



EXTENDING STORY READING FOR DEAF AND HARD-OF-HEARING CHILDREN: ARTIFICIAL INTELLIGENCE AS A MEDIATOR OF BILINGUAL LITERACY IN DONNA JO NAPOLI'S *HANDS & HEARTS*

Kaliakatsou Ioannaⁱ

PhD in Children's Literature, Teacher
Independent Researcher/Teacher,
Ministry of Education, Religious Affairs and Sports,
Greece

Abstract:

Shared story reading represents a fundamental context for children's literacy development; however, deaf and hard-of-hearing children may experience barriers when literacy practices are predominantly organized around spoken language. Contemporary perspectives in Deaf education emphasize bilingual approaches that recognize sign language as a linguistic foundation and written language as an additional pathway for participation and learning. This chapter explores the potential of artificial intelligence (AI) to mediate bilingual literacy through Donna Jo Napoli's multimodal picture book *Hands & Hearts*. Drawing on theories of multimodality, Deaf bilingual education, and inclusive literacy, the chapter examines how AI-supported features can extend connections among American Sign Language (ASL), written language, visual representation, and shared story reading. It argues that AI should be understood not as a replacement for human communication or picture books, but as a mediating tool that expands opportunities for accessible, meaningful, and inclusive bilingual literacy experiences for deaf and hard-of-hearing children.

Keywords: deaf and hard-of-hearing children; multimodal picture books; artificial intelligence; inclusive literacy; shared story reading

1. Introduction

Story reading represents a central context for early literacy development, providing children with opportunities to expand vocabulary, develop narrative understanding, engage imagination, and participate in social and emotional learning. Shared storybook reading has been consistently identified as an important context in which children

ⁱ Correspondence: email kaliazanet1@gmail.com

develop language, comprehension, and knowledge about narrative structures through meaningful interaction with texts and more knowledgeable others (Bus, van IJzendoorn, & Pellegrini, 1995; Dickinson & Smith, 1994; Mol, Bus, de Jong, & Smeets, 2008). Beyond supporting linguistic development, story reading also contributes to children's imaginative capacities, emotional understanding, and social development by allowing them to explore characters' experiences, perspectives, and relationships (Nikolajeva, 2013; Oatley, 2016). However, literacy development is not simply a process of acquiring written language skills; it is a socially situated practice through which children construct and negotiate meaning in interaction with texts, other people, and their cultural worlds. Recent perspectives in literacy research have moved beyond print-centered approaches to recognize that meaning-making involves a range of semiotic resources, including images, gesture, movement, spatial arrangements, and embodied forms of communication (Kress, 2010; Serafini, 2014). This broader understanding of literacy is particularly relevant for deaf and hard-of-hearing (DHH) children, whose experiences of communication and learning are fundamentally shaped by visual modes of interaction and sign language.

For many DHH children, early literacy development is closely connected to the linguistic opportunities available within their educational and family environments. Traditional approaches to deaf education have often been influenced by deficit-oriented perspectives that emphasized the absence of hearing and prioritized spoken language acquisition. Such approaches have frequently overlooked the linguistic richness of sign languages and the ways in which visual communication supports children's cognitive, social, and linguistic development. Contemporary research in Deaf education, however, recognizes sign languages as natural languages with their own grammatical systems, cultural traditions, and expressive possibilities (Swanwick, 2017; Marschark & Hauser, 2012). Within bilingual approaches to Deaf education, sign language is recognized as a primary linguistic resource rather than a compensatory system for the absence of spoken language. As a fully developed natural language, it provides deaf children with a foundation for conceptual development, communication, identity formation, and participation in learning communities. Within this perspective, written language is not positioned as a replacement for sign language but as an additional literacy resource that children develop by drawing on their existing linguistic knowledge, experiences, and understanding of the world. The relationship between sign language and written language is therefore understood as one of connection and meaning-making across different modalities rather than as a transition from one language to another (Padden & Humphries, 2005; Mayer, 2007; Swanwick, 2016; Hoffmeister & Caldwell-Harris, 2014).

Understanding the relationship between sign language and written language is therefore essential to examining literacy development among DHH children. While many hearing children initially develop connections between spoken language and print through auditory experiences, deaf children often establish relationships between written words and meaning through visual and embodied pathways, including signs, images, gestures, and contextual cues. The development of bilingual literacy requires learning

environments where children can encounter and explore concepts across different linguistic and representational systems. In this context, literacy practices that integrate visual communication, shared storytelling, and meaningful interaction provide important opportunities for children to build connections between their signed language and written language.

