DIGITAL SPACES AND AUGMENTATIVE AND ALTERNATIVE COMMUNICATION (AAC). TOWARDS EMOTIONALLY AWARE INCLUSIVE DIGITAL LEARNING SPACES.

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ABSTRACT
The increasing presence of digital technologies in education is progressively transforming traditional classrooms into hybrid learning environments that combine physical and virtual dimensions. In this context, the design of inclusive and emotionally responsive learning spaces becomes essential to support students' communication, engagement, and overall well-being. This paper examines the role of Augmentative and Alternative Communication (AAC) in the development of accessible digital learning environments. Through a theoretical review of studies on inclusive education, hybrid learning spaces, and multisensory technologies, the contribution of AAC tools and symbol-based communication systems to digital educational contexts is discussed. The study highlights how integrating AAC within digital platforms can enhance communicative accessibility and participation, fostering a more inclusive learning ecosystem and the creation of emotionally aware learning environments.

KEYWORDS
AAC; digital inclusion; digital spaces; inclusive learning environments; inclusive Technologies.

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1. Introduction: Digital Learning Spaces and Inclusive Communication

In recent years, the evolution of digital technologies has profoundly transformed learning environments, reshaping not only the tools used for teaching and learning but also the very concept of educational space. Traditional classrooms are progressively giving way to hybrid learning ecosystems characterized by the integration of physical and virtual dimensions, within which students and teachers interact through multiple communication channels. As highlighted by scholars such as Dede (2010), Bonk and Graham (2012), and Luckin (2018), contemporary learning environments are increasingly configured as flexible, interconnected, and customizable contexts capable of adapting to the diverse needs of individuals involved in educational processes.

Within this framework, communication plays a central role not only in the transmission of knowledge but also in the construction of social relationships, active participation, and both individual and collective well-being. According to Vygotsky's (1978) sociocultural perspective, learning develops through social interaction and the mediation of cultural tools; consequently, effective communication represents an essential condition for inclusion and full participation in school life. When such opportunities are limited, the risk of isolation, exclusion, and reduced learning opportunities increases significantly.

Given this centrality, Augmentative and Alternative Communication (AAC) assumes particular relevance. AAC encompasses a set of strategies, tools, and systems designed to support or replace verbal language in individuals with complex communication needs (Beukelman & Light, 2020). Over the years, AAC has progressively expanded its scope, moving from predominantly compensatory approaches toward a broader perspective focused on social participation, self-determination, and communicative accessibility. Recent technological innovations have further facilitated this evolution by enabling the integration of symbols, speech synthesis, digital interfaces, and multimodal systems within educational environments.

The integration of AAC into digital learning spaces also draws attention to a dimension that is crucial for the effectiveness of inclusive processes: the emotional dimension. The ability to communicate, express needs, and participate in social interactions is closely connected to psychological well-being, a sense of belonging, and students' motivation. In this regard, educational research has increasingly focused on Emotionally Aware Learning Environments—contexts capable of recognizing, interpreting, and supporting students' emotional dimensions through the use of intelligent technologies,

sensors, and adaptive systems (Picard, 1997; D'Mello, 2013). These environments are grounded in the assumption that emotions, motivation, and psychological well-being profoundly influence learning processes and active participation.

When considered together, these perspectives highlight how communicative accessibility and attention to emotional dimensions represent complementary elements in the design of truly inclusive educational environments. However, despite the extensive development of research on digital learning environments and AAC, the dialogue between these two fields remains limited, particularly regarding the contribution that AAC can make to the design of inclusive and emotionally aware digital educational spaces. Building on this consideration, the present paper aims to explore the role of AAC in the design of hybrid and emotionally aware learning environments, highlighting its potential to promote communicative accessibility, participation, and well-being within the school community.

2. Hybrid and Emotionally Aware Learning Environments

2.1 Evolution of Learning Environments

Digital transformation has profoundly reshaped the way learning environments are conceived and organized. While educational space was traditionally identified primarily with the physical classroom, the introduction of digital technologies over recent decades has fostered the emergence of increasingly flexible and interconnected contexts in which learning experiences develop through the continuous integration of physical presence and virtuality. From this perspective, learning environments are no longer defined exclusively by spatial and temporal coordinates; rather, they are configured as complex ecosystems in which individuals, digital tools, data, and educational practices interact dynamically. Within this process of redefinition, the diffusion of blended learning models and, subsequently, hybrid learning has accelerated this transformation. While blended learning combines face-to-face and online activities within an integrated educational pathway (Graham, 2013), hybrid environments enable the simultaneous participation of students who are physically present and those connected remotely, thereby expanding opportunities for access and personalized learning. Recent studies indicate that such environments can foster autonomy, flexibility, and more student-centered learning pathways, provided that they are supported by appropriate pedagogical design and accessible technologies (See et al., 2026).

