# Enhancing Writing Skills of Deaf Students through Animated Video

Wan Zhaliha[1], Sunardi[1], Subagya[1], Joko Yuwono[1]

[1]Special Education Magister Department, Faculty of Teacher Training and Education, Universitas Sebelas Maret. Jl. Ir. Sutami 36A, Surakarta 57126, Central Java, Indonesia

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**ABSTRACT:**

This study aims to develop animated video-based learning media to enhance the writing skills of deaf students. The research employed a Research and Development (R&D) approach using the ADDIE model. The participants included 90 special education teachers for needs analysis and 11 deaf students from three special schools for product testing. Data were collected through questionnaires and performance tests, and analyzed using both descriptive and inferential statistics. The developed animated video was designed with accessible features and evaluated through expert validation as well as limited and extensive field trials. The results indicated that the media was highly feasible in terms of design and functionality. Furthermore, the statistical test results showed a significance value of 0.003 (Asymp. Sig. 2-tailed), indicating a significant difference between pre-test and post-test scores. This finding confirms that the animated video media effectively improved students' ability to construct sentences and apply proper writing structures. The integration of visual and interactive elements successfully increased engagement and motivation. The study concludes that animated video media provides an effective and practical solution for supporting the writing development of deaf students, thereby contributing to more inclusive learning practices in special education.

Keywords: Development; Animated Video; Writing Skills; Deaf Students.

## 1. Introduction

Writing is one of the essential skills in language learning, serving not only as a means of communication but also as a tool for organizing ideas, fostering creativity, and supporting academic achievement. Unlike speaking, which is immediate and transient, writing requires accuracy, coherence, and clarity in order to convey thoughts effectively (Jones et al., 2021). For students with normal hearing ability, acquiring writing skills is often a gradual process that develops through continuous exposure to oral language, reading, and structured instruction. However, for students with hearing impairments, writing presents a significant challenge due to their limited access to auditory information, which plays a critical role in the acquisition of vocabulary, sentence structure, and grammar (Gargiulo & Bouck, 2019).

Deaf and hard-of-hearing students rely heavily on visual modalities to process and acquire knowledge. While sign language provides them with an accessible medium of communication, the structural differences between sign language and spoken or written languages often create difficulties in mastering written forms, especially in languages that require strict adherence to grammatical rules, such as Indonesian. Previous studies have shown that children with hearing impairments frequently encounter errors in sentence construction, tend to omit affixes, and often write in reversed structures that do not align with the Subject–Predicate–Object–Complement format required in formal writing (Kadarisma & Juandi, 2021). These challenges are compounded by limited vocabulary acquisition and difficulties in understanding abstract concepts, which further hinder their ability to express ideas in writing.

At the global level, inclusive education has emphasized the importance of ensuring equal access to quality education for students with special needs, including those with hearing impairments. International frameworks such as the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) stress the necessity of providing appropriate accommodations and accessible learning resources. In Indonesia, the government has introduced initiatives such as the Sistem Isyarat Bahasa Indonesia (SIBI) was developed by adopting the concept of Total Communication, combining manual and non-manual signs in the process of conveying messages. Unlike natural sign languages, which have their own structure, SIBI follows Indonesian grammar. Consequently, word formation in SIBI is more complex because it requires combining basic signs with affixes, in accordance with Indonesian linguistic rules (Darmawan et al., 2025).

Numerous interventions have been attempted to address these issues, ranging from the use of picture cards and scramble methods to multimodal approaches integrating visual and textual input (Agalyasri & Bhuvaneswari, 2023). While these methods have shown partial effectiveness, many of them lack sustained engagement and fail to provide learners with the dynamic and interactive learning experience needed to improve writing skills. As highlighted by Aljedaani et al., (2023), deaf students often struggle to maintain attention and motivation in traditional learning settings, which makes it crucial to adopt more engaging and visually oriented media. Research has shown that interactive digital tools, such as gamified learning platforms, can significantly enhance motivation and literacy outcomes for deaf learners (Chan et al., 2022). Moreover, the integration of sign language-based animations has been found to improve comprehension and retention among students with hearing impairments, as it aligns better with their natural visual learning styles (Dostal et al., 2025).

