

## Enhancing Badminton Learning for Deaf Children: Development and Evaluation of an Interactive Video Teaching Module

### Mejora del aprendizaje del bádminton para niños sordos: Desarrollo y evaluación de un módulo interactivo de enseñanza por vídeo

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**Abstract.** This research aims to produce badminton learning media that is more effective and relevant for deaf children. It employs the R&D method with the ADDIE development model, encompassing five stages: analysis, design, development, implementation, and evaluation. Expert validation was conducted during development, involving learning media, special needs, and badminton experts. The implementation stage included product trials conducted at SLB Negeri 1 and SLB Negeri 2 Padang City, with 12 voluntary participants. Product effectiveness was assessed using the T-test. Expert validation results indicate high validity across domains: 89.2% for learning media, 95% for children with special needs, and 95.2% for badminton expertise. Small-scale trials achieved an 84% success rate with an excellent rating. The effectiveness test, with  $T_{count} = 9.916 > T_{table} = 1.796$  at  $p < 0.005$ , demonstrates the efficiency of interactive videos in enhancing understanding and proficiency in badminton short serves among deaf children. This research concludes that the development of badminton learning video media for children with special needs provides an effective solution in increasing their understanding of the sport of badminton. The implications of this research contribute to developing inclusive learning strategies that meet the diverse and specific needs of individuals with disabilities.

**Keywords:** Development, learning media, badminton, deaf children.

**Resumen.** El objetivo de esta investigación es producir medios de aprendizaje de bádminton que sean más eficaces y pertinentes para los niños sordos. Esta investigación emplea el método I+D con el modelo de desarrollo ADDIE, que abarca cinco etapas: análisis, diseño, desarrollo, implementación y evaluación. Durante el desarrollo, se llevó a cabo una validación por expertos, en la que participaron expertos en medios de aprendizaje, necesidades especiales y bádminton. La etapa de implementación incluyó pruebas del producto, realizadas en SLB Negeri 1 y SLB Negeri 2 Padang City, con 12 participantes voluntarios. La eficacia del producto se evaluó mediante la prueba T. Los resultados de la validación por expertos indican una alta validez en todos los ámbitos: 89,2% para medios de aprendizaje, 95% para niños con necesidades especiales y 95,2% para conocimientos de bádminton. Los ensayos a pequeña escala alcanzaron una tasa de éxito del 84%, con una calificación muy buena. La prueba de eficacia, con  $t_{count} = 9,916 > t_{table} = 1,796$  a  $p < 0,005$ , demuestra la eficiencia de los vídeos interactivos para mejorar la comprensión y la pericia en los saques cortos de bádminton entre los niños sordos. La conclusión de esta investigación es que el desarrollo de medios de vídeo de aprendizaje de bádminton para niños con necesidades especiales proporciona una solución eficaz para aumentar su comprensión en el aprendizaje del deporte del bádminton. Las implicaciones de esta investigación contribuyen al desarrollo de estrategias de aprendizaje inclusivo que satisfagan las necesidades diversas y específicas de las personas con discapacidad.

**Palabras clave:** Desarrollo, medios de aprendizaje, bádminton, niños sordos.

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## Introduction

Despite the increase in live births worldwide, many children are born with physical, mental, and intellectual disabilities every day. Their medical condition and disability cause limitations in learning, speaking, or communicating; thus, they need intervention when it comes to education access and inclusion in the community. In Indonesia, the recognition of children with disability, including those who suffer from speech and hearing impairments, is of paramount importance. They should have equal rights to receive appropriate social treatment since the direct impact of their deafness hampers verbal or oral communication, both expressively in speaking and receptively in understanding other people's speech (Hernawati, 2007), hence making it challenging to communicate with other people who commonly use verbal language as a means of communication.

However, education has become more advanced and developed in the 21st century. As a result, various

approaches can be employed to improve the quality of education, such as initiating breakthroughs in curriculum development, enhancing innovation in learning, and providing proper educational infrastructure. The importance of education in Indonesia is well-established by the law, which states that education is a conscious and strategic effort to create a learning atmosphere and learning process. For instance, Law No. 20 2003 concerning the National Education System highlights that students should actively develop their potential to have religious and spiritual strength, self-control, personality, intelligence, noble morals, and skills needed not only for themselves but also for their society, nation and state (Law No. 20 concerning the National Education System, 2003).

