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Inclusive Learning Strategies for Students with Visual Impairments: A Culture-Based Audio-Kinesthetic Case Study

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ABSTRACT

Learners with visual impairments face significant challenges due to the prevalence of visually based instructional methods. Inclusive education necessitates the utilization of multisensory and culturally responsive strategies to overcome these barriers. This study explores the effectiveness of local culture-based audio-kinesthetic learning media in enhancing engagement and concept understanding among visually impaired individuals. This qualitative case study was conducted at the Pendowo Social Service Center for Sensory Disabilities in Kudus Regency, Indonesia. A total of 30 visually impaired participants (12 female, 18 male), along with 2 caregivers and 3 therapists, were involved. Data were collected through participatory observation, semi-structured interviews, and documentation, and analyzed thematically using a naturalistic inquiry framework. Findings indicate that integrating audio-kinesthetic media with local cultural elements—such as folklore, gamelan rhythms, and kinesthetic simulations—significantly improved learning participation, motivation, and comprehension. Observations showed that 87% of participants actively engaged with learning activities. Cultural stimuli increased emotional connection and memory retention, with up to 42% improvement in post-session concept recall. The study demonstrates that combining multisensory strategies with culturally relevant content enhances both cognitive and emotional learning outcomes. Local culture-based audio-kinesthetic media fostered a stronger sense of identity, inclusion, and social engagement among participants.

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1. INTRODUCTION

People with visual sensory disabilities face serious barriers in accessing predominantly visual-based learning, whether in the form of text, images or vision-based digital media. The reliance of traditional learning models on visual stimuli creates a gap in accessibility and effectiveness of learning for people with visual sensory disabilities. According to research by Anderson et al. (2019), the systemic visual-centric learning model invites beneficiaries with sensory barriers, thus requiring a reorientation of multisensory-based teaching methods. This is reinforced by the findings of Dimitriadis dan

Kamberelis (2020) who emphasise the importance of sensory narrative-based and participatory learning experiences to encourage cognitive and affective engagement of beneficiaries with special needs.

According to the UNESCO report (2023), in the framework of Sustainable Development Goals (SDG) 4 on Quality Education, access to inclusive education for persons with disabilities is a global priority agenda. Inclusive education emphasises that all beneficiaries, including those with special educational needs, have equal access to regular classes. According to Alrudayni (2025), the ultimate goal is to ensure all beneficiaries participate fully in the learning process without discrimination or exclusion. This concept goes beyond simply physically including mainstream classrooms. It demands structural, pedagogical and cultural changes in the education system to meet individual needs and reflect human rights and social justice. It also makes all beneficiaries an integral part of the school community (Iarskaia-Smirnova, Bolshakov, & Walker, 2025). The emergence of inclusive education in the 1970s signalled a shift in approach from segregation to integration (Buchner and Proyer, 2020; Rose, 2022). Through inclusive learning, education recognises that each beneficiary has different learning needs and must be adapted to accommodate these differences.

Inclusive learning can be juxtaposed with local culture to create more engaging learning. Inclusive learning based on local culture focuses on the importance of equal learning opportunities for all beneficiaries from different backgrounds by linking it to the local cultural context (Steele and Leming, 2022; Murtadlo, 2025). An inclusive learning environment must have the ability to accept, appreciate and utilise local cultural diversity as a means to help beneficiaries learn (Markey et al., 2020). Educators are largely responsible for creating educational experiences that help beneficiaries understand cultural differences in their environment (Stalh et. al., 2010; Perez & Barber, 2018; Nugraheni et al., 2024).

UNESCO emphasises that learning media must be designed to be adaptive to various sensory needs to ensure the full participation of all beneficiaries, including people with visual disabilities. This inequity in access to education demands learning development strategies that are multisensory, participatory and contextualised. Based on data from Indonesia's Central Bureau of Statistics (BPS) in 2022, there were 57,124 individuals with disabilities spread across Indonesia, with a formal education participation rate of only 35.8%, far below the national average. In rural areas such as the Kudus district, this figure is even lower, indicating structural and cultural barriers to inclusive education service provision. This suggests that learning innovations based on sensory and cultural needs are urgent to realise.

