



Interactive Multimedia for Basic Pencak Silat Skills of Deaf Students in Extracurricular Activities

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ABSTRACT

Purpose: This study examined whether interactive multimedia could improve basic pencak silat skills among deaf students during extracurricular activities at SLBN 2 Pariaman, Indonesia. **Methods:** A quantitative Single Subject Research (SSR) approach with an A–B–A design was used. Two Grade VIII deaf students participated. The intervention combined demonstration videos, animations, visual illustrations, written instructions, and sign-supported explanations. Data were collected through structured observation, performance assessment, and documentation, and were examined using visual analysis of level, trend, stability, and overlap. **Findings:** Both students showed a clear increase in performance during the six intervention meetings. Student R increased from 36.78% at A1 to 96.66% at the final intervention meeting, while Student I increased from 37.35% to 95.00%. The A2 scores remained at 96.66% for R and 95.00% for I. All intervention scores were above the reported A1 scores; based on the available data, the percentage of non-overlapping intervention data was 100% for both students. **Conclusion:** The findings indicate that interactive multimedia supported the acquisition and retention of basic pencak silat skills in these two students. The result should be interpreted within the limits of the small sample and the limited number of baseline observations reported in the manuscript. **Implications:** The study provides a practical example of how visually accessible multimedia can be incorporated into extracurricular physical activity for deaf learners.



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INTRODUCTION

Education is a fundamental right, including for students with disabilities. In special education, learning activities need to be adjusted to students' characteristics so that they can participate meaningfully and develop their academic, social, physical, and independent living skills. For deaf students, access to information is strongly influenced by the way instruction is communicated. This makes the selection of an accessible learning medium an important part of the learning process.

Deaf students may experience barriers when learning depends heavily on spoken explanations because auditory information is not fully accessible to them (Hallahan et al., 2019). In movement-based learning, this issue can become more apparent because students need to understand body position, movement direction, sequence, timing, and coordination at the same time. When these elements are explained mainly through speech, students may need additional visual support to understand and reproduce the movement correctly.

Visual instruction is therefore important in learning for deaf students. Demonstration, repetition, non-verbal communication, and other visual forms of explanation can make movement-based learning easier to follow. Maher (2021) emphasized the importance of visual pedagogies and non-verbal communication in physical education for deaf pupils. In practice, visual support can give students a concrete reference that they can observe again while practicing a movement.

The development of educational technology provides opportunities to strengthen this visual approach. Interactive multimedia can combine video, animation, images, text, and other forms of visual information in one learning environment. For deaf students, the main advantage is not simply the use of technology, but the opportunity to access movement information repeatedly and in a form that does not depend on hearing. Suarsana et al. (2021) showed that multimedia developed on the basis of cognitive learning principles can support learning for deaf students.

Previous studies have also reported benefits from multimedia-based learning for students with hearing impairment. Video-based instruction has been associated with better content comprehension (Almalhy, 2022), while multimedia learning has been reported to support engagement and understanding among deaf learners (Suarsana et al., 2021). Gehret et al. (2025) also highlighted the relevance of accessible e-learning experiences for deaf and hard-of-hearing students. These findings suggest that multimedia has practical value, but the effectiveness of a particular medium still needs to be considered in relation to the learning task.

This issue is particularly relevant to physical and extracurricular activities. Pencak silat involves coordinated movements, balance, concentration, discipline, and the ability to perform a sequence of techniques. Kriswanto (2015) describes pencak silat as both a martial art and a means of physical and character development. For deaf students, extracurricular pencak silat can therefore become a useful context for developing psychomotor skills, provided that the instructional approach is accessible.

In the field, however, learning pencak silat may still rely on verbal explanation combined with teacher demonstration. Such an approach may not provide enough visual detail for students who need to observe a movement several times before practicing it independently. Research on physical education for deaf students has emphasized the importance of adapting instruction to students' sensory and communication needs (Enti & Priyono, 2025).

Preliminary observations at SLBN 2 Pariaman indicated a similar problem. Two Grade VIII deaf students had difficulty performing basic pencak silat movements during extracurricular sessions. Before the intervention, instruction relied mainly on verbal explanation and direct demonstration. The students showed low performance in movement accuracy, coordination, and participation. These observations provided the practical basis for introducing a more visually accessible learning medium.

Interactive multimedia was selected because it allowed the same movement to be presented through several visual forms. Students could watch a demonstration, observe an animated sequence, read a short instruction, and use sign-supported information before practicing the movement. A previous study by Gerhard et al. (2024) specifically discussed a video-based multimedia model for pencak silat self-defense learning among deaf children, providing a relevant basis for applying multimedia to this context.