This evolution toward increasingly flexible models is embedded within a broader

conception of digital education. Contemporary literature describes educational environments as genuine digital ecosystems characterized by the interconnection of platforms, devices, intelligent systems, and digital educational resources. In these contexts, technologies are no longer viewed merely as tools supporting instruction; rather, they become active components in the construction of learning experiences, contributing to the personalization of educational pathways and the collection of data that can enhance the understanding of educational processes.

2.2 Emotionally Aware Learning Environments

The growing complexity of digital learning ecosystems has directed research attention not only toward technological and organizational aspects but also toward the human dimensions that influence educational experiences. Alongside cognitive factors, interest, motivation, curiosity, frustration, anxiety, and a sense of belonging significantly influence students' engagement and the quality of their learning experiences. In increasingly digital and hybrid environments, understanding these dimensions becomes particularly important, as technology-mediated interactions can affect both student engagement and well-being. Building upon the pioneering work of Picard (1997) on affective computing, the idea has emerged that technologies can detect and interpret indicators of users' emotional states. Drawing on these theoretical and technological foundations, Emotionally Aware Learning Environments employ data derived from digital interactions, learning analytics, sensors, and artificial intelligence systems to monitor factors such as engagement levels, attention, motivation, and potential signs of emotional difficulty. Their purpose is not to replace the educational role of teachers but rather to provide information that can support the adaptation of activities, content, and instructional strategies to students' needs. Recent literature highlights the continuous growth of affective computing applications in education, particularly within online and hybrid environments, where emotion monitoring can contribute to sustaining engagement and supporting emotional regulation throughout the learning process. While these solutions offer new opportunities to better support learners, they also raise issues that require critical reflection. The implementation of such technologies demands careful consideration of ethical concerns, privacy protection, and transparency in decision-making processes.

2.3 Implications for Inclusion and Participation

The characteristics of hybrid learning environments and the growing attention to the emotional dimensions of learning converge toward a common objective: the

creation of educational contexts that are more accessible, participatory, and responsive to student diversity. The possibility of personalizing content, modes of access, and forms of participation enables a more effective response to the diverse needs present in contemporary classrooms. Consequently, accessibility, personalization, and participation emerge as closely interconnected dimensions. Digital environments can provide multiple modes of information representation, diverse communication channels, and adaptable learning pathways tailored to students' characteristics, thereby fostering greater equity in access to educational opportunities. At the same time, the monitoring of learning processes and engagement indicators can support timely interventions aimed at promoting well-being and the active participation of all learners (Contreras Rivera, Puma Mamani, Paz Campaña, Urraca Vergara, 2025). However, inclusion cannot be regarded as an automatic consequence of technological innovation. As numerous studies have demonstrated, the mere presence of digital tools does not in itself guarantee the removal of communicative, relational, or cognitive barriers. It is therefore necessary to adopt a design-oriented perspective that views technology as part of a broader educational ecosystem in which accessibility, participation, and well-being are integrated objectives. Within this framework, AAC can play a particularly significant role, contributing to the development of digital learning environments that are not only technologically advanced but also genuinely inclusive. Having established that hybrid environments and affective computing require intentional inclusive design rather than mere technological adoption, the following section examines Augmentative and Alternative Communication (AAC) as a foundational framework for operationalizing communicative accessibility within these digital ecosystems.

3. Augmentative and Alternative Communication in Inclusive Education

3.1 Definition and Principles of AAC

To understand the contribution of AAC within inclusive educational settings, it is necessary to examine its fundamental principles and the theoretical foundations that guide its application. As previously noted, the term augmentative refers to the objective of enhancing existing communicative abilities, whereas alternative denotes the use of communication modes other than spoken language. AAC should not be equated with a specific tool or technological device; rather, it represents a comprehensive approach that considers the individual, the context, and opportunities for participation. According to Light and McNaughton (2014), the primary goal of AAC is to promote active participation in social interactions, educational activities, and everyday life, treating communication as a