Multimedia-based instructional tools, particularly animated video, have gained recognition as powerful resources for enhancing learning outcomes. Animated video combine visual, textual, and auditory elements into a single medium, allowing learners to experience content in a concrete and interactive way. For deaf students, animation offers significant potential as it maximizes the use of visual input, presents language concepts through visual storytelling, and provides captions or sign language integration to bridge linguistic gaps (Tamayo, 2022). Empirical studies have demonstrated the effectiveness of animated video in improving narrative writing, storytelling, and linguistic intelligence among students, including those with special educational needs (Winarsih et al., 2024).

Nevertheless, despite the growing body of evidence supporting the use of animated media, there is still a lack of research specifically addressing the difficulties deaf students in Indonesia face in constructing grammatically accurate sentences, particularly in applying the correct Subject-Predicate-Object-Complement structure. Many existing instructional resources remain text-heavy, abstract, or insufficiently contextualized for students who primarily rely on visual modes of learning. This research gap underscores the need for innovative and accessible learning media that not only align with the curriculum but also provide structured support for improving sentence formation skills. Therefore, this study seeks to respond to these challenges by developing animated

video-based learning media designed to enhance the writing abilities of deaf students. By integrating multimodal features such as visual cues, captions, and interactive exercises, the media aims to foster greater engagement, enhance comprehension, and guide learners in producing correct sentence structures. Beyond its pedagogical contribution, this research holds practical significance for teachers, parents, and policymakers in advancing inclusive education practices and ensuring that deaf students are equipped with the necessary literacy skills to participate fully in academic and social life

## 2. Methodology

### Study Design

This study employed a Research and Development (R&D) approach with the aim of developing animated video media to improve the writing skills of deaf students. The R&D design was chosen because it allows researchers to systematically analyze needs, design instructional media, and test its effectiveness through iterative stages of development. Specifically, this research utilized the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The analysis stage was carried out to identify the specific learning needs of deaf students, particularly their difficulties in sentence construction, vocabulary usage, and grammatical accuracy. In the design stage, researchers developed initial concepts for animated video learning media that were adapted to the linguistic characteristics and learning styles of deaf students. The development stage involved producing the media in the form of animated video equipped with captions and visual cues. The implementation stage was conducted through limited and extensive trials involving deaf students, while the evaluation stage focused on assessing feasibility, effectiveness, and practicality based on expert validation and student performance outcomes.

Data collection techniques in this study included questionnaires and student performance tests. Questionnaires were distributed to gather expert assessments regarding the feasibility and appropriateness of the developed media, while performance tests were administered to measure improvements in students' writing skills before and after using the animated video. The data were analyzed using quantitative descriptive analysis to determine the level of feasibility and effectiveness of the media. The feasibility data from experts were analyzed using a percentage scale to categorize the product's quality, whereas the performance test results were analyzed using gain score analysis to evaluate the improvement in students' writing ability. By integrating development procedures with quantitative analysis, this study ensured that the resulting product was not only theoretically sound but also empirically validated as an effective instructional tool for enhancing the writing skills of deaf learners.

### Instruments

The instruments used in this study were designed to measure both the feasibility of the developed animated video media and its effectiveness in improving the writing skills of deaf students. To assess the feasibility, validation sheets were employed and distributed to media experts, material experts, and practitioners. These validation sheets contained indicators related to content appropriateness, media design, language clarity, technical quality, and pedagogical relevance (Table 1). The experts provided assessments using a Likert scale, and their feedback served as the basis for revising and refining the animated video media.

