ENHANCING SIGN LANGUAGE INTERPRETATION IN TELEVISION NEWS: COGNITIVE CHALLENGES AND TECHNOLOGICAL INNOVATIONS

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Abstract. Sign language interpretation in television news faces significant challenges due to the rapid pace of information delivery and the fundamental linguistic differences between sign and spoken language. This study aims to identify the obstacles sign language interpreters encounter and examine technological innovations that could improve translation accuracy and accessibility. Employing a Narrative Literature Review (NLR) methodology, the study synthesizes academic literature on the effectiveness of sign language interpreters in broadcast journalism. The findings reveal that short-term memory limitations and the inherent complexity of news content significantly influence translation performance. The absence of standardized sign language interpretation practices in television further complicates the delivery of accurate information to deaf and hard-of-hearing audiences. Moreover, nonverbal expressiveness, effective spatial use, and environmental factors—such as lighting and screen layout—play critical roles in the comprehensibility of sign language during broadcasts. This study also emphasizes the urgency of developing AI-based assistive tools and national standards for sign language interpretation in the media sector. It advocates for enhanced interpreter training, especially in handling high-velocity news and technical terminology, and for collaborative initiatives between media institutions and the deaf community to create more inclusive broadcast standards. Ultimately, this research provides theoretical insights through the lens of Information Processing Theory and Cognitive Load Theory and offers practical recommendations to inform policy aimed at inclusive communication. These findings contribute to the broader discourse on improving media accessibility and promoting equity for individuals with hearing disabilities..

Keywords: Television News; Sign Language Interpreter; Sign Language; Media Accessibility

INTRODUCTION

In the digital era and amidst the rapid flow of information, television news remains one of the primary sources through which the public accesses information. However, significant challenges arise in ensuring accessibility for the deaf community, who rely on sign language interpreters to comprehend broadcast content. Television news is often delivered quickly, making it difficult for interpreters to convey complex concepts accurately. For instance, special news segments that include technical terminology related to politics or economics often pose difficulties for interpreters in maintaining the integrity of the message (Fitria, 2024). As a result, delays in interpretation frequently occur, potentially causing deaf viewers to miss essential parts of the news being presented (Dhoest & Rijckaert, 2021).

Numerous studies have explored the challenges associated with sign language interpretation in television news, yet no fully effective solution has been found to overcome these limitations. Previous research indicates that information delivery through sign language interpreters is often hindered by technical constraints, including the interpreter's display size being too small, the speed of interpretation not matching the pace of the newsreader, and the absence of standardized sign language presentation on television (Duhomnicu & Damian, 2021). Miller's Information Processing Theory (1956) posits that humans are limited to processing information quickly, which may explain why interpreters struggle to capture and deliver information accurately (Wehrmeyer, 2020). However, no study has examined the application of this theory in the context of sign language interpretation for television news.

This study aims to analyze sign language interpreters' challenges in delivering accurate television news and explore technological innovations that may support their role. The study will focus on news programs that incorporate sign language interpreters as part of their accessibility services. By reviewing various approaches and technologies implemented in different countries, this research seeks to propose more effective solutions to enhance information access for the deaf community (Yi et al., 2021). This analysis shows that implementable strategies can be identified to improve the sign language interpretation system in television news broadcasts.

The urgency of this research is grounded in the principle that equal access to information is a fundamental right for all individuals, including those who are deaf. Through innovations in sign language interpretation, it is hoped that the quality of news access for the deaf community can be enhanced, enabling them to receive information more completely, quickly, and accurately. Therefore, this study is crucial in understanding the existing challenges and identifying practical solutions that can be implemented within the broadcasting industry (Ntombela et al., 2024).

Television has long served as a primary medium for disseminating information to the public, with news programs among the most widely consumed content. Television news presents current information to audiences through broadcasts combining visual and auditory elements (Nguri, 2019). Over time, television news has undergone various transformations—from an initial focus on delivering factual information to adopting a more dynamic and entertaining format through infotainment (Bykov, 2022). However, the speed at which news is delivered often presents a barrier for certain groups, such as the deaf, who depend on sign language interpreters to comprehend broadcast content.