Although previous studies have examined multimedia for deaf students and some have addressed physical education or pencak silat, the available literature gives less attention to the use of interactive multimedia specifically for extracurricular basic pencak silat skills among deaf students. For example, Gerhard et al. (2024) focused on a video-based multimedia model, while Enti and Priyono (2025) examined teachers' efforts to improve psychomotor abilities in physical education. The present study extends this discussion by examining changes in basic pencak silat performance when interactive multimedia is used in an extracurricular setting. The study therefore aimed to determine whether interactive multimedia could improve the basic pencak silat skills of deaf students through an SSR A–B–A design.

METHOD

Research Design

The study employed a quantitative Single Subject Research (SSR) approach using an A–B–A withdrawal structure. In principle, the design consists of an initial baseline (A1), intervention (B), and return-to-baseline (A2). A1 represents performance before the multimedia support, B represents performance during multimedia-supported instruction, and A2 represents performance after withdrawal of the multimedia support. The available research documentation, however, contains one reported score for A1 and one reported score for A2 for each participant, while six observations are available in phase B. Consequently, the present manuscript uses the A–B–A structure descriptively and does not claim that baseline stability or withdrawal effects were experimentally established. SSR is useful for examining individual response patterns, but its evidentiary strength depends on repeated measurements and clear phase stability (Horner et al., 2005; Kazdin, 2011; Sunanto et al., 2005).

Setting and Participants

The study was conducted at SLBN 2 Pariaman, West Sumatra, Indonesia, during extracurricular pencak silat sessions in the second semester. Two Grade VIII deaf students participated and were identified as R and I to protect confidentiality. Participants were selected purposively because they were enrolled in the extracurricular activity and experienced difficulties in performing the targeted basic pencak silat movements. Each session lasted approximately 80 minutes (2 × 40 minutes) according to the school's extracurricular schedule.

Intervention

The intervention consisted of interactive multimedia developed around the visual and communication needs of the participants. The material combined demonstration videos, animated movement sequences, visual illustrations, short

written instructions, and sign-supported explanations. Target content included ready stance, basic standing positions, punching, kicking, defensive movements, coordination, and balance. During each intervention meeting, students first accessed the multimedia representation and then practiced the target movements under teacher supervision. The demonstrations could be replayed so that students could review a movement sequence before attempting it again. Thus, multimedia functioned as supplementary visual support and did not replace teacher guidance.

Instrument and Data Collection

Data were collected through structured observation, performance assessment, and documentation. The performance checklist covered readiness posture, standing position, punching accuracy, kicking accuracy, body balance and coordination, movement-sequence accuracy, concentration, and independence. Scores were converted into percentages using $P = (F/N) \times 100\%$, where P is the percentage score, F is the obtained score, and N is the maximum possible score. The reported dataset contains the following observations: one A1 score, six B scores, and one A2 score for each participant. The manuscript documentation states that content validation was conducted through expert judgment involving specialists in special education and adaptive physical education. However, the available research documentation does not provide the number of validators, their academic or professional qualifications, or an inter-observer agreement coefficient. These details are therefore not added or estimated in this revision. Their absence is treated as a measurement-quality limitation and should be supplemented from the original validation and observation records if those records are still available.

Data Analysis

Data were analyzed visually by examining level and trend across the reported phases. The analysis focused on (1) the direction of change within phase B, (2) the difference between the reported A1 score and the final B score, and (3) the relationship between the final B score and the reported A2 score. In the original manuscript, percentage of non-overlapping data (PND) was also calculated using the single A1 observation as the baseline reference. Because PND normally benefits from repeated baseline observations and a single baseline point cannot establish baseline variability, PND is not used as primary evidence of intervention effectiveness in this revision. This decision follows the reviewer concern regarding the adequacy of the A–B–A evidence.

RESULTS

The results are presented for the two participants across the baseline, intervention, and return-to-baseline conditions. Because A1 and A2 are reported as single scores in the available dataset, the clearest evidence of change comes from the six intervention meetings and the comparison of the first and last reported scores. The study involved two Grade VIII deaf students at SLBN 2 Pariaman. Student R had an initial score of 36.78%, while Student I had an initial score of 37.35%. Both scores were below the reported Minimum Mastery Criterion (KKM) of 80%.

Baseline Phase (A1)

The A1 condition was used to describe the participants' performance before multimedia was introduced. Instruction at this stage relied on verbal explanation and direct demonstration without multimedia support. The available data provide one reported baseline score for each participant, rather than a series of separate baseline observations. Both participants showed low performance at baseline. Their difficulties were observed in movement coordination, movement execution, concentration, and confidence during practice. The baseline scores were 36.78% for R and 37.35% for I.

