

Exploring the use of SIBIKU multimedia to enhance learning participation among deaf students in a special school context

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- A – Research concept and design
- B – Collection and/or assembly of data
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- F – Final approval of article



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ABSTRACT

Background: Observations at SLB C YPALB Perwari Kuningan indicate low motivation and limited participation among deaf students during learning activities. Interactive multimedia such as SIBIKU is expected to address these challenges.

Objectives: This study aims to (1) examine the implementation of SIBIKU multimedia in learning, (2) analyze students' responses, and (3) evaluate changes in students' learning participation and vocabulary acquisition.

Methods: This study employed a descriptive qualitative design with a field-based approach. Participants were selected using purposive sampling, consisting of one teacher and deaf students involved in computer learning activities. Data were collected through participatory observation, semi-structured interviews, and documentation. The main instrument was the researcher, supported by observation and interview guidelines. Data were analyzed using thematic analysis following Miles and Huberman's model, including data reduction, data display, and conclusion drawing, with triangulation to ensure validity.

Results: The findings show that SIBIKU multimedia enhances student participation, as indicated by (1) increased attention to learning media, (2) active imitation of sign language movements, (3) higher frequency of student interaction and turn-taking, and (4) greater engagement in learning tasks such as word-guessing activities. Students also demonstrated improved motivation and more independent learning behavior.

Conclusions: SIBIKU multimedia provides a visually rich, interactive learning environment that effectively increases participation and engagement among deaf students, making it a promising tool for inclusive education.

Keywords: deaf students, multimedia learning, participation, qualitative study, SIBIKU.

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INTRODUCTION

Learning in the 21st century, particularly in the era of the Industrial Revolution 4.0, requires students to develop critical, creative, collaborative, and communicative competencies (Budiyanto et al., 2024; Indriani et al., 2021; Tohani & Aulia, 2022). This demand applies not only to students in general education but also to children with special needs, including those with hearing impairments. Therefore, learning approaches must be adaptive and aligned with students' characteristics, abilities, and learning preferences to ensure inclusive and equitable education. In this context, technology-based learning media, especially multimedia, plays a crucial role in facilitating meaningful learning experiences (Jayasekara, 2024).

Children with special needs require specialized educational services tailored to their individual conditions to optimize their development potential (Kumar, 2025; Scifo et al., 2025). In Indonesia, such services are provided through special schools (SLB) and inclusive schools. Among various categories of children with special needs, deaf students face significant challenges in communication and language acquisition due to hearing limitations, which often impact their participation in classroom activities (Yusuf et al., 2022). As a result, learning strategies for deaf students must emphasize visual-based approaches and interactive media to support comprehension and engagement.

Multimedia learning has been widely recognized as an effective approach to enhance student engagement and learning outcomes. According to Mayer (2009), multimedia learning integrates visual and auditory information to improve understanding and retention. In the context of deaf education, visual-based multimedia is particularly important because it aligns with students' reliance on visual perception (Debevc et al., 2010). Furthermore, the integration of inclusive educational technologies has been shown to support accessibility and participation among students with diverse needs (Al-Azawei et al., 2016).

However, several previous studies still show important limitations. First, research by Debevc et al. (2010) focused on multimedia accessibility for deaf users through sign language interpreters but did not examine its impact on classroom participation. Second, Al-Azawei et al. (2016) discussed inclusive learning design frameworks but did not specifically address the implementation of interactive multimedia in special school contexts. Third, studies on multimedia learning based on Mayer (2009) mainly emphasize cognitive outcomes rather than behavioral aspects such as student participation and social interaction. These gaps indicate that there is still limited research that integrates sign language-based multimedia, classroom participation, and real implementation in special school environments.

Based on these limitations, this study introduces a novel approach by implementing SIBIKU, an interactive multimedia application specifically designed for deaf students that integrates sign language videos, interactive exercises, and gamification features. The novelty of this study lies in its focus on (1) sign language-based multimedia tailored for deaf learners, (2) its implementation in an authentic special school setting, and (3) its emphasis on improving student participation and behavioral engagement rather than solely cognitive outcomes.