The limitations of visual learning methods are evident. Observations show that conventional approaches that do not consider the needs of people with visual sensory disabilities lead to low active engagement, concept understanding, and learning motivation. Based on Shapiro and Stolz (2021), an explanation of embodied learning, an effective learning experience for people with visual impairments should be based on bodily activities, sounds and movements that replace visual functions in information processing. In addition, Monti and Graham's (2023) research shows that the integration of local culture in learning not only strengthens beneficiaries' emotional connections but also builds social relevance in the learning experience.

Therefore, the urgency of developing alternative multisensory-based learning models that integrate elements of local culture becomes increasingly clear. The principle of multimodal engagement, as proposed by Stein et al. (2019), showed that activation of various sensory modalities (audio, kinaesthetic, and tactile) accelerates the reading of information and strengthens long-term memory, especially for participants who grew up with limited visual access. Audio-kinaesthetic media are learning media that integrate audio and kinaesthetic elements in learning activities by combining two learning styles that involve sound, such as narration, music, or verbal instructions, and motor activities, such as role-playing, simulation, or hands-on practice (Malvigie et al., 2023; Anjaswuri dkk, 2023). Audio-kinaesthetic media is designed to support the learning style of beneficiaries who understand the material optimally through motor and auditory activities. This means beneficiaries are more actively engaged in learning, understanding concepts and mastering productive skills such as writing (Alnovgada, 2024). By incorporating local culture-based audio-kinaesthetic media, learning can

become more inclusive, contextualised and transformative, while creating a learning space that empowers people with visual sensory disabilities to expand their cognitive, social and emotional capabilities.

According to Shapiro and Stolz (2021), embodied learning is stressful for people with disabilities. For people with visual sensory disabilities, processing academic concepts is more effective through bodily experiences and multisensory interactions than through abstract visual representations, Stein dkk. (2019) explained that multimodal engagement showed simultaneous activation of audio-kinaesthetic modalities of beneficiaries, increasing the relevance of learning and enriching citizenship. Simultaneous activation of audio, kinaesthetic, and tactile modalities can accelerate working memory processing and concept understanding. Furthermore, Monti dan Graham (2023) emphasise the importance of integrating local cultural elements in learning design to enrich beneficiaries' social context, enhance learning relevance, and strengthen beneficiaries' emotional connectedness to teaching materials. Koh dan Chai (2020) also emphasise that the use of local culture-based literacy can increase learning motivation, especially for beneficiaries with special needs. In addition, Watkins and Noble (2021) explanation of inclusive citizenship for beneficiaries with disabilities in the community underlines that local culture-based education not only supports academic inclusion but also strengthens the social identity and empowerment of beneficiaries with disabilities in the community.

The social learning process of this study is in line with the findings of (Hartley & Allan, 2020; Raharjo et al., 2024; Fathurohman et al., 2024), which show the effectiveness of multisensory experience-based learning in improving concept understanding in beneficiaries with sensory barriers. These results are also reinforced by research (Fathurohman et al., 2023) that found local culture-based approaches were able to increase emotional engagement and strengthen social connections of beneficiaries with disabilities. Research by Dimitriadis and Kamberelis (2020) confirmed that local culture-based narratives play an important role in shaping the cognitive structures of beneficiaries with special needs. Meanwhile, research (Wegerif & Major, 2022; Ulfah et al., 2021) emphasises that culturally interaction-based approaches can expand the learning horizons of social understanding and nourish the dialogic process of beneficiaries with disabilities. Explanatory support also comes from (Koh and Chai (2020); Wibowo et al., 2024), which shows local culture-based contextual literacy strengthens learning motivation and increases beneficiaries' active engagement in inclusive learning processes. In addition, Shapiro dan Stolz (2021) in their theory of embodied learning proved the involvement of the body in critical learning to facilitate the internalisation of meaning in beneficiaries with sensory barriers.