Table 1. Evaluate the effectiveness of the media grid

| No | Aspects | Indicator |
|---|---|---|
| 1. | Material | The media can be used as a learning tool. |
| 2. | Functionality | The media features function well. |
| 3. | Language | The language is easy to understand. |
| 4. | Display | The media display is attractive and easy to understand. |
| 5. | Audio | The sound is clear and increases enthusiasm. |

Table 2. Evaluate the effectiveness of the media grid

| No | Aspects | Indicators |
|---|---|---|
| 1. | The content of the ideas presented | In-depth understanding of the topic being written |
| 2. | Construction/writing structure/organization of content | a. The ability to connect ideas appropriately<br>b. The ability to construct effective sentences |
| 3. | Grammar | Correct writing of the S-P-O structure |
| 4. | Writing grammar includes accuracy of writing and punctuation. | a. Correct writing<br>b. Correct punctuation<br>c. Correct capitalization |

To evaluate the effectiveness of the media, student performance tests were administered before and after the implementation of the animated video (Table 2). The writing test was structured to measure several key indicators of writing skills, including idea development, organization of sentences and paragraphs, vocabulary usage, grammatical accuracy, and mechanics such as punctuation and spelling (Taye & Mengesha, 2024). These indicators were adapted from standardized writing rubrics to ensure that the assessment was comprehensive and aligned with educational standards. In addition to tests, questionnaires were also given to students to capture their responses toward the animated video media, focusing on aspects such as attractiveness, ease of use, clarity of instructions, and perceived usefulness in supporting their learning process.

**Procedure**

The procedure of this study followed the stages of the Research and Development (R&D) model with reference to the ADDIE framework, which consists of analysis, design, development, implementation, and evaluation. At the analysis stage, the researcher identified the learning needs of deaf students through observation and preliminary discussions with teachers. This stage revealed that students often faced difficulties in constructing grammatically correct sentences, using appropriate vocabulary, and organizing ideas coherently. Based on this needs assessment, the design stage was carried out by preparing storyboards, scripts, and instructional frameworks for the animated video media. The design emphasized the integration of visual cues, written captions, and clear narrative structures that could support students' comprehension and writing practice.

The animated video media was produced according to the design specifications, incorporating expert suggestions and feedback to ensure that the product was both pedagogically sound and technically feasible by experts. Revisions were made based on their evaluations before proceeding to the implementation stage. During implementation, the media was tested in two phases a limited field test involving a small group of deaf students to identify practical issues, followed by a extensive field test with all participants to measure effectiveness more comprehensively. At each stage, data were collected through questionnaires, expert validation sheets, and student performance tests. Finally, the evaluation stage was conducted to analyze the data and determine the overall feasibility and effectiveness of the animated video media.

**Participants**

This study involved two groups of participants: teachers and students with hearing impairments. The needs analysis phase included 90 special education teachers from across Central Java, all of whom taught grade VIII deaf students. Their input was essential for identifying classroom challenges, determining the relevance of animated video media, and validating its alignment with the learning needs of deaf learners.

For the development and testing phases, the participants were deaf students enrolled in grade VIII at different special schools in Indonesia. The Limited Field Test was conducted with five students from SLB YRTRW Surakarta, while the Extensive Field Test involved six students were three from SLB YAAT and three from SLB Negeri Karanganyar. They shared common characteristics such as limited vocabulary mastery, frequent grammatical errors in writing, and difficulties in constructing coherent sentences conditions directly related to the focus of this study on improving writing skills. Despite these challenges, the students possessed normal intellectual potential and were able to follow structured learning activities when supported with appropriate instructional media.

## 3. Results

### Analysis of Teacher Needs for the Development of Animated Video Media

The selection of this research location was based on the consideration that these schools have students with hearing impairments (deaf) who require innovative learning media to support the development of writing skills, particularly in learning the Subject-Predicate-Object (SPO) sentence structure. The data collection process was carried out through a needs analysis questionnaire given to teachers at the three schools. The questionnaire was designed to determine the current state of writing learning, the media used, the obstacles faced, as well as the teachers' hopes and needs for the development of animated video-based learning media. The need to develop these animated video was also based on the teachers' hopes that the resulting learning media would not only add variety, but could actually increase student motivation, engagement, and learning outcomes, particularly in writing skills. The teachers wanted the features in the animated video to be able to adapt to the characteristics of deaf students, with simple yet communicative image presentation, clear text use, and easy-to-understand visual narratives.