Multimodal picture books offer a particularly valuable context for such learning. Unlike texts that rely primarily on written language, picture books communicate meaning through the interaction of multiple modes, including written text, illustration, page composition, visual perspective, gesture, and embodied expression. These multimodal features allow children to engage with stories through different pathways and to actively participate in the construction of meaning. For DHH children, visual elements are not simply additional support for understanding the written text; they represent essential resources through which narratives, concepts, and emotions are explored. When picture books incorporate sign language, they can create meaningful connections between written words, signs, images, and lived experiences, functioning as spaces where bilingual and multimodal meaning-making can develop.

This study aims to explore how a multimodal picture book that integrates sign language can support bilingual and inclusive literacy practices among deaf and hard-of-hearing (DHH) children. Moving beyond approaches that conceptualize accessibility as the simple translation of written text into another language, the study examines picture book reading as a process of bilingual meaning-making, where children construct understanding through the interaction of written language, sign language, visual representation, gesture, and embodied communication. In particular, the study investigates how emerging AI-supported tools can function as mediating resources within this process, creating additional pathways for children to engage with stories across linguistic and semiotic modes.

The study focuses on Donna Jo Napoli's *Hands & Hearts* as a case study because the book exemplifies the possibilities of picture books as spaces for the representation and exploration of Deaf linguistic and cultural experiences. Developed within a broader project that sought to connect language and literature through bilingual digital storytelling, Napoli collaborated with others to create electronic books and videos that present stories through both spoken/written languages and sign languages. These resources were designed to support shared reading between hearing family members and deaf children by enabling access to narratives through multiple linguistic pathways. Within this context, *Hands & Hearts* provides a particularly relevant case because it does not present sign language as a compensatory strategy for a perceived limitation but as a meaningful language system embedded within everyday family communication. Through the story of a mother and child sharing experiences at the beach, the picture book represents signing as a natural form of interaction, affection, and connection. The integration of written language, illustrations, and sign representations creates a multimodal environment in which children can associate words, signs, visual cues, and lived experiences. Therefore, the book offers an appropriate context for examining how

bilingual literacy can develop through the coordination of different modes of communication.

The scope of this study is not to evaluate the effectiveness of AI translation technologies in isolation, nor to position AI as a replacement for human sign language interaction. Instead, it examines the pedagogical potential of AI as a mediating layer within a wider literacy environment. Using *Hands & Hearts* as a case study, the study considers how an AI-supported application can extend access to the text by supporting connections between written words, sign language, and visual meaning. The focus is placed on how children engage with multiple forms of representation and how these resources contribute to participation, autonomy, and the construction of meaning during shared reading.

By bringing together perspectives from multimodal literacy, bilingual Deaf education, and AI-mediated learning, this study contributes to ongoing discussions about inclusive literacy practices. It argues that contemporary digital tools should not be understood merely as mechanisms for increasing access to existing texts; rather, when thoughtfully integrated, they can participate in the creation of richer environments where children encounter literature through multiple linguistic, visual, and embodied pathways. In this way, *Hands & Hearts* becomes not only a picture book for learning signs but a site for exploring how technology, language, and storytelling can work together to support more equitable forms of literacy engagement.

2. Deaf Bilingualism and Multimodal Literacy Development

For many years, approaches to literacy education for deaf learners were largely shaped by models that placed spoken language development and access to auditory information at the center of reading acquisition. Within this framework, challenges in literacy learning were often attributed to deafness itself or to reduced exposure to spoken language, rather than to broader factors related to language accessibility and educational experiences. However, research in Deaf education has increasingly questioned these deficit-based interpretations, demonstrating that deaf children are capable of developing strong linguistic and literacy abilities when they have early access to an accessible first language and are supported within rich, inclusive learning environments (Mayer, 2007; Marschark & Hauser, 2012; Swanwick, 2016). Contemporary perspectives increasingly emphasize that literacy development is shaped not by deafness itself, but by factors such as early language access, quality of interaction, educational approaches, and opportunities to engage with meaningful texts (Humphries et al., 2012; Hall, 2017).