Student	Percentage Score	Performance Category
R	36.78%	Low
I	37.35%	Low

The results indicate that both participants performed below the Minimum Mastery Criterion (KKM), which had been established at 80%. The low scores suggest that conventional instructional methods were insufficient to support the visual learning characteristics of deaf students. The difficulties experienced by the students were primarily associated with limited understanding of movement sequences and inadequate visual instructional support. Since deaf students rely heavily on visual information processing, verbal instruction alone did not effectively facilitate movement comprehension.

The baseline scores were substantially below the 80% KKM used in the study. The difference between the initial score and the mastery criterion was 43.22 percentage points for R and 42.65 percentage points for I. These results show that the participants entered the intervention with limited mastery of the targeted movements.

The low baseline performance was mainly related to difficulties in understanding movement sequences and the limited visual support available during instruction. This observation is consistent with the need for accessible visual communication in learning for deaf students (Maher, 2021; Enti & Priyono, 2025).

Intervention Phase (B)

Meeting	Student R	Student I
1	43.33%	41.66%
2	48.33%	43.33%
3	66.66%	66.66%
4	75.00%	71.66%
5	86.66%	83.33%
6	96.66%	95.00%

Interactive multimedia was introduced during the intervention phase. The materials presented the target movements through video, animation, visual instructions, images, and sign-supported explanations. The six intervention meetings addressed ready stance, basic standing positions, punching, kicking, defensive movements, coordination, and balance. Students could replay the demonstrations before and during practice. The results demonstrate a consistent increase in students' performance throughout the intervention sessions. During the first and second meetings, students still required guidance and reinforcement in understanding movement sequences. However, beginning from the third meeting, both students showed notable improvement in movement coordination and execution accuracy.

By the fourth meeting, both students achieved scores approaching the Minimum Mastery Criterion (KKM). Subsequently, in the fifth and sixth meetings, students demonstrated substantial mastery of the pencak silat movements with significantly improved confidence, concentration, and independence. Student R's performance increased from 36.78% during baseline to 96.66% during intervention, while student I's performance improved from 37.35% to 95.00%. These findings indicate that the interactive multimedia intervention positively affected students' psychomotor learning outcomes.

Performance increased across all six intervention meetings for both participants. Student R improved from 43.33% in the first meeting to 96.66% in the sixth meeting. Student I increased from 41.66% to 95.00%. The largest increases were visible between the second and third meetings, after which performance continued to rise. By the fourth meeting, R reached 75.00% and I reached 71.66%, bringing both students closer to the 80% KKM. In the fifth meeting, both students exceeded 80%, and by the sixth meeting their scores were above 95%. The pattern suggests a gradual improvement rather than an immediate effect. Compared with A1, Student R increased by 59.88 percentage points, from 36.78% to 96.66%, while Student I increased by 57.65 percentage points, from 37.35% to 95.00%. These changes indicate substantial improvement during the intervention period, although the small number of baseline observations limits the strength of causal interpretation.

Student	Percentage Score	Performance Category
R	96.66%	Very Good
I	95.00%	Very Good

Baseline Phase (A2)

After the intervention was withdrawn, the A2 phase was used to examine whether the students could maintain the acquired skills without continued multimedia assistance. In the available dataset, A2 is represented by one final score for each participant. Students were able to independently perform movement sequences with improved body coordination, movement accuracy, and confidence. Furthermore, students demonstrated greater enthusiasm and active participation during extracurricular activities compared to the initial baseline phase.

Visual Analysis of Data

Visual analysis in Single Subject Research focuses on identifying changes in behavior across research phases through trend direction, stability, level changes, and overlap analysis. Both participants maintained their final intervention performance in A2. R scored 96.66% and I scored 95.00%, the same as their final B scores. This pattern suggests that the skills demonstrated at the end of the intervention were retained after multimedia support was withdrawn.

During A2, the students were able to perform the movement sequences with improved coordination, accuracy, and confidence. Their scores also remained above the 80% KKM. However, because only one A2 score is reported for each participant, the maintenance of the effect should be interpreted as an indication of retention rather than definitive evidence of long-term maintenance.