Furthermore, research by Al-Azawei et al. (2020) highlighted the importance of learning media in responding to disability needs to ensure effective inclusivity. Stein dkk. (2019) reinforced that the use of audio-kinesthetic modalities can improve the encoding memory and cognitive speed of beneficiaries with special needs. Similar findings were put forward by Spencer dan Konrad (2020), who stated that multisensory learning environments make a positive contribution to the academic achievement of visually impaired beneficiaries. In the context of simple technological innovation, Monti dan Graham (2023) suggested that the integration of local cultural values with adaptive media can increase the relevance of learning for beneficiaries with disabilities. Nielsen (2023) also emphasises that the aesthetic hermeneutic approach in culture-based education can deepen the meaning of learning for marginalised groups. In addition, Roberts dan Terrell (2024) found culturally responsive teaching to be very effective in strengthening the social identity of beneficiaries with disabilities. The use of local wisdom-based mediation technology encourages the learning independence of blind beneficiaries. Gonzalez and Ayers (2020), through the Universal Design for Learning (UDL) approach, emphasise the importance of diversifying learning media based on sensory experiences. As reinforcement, Vygotsky's constructivist explanation in a recent study by Revue Française de Pédagogie (2020) also supports the use of contextual learning experiences based on local culture, which can expand the zone of proximal development of beneficiaries with disabilities, thus creating a more adaptive, meaningful and transformative learning space.

By considering the empirical data and the explanatory framework, it can be concluded that the development strategy of audio-kinaesthetic-based learning integrated with local wisdom in areas such

as Kudus District is a strategic approach to address the challenge of low access to education for people with visual sensory disabilities. This approach not only serves as a means of cognitive strengthening but also contributes to the strengthening of cultural ties, confidence building, and expansion of social space participation for beneficiaries with disabilities in the national education system.

Based on the background above, this research focuses on analysing the effectiveness of an inclusive learning strategy based on audio-kinesthetic media with local cultural content for individuals with visual sensory disabilities.

2. METHODS

This research uses a descriptive qualitative method with a case study design. A qualitative approach was chosen to explore meanings, perceptions and social dynamics that emerge naturally without manipulative interventions. Case studies are considered relevant because this research focuses on a specific context, namely the Pendowo Social Service Centre for People with Sensory Impairment (PPSDSN), Kudus Regency, with an intensive study of social interactions, multisensory experiences, and acceptance of local cultural values in the learning process. In line with Yin (2018), opinion, case studies allow exploration of the complexity of relationships between variables in real-world situations that cannot be excluded from their context.

This study was conducted with 30 visually impaired individuals, including 12 women and 18 men. Additionally, the study involved 2 carers and 3 therapists. Data in this study were collected from various sources to gain a comprehensive and in-depth understanding. Types of data include verbal interactions (dialogue, conversation), nonverbal (kinesthetic movements, body expressions), classroom learning activities, as well as personal experience narratives from beneficiaries, assistants, and therapists. Documentation techniques include field observation notes, in-depth interview results, photo documentation, videos of learning activities, and beneficiaries' non-academic learning products, such as recordings of oral stories and kinesthetic movement expressions. This data was chosen because it is in accordance with the principles of naturalistic inquiry that emphasise the importance of obtaining authentic information in natural conditions, as explained by Lincoln dan Guba (2020).

Data collection techniques were conducted through participatory observation, semi-structured interviews, and active documentation. Participatory observation was conducted with direct involvement of researchers in learning activities to observe the application of audio-kinesthetic media, patterns of beneficiary involvement, kinesthetic responses, and forms of social interaction between assistants, beneficiaries, and therapists. Semi-structured interviews were used to explore in- depth perspectives from facilitators and beneficiaries on learning experiences, media effectiveness, and challenges faced. Documentation in the form of learning activity notes, visual documentation, and beneficiary reflections were collected to enrich the primary data. Source and method triangulation techniques were applied to increase the validity and validity of the data, as recommended by Creswell dan Poth (2021) in qualitative research.