A central principle emerging from research in Deaf education is the recognition of sign languages as fully developed natural languages rather than alternative forms of communication created to compensate for hearing loss. Sign languages possess complex linguistic systems, including grammatical structures, vocabulary, discourse patterns, and expressive resources that are distinct from spoken languages. For example, American Sign Language (ASL) is not a manually coded representation of a spoken or written

system but an independent language that constructs meaning through spatial organization, movement, facial expression, body posture, and gaze (Padden & Humphries, 2005). Similar linguistic characteristics are evident across national sign languages, demonstrating that sign languages provide deaf children with complete access to language from early childhood when available. Recognizing sign language as a first language reflects a broader shift away from medicalized views of deafness, which have traditionally focused on impairment and limitation, towards sociocultural perspectives that understand deafness through the lenses of language, identity, community, and participation. Within this perspective, sign language is not only a means of communication but also a central element of Deaf identity and belonging, connecting children with linguistic communities and shared cultural experiences (Lane, 1992; Ladd, 2003).

Empirical studies have consistently demonstrated the importance of early sign language access for cognitive and literacy development. Research by Mayberry and colleagues has shown that early exposure to a natural sign language supports linguistic processing and later language outcomes, highlighting the importance of accessible first-language development rather than delayed communication experiences (Mayberry, 2007; Mayberry & Kluender, 2018). Similarly, studies of deaf children with strong sign language foundations have reported advantages in vocabulary knowledge, narrative understanding, and metalinguistic awareness, all of which contribute to literacy development (Chamberlain & Mayberry, 2008; Hoffmeister & Caldwell-Harris, 2014). These findings suggest that literacy is not developed through print exposure alone; rather, children construct meaning from written texts by drawing upon existing linguistic knowledge, conceptual understanding, and experiences developed through communication.

Within bilingual approaches to Deaf education, sign language is therefore understood as a linguistic foundation, while the written system is introduced as an additional literacy resource. Bilingual-bimodal development refers to the acquisition of two languages that operate through different modalities: a visual-gestural language and a written language system. Unlike spoken bilingualism, which involves the coordination of two auditory languages, bilingual-bimodal development requires children to navigate relationships between visual, embodied, and written forms of representation (Grosjean, 2010; Swanwick, 2016). This distinction is particularly important because written language is not acquired through a direct relationship between sound and print for many DHH learners. Instead, children often construct connections between written words and meaning through sign language, visual experiences, contextual information, and conceptual knowledge.

Research on deaf literacy has demonstrated that the relationship between sign language and written literacy is mediated by language knowledge rather than by auditory experience alone. Hoffmeister and Caldwell-Harris (2014), for example, found that sign language proficiency contributes significantly to reading comprehension because it provides children with linguistic and conceptual resources that support

interpretation of written texts. Similarly, Mayer (2007) argues that successful literacy development among deaf learners depends on establishing meaningful connections between accessible language, knowledge of the world, and written representation. These findings challenge the assumption that sign language competes with literacy development and instead demonstrate that a strong first-language foundation can facilitate engagement with written texts.

From a bilingual perspective, written literacy develops through cross-modal connections. A child may first encounter a concept through a sign, connect it with personal experience, recognize it in an illustration, and later associate it with a written form. These processes illustrate that literacy learning involves movement across representational systems rather than the acquisition of print in isolation. For DHH children, images, gestures, signs, and written forms may operate together as interconnected resources for constructing meaning. Such processes are consistent with broader theories of multimodal literacy, which conceptualize communication as involving multiple semiotic resources, including language, images, gesture, movement, spatial organization, and material forms (Kress, 2010; Jewitt, Bezemer, & O'Halloran, 2016).

Multimodality is particularly significant within Deaf literacy contexts because sign languages themselves are inherently embodied and visual. Meaning is created not only through manual signs but also through facial grammar, eye gaze, body movement, spatial positioning, and interaction between signers (Sandler & Lillo-Martin, 2006). Consequently, literacy practices that incorporate visual storytelling, gesture, signing, and images align with the communicative strengths of many DHH learners. Picture books, in particular, provide rich opportunities for this type of meaning-making because they require readers to interpret relationships between written text, illustration, visual sequencing, and embodied representation.