Table 3. Analysis of Teacher Needs for Animated Video Development

| No. | Indicator | Percentage |
|---|---|---|
| | ***Present condition*** | |
| 1. | Frequency of media use in learning | 100% Often |
| 2. | Type of media used in learning | 66.67% Visual<br>33.33% Audio |
| 3. | Media sources used in learning | 33.33% Social Media<br>33.33% Assistance from other parties<br>33.33% Government assistance |
| 4. | Frequency of media use in SPO learning | 100% Rare |
| 5. | Types of media used in SPO learning | 66.67% Writing<br>33.33% Image |
| 6. | Effectiveness of media use in SPO learning | 100% Ineffective |
| 7. | Deaf students are more responsive to visual media than text. | 33.33% Agree<br>66.67% Strongly agree |
| 8. | Deaf students' interest in SPO learning media | 100% Not interested |
| 9. | Deaf students feel bored during SPO learning | 100% Agree |
| 10. | Reasons why students experience difficulties in understanding SPO material | 33.33% of SPO material is too abstract/not contextual<br>33.33% Differences in the structure of sign language and written language |

| | | |
|---|---|---|
| | | 33.33% Limited language access through hearing |
| 11. | Strategies used in SPO learning | 33.33% Give example sentences<br>33.33% Demonstration of the meaning of subject, predicate, object<br>33.33% Understanding of subject, predicate, object |
| | ***Perception of Animated Video Development*** | |
| 1. | Using animated video in SPO learning | 66.67% Strongly agree<br>33.33% Agree |
| 2. | Student interest level | 66.67% Interesting<br>33.33% Very interesting |
| | ***Required Features*** | |
| 1. | Sign interpreter | 100% Agree |
| 2. | Caption | 100% Agree |
| 3. | Questions and Answers | 66.67% Agree<br>33.33% Strongly Agree |
| 4. | Audio | 66.67% Agree<br>33.33% Strongly Agree |
| 5. | Characteristics and context in everyday life | 33.33% Strongly agree<br>66.67% Agree |
| 6. | Clear and precise language | 66.67% Strongly agree<br>33.33% Agree |
| 7. | Color | 33.33% Primary or basic<br>66.67% Combined |
| 8. | Time | 100%<br>3-5 minutes |
| 9. | Font type | 66.67%<br>Calibri<br>33.33% Times New Roman |
| 10. | Font size | 66.67% 16<br>33.33% 14 |
| 11. | Accessible media | 66.67% Smartphones, laptops, tablets<br>33.33% Smartphones |

Based on the results of the needs analysis, it was found that although 100% of teachers stated that they frequently use media in learning, the types of media used were still limited to visual media 66.67% and audio 33.33%. The sources of learning media also varied, with one-third of teachers relying on social media, one-third on assistance from other parties, and one-third on government assistance. However, when it came to learning to write SOP sentences, 100% of teachers revealed that they rarely used media and considered the existing media ineffective. The types of media used were still predominantly written 66.67% and images 33.33%, which were considered less effective in increasing the interest of deaf students.

Field findings indicate that deaf students are more responsive to visual media than text, with 66.67% of teachers stating that they strongly agree and 33.33% agree. However, all 100% of teachers stated that students were not interested in the existing SPO learning media and even felt bored during the learning process. This indicates a gap between the media used by teachers and students' learning needs. The main causes of students'

difficulties in understanding SPO material were identified in three factors, each with the same percentage of 33.33%, namely: (1) SPO material that is considered too abstract and not contextual, (2) the difference in the structure of sign language and written language, and (3) limited language access due to hearing impairments.