fundamental human right.
A particularly relevant principle is that of communicative competence, introduced by Light (1989), according to which communicative effectiveness depends on the interaction among linguistic, operational, social, and strategic competencies. This model has contributed to shifting attention from the mere acquisition of tools toward the creation of genuine opportunities for participation within everyday contexts. Over recent decades, research has progressively adopted perspectives that emphasize the interaction between individuals and their environments, moving beyond a view of disability centered exclusively on individual deficits. In schools—where participating in activities, collaborating with peers, and expressing opinions require effective expressive forms—numerous studies have demonstrated that AAC can promote engagement, increase opportunities for social interaction, and support personal autonomy (Mirenda, 2014; Beukelman & Light, 2020).
The effectiveness of AAC, however, depends heavily on the quality of the surrounding environment. Teachers, classmates, and families play a decisive role in creating communicatively accessible contexts. From this perspective, AAC functions as an inclusive practice that fosters a school culture grounded in the recognition of communicative diversity.

3.2 AAC Tools and Systems

AAC systems can take many different forms depending on the characteristics and needs of the individual. A primary distinction concerns the difference between unaided and aided AAC. Unaided AAC includes communication methods that do not require external tools, such as gestures, facial expressions, and sign language. Aided AAC, by contrast, involves the use of material or technological supports, which can be further divided into low-tech and high-tech solutions.
Low-tech tools are characterized by limited technological complexity and include communication boards, communication books, visual schedules, and printed symbolic supports. These tools are often inexpensive, highly customizable, and readily available. High-tech solutions rely on electronic and digital devices such as speech-generating devices, tablets equipped with dedicated applications, communication software, and systems incorporating speech synthesis. Among the most widely used resources are graphic symbol systems (such as ARASAAC, PCS, and Widgit), which allow concepts, actions, emotions, and needs to be represented through visual modalities that facilitate both comprehension and expression. Technological developments have significantly expanded these possibilities. Tablets and dedicated applications enable students to construct complex messages and participate more independently. As noted by Beukelman and Light (2020), the widespread adoption of mobile technologies has made AAC

increasingly flexible, customizable, and integrated into everyday activities. Beyond ensuring functional access to communication, AAC plays a significant role in promoting emotional well-being. The ability to express desires, preferences, and emotions constitutes an essential element in the construction of personal identity and the development of meaningful relationships. Conversely, communication limitations often lead to frustration and social isolation. Access to effective communication tools contributes to increased self-efficacy, self-determination, and a stronger sense of belonging (Light & McNaughton, 2014). This relationship appears especially significant in light of discussions surrounding Emotionally Aware Learning Environments: if emotions constitute an essential component of learning, the ability to communicate and share them becomes a prerequisite for meaningful participation. While traditional AAC practices have demonstrated clear benefits for individual communicative competence and well-being, the rapid evolution of educational technologies necessitates translating these principles into digital environments. Section 4 explores how the convergence of digital learning platforms, artificial intelligence, and AAC creates new possibilities for inclusive interaction.

4. Digital Spaces and AAC: Toward Inclusive Learning Environments

The evolution of digital learning environments has progressively expanded the possibilities for integrating AAC within educational settings. While initially implemented primarily through printed materials, recent technological innovations have facilitated its integration into digital platforms, mobile applications, and online collaborative environments. Within this context, AAC is no longer regarded merely as a set of compensatory tools for specific groups of learners, but as an essential component in the design of learning environments that are genuinely accessible to all.

The convergence of digital technologies and AAC opens new perspectives for the development of educational spaces capable of addressing diverse communicative, cognitive, and emotional needs. This perspective is fully aligned with the principles of Inclusive Education and Universal Design for Learning (UDL), according to which educational environments should be designed from the outset to provide multiple means of access, participation, and expression (CAST, 2018).

E-learning platforms, virtual environments, and online collaboration tools now offer significant opportunities for integrating AAC resources into everyday teaching. One of the most relevant aspects concerns the possibility of designing accessible interfaces that combine verbal language, graphic symbols, images, audio resources, and visual supports. This multimodality enables students to access content through different perceptual and communicative channels.

According to Meyer, Rose, and Gordon (2014), the availability of multiple means of representation constitutes an essential condition for promoting the participation of learners with diverse characteristics. The integration of symbols and visual supports within digital platforms can contribute to reducing cognitive load, facilitating the comprehension of instructions, and supporting active participation, becoming a valuable resource for the entire learning community.

4.1 Digital Technologies for Inclusive Communication

The development of digital technologies has significantly expanded the range of tools available for inclusive communication. AAC applications, speech synthesis software, speech-generating devices, and collaborative platforms now make it possible to create learning environments in which students can express themselves, interact, and participate through different communicative modalities.