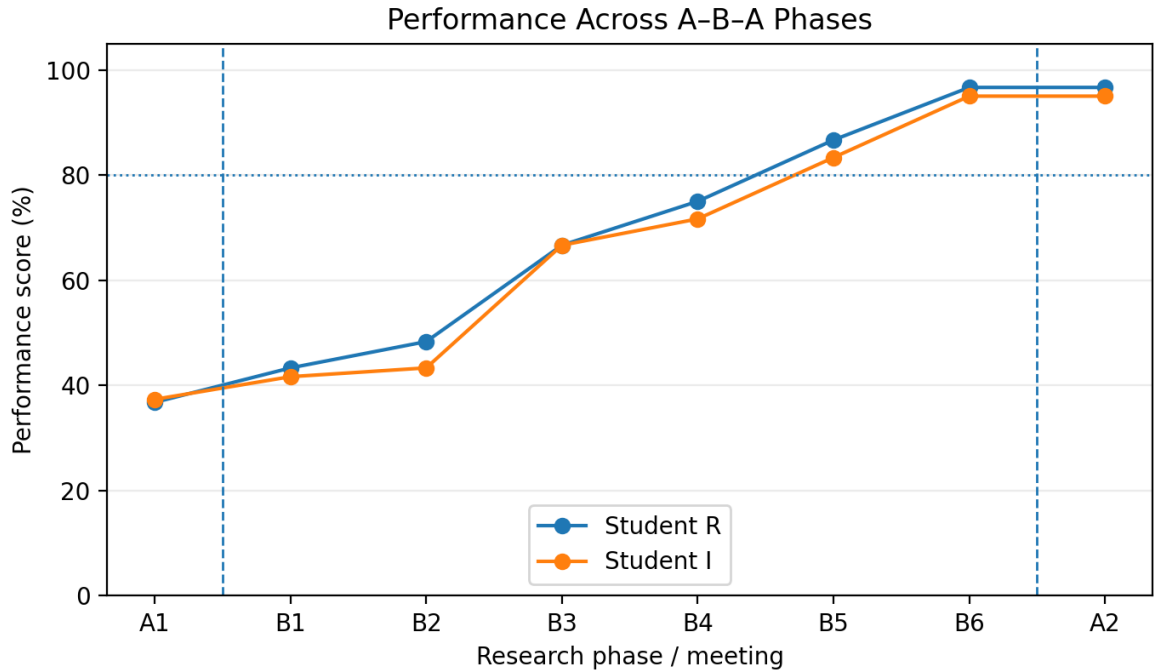


Figure 1. Performance scores across the reported A–B–A observations.

Visual Analysis of Data

Visual analysis was conducted by comparing the level and direction of scores across A1, B, and A2. The available data show a clear upward pattern during the six intervention meetings and stable high scores at the reported A2 point.

1. Trend Direction

Both participants showed a positive upward trend throughout the intervention phase. R increased from 43.33% to 96.66%, while I increased from 41.66% to 95.00% across six meetings. The upward pattern is also visible when the intervention scores are compared with the much lower A1 scores.

2. Stability of Data

The single reported A1 and A2 scores do not allow phase stability to be estimated in the same way as a series of repeated baseline measurements. Within phase B, however, both participants showed a consistent increase across the six meetings, and the final two scores for each participant were above the KKM.

3. Level Change

The level change from A1 to the final B observation was 59.88 percentage points for R and 57.65 percentage points for I. The final B scores were also 59.88 and 57.65 percentage points higher, respectively, than the corresponding A1 scores.

4. Overlap Analysis

Using the available A1 scores as the baseline reference, all six B scores were higher than the corresponding A1 score for both participants. The percentage of non-overlapping intervention data (PND) is therefore 100% for R and 100% for I. This result indicates a clear separation between the reported baseline and intervention scores, but it should be interpreted cautiously because each participant has only one reported A1 observation. The improvement in students' performance can be explained through the visual learning characteristics of deaf students. Hearing impairment limits students' ability to access auditory information; therefore, they depend primarily on visual input during learning activities. Interactive multimedia provides concrete visual demonstrations that enable students to repeatedly observe and imitate movement sequences more accurately (Niratama, F., Wagino, W., Widajati, W., & Yulianti, 2023).

These findings are consistent with the Cognitive Theory of Multimedia Learning proposed by Mayer (2014), which states that individuals learn more effectively when information is presented through integrated visual and verbal representations rather than through verbal instruction alone. Multimedia learning facilitates dual-channel processing and reduces cognitive overload, thereby improving comprehension and retention (Mayer, 2014).

In the context of deaf education, visual presentation is particularly essential because deaf students process information predominantly through visual sensory modalities. The use of videos, animations, and visual instructions in this study allowed students to understand movement directions, body positioning, and coordination more effectively than through traditional demonstration methods alone.