Research examining shared reading practices with deaf children further highlights the importance of interaction and visual communication during literacy activities. Studies of deaf-parent and deaf-child reading interactions have shown that effective shared reading often involves strategies such as attention directing, pointing, signing, elaboration, and discussion of visual elements within texts (Berke, 2013; Nikolarazi et al, 2013). These practices demonstrate that reading is not simply the decoding of written symbols but a socially mediated process in which children construct meaning through interaction with others and with multiple forms of representation.

Therefore, contemporary understandings of Deaf literacy position sign language not as an obstacle to reading development but as a valuable linguistic and cognitive resource. When children have access to a strong first language, they are better equipped to develop vocabulary, narrative competence, comprehension strategies, and connections between concepts and written forms (Hoffmeister & Caldwell-Harris, 2014; Mayer, 2007). Bilingual-bimodal approaches recognize that sign language and written language can work together to support literacy development, with each system contributing different possibilities for communication and meaning-making. This perspective provides an

important foundation for examining multimodal picture books and AI-supported literacy tools, where children are invited to engage with stories through the interaction of written language, sign language, images, and embodied forms of communication.

3. AI-Mediated Multimodal Literacy: Extending Sign Language Access and Meaning-Making through Picture books

The emergence of artificial intelligence (AI) introduces new possibilities for extending the multimodal affordances of picture books such as *Hands & Hearts*. However, the educational significance of AI does not lie in replacing the linguistic, cultural, and relational dimensions of literacy practices. Rather, its potential lies in creating additional opportunities for interaction, participation, and exploration across different modes of communication. From a multimodal literacy perspective, technologies can be understood as mediating tools that reshape how readers encounter, interpret, and respond to texts (Kress, 2010; Jewitt, Bezemer, & O'Halloran, 2016). In the context of Deaf education, this perspective is particularly important because literacy development is already grounded in visual, spatial, and embodied forms of meaning-making. AI therefore represents not a substitute for sign language or human interaction, but an additional semiotic resource that may support connections among written language, sign language, images, gesture, and embodied expression.

The relevance of AI-supported literacy tools becomes especially evident when considering picture books designed around bilingual and multimodal communication. *Hands & Hearts* provides an important example because the book itself already operates across multiple modes, combining written language, American Sign Language (ASL), illustration, facial expression, gesture, and emotional interaction. The inclusion of ASL does not simply provide access to the narrative for deaf readers; it positions signing as a meaningful linguistic and cultural practice within everyday family relationships. AI technologies can extend these affordances by enabling dynamic forms of engagement with the text, allowing children and families to explore relationships between written forms, visual representation, and signed communication.

One of the most significant contributions of AI-supported applications is their capacity to provide greater access to the dynamic features of sign languages. Unlike written languages, sign languages are produced through movement and embodied expression. Meaning is constructed not only through handshape and movement but also through facial grammar, gaze, body orientation, spatial relationships, and timing (Sandler & Lillo-Martin, 2006). A printed representation of a sign can communicate aspects of meaning, but it cannot fully represent the temporal and embodied nature of signing. AI-supported avatars and interactive systems therefore create possibilities for representing movement-based linguistic information in ways that traditional print materials cannot. Through animated demonstrations, digital overlays, or interactive storytelling environments, children can observe how signs are produced and how meaning is conveyed through the whole body.

Within this context, StorySign (Huawei) represents one of the most relevant examples of AI-supported shared reading for deaf children. The application uses optical character recognition (OCR), artificial intelligence, and an animated signing avatar to connect printed text with sign language representation. By recognizing selected children's books and presenting corresponding signs through a digital avatar, StorySign creates a bridge between written language and visual communication. Its significance lies not simply in translating words into signs but in supporting a reading process in which children can move between different modes of meaning-making. The child encounters the written word, the illustration, the signed representation, and the narrative context as interconnected resources rather than separate forms of information.

Other AI-supported technologies demonstrate different possibilities within Deaf literacy and accessibility contexts. Hand Talk, through avatars such as Hugo and Maya, primarily functions as a translation platform that converts written or spoken language into sign language. While its main purpose is linguistic accessibility, educational applications may use it to support vocabulary development and concept exploration. VL2 Storybook Apps, developed through Gallaudet University's Visual Language and Visual Learning (VL2) research initiatives, represent a different model because they are grounded in bilingual literacy principles. Rather than relying on automated translation, these applications combine professionally produced ASL storytelling, written language, and interactive features that encourage prediction, discussion, and narrative engagement. This approach reflects research showing that literacy development among deaf children benefits from rich linguistic interaction and access to meaningful narratives (Hoffmeister & Caldwell-Harris, 2014; Mayer, 2007).