Mobile technologies have had a particularly significant impact on this process. Tablets and smartphones enable the integration of personalized communication tools into everyday activities, reducing the gap between educational settings and daily life. As highlighted by Beukelman and Light (2020), the increasing accessibility of mobile devices has promoted a broader dissemination of AAC, contributing to overcoming the traditional distinction between specialized tools and mainstream technologies.

Alongside individual communication tools, collaborative digital environments are becoming increasingly important. Discussion forums, shared digital whiteboards, collaborative content-creation platforms, and applications for synchronous and asynchronous communication provide new opportunities for participation. Within these contexts, communication is no longer conceived as a unidirectional process but rather as a shared social practice in which each participant can contribute according to their own expressive modalities. This perspective resonates with Wenger's (1998) concept of communities of practice, according to which learning develops through active participation in community activities. Making such communities communicatively accessible means creating conditions that enable all students to participate in collaborative knowledge-construction processes.

4.2 AAC and Emotionally Aware Learning Environments: the role of AI

The growing diffusion of Emotionally Aware Learning Environments provides further opportunities to reconsider the role of AAC within digital educational contexts. While these environments aim to support students' well-being through technologies capable of detecting emotional indicators, understanding emotions

cannot be entrusted solely to sensors, algorithms, or data-analysis systems. Emotions are also expressed through communication, self-narration, and social interaction. From this perspective, AAC plays a complementary role alongside emotion-monitoring technologies by providing students with concrete tools for communicating their emotional experiences.

Currently, the integration of artificial intelligence is making AAC tools increasingly sophisticated, flexible, and tailored to individual needs. AI systems are capable of adapting to users' communicative characteristics by identifying preferences, recurrent gestures, and behavioral patterns to suggest symbols, images, or linguistic expressions appropriate to the context. The use of symbols to represent emotions and moods can facilitate expression among students who experience difficulties using verbal language, reducing situations of frustration and social isolation. Recent research highlights that the synergy between AI and AAC can enhance relational exchanges among children with autism, their peers, and educational professionals (Zdravkova et al., 2022).

For example, technology-assisted visual supports play an important role in inclusive education. Among these tools, GoVisual (GoVisual™, 2022) utilizes image-based strategies by converting photographs into dynamic Visual Scene Displays (VSDs) and hotspot-based communication boards, thereby supporting language acquisition, contextual comprehension, and storytelling for learners with complex communication needs (Tintarev et al., 2016; GoVisual, 2022). In parallel, AI-driven computer vision models are expanding accessibility for gesture- and sign-based communication. A representative example in open-source mobile application development is *HearMeOut* (Elgarch, 2021), a mobile-based American Sign Language (ASL) translation system. The application utilizes computer vision algorithms and machine learning models (such as Convolutional Neural Networks) to capture, recognize, and translate hand gestures in real time into visual or text-based outputs, facilitating bridge communication between signers and non-signers (Srivastava, 2021; Li et al., 2022) to organize them into coherent sentences.

More broadly, speech-to-Text (STT) technologies represent another important resource, automatically transcribing spoken language into written text to enhance daily interactions (Seebun & Nagowah, 2020). Similarly, technologies dedicated to sign language translation play a significant role in promoting inclusion, converting gestures into text or intelligible spoken messages for individuals unfamiliar with sign language (Truong et al., 2016). The operation of such systems is primarily based on machine learning techniques that employ advanced models, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), and deep learning algorithms (Bendarkar et al., 2021; Bantupalli & Xie, 2018).

Among the most innovative technological solutions, smart communication

gloves have emerged as a significant advancement in human–computer interaction. Equipped with integrated sensors, these devices detect hand movements and translate them into natural language, combining the potential of virtual and augmented reality with the principles of AAC (Ozioko & Dahiya, 2022). At the same time, scientific research has increasingly focused on the analysis of facial expressions, which constitute an essential component of communication through sign languages (Cardoso et al., 2020; Silva et al., 2020). In this regard, studies conducted in Brazil have demonstrated that models based on CNNs and hybrid CNN–LSTM architectures can successfully recognize facial expressions associated with the Brazilian Sign Language (Libras), contributing to a more accurate and comprehensive translation of communicative messages (Silva et al., 2020). Collectively, these developments highlight the growing potential of AI to support multimodal communication by integrating speech, gestures, facial expressions, and visual cues. Such advances contribute not only to improving communicative accessibility but also to fostering greater participation, autonomy, and social inclusion for individuals with communication disabilities.

