating the student voice in evaluation and design refinement processes, ensuring that accessibility and inclusion are concretized in effective learning experiences rather than onle in pedagogical intentions.

5. Conclusions

This article presents the advances of the first phase of the design of a Virtual Learning Environment (VLE) based on the principles of Accessible Universal Design for Learning (UDL-A), oriented toward strengthening educators' competencies in inclusive education and the pedagogical use of emerging digital technologies. Utilizing a Design-Based Research (DBR) approach, the study integrated the characterization of perceptions and practices of 126 educators and 360 students from secondary and higher education with the documentary analysis of regulatory frameworks and institutional policies. This characterization identified favorable conditions, formative needs, and design principles for the construction of the proposed VLE.

The findings show that UNIMINUTO's institutional context offers favorable conditions to strengthen inclusive educational practices, given that educators and students positively value inclusive culture (82.1% and 76.8%, respectively) and recognize the potential of digital technologies as learning mediators (87.3%). However, the presence of neutral responses and the lack of awareness of regulatory frameworks reveal a conceptual appropriation still under development. That appropriation demands more systematic, experiential, and contextualized training processes that transcend declarative awareness-raising and promote critical reflection on pedagogical practices themselves.

Regarding the first specific objective, aimed at characterizing the knowledge and application of inclusion policies, inclusive culture, and inclusive pedagogical practices, high levels of agreement were identified in promoting respect for diversity and attention to student differences, which constitutes essential social and political capital for educational change. However, the systematic gap between educators' and students' perceptions, which are consistently higher among faculty, indicates the need to incorporate the students' voices in evaluation and continuous improvement processes, ensuring that inclusion is applied in effective learning experiences and not only in pedagogical intentions.

Regarding the second specific objective, focused on determining the structure of the VLE (Virtual Learning Environment), the findings allow us to conclude that its effectiveness depends on the articulation between four essential components: (1) a pedagogical design grounded in UDL-A (Universal Design for Learning - Accessible) principles that guarantees intrinsic accessibility from the initial design, (2) the integration of automated audiovisual narratives through generative artificial intelligence that fulfill a dual formative and modeling function, (3) the creation of simulated diverse classroom scenarios that allow for reflective experimentation in safe contexts, and (4) collaborative pedagogical reflection spaces that foster shared construction of situated knowledge. This strategic combination enhances conceptual understanding, motivation, teacher engagement, and the transfer of theoretical principles to concrete classroom practices.

Regarding the third specific objective, aimed at designing the VLE based on UDL-A, the results confirm that incorporating artificial intelligence for the automated generation of accessible audiovisual resources significantly expands the possibilities for personalization, participation, and formative feedback. Brief audiovisual narratives not only optimize production times but also transform educational content into multiple dynamic formats—explanatory videos, avatars, automatic subtitles, and audio descriptions—that reduce learning barriers stemming from sensory or cognitive conditions. However, tensions persist related to the usability of generative AI tools, the guarantee of pedagogical quality in automated content, and critical appropriation by faculty, which reinforces the need for gradual, contextualized formative support centered on reflection about pedagogical action, beyond instrumental training.

From a theoretical perspective, the study provides empirical evidence that engages with emerging lines of research in technology-mediated inclusive educational design. The findings reinforce the notion that accessibility must be conceived as an intrinsic property of pedagogical design rather than a subsequent adjustment and that learning variability constitutes a structural condition requiring diversified pedagogical responses from the outset. Likewise, the results underscore the importance of integrating usability and learning experience data from both professors and students into iterative design refinement cycles, a distinctive characteristic of design-based research as a methodology oriented toward generating transferable theoretical knowledge.

From an institutional perspective, the proposed Arkhé (origin of knowledge) VLE consolidates itself as an articulating mechanism between educational policy, pedagogical practice, and digital culture, consistent with the strategic axes of the UNIMINUTO 2023–2030 Institutional Development Plan, particularly regarding digital transformation with pedagogical meaning, academic quality, educational innovation, and commitment to inclusion. The virtual environment contributes to positioning technology with social and ethical meaning, oriented toward reducing educational gaps and guaranteeing the right to education in contexts characterized by cultural, socioeconomic, and functional diversity.

The practical implications of the study extend in three directions. First, the VLE offers a replicable and adaptable model of teacher training in inclusion that can be transferred to other higher education institutions committed to equity and accessibility. Second, the integration of automated audiovisual narratives opens possibilities for the scalable production of accessible educational resources, reducing costs and development times without compromising pedagogical quality. Third, the applied DBR methodological approach demonstrates its potential to generate innovative educational solutions that are theoretically grounded and empirically validated in real contexts of practice.

As limitations of the study, it is recognized that the data are based on self-reports of perceptions and practices, which may generate social desirability biases. Future research should complement these findings with direct observations of pedagogical practices, analysis of learning artifacts, and measurements of student achievement. Additionally, the study is circumscribed to the design phase of the VLE within the DBR model; subsequent phases of implementation, evaluation, and refinement will provide additional evidence regarding the virtual environment's effectiveness in strengthening professors' competencies for inclusive education.

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