More recent developments in AI-generated signing avatars, including Signapse and SiMAX, focus on improving the naturalness and expressiveness of digital signing. These systems attempt to represent not only manual signs but also facial expression, posture, and body movement, recognizing that effective sign communication depends on multiple embodied elements. Although many of these technologies were initially developed for public accessibility, their potential educational applications are significant. More expressive avatars may support children's understanding of emotions, conversational meaning, and grammatical features that are embedded within facial and bodily expression.

Another emerging area involves movement-recognition technologies such as Google MediaPipe, which differs from translation-based systems because it does not generate sign language directly. Instead, it uses machine-learning models to recognize hand movements, finger positions, and body poses. Within educational settings, such technologies may support interactive learning environments where children practice signs, receive visual feedback, and participate in movement-based literacy activities. These developments demonstrate that AI in Deaf education is not a single technology but a range of approaches that support different aspects of communication, access, and participation.

Despite these possibilities, the integration of AI into sign language contexts requires careful theoretical and ethical consideration. Sign languages cannot be reduced to direct word-for-word translations from spoken or written languages. They are complex linguistic systems shaped by cultural practices, community knowledge, and historical experiences (Lane, 1992; Padden & Humphries, 2005). Consequently, AI systems designed for Deaf learners should be developed through meaningful collaboration with Deaf communities, educators, and sign language experts. Without the involvement of Deaf users and linguistic specialists, technological solutions risk reducing complex sign languages to simplified representations that overlook their grammatical, cultural, and embodied dimensions. The purpose of AI in Deaf education should therefore be understood as enhancing access, communication, and participation rather than replacing human linguistic interaction and the social relationships through which language develops (Bragg et al., 2019; Kusters, De Meulder, & O'Brien, 2017).

4. Educational Plan: AI-Mediated Bilingual Shared Reading with *Hands & Hearts*

Donna Jo Napoli's *Hands & Hearts* provides an important context for exploring AI-mediated bilingual shared reading because the picture book itself is based on the principles of multimodal communication and inclusive meaning-making. The book presents the relationship between a mother and her child through an everyday experience at the beach while introducing American Sign Language (ASL) as a natural and meaningful form of communication. Rather than presenting sign language as an additional support for children who cannot access spoken language, *Hands & Hearts* represents signing as a language of connection, affection, identity, and participation. Through the combination of written language, illustrations, signs, gesture, and bodily expression, the book demonstrates that communication is created through multiple ways of expressing and understanding meaning.

The importance of *Hands & Hearts* lies in the way it challenges traditional views of early literacy that focus mainly on written words and decoding skills. Instead, the picture book reflects contemporary understandings of literacy as a multimodal and socially situated practice, where children construct meaning through the interaction of different resources, including images, language, movement, and gesture (Kress, 2010; New London Group, 1996). The book does not simply provide access to a story through ASL; it creates a literacy environment where children experience communication as a combination of linguistic, visual, and embodied forms.

The analysis of *Hands & Hearts* draws on two complementary perspectives for understanding how the picture book creates meaning. The first is a multimodal perspective, which examines how written language, illustrations, signs, and visual design work together to communicate ideas. The second is an embodied perspective, which focuses on how meaning is expressed through hands, facial expressions, body movement, and relationships between people. Together, these perspectives help explain

why *Hands & Hearts* provides valuable opportunities for bilingual and inclusive literacy practices.

From a multimodal perspective, illustrations in picture books are not simply decorative elements that support written text; they function as important systems of meaning (Nikolajeva & Scott, 2006; Serafini, 2014). In *Hands & Hearts*, the illustrations communicate emotions, actions, and relationships that are not always expressed through words. For example, the cover illustration shows the mother and child facing each other while their hands meet in the center of the image. The positioning of their hands immediately directs attention to communication and interaction. Their open body positions and physical closeness suggest trust, affection, and shared understanding. Before reading any written words, children can interpret the relationship between the characters through visual information. This demonstrates how images function as meaningful texts that invite observation and interpretation.