The urgency of this study is grounded in the low level of student participation observed at SLB C YPALB Perwari Kuningan, where many deaf students show limited motivation and involvement during learning activities. Without appropriate learning media, these challenges may hinder students' ability to fully engage in the

learning process and develop essential competencies. Therefore, innovative and accessible multimedia solutions are needed to address these issues.

Accordingly, this study aims to: (1) examine the implementation of SIBIKU multimedia in learning activities, (2) analyze students' responses to its use, and (3) evaluate its role in increasing participation and engagement among deaf students. The findings of this study are expected to contribute to the development of inclusive, technology-based learning practices by providing empirical evidence on the effectiveness of interactive multimedia in enhancing participation among students with special needs, particularly in special school contexts.

METHODS

Study Design and Participants

This study employed a descriptive qualitative design with a field-based approach to explore in depth the implementation of SIBIKU learning multimedia and its role in enhancing the participation of deaf students. A qualitative approach was chosen to capture participants' experiences, interaction patterns, and behavioral changes during the learning process, rather than to test statistical hypotheses.

The participants consisted of one computer skills teacher and eight deaf students enrolled at SLB C YPALB Perwari Kuningan, Indonesia. The students were aged between 12–15 years and had moderate to profound hearing impairments, with basic abilities in sign language communication. Participants were selected using purposive sampling, based on their direct involvement in computer learning activities utilizing SIBIKU multimedia. This sampling ensured that the data reflected authentic classroom practices within a special education context.

Ethical approval statement

The study received approval from the ethical committee at the Universitas Muhammadiyah Kuningan with the assigned approval number 014/KEP/II.3.ETIK.0/B/2025.

Procedure

The study was conducted over a period of four weeks, consisting of eight learning sessions (two sessions per week, each lasting approximately 60 minutes).

The research procedure was carried out in three main stages. First, preliminary observation was conducted to identify initial learning conditions, student participation levels, and challenges faced by teachers in teaching deaf students. Second, the implementation stage involved the integration of SIBIKU multimedia into computer learning activities across the eight sessions. During this stage, the teacher used the application as the primary instructional medium, while students engaged in interactive features such as sign language videos and word-guessing exercises.

Throughout the implementation, the researcher conducted participatory observations to document students' behavioral engagement, interaction patterns, and responses to the multimedia. The final stage involved semi-structured interviews with the teacher and selected students to explore their experiences, perceptions, and perceived changes in learning participation. All activities were conducted in a natural classroom setting without altering the regular instructional structure.

Research Instruments

In qualitative research, the researcher served as the primary instrument responsible for data collection and interpretation. To support the data collection process, several instruments were employed:

1. Observation guidelines, used to systematically record indicators of student participation, such as attention, interaction, and engagement;
2. Semi-structured interview guides, designed to explore participants' experiences, perceptions, and challenges related to the use of SIBIKU; and
3. Documentation, including lesson plans, application screenshots, and field notes of classroom activities.

The use of multiple instruments enabled the collection of comprehensive and in-depth data while enhancing the credibility of the findings.

Data Analysis

Data were analyzed using thematic analysis based on Miles and Huberman's interactive model, which consists of data reduction, data display, and conclusion drawing. In the data reduction stage, data obtained from observations, interviews, and documentation were coded and categorized into relevant themes, such as student participation, engagement, and behavioral changes.

In the data display stage, findings were organized into descriptive narratives and thematic matrices to facilitate pattern identification and interpretation. Finally, conclusions were drawn through an iterative process of verification by comparing data across sources.

To ensure the trustworthiness of the data, this study applied triangulation of data sources and techniques, as well as prolonged engagement during the fieldwork. These strategies strengthened the validity and reliability of the research findings.

RESULTS

In this study, student participation is defined as observable behavioral engagement during learning activities, including attention, interaction, response to tasks, and involvement in classroom activities. The concept of increase in participation refers to a qualitative improvement in the frequency, intensity, and diversity of these observable behaviors across learning sessions. This includes changes from passive behaviors (e.g., silence, lack of response) to active engagement (e.g., imitating movements, asking questions, volunteering to participate).