Sign language interpreters are critical in bridging communication between

deaf individuals and the wider public. These interpreters can be categorized based on their work environment and interpretation methods. Broadly, there are two main categories of sign language interpreters: community and conference interpreters (Lee & Hwang, 2021). Community interpreters typically operate in everyday settings such as hospitals and schools, while conference interpreters work in formal events or media contexts, including television news. In the context of television news, interpreters must be able to manage the rapid pace of information delivery and the complexity of the technical terminology used by news anchors (Alzahrani, 2022).

Sign language is a communication system that uses hand movements, facial expressions, and body posture to convey meaning. It is not merely a set of gestures but a language with its grammar and linguistic structure (Emmorey, 2023). Each country has its sign language, such as American Sign Language (ASL) in the United States and Bahasa Isyarat Indonesia (BISINDO) in Indonesia. These differences highlight the need for interpreters to deeply understand the linguistic and cultural variations embedded in the sign language they employ (Wilcox et al., 2024).

In the context of interpretation, sign languages can be categorized by function— such as natural sign languages and manually coded sign systems (Murtagh, 2020). Natural sign languages develop organically within deaf communities and have unique grammatical structures, while manually coded sign systems adapt spoken languages into sign form. These two types have different implications for television news interpretation, as interpreters must select the appropriate approach to maintain informational accuracy.

The role of sign language interpreters in television news is increasingly recognized, with more TV stations now incorporating interpreters in some news programs. However, key challenges remain, including the absence of a national standard for news interpretation and the lack of proper training for sign language interpreters working in electronic media (Philip, 2023). Accordingly, this study highlights the importance of innovation in sign language interpretation technologies to improve the accessibility of television news for the deaf community.

Additionally, while technological solutions, such as AI-driven sign language avatars or automated interpretation systems, are beginning to emerge (Yi et al., 2021), comprehensive analyses of their practical application in the specific television news environment remain scarce. There is limited empirical exploration of how human-centered and AI-based approaches could complement each other to optimize accessibility without sacrificing human interpretation's nuanced, context-sensitive nature.

This study aims to fill these gaps by:
1. Applying cognitive frameworks to examine the challenges interpreters face during live television news systematically.
2. Exploring the potential of technological innovations to augment interpreter performance, beyond merely replacing human interpreters.
3. Highlighting the critical need for national standards in broadcast sign language interpretation, particularly in countries like Indonesia, where such standards are currently lacking.

Through a Narrative Literature Review (NLR) methodology, this research not only synthesizes prior findings but also offers theoretical insights and practical recommendations. The contribution of this study lies in bridging the cognitive, technological, and policy perspectives, thus

advancing the academic discourse on media accessibility and offering actionable strategies for making television news more inclusive for deaf and hard-of-hearing audiences.

METHOD

This study focuses on the effectiveness of sign language interpreters in conveying information in television news broadcasts. Interpreters are crucial in ensuring information accessibility for the deaf community, particularly in news contexts where content is often delivered rapidly and includes complex technical terminology (Ntombela et al., 2024). The effectiveness of sign language interpretation in television news is significantly influenced by time constraints in interpreting and the complexity of the content presented (Fitria, 2024). These challenges make it difficult to ensure that deaf audiences receive accurate and comprehensible information without losing the core meaning of the broadcast news.

This study adopts a library research method using a Narrative Literature Review (NLR) approach. This method enables the researcher to construct an overarching view of the effectiveness of sign language interpretation in television news based on existing literature (Dhoest & Rijckaert, 2021). The data in this study comprises primary data sourced from journals and previous research related to the role of sign language interpreters in broadcast media. Meanwhile, secondary data includes literature discussing concepts relevant to the study's keywords, such as television news, sign language, and technological innovations in interpretation (Standi et al., 2023). The theoretical framework employed in this research draws from George A. Miller's Information Processing Theory (1956) and John Sweller's Cognitive Load Theory (1988). The Information Processing

Theory posits that humans have a limited capacity for storing and processing information in a short period, which, in the context of this study, suggests that sign language interpreters may need to simplify news content to ensure it remains accessible to deaf audiences (Wehrmeyer, 2020). Meanwhile, Cognitive Load Theory asserts that complex information received quickly can overwhelm mental capacity, making effective interpreting strategies essential for enhancing news comprehension among the deaf community (Yi et al., 2021).