Each page of the book is accompanied by the representation of ASL signs alongside written words, creating a visual relationship between different forms of communication. The focus on the hands encourages children to attend to the movement, shape, and position of signs, highlighting that meaning is not communicated through written language alone but also through embodied expression. This visual integration is particularly significant because sign languages are visual-spatial languages in which meaning is constructed through the coordination of hand movements, facial expressions, body posture, gaze, and the use of space (Sandler & Lillo-Martin, 2006). Through this design choice, the picture book demonstrates that communication can take multiple forms and that different modes can work together to support understanding and meaning-making.

The embodied perspective further highlights how *Hands & Hearts* represents communication as a social and emotional experience. The relationship between the mother and child is communicated through touch, movement, and shared activity. In the illustrations where the characters hold hands and move together, their bodies create a visual connection that represents trust, cooperation, and emotional closeness. The meaning of these scenes is not produced only through words but through the interaction of bodies, gestures, and relationships.

This emphasis on embodied communication is particularly significant for deaf and hard-of-hearing (DHH) children because visual and bodily forms of expression are central to many Deaf experiences. The book presents communication as something that involves the whole person rather than only speech or print. In doing so, *Hands & Hearts* challenges deficit perspectives of deafness and highlights sign language as a rich and complete form of human communication.

Building on these affordances, this educational plan (Table 1) proposes an AI-mediated bilingual shared reading approach in which artificial intelligence functions as an additional resource for extending the possibilities already present in *Hands & Hearts*. The central principle of this approach is that AI does not replace the bilingual teacher, Deaf language users, or the social nature of shared reading. Instead, AI creates additional

connections among ASL, written language, illustrations, and embodied communication. In this context, technology supports children's engagement with the picture book as a rich multimodal environment where meaning is constructed through interaction.

An AI-supported tool can contribute to this process by providing dynamic representations of signs and helping children connect written words with ASL. However, AI is not viewed as a simple translation system. Its role is to support exploration, comparison, and participation across different modes of communication. The bilingual teacher remains the central mediator who guides discussion, encourages interpretation, and supports children's use of their own linguistic resources.

During the first stage of the reading experience, children explore the illustrations before focusing on written language. The teacher encourages children to observe the characters' hands, facial expressions, and body positions. Questions such as "What do you see?", "What are the characters doing with their hands?", and "How do you know how they feel?" support children in reading images and recognizing visual elements as meaningful sources of information.

In the next stage, AI supports connections between written language and ASL. Children explore how a written word, a sign, and an illustration can communicate the same idea in different ways. Through this process, children develop awareness that bilingual meaning-making involves movement between different representational systems rather than learning isolated vocabulary.

The teacher then guides children to explore the embodied nature of communication. Children examine how hands, facial expressions, and body movements communicate emotions and intentions. They discuss how characters express happiness, care, or excitement without relying only on written words. Through role-play and signing activities, children experience communication as an embodied and interactive practice. The final stage encourages children to become creators of their own multimodal texts. Children may draw a scene from the story, choose related signs, use written words, or combine different forms of expression to communicate their ideas. AI can provide additional support by helping children recall signs or explore vocabulary, while the teacher continues to guide creativity and reflection.

The educational value of this approach lies in understanding AI as part of a wider literacy environment. AI does not create the inclusive potential of *Hands & Hearts*; rather, it extends the possibilities already embedded in the picture book. Through the interaction of ASL, written language, illustrations, embodied communication, and technology, children experience literacy as a flexible and participatory process.

Ultimately, *Hands & Hearts* demonstrates how contemporary picture books can support inclusive literacy education by recognizing diverse ways of communicating and meaning-making. When combined with thoughtful AI mediation, the book becomes not only a resource for learning signs but also a space where children explore language, emotion, identity, and connection. In this way, AI supports the broader goal of inclusive education: creating environments where all children can communicate, participate, and belong.

5. Conclusion and Directions for Further Research: AI-Mediated Picture Book Reading, Opportunities and Challenges

The exploration of *Hands & Hearts* demonstrates how contemporary picture books can function as powerful spaces for rethinking literacy, communication, and inclusion. Moving beyond traditional approaches that define literacy primarily through the acquisition of written language, the picture book illustrates how children construct meaning through the interaction of multiple modes, including images, gesture, movement, facial expression, emotional engagement, and linguistic systems. Through the integration of written language and American Sign Language (ASL), *Hands & Hearts* presents bilingual-bimodal communication not as an alternative pathway to literacy but as a rich and legitimate way of understanding, expressing, and participating in shared experiences.