Table 1. Summary of Themes and Participation Indicators

Theme	Description	Participation Indicators
Integration of Multimedia	Use of SIBIKU in classroom learning	Students focus on screen, follow instructions, explore application features
Interaction	Student engagement with content and peers	Imitating sign movements, asking questions, demonstrating to peers
Motivation	Emotional and behavioral involvement	Showing enthusiasm, asking for turns, repeating activities voluntarily
Behavioral Change	Changes in learning patterns	Increased attention span, reduced passivity, more independent learning

Theme 1: Integration of SIBIKU Multimedia in Learning Practices

The first theme describes how SIBIKU multimedia is gradually integrated into computer skills learning. Teachers use this application as the main medium for delivering sign language vocabulary, independent exercises, and informal evaluations. In the initial stage, teachers introduce the application interface and the functions of each menu to students (Figure 1).



Figure 1. Sibiku Application Interface

After the introduction, students were given the opportunity to explore the application directly. Observations showed that this approach facilitated the transition from conventional learning to multimedia-based learning. The teacher said:

“With SIBIKU, children understand more quickly. I don't need to explain things over and over again; they can immediately see and imitate the movements from the video.” (Teacher)

This shows that multimedia not only functions as a visual aid, but also as a facilitator of independent learning for deaf students.

Theme 2: Active Participation through Interactive Application Features

The second theme highlights the increase in student participation that has resulted from the use of interactive features in the SIBIKU application. The letters and numbers menu is the starting point for student engagement because it presents simple and easy-to-follow visuals (Figure 2).

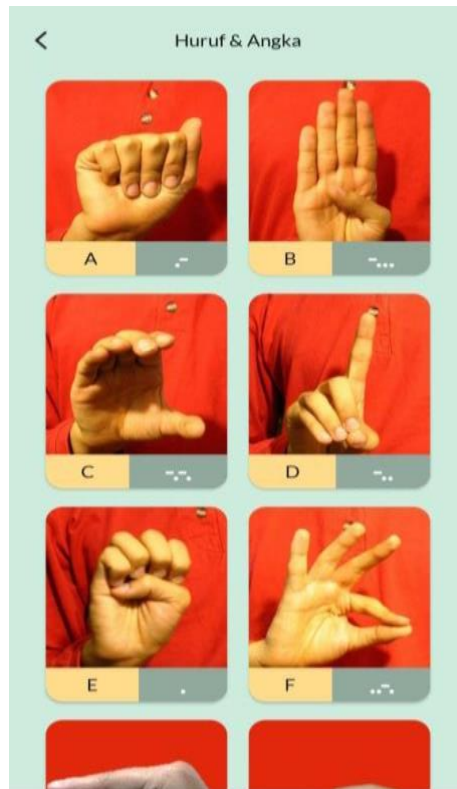


Figure 2. Letters and Numbers in the SIBIKU Application

Observations showed that students focused more on the screen, imitated sign movements, and actively asked for turns to try. One student said:

"I like the letters, the pictures move so I can follow along." (Student)

Participation increased significantly when students used the sign language menu that displayed videos of sign language movements.



Figure 3. Sign Language Section in the SIBIKU Application

Students not only imitated the movements, but also demonstrated them to their classmates (Figure 3). The teacher observed:

"They are usually quiet, but now they show the movements to their friends. The class has become more lively." (Teacher)

These findings show that visual and video features play an important role in encouraging active participation and social interaction among deaf students.

Theme 3: Emotional Engagement and Learning Motivation through Word Guessing Activities

The third theme relates to changes in student learning motivation, which are clearly evident in the use of the word guessing menu. This feature serves as both practice and informal evaluation, packaged in the form of an interactive game (Figure 4).