The research process in a Narrative Literature Review (NLR) does not follow a rigid structure as seen in systematic reviews; instead, it is more exploratory and descriptive (Duhomnicu & Damian, 2021). The researcher begins by identifying relevant research topics and collecting literature from various academic sources, including journals, books, and scientific conferences. Data is collected using keyword searches related to the effectiveness of sign language interpreters in television news, followed by a literature selection based on relevance and source quality. Subsequently, the collected literature is analyzed to identify patterns and relationships among findings from previous studies.

The data analysis technique used in this research is content analysis, which aims to understand patterns, relationships, and key information within the various literature sources (Chew & Cheung, 2022). This analysis process involves categorizing information, synthesizing significant findings, and interpreting the data to better understand the challenges and innovations in sign language interpretation within television news broadcasts. Through this approach, the study seeks to contribute to developing more effective and inclusive interpretation methods within the broadcasting industry

RESULTS AND DISCUSSION

Research Finding. Television news is a form of information delivery with specific characteristics, notably its audiovisual nature and the tendency to be presented in a fast-paced, fleeting manner. Literature indicates that television news relies on a combination of verbal and visual elements to capture viewers' attention and enhance comprehension of the information being delivered (Nguri, 2019). A study on television news audiences revealed that the interaction between viewers and news content depends not solely on the content itself but also on the delivery style and other external factors, such as social and cultural backgrounds (Jaggi & Patankar, 2022).

Further elaboration from the literature shows that the rapid pace of news presentation can pose significant difficulties for individuals with special needs, particularly the deaf and hard-of-hearing community. Previous studies emphasize that deaf audiences often struggle to fully comprehend news interpreted simultaneously into sign language, especially when technical terms or rapidly developing events are involved (Gollust et al., 2019). This highlights a gap in information accessibility, prompting the need for innovative solutions to improve the effectiveness of news delivery for the deaf community.

This study's central focus is the relationship between the speed of television news delivery and the challenges sign language interpreters face. Limitations in real-time interpreting speed can lead to a mismatch between the information presented by the newscaster and the interpretation received by deaf viewers. Prior studies confirm that more adaptive news delivery methods, such as using summaries or rephrasing news more slowly, can improve comprehension among deaf audiences (Dhoest & Rijckaert, 2021).

In the context of sign language interpreters, previous research has identified various types of interpreters working in broadcast media. Sign language interpreters can be categorized based on their working methods: simultaneous interpreters, who interpret news in real-time as it is broadcast, and consecutive interpreters, who deliver translations after the news segment has been read (Ntombela et al., 2024).

Further explanations on sign language interpretation highlight that the effectiveness of interpretation in television news depends on the interpreter's linguistic and technical skills. Studies show that interpreters with a deeper understanding of sign language structure tend to convey information more accurately and efficiently (Standi et al., 2023). However, challenges such as rapid news delivery and the use of technical terminology remain key issues that need to be addressed.

The relationship between the challenges faced by sign language interpreters and the needs of deaf audiences suggests that more flexible interpretation standards could enhance news accessibility. Several studies underscore the importance of specialized training for television news interpreters to improve the accuracy and effectiveness of interpretation in mass media contexts (Chew & Cheung, 2022).

Studies on sign language reveal that each country has a distinct sign language system, with unique linguistic structures. For instance, the Indonesian Sign Language (Bahasa Isyarat Indonesia – BISINDO) differs syntactically and lexically from the American Sign Language (ASL) (Emmorey, 2023). In addition to BISINDO, Indonesia has another system called Sistem Isyarat Bahasa Indonesia (SIBI). These differences require interpreters to understand the linguistic variations in sign languages to avoid misinterpretations.

Further explanation regarding sign language variations shows that cultural factors also shape meaning and communication structures within sign languages. Studies indicate that sign language does not rely solely on hand gestures but also incorporates facial expressions and body posture to convey complex meanings (Wilcox et al., 2024). Therefore, television news interpreters must pay close attention to non-verbal elements in news delivery to ensure better comprehension by deaf audiences.

The relationship between sign language variation and the challenges interpreters face in television news indicates that technological approaches can help improve translation accuracy. Recent studies have highlighted using artificial intelligence in sign language translation to enhance information accessibility for the deaf community (Yi et al., 2021). Accordingly, this study confirms that a combination of human training and technological innovation can be a viable solution to improve the effectiveness of sign language interpretation in television news broadcasts.