Despite these significant opportunities, several critical issues must be considered. The effectiveness of intelligent systems depends largely on the quality of the training data and on the ability of algorithms to adequately represent the linguistic, cultural, and communicative diversity of users. In educational contexts, these technologies carry the risk of introducing interpretative biases or steering communication toward standardized expressive models. Particular attention should be devoted to the automatic recognition of emotions. Although technologies based on the multimodal analysis of vocal, behavioral, and facial data provide new opportunities for understanding student engagement, emotions are complex, context-dependent phenomena that cannot be inferred unambiguously from specific observable indicators. This limitation becomes even more evident in the case of students with motor, neurological, or communication disabilities, whose expressive modalities may differ substantially from the patterns used to train algorithmic models. For this reason, emotion-recognition systems should be regarded as supportive tools rather than substitutes for educational judgment and human relationships. From this perspective, the implementation of AI-enhanced AAC systems requires a human-centered approach that combines technological innovation with pedagogical sensitivity, ethical responsibility, and respect for individual differences. Artificial intelligence should therefore be understood not as a replacement for human communication, but as a resource capable of supporting accessibility, participation, and communicative inclusion within educational environments. Within this context, technology provides parents, teachers, and professionals with valuable tools for establishing more effective interactions

based on the students' own communicative codes and choices. Every symbol thus represents an opportunity for expression, and every interaction contributes to the development of more meaningful and participatory communication pathways.

5. Designing Inclusive Digital Spaces: Principles, Scenarios, and Future Perspectives

5.1 Principles for the Design of Inclusive Digital Spaces

While existing empirical literature widely validates the instructional effectiveness of Universal Design for Learning (CAST, 2018; Meyer et al., 2014) and the benefits of AAC in physical classrooms (Beukelman & Light, 2020), we argue that extending these frameworks to hybrid digital spaces requires a fundamental theoretical shift. In this paper, we build upon Passini's (1984) spatial Wayfinding Theory to propose a novel conceptual adaptation: digital communicative wayfinding is the ability to navigate content, relationships, and learning pathways. When applied to digital educational spaces, wayfinding acquires a multidimensional character:

- *Cognitive orientation*: supports the understanding of information structures.
- *Communicative orientation*: enables learners to identify the most appropriate means of expression.
- *Social orientation*: facilitates access to learning communities.
- *Emotional orientation*: helps learners recognize and manage their affective experiences.

From this perspective, AAC can be understood as a genuine communicative wayfinding infrastructure, capable of making hybrid learning environments more comprehensible, predictable, and participatory. Inclusive design therefore requires a systemic vision in which accessibility, communication, emotions, and orientation are treated as interconnected dimensions.

5.2 Toward an Emotionally Aware Inclusive Digital Learning Space

The intersection of communicative accessibility, affective computing, and wayfinding suggests the need to move beyond viewing digital environments merely as content-delivery platforms. Instead, contemporary learning environments must be designed as socio-emotional relational ecosystems. To operationalize this integration, we propose the *Emotionally Aware Inclusive*

Digital Learning Space (EAIDLS) framework.
The EAIDLS model is structured around three core, interacting axes that bridge communicative and affective dimensions:

-Adaptive Accessibility Axis: Ensures that learners encounter minimal cognitive, sensory, and technical friction. Beyond basic physical accessibility, it incorporates dynamic interface adaptation (e.g., auto-adjusting visual densities, flexible input modalities) aligned with Universal Design for Learning (UDL) principles;

-Collaborative and Shared Communication Axis: Re-conceptualizes AAC from an individual compensatory device into a collective classroom language practice. In an EAIDLS, symbol sets, multimodal communication boards, and predictive tools are integrated into shared digital whiteboards and discussion forums, allowing peers and educators to co-use AAC modalities;

-Emotional Expression and Awareness Axis: Connects automated affective computing tools (e.g., engagement and stress analytics) with proactive expressive channels. Crucially, it balances automated sensor data with user-driven agency by providing explicit AAC symbol sets for emotional self-narration, enabling students to express nuanced internal states rather than relying solely on algorithmic inference.