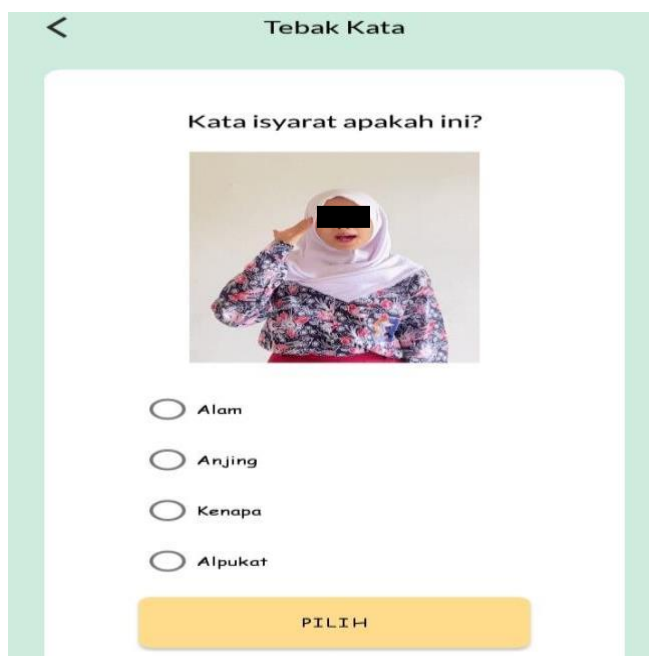


Figure 4. Guess the Word Section in the SIBIKU App

Students showed high enthusiasm, waited for their turn, and responded actively. One student said:

“Guessing words is like playing a game, so I want to keep trying.” (Student)

The teacher also added that students who were previously passive became more courageous in participating:

“Children who usually don't want to try are now asking to try again. They look happy and are not afraid of making mistakes.” (Teacher)

These findings show that gamification elements in multimedia can increase students' intrinsic motivation and create a more enjoyable learning experience.

Theme 4: Changes in Learning Behavior and Classroom Environment

The final theme shows changes in students' overall learning behavior. After using SIBIKU, students are more focused, maintain their attention longer, and are more independent in following lessons. Teacher-student interactions have become more balanced because teachers no longer dominate explanations but instead act as facilitators. Teachers shared the following reflections:

“Now it is easier for me to manage the class because the children are focused on the media. Learning is more focused and they don't get bored easily.” (Teacher)

These findings show that SIBIKU multimedia not only increases individual participation, but also helps create a learning environment that is more conducive, inclusive, and responsive to the needs of deaf students.

DISCUSSION

This study demonstrates that the use of SIBIKU multimedia learning contributes positively to increasing the learning participation of deaf students in computer skills learning. The findings indicate that the integration of visual elements, videos, and interactive features within the application enhances students' attention, active involvement, and motivation during the learning process. This improvement in participation is reflected in observable behavioral changes, including increased focus, more frequent interaction, and greater willingness to engage in learning activities. These results support the broader perspective that multimedia-based learning environments play a crucial role in facilitating meaningful learning experiences for students with special needs, particularly those with hearing impairments who rely heavily on visual stimuli (Mayer, 2009; Debevc et al., 2010).

The increase in student participation can be further explained through the lens of multimedia learning theory, which emphasizes the integration of multiple sensory channels to enhance understanding. In the context of deaf students, the dominance of visual processing makes video-based sign language representations significantly more effective than text-based or static instructional materials. The use of dynamic visualizations in SIBIKU allows students to directly observe and imitate sign language movements, thereby supporting both comprehension and active engagement. This aligns with previous findings that interactive multimedia can increase learning engagement by presenting information in a more accessible, attractive, and cognitively meaningful way (Moreno & Mayer, 2007). Furthermore, the findings extend prior research by demonstrating that multimedia does not only improve cognitive outcomes but also influences behavioral dimensions of learning, particularly participation and interaction.

In addition to cognitive and behavioral engagement, the role of gamification features, such as the word-guessing menu, is particularly significant in fostering emotional engagement among students. The results show that students become more enthusiastic, actively seek opportunities to participate, and demonstrate persistence in completing tasks. This supports the argument that learning environments that incorporate elements of play can reduce psychological barriers, such as fear of making mistakes, and increase intrinsic motivation (Clanton Harpine, 2024). From a theoretical perspective, this finding is consistent with self-determination theory (Ryan & Deci, 2024), which highlights the importance of autonomy, competence, and enjoyment in driving student engagement. When learning activities are perceived as enjoyable and interactive, students are more likely to participate actively and sustain their attention (Liaw & Huang, 2013; Sun, & Hsieh, 2018).

Another important finding of this study is the changing role of the teacher during the implementation of multimedia learning. The use of SIBIKU shifts the instructional approach from teacher-centered to more student-centered learning, where the teacher acts as a facilitator rather than the primary source of information. This transformation enables students to explore learning materials independently while still receiving guidance when needed (Bonfield et al., 2020). Such a shift is particularly important in special education contexts, where individualized support and flexible learning environments are essential. This finding reinforces constructivist

learning principles, suggesting that active engagement and interaction with learning media can enhance knowledge construction and participation (Machumu & Zhu, 2017).