To address these challenges, teachers employ a variety of strategies, including providing example sentences, demonstrating the meaning of subjects, predicates, and objects, and providing an understanding of the structure of SOP. However, these strategies are still considered less than optimal without the support of learning media appropriate to the characteristics of deaf students. Therefore, the majority of teachers emphasize the importance of using animated video as an alternative medium. Sixty-six-seven 66.67% strongly agreed and 33.33% agreed that the use of animated video would be effective in SOP learning, and they were even considered interesting by 66.67% and very interesting by 33.33% for deaf students.

Teachers provide input regarding the features needed in developing animated video. The analysis results show that there are several features that are the main needs, namely the presence of sign language interpreters and captions each 100% agree, the provision of questions and audio, and the use of characteristics close to the context of students' daily lives. From a technical aspect, teachers recommend that animated video be 3–5 minutes long, use attractive color combinations 66.67%, Calibri font type 66.67% with size 16 66.67%, and can be accessed via smartphones, laptops, or tablets.

**Animated Video Product**

The product developed in this research is an animated learning video specifically designed to support the writing skills of deaf children, particularly in understanding the Subject–Predicate–Object (SPO) sentence structure. This animated video was compiled based on the results of an analysis of teacher and student needs, so that each component displayed has considered pedagogical, visual, and accessibility aspects. In general, the animated video product consists of three main parts: the initial display, the main display, and the final display, each of which has its own function and characteristics.

The opening screen of the animated video displays the author's identity, video title, learning elements, outcomes, and learning objectives (Figure 1). This section serves as an initial orientation, providing students with an overview of what they will learn. Furthermore, the opening screen is designed to create an engaging first impression through the selection of bright colors, the use of clear and easy-to-read fonts, and simple yet communicative transition animations. The presence of the author's identity in this section aims to provide product legitimacy, while the presentation of learning objectives helps deaf students understand the direction of their learning. With an organized information structure from the start, both teachers and students can more easily connect the video material to classroom learning needs.

Figure 1. Initial View of the Animated Video

The core section is the most important component of the animated video because it contains the SOP learning material. At this stage, the video explains how a simple sentence can be formed using the order of Subject, Predicate, and Object (Figure 2). The material is presented using a combination of visuals in the form of illustrations, written text, character animations, and support from a sign language interpreter. With this multimodal approach, deaf students not only read text but also understand concepts through visual representations and sign language. To facilitate understanding, SOP sentences used in the video are taken from the context of students' daily lives, such as activities at school, at home, and in their social environment. This is in line with the results of the needs analysis, which showed that contextual material is easier for students to understand than abstract material. Furthermore, the core section also includes simple questions aimed at directly checking students' understanding. These questions are presented in an interactive visual format, for example by showing images of certain situations and then asking students to identify the subject, predicate, and object.

Figure 2. Core View of Animated Video

The animated video concludes with positive affirmations, including "Terimakasih" and "Selamat Belajar!" These affirmations serve more than just a closing message (Figure 3); they also serve as a form of motivation and appreciation for students upon completing the lesson. Positive affirmations can provide a sense of satisfaction and boost enthusiasm for learning, especially for deaf students who often require non-verbal reinforcement to maintain motivation. With a simple yet communicative presentation, the video's ending creates a positive impression, encouraging students to return to the classroom the next time.