The significance of the picture book lies in its representation of sign language as a complete linguistic and cultural practice rather than as a compensatory tool for overcoming a perceived limitation. By placing hands, gestures, and embodied communication at the center of the narrative, the book challenges deficit-oriented understandings of deafness and contributes to broader perspectives of literacy as a social, cultural, and multimodal practice. For deaf and hard-of-hearing children, *Hands & Hearts* provides linguistic recognition and representation, while for hearing children it offers opportunities to develop awareness of diverse forms of communication. In this sense, the picture book functions not only as a literacy resource but also as a space for developing understanding, empathy, and respect for linguistic diversity.

The integration of artificial intelligence further extends the educational possibilities of multimodal picture books by creating additional pathways between written language, ASL, illustrations, and embodied expression. AI-supported applications demonstrate how technology can mediate bilingual shared reading by providing dynamic access to sign representations, supporting vocabulary development, and encouraging interaction with texts. When integrated appropriately, AI may be particularly valuable in inclusive classrooms and family literacy contexts because it can provide additional support for children, educators, and caregivers who are developing confidence in bilingual-bimodal communication.

Nevertheless, the use of AI in Deaf education requires a critical and balanced perspective. Although AI offers important opportunities, it also presents limitations. Sign languages are complex natural languages shaped by grammar, culture, and community practices; therefore, AI systems cannot fully capture the linguistic and cultural dimensions of signing without meaningful collaboration with Deaf communities. Automated representations may risk simplifying signs, overlooking regional variation, or reducing embodied communication to mechanical movement. Furthermore, excessive dependence on digital tools may weaken the relational aspects of shared reading if technology replaces rather than supports interaction between children and human communication partners. For this reason, AI should be positioned as a mediating

resource that enhances participation while preserving the central role of teachers, families, and Deaf language users.

Another important consideration concerns issues of accessibility, teacher preparation, and digital equity. The educational benefits of AI depend not only on the quality of the technology itself but also on whether educators have the knowledge and confidence to integrate it meaningfully into literacy practices. Without appropriate training and critical understanding, AI may become an additional resource available only to some learners rather than a tool that promotes inclusion. Future approaches should therefore consider not only technological development but also professional learning, ethical design, and culturally responsive implementation.

Further research is needed to investigate how AI-mediated picture book reading influences bilingual literacy development among DHH children. While existing research has examined the importance of early sign language access, multimodal literacy, and digital learning environments separately, less is known about the interaction between these areas. Future studies could explore how AI-supported picture books affect vocabulary development, narrative comprehension, reading motivation, and the ability of children to move between sign language and written systems. Longitudinal research would be particularly valuable in examining whether sustained engagement with AI-mediated bilingual texts contributes to stronger literacy trajectories over time.

Additional research should also examine children's and families' experiences with AI-supported shared reading. Since literacy development occurs within social relationships, studies should investigate how parents, teachers, and peers use AI tools during collaborative reading activities and how these technologies influence communication patterns. Research involving Deaf educators and Deaf adults is especially important to ensure that AI applications reflect Deaf perspectives and support linguistic agency rather than simply increasing accessibility from an external viewpoint.

Ultimately, *Hands & Hearts* illustrates a shift from understanding literacy as a single pathway towards recognizing it as a dynamic process of meaning-making across languages, images, bodies, technologies, and relationships. AI has the potential to strengthen this process by extending access and interaction, but its educational value depends on maintaining the human, cultural, and linguistic dimensions of literacy. When developed collaboratively and implemented critically, AI-mediated picture book practices can contribute to more inclusive learning environments where all children are supported to communicate, connect, and belong.