The findings indicate that interactive multimedia was associated with improved basic pencak silat performance in the two deaf students who participated in the study. The most visible change occurred during the intervention phase, when scores increased across all six meetings. This pattern is consistent with the purpose of visual learning support in physical education for deaf students.

One possible explanation is that multimedia gave students a stable visual reference for each movement. Instead of relying on a single teacher demonstration, students could replay the same movement and compare it with their own performance. This may have made movement direction, body position, and sequence easier to understand. [Maher \(2021\)](#) similarly emphasized visual pedagogies and non-verbal communication in physical education for deaf learners.

The findings can also be discussed in relation to the Cognitive Theory of Multimedia Learning. [Mayer \(2014\)](#) argues that learning can be supported when information is organized through complementary representations. In this study, the combination of movement video, animation, written information, and sign-supported explanations provided several visual cues that students could use while learning the same motor task.

The result is also in line with earlier studies on multimedia for deaf students. [Almalhy \(2022\)](#) reported improved content comprehension with video tutorial delivery, while [Suarsana et al. \(2021\)](#) showed that multimedia learning can support understanding among deaf learners. The present findings add a psychomotor context by applying multimedia to basic pencak silat movements rather than primarily academic content.

The increase in performance was accompanied by changes in students' observed confidence, concentration, and independence. These changes were not analyzed as separate outcome variables, so they should not be treated as independent effects of the intervention. Nevertheless, their appearance during practice is relevant because successful performance may make students more willing to repeat movements and participate actively.

The findings are also relevant to previous work on physical education for deaf students. [Enti and Priyono \(2025\)](#) emphasized the role of teachers in supporting psychomotor development, while [Gerhard et al. \(2024\)](#) demonstrated the relevance of video-based multimedia in pencak silat learning for deaf children. Together, these studies provide a reasonable basis for viewing visual multimedia as a useful complement to teacher-guided practice.

From a methodological perspective, SSR allowed the researchers to follow changes in each participant rather than relying only on a group average. This is useful in special education because individual learning responses can differ considerably ([Horner et al., 2005](#); [Sunanto et al., 2005](#)). In the present study, the individual score trajectories show a similar direction of change for both participants.

There are, however, important limitations. First, only two students participated, so the findings cannot be generalized to deaf students in other schools or age groups. Second, the available dataset reports only one A1 and one A2 score for each participant, which limits the assessment of baseline stability, phase changes, and maintenance. Third, the manuscript does not report an inter-observer agreement coefficient or detailed validator information. Finally, factors such as repeated practice, maturation, or events occurring during the intervention cannot be completely ruled out as alternative explanations for the observed improvement.

Despite these limitations, the pattern of improvement is practically meaningful. Both participants exceeded the 80% KKM during the intervention and maintained their final scores in A2. The findings support the use of interactive multimedia as a supplementary visual medium rather than as a replacement for teacher supervision. Further studies should use more repeated baseline and maintenance measurements, report inter-observer agreement, and involve more participants or settings.

CONCLUSION

The study found that interactive multimedia was followed by a clear improvement in basic pencak silat performance among the two Grade VIII deaf students who participated in the extracurricular activity. R increased from 36.78% at A1 to 96.66% at the final intervention meeting, while I increased from 37.35% to 95.00%. Both participants retained the same final scores at the reported A2 point. The results suggest that visual multimedia can help deaf students understand and practice movement sequences by providing demonstrations that can be observed repeatedly. However, the findings should be interpreted within the limits of the small sample and the limited baseline and maintenance observations reported in the dataset. For future research, studies should include several baseline and maintenance sessions, report inter-observer agreement and validator characteristics, and involve more participants or schools. Researchers may also compare different forms of visual media, such as video, interactive presentations, or augmented reality, to determine which features provide the greatest support for psychomotor learning.

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AUTHOR CONTRIBUTION STATEMENT

CZS conceptualized the study, designed the research procedures, developed the interactive multimedia intervention, conducted the intervention sessions, collected and analyzed the data, interpreted the findings, and prepared the original manuscript draft. BS contributed to the research design, provided methodological guidance, supervised the implementation of the study, and critically reviewed the manuscript. TH contributed to the conceptual framework, supervised the research process, and reviewed and revised the manuscript for important intellectual content. IT provided academic supervision, contributed to data interpretation, and critically reviewed the manuscript. All authors read and approved the final version of the manuscript.

AI DISCLOSURE STATEMENT

The authors report that the research was conceived, conducted, analyzed, written, and edited by the authors. Any use of external editorial assistance should be disclosed in accordance with the journal's policy.

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