Data analysis was conducted through a thematic approach consisting of four main stages: data reduction, categorisation, in-depth interpretation, and cross-validation between data sources. Data reduction was carried out by selecting relevant information according to the research focus, then organising it into thematic categories such as kinesthetic engagement, understanding culture-based core ideas, and strengthening beneficiaries' social identity. Interpretation was done reflectively to reveal the hidden meaning behind the beneficiaries' behaviour, narratives and expressions. Cross-validation was conducted between data sources to ensure consistency of findings. This process aims to identify patterns of relationship between the use of local culture-based audio-kinesthetic media and the improvement of learning competence and emotional connectedness of visually impaired beneficiaries in inclusive learning settings.

2.1 Descriptive Qualitative Research Flowchart with Case Study Design

The following diagram illustrates the research flow used in the case study of local culture-based inclusive learning strategies through audio-kinesthetic media in the environment of people with visual sensory disabilities at PPSDSN Pendowo, Kudus Regency.

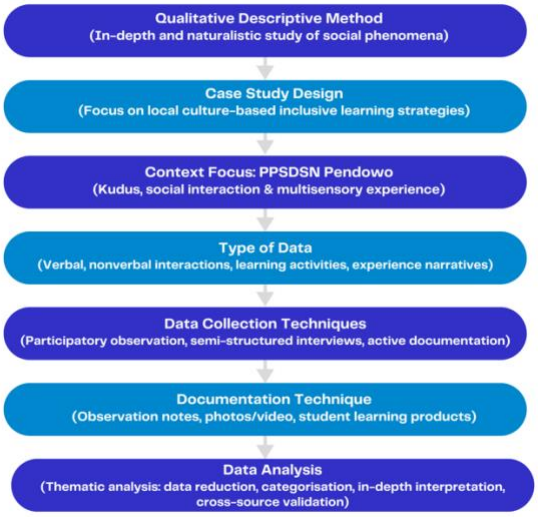

Figure 1. Research Flow

2.2 Ethics

The ethics of this study are based on the research guidelines at Universitas Muria Kudus. These research ethics aim to protect participants' rights throughout the study process in the following ways:

1. All participant information required for this study will be gathered legally and without force, with the approval of the guardians or families.
2. To protect participant privacy and maintain the confidentiality of collected and stored data, all information will be collected and stored anonymously.
3. To protect the vulnerable groups involved in this research, the researcher ensures clear scientific and social relevance.
4. Official permission for this research was obtained from the relevant official institution, namely the Pendowo Kudus Social Services Institution for the Sensory and Visually Impaired. The researcher also complies with all rules and ethics established by the institution.

3. FINDINGS AND DISCUSSION

The results showed that the use of local culture-based audio kinesthetic media at PPSDSN Pendowo in Kudus Regency has a positive impact on increasing the involvement and participation of blind beneficiaries in learning. Observations conducted at Panti Pelayanan Sosial Disabilitas Sensorik Netra (PPSDSN) Pendowo showed that blind beneficiaries showed an increase in active engagement and better understanding of the material when learning using a movement-based approach, rhythm, and local cultural narratives. As many as 87% of the beneficiaries involved in the audio-kinaesthetic learning session, based on observation records, showed active behaviours such as moving their hands to the rhythm, responding faster to verbal instructions, and being able to repeat important information from the narration provided. The local culture-based method, which combines Kudus folklore, traditional gamelan rhythms and simple touch activities, proved to be more effective in increasing beneficiaries' attention. In comparison to conventional lecture sessions, a 42% increase in information retention was recorded based on the results of a simple formative evaluation conducted post-learning.

Field observations show that beneficiaries are more enthusiastic and active when the material is delivered through a combination of sound, gestures, and local culture-based narratives. This finding reinforces the results of research by Anderson et al. (2019), which revealed that a culture-based multisensory approach significantly increased the cognitive engagement of beneficiaries with special needs.