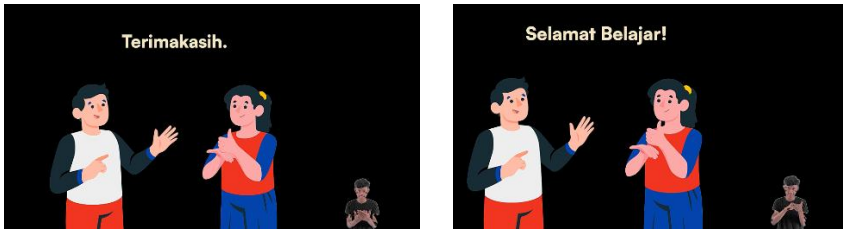


Figure 3. Positive Affirmation Animated Video

The animated video are designed for flexible access across a variety of devices, including smartphones, laptops, and tablets. The video files are packaged in MP4 format, making them compatible with almost all commonly used digital media players. Teachers and students can download these files and play them at any time, whether in the classroom or at home. Furthermore, the video are equipped with playback controls that allow users to play, pause, rewind, and adjust the speed of the display as needed. This is important for deaf students, as they take longer to comprehend material presented in visual and text formats. Volume adjustments are also available, although the video' primary focus is on the visual aspects and sign language. Compatibility tests have been conducted to ensure that video can be played optimally on various screen resolutions, both on small devices

like smartphones and large screens like laptops or projectors. This ensures that visual quality and content clarity are maintained without distortion. Colors, font types, and font sizes have also been adjusted to ensure clarity even on low-resolution devices.

**Limited Field Test**

A limited field trial was conducted to obtain initial feedback from students as direct users of the developed animated video product. This small sample size allowed researchers to obtain more specific feedback on material, functionality, language, display, and audio aspects before the product was tested more widely.

Table 4. Limited Field test

| Student Name | Aspect | | | | |
|---|---|---|---|---|---|
| | Material | Functionality | Language | Appearance | Audio |
| D | 9 | 9 | 11 | 29 | 9 |
| F | 10 | 10 | 15 | 28 | 9 |
| N | 10 | 9 | 14 | 30 | 10 |
| R | 8 | 9 | 13 | 29 | 10 |
| V | 9 | 10 | 14 | 28 | 10 |
| Number of Questions | 2 | 2 | 3 | 6 | 2 |
| Total Score | 46 | 47 | 67 | 144 | 48 |
| Average | 9.2 | 9.4 | 13.4 | 28.8 | 9.6 |
| Average Score: 70.4 | | | | | |

$$\text{Result} = \frac{N\ Score}{Max\ Score} \text{ x } 100 = 93{,}86$$

The average score obtained from the five aspects was 70.4, with a feasibility level calculation of 93.86% in (Table 4). This figure indicates that the animated video product is included in the category of very suitable for use. Specifically, the highest score was in the appearance aspect with an average of 28.8, indicating that students found the visual appearance of the animated video very interesting and easy to understand. The language aspect also received a fairly high score with an average of 13.4, indicating that the use of text and visual narration in the video is appropriate to the needs of deaf students. Students also provided suggestions for improvement, particularly regarding the size of the sign language interpreter featured in the video. According to students, the size of the sign interpreter needs to be enlarged to make it easier to see clearly and not complicate understanding. This is an important note for researchers to revise the product before moving on to a larger trial phase. Therefore, it can be concluded that the developed animated video product is suitable for larger-scale testing after improvements were made based on student feedback.

**Extensive Field Test**

The next stage was an Extensive Field test, which aimed to obtain a broader picture of user assessments. This extensive field test aimed to assess the consistency of the assessment results and ensure that the animated video product could be used in different school contexts.

Table 5. Extensive Field Test

| Student Name | Aspect | | | | |
|---|---|---|---|---|---|
| | Material | Functionality | Language | Appearance | Audio |
| A | 10 | 10 | 14 | 30 | 10 |
| H | 10 | 9 | 14 | 28 | 10 |
| ND | 9 | 8 | 14 | 28 | 10 |
| B | 10 | 10 | 14 | 28 | 8 |

| | | | | | |
|---|---|---|---|---|---|
| DL | 9 | 10 | 14 | 29 | 9 |
| L | 9 | 9 | 14 | 27 | 10 |
| Number of Questions | 2 | 2 | 3 | 6 | 2 |
| Total Score | 57 | 56 | 84 | 176 | 57 |
| Average | 9.5 | 9.3 | 14 | 29.3 | 9.5 |
| Average Score: 71.6 | | | | | |