The novelty of the EAIDLS framework lies in resolving a major limitation in existing literature: the disconnect between affective sensing and communicative action. Existing Emotionally Aware Learning Environments detect emotional states (e.g., frustration, boredom) via algorithms but often lack accessible mechanisms for non-verbal students to respond or articulate why they feel that way. Conversely, traditional AAC systems focus primarily on functional needs (e.g., asking for objects) rather than dynamic emotional dialogue within hybrid learning spaces. EAIDLS bridges this gap by positioning AAC as the expressive and navigational bridge (communicative wayfinding) within emotionally responsive digital ecosystems.
To apply the EAIDLS model in instructional design and classroom practice, educators and system architects can follow a three-tiered implementation pipeline:

-Design Phase (Interface & Environment): Integrate multimodal AAC symbol sets (e.g., ARASAAC) directly into LMS toolbars, visual menus, and navigation pathways, reducing cognitive load and facilitating orientation.
-Interaction Phase (Instructional Routines): Establish inclusive communication norms where all learners—verbal and non-verbal—use shared visual-symbolic channels during daily check-ins, group discussions, and peer collaboration.
-Feedback & Support Phase (Affective Triangulation): Combine non-intrusive AI affective analytics (e.g., tracking participation drop-offs or interaction friction) with user-initiated AAC emotional prompts, allowing teachers to offer targeted pedagogical support without compromising student agency or privacy.

Recent advances in audio intelligence systems demonstrate how technologies can support the recognition of distress, exclusion, or conflict through vocal analysis. However, the construction of an EAIDLS cannot be limited to the automatic recognition of affective states. Alongside emotion recognition, it is equally crucial to foster emotion expression—the learners' ability to actively communicate their inner states. This is precisely where AAC acts as a mediating layer: it provides the essential multimodal vocabulary that enables learners to represent emotional experiences even when verbal communication is limited or challenging.
In this framework, AI functions as an assistive infrastructure connecting these axes through interface personalization, predictive language generation, and context-dependent support. AI-enhanced AAC becomes a communicative foundation that reinforces emotional well-being and active belonging.

5.3 Future Perspectives: From Access to Meaningful Participation

Emerging frameworks in digital inclusion emphasize that the quality of educational experiences depends on learners' ability to participate actively in learning communities and express their unique identities. In this regard, the IN+ Principles of Meaningful Digital Inclusion (INCLUDE+ Network) offer a valuable path for future design through six core pillars:

- *Holistic Approach*: Views inclusion as a complex, non-neutral process that addresses power dynamics, actively involving users in defining the communicative and relational modalities of their educational experiences.
- *Sustainability*: Focuses on developing inclusive practices and resilient educational communities that can be maintained over time, rather than relying on isolated technological interventions.

- *Diversity*: Recognizes plural experiences and diverse communicative modalities—including those supported by AAC—as sources of innovation and collective enrichment.
- *Responsiveness*: Demands environments capable of adapting to the emerging needs of educational communities, leveraging AI for continuous personalization of resources.
- *Collective Care*: Places the emotional safety and mutual well-being of learners, teachers, and professionals at the center of educational design.
- *Meaningful Digital Inclusion*: Rejects standardized, top-down solutions in favor of co-designed digital experiences that are contextually grounded and value local communicative practices.

In light of these principles, future hybrid learning environments must be conceived as communicative, wayfinding-oriented, and emotionally aware ecosystems. Within such contexts, AAC—integrated with the adaptive opportunities of artificial intelligence and guided by inclusive design—serves as a foundational infrastructure. The ultimate goal is not merely to ensure technical access to digital environments, but to guarantee that every learner can navigate, communicate, express emotions, and participate authentically in the co-construction of knowledge.

6. Conclusions

The digital and hybrid transformation of educational spaces is not merely a technical transition, but a profound pedagogical shift that challenges our understanding of inclusion. As argued throughout this paper, building a truly Emotionally Aware Inclusive Digital Learning Space (EAIDLS) requires looking beyond basic digital access to foster genuine, multi-channel participation. By transforming Augmentative and Alternative Communication (AAC) from a specialized compensatory tool into a foundational infrastructure for the entire classroom, educators can design digital environments that recognize the tightly intertwined nature of communication, cognition, and emotion.
The integration of artificial intelligence opens unprecedented opportunities for adaptive, multimodal communication, yet it also demands high pedagogical sensitivity and strict ethical oversight. Technology must not be used to automate emotion or standardize expression; rather, its role is to amplify human connection and provide an expressive voice to those with complex communication needs. Ultimately, the future of meaningful digital inclusion lies in our ability to design hybrid learning ecosystems where every student—regardless of their expressive modality—possesses the autonomous wayfinding

tools to navigate knowledge, communicate their inner world, and experience an authentic sense of safety and belonging within the school community.

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