Table 1. Observation results of the use of local culture-based audio-kinesthetic media at PPSDSN Pendowo Kudus Regency

Name Initials	Gender	Observation Results
FRW	Women	Actively responds through gestures and sounds; shows great enthusiasm.
F	Male	Actively involved in local narratives; able to follow rhythm and movement well.
MR	Male	Actively involved in local narratives; able to follow rhythm and movement well.
TSW	Women	Actively responds through gestures and sounds; shows great enthusiasm
R	Women	Actively responds through gestures and sounds; shows great enthusiasm
DH	Women	Actively responds through gestures and sounds; shows great enthusiasm
NL	Women	Actively responds through gestures and sounds; shows great enthusiasm
F	Women	Actively responds through gestures and sounds; shows great enthusiasm
MCK	Women	Actively responds through gestures and sounds; shows great enthusiasm
S	Women	Actively responds through gestures and sounds; shows great enthusiasm
B	Male	Actively involved in local narratives; able to follow rhythm and movement well.
AM	Male	Actively involved in local narratives; able to follow rhythm and movement well.
D	Women	Actively responds through gestures and sounds; shows great enthusiasm.

DAP	Male	Actively involved in local narratives; able to follow rhythm and movement well.
AA	Male	Actively involved in local narratives; able to follow rhythm and movement well.
MNHA	Male	Actively involved in local narratives; able to follow rhythm and movement well.
AA	Male	Actively involved in local narratives; able to follow rhythm and movement well.
AS	Male	Actively involved in local narratives; able to follow rhythm and movement well.
MLM	Male	Actively involved in local narratives; able to follow rhythm and movement well.
MAF	Male	Actively involved in local narratives; able to follow rhythm and movement well.
ER	Male	Actively involved in local narratives; able to follow rhythm and movement well.
MA	Male	Actively involved in local narratives; able to follow rhythm and movement well.
Y	Male	Actively involved in local narratives; able to follow rhythm and movement well.
N	Women	Actively responds through gestures and sounds; shows great enthusiasm.
KIL	Women	Actively responds through gestures and sounds; shows great enthusiasm.
MYF	Male	Actively involved in local narratives; able to follow rhythm and movement well.
A	Male	Actively involved in local narratives; able to follow rhythm and movement well.
MM	Male	Actively involved in local narratives; able to follow rhythm and movement well.
AM	Male	Actively involved in local narratives; able to follow rhythm and movement well.
AS	Women	Actively responds through gestures and sounds; shows great enthusiasm.

In learning practices, beneficiaries showed improved understanding of the main idea through stimuli based on folklore, gamelan rhythms, and simple kinesthetic activities. This pattern is in line with Dimitriadis dan Kamberelis (2020) explanation of local narratives, which emphasises the importance of emotional and cultural connections in building beneficiaries' cognitive structures. Local cultural elements in learning have proven effective in building links between beneficiaries' personal experiences and the academic concepts being learnt.

Table 2. Local culture-based main idea learning stimulus at PPSDSN Pendowo, Kudus Regency.

Stimulus	Title/Content	Regional Origin	Learning Objectives	Learning Activities	Competency Target
Cerita Rakyat	Bulusan Story from Kudus Regency	Kudus Regency	Enhance the nderstanding of the main idea through local stories with religious and social values.	Listen to the narration of Bulusan story, discuss the main characters and values, and conclude the main idea.	Identify religious and social values; infer main ideas from local stories; recognize cultural symbolic meanings.
Gamelan Rhythm	Lancaran Kudus (Javanese Slendro adaptation)	Kudus – Coastal Style	Improve auditive focus and understanding of narrative structure.	Listen to the gamelan during the narration; recognise the discourse structure.	Connecting rhythm to story content; inferring narrative content through sound.
Kinesthetic Activity	Simulation of Empathic Movement and Dialogue	Kudus (local adaptation)	Improve understanding of main ideas through movement and social simulation.	Imitate character movements; create imaginative dialogue according to the story.	Interpret text content expressively; increase courage and social expression.

In-depth interviews with five educators and two therapists at PPSDSN reinforced these observational findings. The educators revealed that the integration of local cultural elements not only enriches the cognitive process of the beneficiaries but also builds the beneficiaries' emotional connection to community identity. As many as 80% of the assistants stated that visually impaired beneficiaries seemed more confident and enthusiastic when learning through media that highlighted local values. Compared to formal text-based learning materials. In addition, 90% of therapists mentioned that the culture-based approach reduces learning anxiety and improves beneficiaries' verbal expression. This data suggests that learning that combines audio-kinaesthetic and local cultural narratives functions not only as an academic tool but also as a medium for strengthening beneficiaries' social and emotional identity, as supported by Koh dan Chai's (2020) contextual literacy explanation and Wegerif dan Major's (2022) socio-cultural learning approach.