$$\text{Result} = \frac{N\ Score}{Max\ Score} \text{ x } 100 = 95{,}46$$

The average score of 71.6, with a feasibility percentage of 95.46% in (Table 5). This score is higher than the results of the limited field test, indicating an increase in student acceptance of the animated video product after revisions based on previous suggestions. In terms of material, functionality, language, display, and audio, all students gave positive assessments. The highest average score was obtained for the display aspect with a score of 29.3, which confirms previous findings that the animated video visualization is very attractive and appropriate for the characteristics of deaf students. Based on these results, the developed animated video product can be categorized as very feasible for implementation in writing lessons. This also confirms that animated video-based learning media has great potential to increase the engagement and interest of deaf students in learning SPO material.

**Effectiveness test**

After being declared feasible through limited trials and extensive field testing, the animated video product's effectiveness was then tested by measuring students' writing skills. Data was obtained by comparing the results of the pre-test and post-test for writing skills.

Table 6. Descriptive Test

| Type | Mean | Min | Max | Std. Dev |
|---|---|---|---|---|
| Pretest | 19,91 | 11 | 30 | 7,273 |
| Posttest | 35,82 | 31 | 39 | 2,442 |

The average student score during the Pretest was 19.91, with a standard deviation of 7.273. Meanwhile, the average Posttest score increased significantly to 35.82, with a smaller standard deviation of 2.442 in (Table 6). This indicates a significant improvement in students' writing skills after receiving intervention in the form of learning with animated video.

To determine the significance of the difference between the pretest and posttest results, a Wilcoxon Signed Ranks Test was conducted because the data were paired and not normally distributed.

Table 7. Wilcoxon Test

| Statistic | Nilai |
|---|---|
| Z | -2,943 |
| Sig. (2-tailed) | 0,003 |

The test results, shown in (Table 7), show a significance value (Asymp. Sig. 2-tailed) of 0.003, lower than the 0.05 significance level. Thus, the alternative hypothesis is accepted, meaning there is a significant difference between the pre-test and post-test scores. This proves that the intervention using animated video media is effective in improving the writing skills of deaf students. In other words, the developed media is not only deemed feasible in terms of appearance and

functionality, but also proven to have a significant positive impact on student learning outcomes.

**4. Discussion**

Case studies show that deaf students still have relatively low writing skills, particularly in constructing sentences using the Subject-Predicate-Object (SPO) pattern. This condition is understandable considering that writing is a complex productive skill, requiring mastery of vocabulary, grammar, and the ability to organize ideas coherently (Beal et al., 2024). In deaf children, language barriers due to limited hearing also significantly impact their ability to understand sentence structure (Marschark & Spencer, 2010). Thus, the use of appropriate learning media is an urgent need to support their writing skills.

One of the causes of the poor writing skills of deaf students is the minimal use of innovative learning media in schools. Based on observations, teachers often use conventional methods such as written explanations on the board and practice exercises. This method is less effective for deaf students who have visual-based learning characteristics. According to Aljedaani et al., (2023), learning media plays a crucial role in facilitating conceptual understanding, especially for students with special needs. Without appropriate media, the learning process tends to be monotonous, difficult to attract attention, and ultimately less than optimal in improving learning outcomes.

Field findings also show that teachers strongly support the use of animated video as an alternative learning medium. Based on the needs analysis, positive responses demonstrate that teachers recognize the importance of visual-based media in supporting the learning process for deaf children. These findings align with Mayer's (2021) Cognitive Theory of Multimedia Learning. This theory emphasizes that the combination of text, images, animation, and audio can enhance information processing through dual channels: visual and verbal. Although deaf children cannot fully access information through audio, they can still leverage the visual power of animation and text. This makes animated video a potential medium to facilitate their understanding. Research by Singh & Ozarkar (2024) also confirms that animation-based media can help students understand abstract concepts through concrete visual presentation.