However, the increase in participation observed in this study should also be critically examined in relation to the novelty effect of technology. The introduction of a new and interactive multimedia application may initially attract students' attention and stimulate enthusiasm due to its novelty. While this effect contributes positively to engagement, it raises questions about the sustainability of participation over time. Without continuous development of content and features, the level of engagement may decrease as students become familiar with the application (Imlawi, 2021). Therefore, future studies should investigate the long-term effectiveness of multimedia learning and explore strategies to maintain student engagement beyond the initial implementation phase.

LIMITATIONS OF THE STUDY

Despite the positive findings, several limitations need to be acknowledged. First, the implementation of SIBIKU multimedia still relies on teacher assistance, particularly during the early stages of use. This indicates that the application has not yet fully supported independent learning among students. The development of more structured usage guidelines and user-friendly interfaces is necessary to enhance student autonomy (Saxena, Voss, & Mahmood, 2024). Second, the content of the application is still limited to certain vocabulary areas, which may restrict its broader applicability in different learning contexts. Continuous content expansion and contextualization are essential to ensure the sustainability and relevance of the application.

This study is also limited by its small sample size and focus on a single special school, which limits the generalizability of the findings. In addition, the use of qualitative methods means that the increase in participation is interpreted based on observed behaviors and participant perceptions rather than quantitative measurement (Jervis & Drake, 2014). Therefore, future research is recommended to adopt mixed-method approaches that combine qualitative insights with quantitative data to provide a more comprehensive evaluation of multimedia learning effectiveness.

From a practical perspective, the findings of this study have important implications for both educational practice and policy. Schools should consider integrating interactive multimedia into special education curricula as a strategy to enhance student participation and engagement. This requires institutional support in terms of teacher training, infrastructure development, and access to digital learning resources. Furthermore, from a design perspective, the development of inclusive multimedia should prioritize visual clarity, interactivity, and alignment with sign language communication to meet the specific needs of deaf learners.

Overall, this study confirms that SIBIKU multimedia learning has strong potential as an inclusive learning tool that supports not only cognitive understanding but also active participation, motivation, and social interaction among deaf students. With further development in terms of content, usability, and scalability, such multimedia applications can become sustainable solutions for improving the quality of learning in special education contexts.

CONCLUSIONS

This study concludes that the use of SIBIKU learning multimedia plays a positive role in increasing the learning participation of deaf students by providing visual, interactive, and contextual learning experiences. The integration of sign language video features, interactive exercises, and gamification elements enables students to be more actively involved in the learning process, while also assisting teachers in creating a more conducive and inclusive learning environment. The findings confirm that interactive multimedia can serve as an effective alternative learning medium for children with special needs, particularly in learning contexts that rely heavily on visual engagement.

Despite these promising results, this study has several limitations, particularly in terms of the small number of participants and the focus on a single school context, which limits the generalizability of the findings. Nevertheless, this study provides empirical contributions to the development of technology-based learning practices in special education and offers a foundation for further exploration of multimedia learning for deaf students.

Future research is strongly recommended to expand this study by employing quantitative approaches to measure the effectiveness of multimedia learning more objectively, including the use of standardized participation scales. In addition, controlled experimental designs are needed to compare the impact of multimedia learning with conventional instructional methods in order to determine causal relationships. Further studies should also explore the implementation of similar multimedia applications in diverse inclusive education contexts, including different types of special schools and inclusive classrooms, to examine the scalability and adaptability of such technologies across various learning environments.

AI DISCLOSURE STATEMENT

During the preparation of this manuscript, the authors used Grammarly (Grammarly Inc.) to improve the readability, grammar, and clarity of the writing. All suggestions provided by the tool were carefully reviewed and selectively applied by the authors. The authors take full responsibility for the accuracy, integrity, and content of this manuscript.

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DATA AVAILABILITY

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to restrictions containing information that could compromise the privacy of research participants.

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CONFLICT OF INTEREST

The author hereby declares that this research is free from conflicts of interest with any party.

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