Challenges and Technological Innovations in Sign Language Interpretation in Television News

Aspect	Challenges Faced	Supporting Technological Innovations
Speed of News Delivery	Interpreters struggle to keep up with the fast pace of live news broadcasts.	Use of AI-based text-to sign language translation technology.
Complexity of Technical Terms	Difficulty in accurately translating poutical, economic, and legal terminology.	Development of interactive digital dictionaries for intepreters.
Short-Term Memory Limitations	Interpreters must process and retain a large amount of information within a short time frame.	AI-based processing systems to simplify news content into sign languag format.
Lack of Standardization	Absence of standardized sign language interpretation practices in television news.	Implementation of digital platform-based regulations and interpreter training.
Interpretation Errors	Small screen size and visual distractions hinder comprehension for deaf viewers.	Automated verification systems to detect inconsistencies in interpretation.

These findings underscore the importance of integrating technology to support the role of sign language interpreters, ensuring that television news becomes more inclusive and accurate for the deaf and hard-of-hearing community.

Discussion. The findings of this study indicate that sign language interpretation in television news still faces various significant challenges, particularly regarding the speed of delivery and accuracy of information. The rapid tempo of news broadcasts often causes interpreters to struggle to deliver complete information, especially when the content involves technical terms or complex concepts. The findings of this study affirm that sign language interpretation in television news is heavily influenced by the cognitive demands placed on interpreters, particularly regarding speed and informational complexity. As news broadcasts are typically rapid and information-dense, interpreters face significant difficulties in processing, translating, and delivering messages accurately and comprehensively within a short time window. These challenges are exacerbated when dealing with technical jargon or rapidly evolving news stories, resulting in interpreters simplifying content to maintain coherence and flow. Consequently, there is a potential loss of detail, which affects the completeness of the information received by deaf audiences.

This phenomenon can be directly explained through Miller's Information Processing Theory (1956), which posits that individuals have a limited capacity to process information at any given moment. When the cognitive load exceeds this limit, errors, omissions, and meaning reductions become inevitable. Similarly, Sweller's Cognitive Load Theory (1988) further supports these findings by emphasizing that high intrinsic and extraneous cognitive loads impair real-time information handling, making practical

interpretation particularly challenging under live broadcast conditions. Hence, the constraints experienced by sign language interpreters are not merely operational or technical but rooted in fundamental cognitive limitations.

Moreover, the findings align with previous research, such as Wehrmeyer (2020), which highlighted that interpreters often struggle to maintain accuracy under time constraints, and Dhoest and Rijckaert (2021), who noted that simultaneous interpretation frequently results in loss of nuance, particularly for complex news topics. However, unlike earlier studies that primarily discussed these challenges descriptively, this research integrates a theoretical framework to explain why these limitations occur, thus offering a more structured understanding of the underlying problems.

Furthermore, structural differences between spoken language and sign language contribute to limitations in interpretation, often resulting in meaning reduction during the translation process. Technical factors, such as limited visual space for sign language interpreters on television screens and the absence of standardized translation protocols, also exacerbate the difficulties faced by both interpreters and deaf audiences. In this context, technological innovations, such as artificial intelligence and automated translation systems, have been proposed as potential solutions to enhance the effectiveness of interpretation in television news.

Regarding technological innovation, this study identifies artificial intelligence (AI) as a promising yet underdeveloped tool to support interpretation services. Although previous studies, such as Yi et al. (2021), have proposed AI-based solutions like sign language avatars, there is still limited real-world application in high-pressure environments like live television news. Furthermore, these AI systems often

lack the flexibility, cultural sensitivity, and nonverbal expressiveness that human interpreters naturally provide. This study suggests that future technologies must focus on augmenting — rather than replacing — human interpreters by assisting them in managing cognitive load during live broadcasts.

Another important insight is the need for standardized national protocols for sign language interpretation in television media. Current practices vary widely between broadcasters, leading to inconsistent quality of interpretation. Prior research by Philip (2023) underscores the importance of standardized interpreter training in educational settings, and this study extends the argument into the broadcasting domain. Implementing comprehensive standards would ensure a baseline of quality and help guide technological development and interpreter education programs toward meeting the real needs of deaf audiences.

These findings are also consistent with previous studies highlighting the challenges of sign language interpretation in mass media. Wehrmeyer (2020), for example, emphasized that the limitations of short-term memory in processing information hinder interpreters from conveying news content accurately. However, this study contributes further by linking these challenges to the theoretical framework of Information Processing Theory and Cognitive Load Theory. This approach provides a deeper understanding of how interpreters process complex information under time constraints. Additionally, this study offers a new perspective by exploring technology-based solutions, which remain underrepresented in prior research, especially in Indonesia's broadcasting context.