Table 1: Educational Plan: AI-Mediated Bilingual Shared Reading with Hands & Hearts

Lesson Stage	Learning Objective	Teacher's Role	Role of AI as a Mediator (StorySign)	Questions for Children (AI-mediated meaning-making)
1. Exploring the Cover	Activate children's visual thinking and prior knowledge before reading	The teacher invites children to observe the cover and share predictions through sign language, gestures, and discussion.	AI is not introduced yet. Children first construct their own interpretations from visual information.	- What do you notice first? - What do the hands tell us? - What do you think this story might be about? - What clues can you find in the picture?
2. First Encounter with the Story	Establish connections between written words, images, and meaning	The teacher introduces the page and encourages children to observe the relationship between text and illustration.	AI provides access to written words through sign language, allowing children to encounter the text through a visual linguistic mode.	- Which word matches this picture? - What do you understand from the picture and the sign together? - How do the words and images help us understand the story?
3. Developing Sign Vocabulary	Build bilingual vocabulary and strengthen connections between sign, print, and image	The teacher highlights key words and supports children in using them within the story context.	AI provides repeated visual demonstrations of signs, supporting independent exploration and vocabulary reinforcement.	- Where can you find this idea in the picture? - What does this sign tell us about the story? - Can you connect the written word, the sign, and the image?
4. Reading the Illustrations	Develop visual literacy and infer meaning from images	The teacher guides children to examine facial expressions, body language, gestures, colours, and composition.	AI supports language access but does not interpret the image; children construct their own meanings.	- What is happening in this picture? - How do you know? - Which part of the illustration helped you understand? - What do the characters' bodies and hands communicate?
5. Understanding Emotions	Develop emotional awareness and interpretation of visual and embodied cues	The teacher encourages children to connect facial expressions, gestures, and feelings.	AI provides access to emotional vocabulary through sign language, supporting children in expressing interpretations.	- How is the character feeling? - What helps you understand that feeling? - How can you show this feeling with your face or hands? - Which sign expresses this emotion?
6. Hands as Communication	Recognize sign language and gestures as meaningful forms of communication	The teacher discusses how hands can communicate ideas, feelings, and relationships.	AI acts as a bridge between written language and sign language, reinforcing the understanding that meaning can be represented through different modes.	- What are the hands communicating? - Can we understand the message without spoken words? - How do hands create meaning in this story?

				- Are there different ways to express the same idea?
7. Collaborative Meaning-Making	Encourage peer interaction and shared interpretation	Children work together to discuss pages and explain meanings to each other.	AI functions as a supportive resource when children need access to unfamiliar vocabulary or signs.	- Can you explain this page to your partner using signs, pictures, and gestures? - Did you use the same signs or different ways to explain the idea?
8. Retelling the Story	Develop narrative skills through multimodal expression	The teacher invites children to reconstruct events using signs, images, gestures, and words.	AI provides linguistic scaffolding by supporting recall of important vocabulary from the story.	- What happened first? - What happened next? - Can you tell this part of the story using signs and pictures? - Which signs help you remember the story?
9. Creative Response	Encourage children to create their own meanings using multiple modes	Children create drawings and select meaningful words/signs connected to the story.	AI supports children in exploring vocabulary needed to express their ideas.	- What did you like from the story? Draw it. - Can you show the word or sign for your picture? - What is happening in your picture?
10. Reflection and Meaning-Making	Encourage metacognition about the reading experience	The teacher leads discussion about how different modes contributed to understanding.	AI remains a background scaffold that supported access and participation throughout reading.	- How did you understand the story? - Did the pictures/signs/words help you? - Can we say something in different ways? - What can our hands tell others?

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Conflict of Interest Statement

The author declares no conflicts of interest.

About the Author

Dr. Kaliakatsou Ioanna is an educator and researcher with extensive experience in primary education, early childhood literacy, and inclusive pedagogy. She holds a PhD and a Master's degree in Education and has been actively involved in research and professional development in the fields of literacy, multimodal learning, and children's literature. Her academic interests focus on picture books as multimodal texts, critical visual literacy, inclusive literacy practices, and the role of materiality and sensory engagement in early childhood education. Her work explores how contemporary picture books can create accessible and meaningful learning experiences for diverse groups of children, including autistic learners and children with different communication profiles. Her research also examines the intersections of multimodality, embodied cognition, Universal Design for Learning (UDL), and social inclusion, with particular emphasis on developing pedagogical approaches that promote participation, agency, and equity in early literacy classrooms. She has presented her work at national and international conferences and has contributed to academic publications on children's literature, literacy education, and educational innovation. Alongside her academic work, Dr. Kaliakatsou Ioanna has extensive experience in teacher education and curriculum development and is actively engaged in initiatives that promote inclusive education and community participation. Her current research continues to investigate multisensory picture books, visual meaning-making, and the educational potential of multimodal storytelling in fostering literacy, communication, and social inclusion for all children.

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