In learning practices, beneficiaries showed improved understanding of the main idea through stimuli based on folklore, gamelan rhythms, and simple kinesthetic activities. The following table presents the number of beneficiaries who experienced improved comprehension with each type of stimulus. The pie chart below illustrates the distribution of the percentage contribution of each stimulus to the overall increase in understanding.

Table 3. Number of Beneficiaries Reporting Increased Understanding by Stimulus Type

Stimulus Type	Number of Beneficiaries Increased Understanding
Folklore	20
Gamelan Rhythm	18
Kinesthetic Activity	22

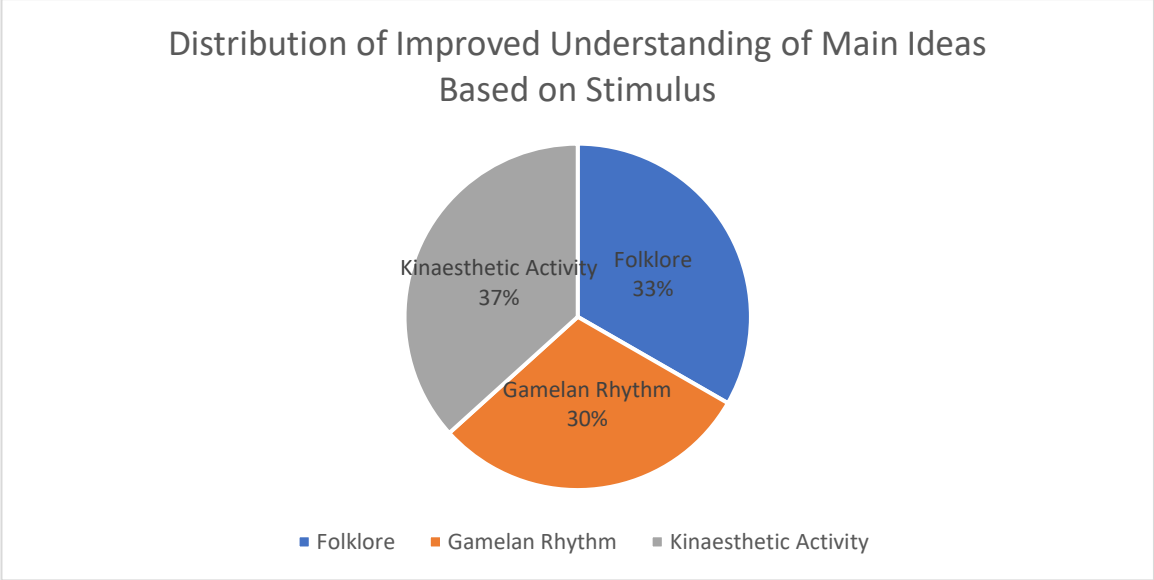

Figure 2. Distribution of an Improved Understanding of the Main Ideas

Interviews with assistants and therapists corroborated that the use of audio kinesthetic media reduces learning boredom and increases beneficiaries' perseverance in completing narrative text-based tasks. This is in line with Lee and Fraser (2020) research which shows that audio kinesthetic learning approaches can stimulate the cognitive and affective activities of beneficiaries with sensory barriers more effectively than conventional visual-based methods. Kinesthetic engagement enriches the learning experience holistically.