The results of this study underline the urgency of reforming sign language interpretation systems in television news as part of the broader effort to ensure inclusive

access to information. Without immediate intervention, deaf viewers will experience significant obstacles in comprehending news content. Moreover, improvements in the quality of sign language interpretation will not only benefit the deaf community but also contribute to the overall effectiveness of media communication by making information delivery more universal and accessible to a broader audience.

This study's practical implications highlight the need to develop national standards for sign language interpretation in television news. Although various countries have adopted different approaches and technologies, not all are directly transferable. Thus, a comprehensive evaluation and contextual adaptation of best practices implemented elsewhere are necessary. Furthermore, continuous professional development for interpreters is essential, particularly to prepare them for handling increasingly fast-paced and complex news content.

Cognitive and linguistic factors are crucial in explaining sign language interpreters' challenges. According to Cognitive Load Theory, interpreters experience limitations in processing complex information within short periods, making meaning reduction an inevitable strategy. Additionally, variations in sign language systems, such as the differences between Indonesian Sign Language (BISINDO) and the Indonesian Systematic Sign Language (SIBI), further contribute to potential gaps in audience comprehension. Therefore, it is important to recognize that interpretation challenges arise from technical constraints and cognitive and cultural-linguistic dimensions.

The discussion reveals that the challenges in sign language interpretation are multi-dimensional, involving cognitive, technical, and systemic factors. Addressing these challenges requires a holistic strategy that includes cognitive-based interpreter training, supportive AI tools, and regulatory reform. By situating the findings within both theoretical and empirical contexts, this study provides a solid foundation for future research and practical improvements in media accessibility.

Several concrete steps can be taken to address these challenges to improve the effectiveness of sign language interpretation in television news. First, AI-based technologies should be developed to support interpreters in managing high-speed news delivery while maintaining message accuracy. Second, interpreter training programs should emphasize the mastery of technical terminology and strategies for real-time communication. Third, regulatory frameworks concerning interpretation standards in broadcast media need to be clarified and implemented consistently. By taking these steps, the accessibility of news for deaf audiences can be significantly improved, contributing to a more inclusive national broadcasting system.

CONCLUSION

This research highlights a critical and underexplored dimension of media accessibility: sign language interpreters' cognitive challenges in the high-speed television news environment. Unlike prior studies that have mainly described interpretation difficulties, this study, grounded in Information Processing Theory and Cognitive Load Theory, reveals the cognitive mechanisms that underlie the interpreters' struggle to deliver complete and accurate messages. It shows that rapid news delivery and complex technical content overwhelm interpreters' processing capacity, leading to simplified or partial translations and potential information loss for deaf audiences.

Additionally, this study emphasizes that technological solutions — particularly AI-based interpretation systems — while promising, are not yet sufficient to replace the nuanced and culturally aware role of human interpreters. Instead, such technologies should be developed as complementary tools to alleviate cognitive burdens, not as substitutes. This nuanced view offers a more realistic roadmap for future innovations to enhance information accessibility for deaf and hard-of-hearing communities.

This study's theoretical contribution lies in applying cognitive frameworks to media interpreting practices, offering a structured understanding of the interpreter's experience during live television news. It recommends urgently establishing national standards for interpreter practices in broadcasting and calls for investment in interpreter training focused on cognitive resilience and technical vocabulary mastery. These steps are crucial to ensure equitable access to information for all citizens, aligning with global media inclusivity and human rights principles.

Nevertheless, the study's reliance on a Narrative Literature Review approach presents limitations. The absence of empirical field data constrains the ability to measure interpreter performance or audience comprehension outcomes directly. Future research should therefore involve empirical designs, such as experiments or surveys with deaf audiences, to validate and extend the theoretical findings presented here.

Moreover, future studies should explore how emerging technologies, including real-time AI assistance and immersive graphics, can be practically integrated into live news broadcasts without diminishing the quality of interpretation. Such investigations could yield innovative hybrid models where human expertise and technological advancement work together to create fully inclusive broadcast environments. Thus, this study is a theoretical and practical step toward realizing more accessible, equitable, and inclusive media landscapes.

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