Furthermore, the use of animated video aligns with the Universal Design for Learning (UDL) principles, which emphasize the importance of providing diverse information representations tailored to students' needs (Zhang et al., 2022). For deaf students, animated video featuring text, moving images, and the addition of sign language interpreters will expand the accessibility of the material. This way, communication barriers can be minimized and students' understanding of SOP sentence structure can be further enhanced.

Technically, this animated video was developed in MP4 format, a universal format compatible with various devices, including smartphones, laptops, and tablets. This format selection is crucial because it ensures flexibility and ease of access for users. According to Oyekunle et al., (2024), digital learning media must be responsive, compatible across devices, and equipped with simple navigation features to ensure inclusive use by various student groups. Playback control features such as play, pause, rewind, and volume control allow students to adjust their learning pace to suit their individual needs. This type of control is crucial for deaf students, as they may take longer to understand text and animations.

Additionally, display compatibility tests were conducted on various screen resolutions, from small to large devices. The goal was to maintain visual quality, text readability, and animation clarity. According to Clark & Mayer (2023), good technical learning media must consider readability, resolution, and display consistency to optimally convey the learning message. This compatibility test demonstrated that the developed animated video could be displayed well without compromising the quality of the content.

The results of the study indicate that the use of animated video in learning Subject-Predicate-Object (SPO) material has proven effective in improving the writing skills of deaf students. Initial pretest data is categorized as a moderate level of writing skills. This condition reflects the limitations

of deaf students in understanding simple sentence structures. Communication barriers and limited access to spoken language often make deaf children face difficulties in understanding grammar and sentence structures in writing. This difficulty is further exacerbated if the learning media used does not support their visual needs (Vizzi et al., 2023).

After learning with animated video media, posttest results showed a significant increase, indicating a marked improvement in students' writing skills. This improvement aligns with the Cognitive Theory of Multimedia Learning proposed by Mayer (2021), which explains that the combination of visuals and text in animated media can better facilitate students' cognitive processes than relying solely on conventional methods. For deaf students who rely on visual modalities, the use of animation and text is very helpful in strengthening the understanding of grammatical concepts (Yasin & Mohamad, 2024).

The effectiveness of animated video media can be explained through several advantages. First, animated video can help teachers overcome the limitations of conventional teaching media. Teachers who previously only used blackboards and textbooks are now assisted by visual media that are more engaging and tailored to the needs of deaf students. This is in accordance with the opinion of Soares et al. (2024), who stated that animated video make it easier for teachers to convey material, while also making it easier for students to understand the learning content. Second, animated media can increase students' attention. Moving visual elements can maintain attention longer, making students more active in learning.

Furthermore, another advantage of animated video media is its ability to connect learning material to students' daily lives. By presenting concrete illustrations through moving images, students more easily connect SOP grammatical concepts to their personal experiences. Research by Izzaturahma et al. (2021) shows that the use of animated media in learning clarifies understanding of abstract concepts while strengthening students' memory through contextual visual repetition. For deaf children, who often have limited ability to receive verbal explanations, this type of visual presentation is very helpful (Freitas et al., 2022). The results of this study also show that animated video not only improve writing skills in terms of sentence structure but also impact the learning motivation of deaf students. Deaf children tend to be more engaged and enthusiastic when learning is presented in a dynamic visual format compared to static media. With increased motivation, students are more encouraged to try writing sentences repeatedly until they develop better writing skills.

## 5. Conclusion

Teachers believe that learning environments require innovative, engaging, interactive media that aligns with the characteristics of deaf students. The development of animated video-based learning media has proven to be effective in improving the writing skills of deaf students. The media designed with accessible and interactive features was validated by experts and tested through limited and extensive field trials, showing high feasibility in both design and functionality. The integration of visual and interactive elements increased student engagement and motivation, providing a more meaningful and inclusive learning experience. The animated video will make the writing learning process easier to understand, increase motivation, and provide a more meaningful learning experience for deaf children.

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