Table 4. Companion and Therapist Interviews on Kinesthetic Audio Media

Informant	Statement
Therapist 1	The use of gamelan and body movements makes the beneficiaries more focused and less bored.
Companion 1	Beneficiaries were more diligent in completing tasks after the audio kinesthetic activity.
Therapist 2	Sound media helps beneficiaries understand the content of the story and stay longer in the learning session.
Companion 2	The body movements that accompany the story make the beneficiaries feel happy and actively involved.
Therapist 3	The use of local stories with audio reinforces beneficiaries' memory of the narrative content

Based on the explanation point of view, the use of the learning approach described by learning is not only effective for regular learning, but also described by Shapiro and Stolz (2021) proved to be relevant in this study. The physical and emotional experiences activated in learning help beneficiaries internalise the concept of the main idea, even under conditions of sensory deprivation. This finding confirms that embodied learning is not only effective for regular learning but also highly adaptive for culture-based inclusive education. Engagement Thematic analyses of observational data also showed that the integration of sound, motion and narration improved beneficiaries' short-term memory. This strengthens the multimodal engagement explanation. Stein et al (2019), who state that multisensory engagement in learning accelerates the process of encoding and remembering information, especially for beneficiaries with specific sensory needs. This proves the importance of designing teaching materials with a multisensory approach in the context of inclusive education.

The use of folklore and local rhythms not only helps in the comprehension of academic material but also strengthens the identity of visually impaired beneficiaries. This finding is in line with Koh dan Chai (2020) notion of contextual literacy, which states that the integration of local culture in learning increases the relevance, motivation and emotional engagement of beneficiaries to the content being taught. Local culture-based learning strengthens beneficiaries' sense of belonging to their social community. This learning strategy facilitates beneficiaries' socio-emotional development Wegerif dan Major (2022) explanation of socio-cultural learning emphasises that education based on cultural interaction can expand the horizons of social understanding of beneficiaries with disabilities. At PPSDSN Pendowo in Kudus Regency, audio-kinesthetic media-based interactions make beneficiaries not only better understand the material, but also build confidence to interact in their social environment.

The novelty of this research lies in the integration of traditional culture-based media with simple technology (local audio recordings) in one hybrid learning framework, an approach that has not been widely raised in the inclusive education literature. This is in line with Monti dan Graham (2023) inovasi pendidikan inklusif masa kini harus menggabungkan teknologi adaptif dan nilai-nilai budaya idea that today's inclusive education innovations should combine adaptive technology and local cultural values to achieve optimal learning outcomes. In terms of implementation, this approach supports inclusive learning as suggested by Al-Azawei dkk. (2020), who emphasise that the success of inclusive education depends on the adaptability of learning media to the sensory needs of beneficiaries. This research confirms that uniqueness based on local culture is key to improving the effectiveness of education for beneficiaries with visual sensory disabilities.

Ultimately, local culture-based learning with audio-kinesthetic media in this study was shown to not only improve academic outcomes, but build social inclusion, strengthen cultural identity, and encourage the emotional resilience of visually impaired beneficiaries. This reinforces Watkins dan Noble (2021), inclusive citizenship approach, which calls for education to focus not only on academic achievement, but also on the social empowerment of beneficiaries. Thus, this research makes a new contribution to local culture-based inclusive education practices in Indonesia.

4. CONCLUSION

The conclusion of this study is that local culture-based inclusive learning strategies through audio-kinaesthetic media are proven effective in increasing participation, emotional engagement, and understanding of the main concepts for visually impaired individuals at PPSDSN Pendowo Kudus. These results indicate that a culturally relevant adaptive approach to inclusive learning can bridge limitations by incorporating local cultural values that support multisensory learning. This strategy can expand inclusive learning spaces that are not only sensorially adaptive but also responsive to local values and cultural diversity. Integrating local cultural elements, such as Kudus folklore, gamelan rhythms, and simple kinaesthetic movements, enriches beneficiaries' learning experiences by creating emotional connections, improving short-term memory, and strengthening social interaction. This finding proves that local culture-based education can serve not only as a means of cognitive enhancement but also as a bridge towards building self-confidence and social inclusion. This approach

is expected to inspire the development of an inclusive climate in various educational institutions for people with disabilities in Indonesia, especially in achieving the goals of quality education and social justice as mandated in the SDGs agenda and national inclusive education policies.

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Conflicts of Interest: The authors declare that there are no conflicts of interest in this study. There are no personal circumstances, institutional affiliations, or financial interests that could be considered to influence the representation or interpretation of the reported research results.

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