The aforementioned law undoubtedly also applies to children with special needs as they have the same right to get a decent education. Additionally, the state has also specifically regulated their rights in law which guarantees appropriate social treatment for them (Republic of Indonesia Law No. 8 concerning Persons with Disabilities,

2016). The law acknowledges the limitations in verbal communication and highlights the direct impact of deafness, which includes difficulty speaking and understanding speech. These impairments make it challenging for special needs children to communicate with those around them who use verbal language. Based on these conditions, a new learning approach that focuses on disabled students' experience is needed, particularly in physical education (Sepdanius, 2018).

Physical education and activity plays a vital role in the lives of children with special needs, improving social skills, emotional well-being, and overall quality of life (ORHAN et al., 2023). Engaging in activity can reduce stress levels within families and improve their overall functioning. In addition, children with special needs will develop their social skills and motivation by participating in sports event (Fithroni et al., 2024). One competitive physical activity many Indonesian children with special needs are interested in is badminton, which is also included in the World Paralympic Games. This sport is a fundamental tool to achieve a change in attitudes towards disability at all ages and to promote the value, participation, and awareness aspects of sport (Campos Campos et al., 2023). The enthusiasm of Indonesian people with disabilities towards badminton is also high, as evidenced by the large number of disabled athletes who competed nationally and the fact that Indonesia's winning of gold medals at the Paralympic Games in Tokyo in 2020 (BWF, 2020). This proves that badminton is a popular sport played by children with special needs in Indonesia.

Special treatment is required according to the needs of participants in badminton training and tournament. Specificities in badminton have been introduced, starting from the introduction stage of the sport to the consolidation of playing badminton (Sepdanius et al., 2023). However, based on observations during the 2021 National Paralympic Olympics in West Sumatra in Indonesia, the aspect of the badminton game that is often overlooked is the initial shot, commonly known as the serve, especially the short serve. Short serves carried out by children with special needs often experience fault serves or failure. This problem arises from various factors, including good communication in conveying information related to the five mistakes in badminton short serves during learning and practice. To overcome these obstacles, it is important to communicate with special needs children in a clear and engaging way so that they can easily understand the instructions.

Therefore, the approach of using good-quality instruments contribute to learning success (Rifki et al., 2022). This present research is essential in developing effective and relevant learning methods for deaf children by designing interactive video communication media to convey badminton material. It can positively impact their understanding of badminton both as an extracurricular activity and personal achievement. Furthermore, this research aims to answer the following research questions: How can developing interactive video communication

media improve deaf children's understanding of badminton sports activities? This research implies that it can contribute to developing a sports curriculum that is more sensitive to the needs of deaf children, with specific attention to some particular aspects.

## Method

### Research design

Development is a research step that aims to develop or perfect an existing product and test its effectiveness. In this research, R&D research was used with the ADDIE development model, which consists of five stages as shown in Figure 1: Analysis, Design, Development, Implementation, and Evaluation (Piskurich, 2011). The ADDIE model is the framework most frequently used by instructional designers (Morrison et al., 2019). One of the advantages that can be done with this model is fast prototyping (Yasir Ahmad, 2013). These improvements allow for feedback based on continuous assessment throughout the development process.

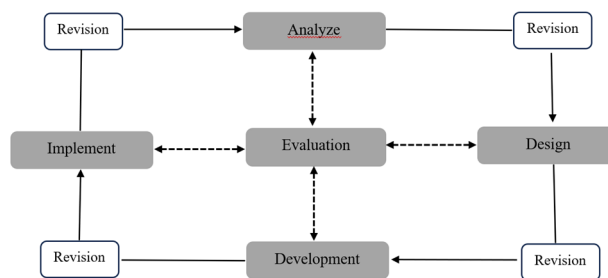


Figure 1. ADDIE Model (Piskurich, 2011)

### Data Collecting

The researcher carried out several stages of data collection. The first stage, a needs analysis, was conducted by observing and interviewing participants. The result of the needs analysis became a basis for product design. During the development stage, data collection was carried out with expert validation consisting of media experts, experts for children with special needs, and badminton experts. Next, for the implementation stage, the researcher conducted product trials including both small-scale and field trials. Small-scale trials used small-group trial instruments in the form of questions related to the clarity of content, accuracy, suitability, ease, and attractiveness. This question was designed with four measurement scales: very good, good, bad, and bad. It also tested product effectiveness by collecting data from student field tests using pre-tests and post-tests on the material being tested. Evaluation was carried out at each stage as a revision towards improvement.

### Participants

The research was conducted at SLB Negeri 1 Padang City and SLB Negeri 2 Padang City. A total of 12 participants voluntarily agreed to take part in this research.

The 12 participants were students who had unique characteristics according to the inclusion criteria of having limitations in hearing and speaking.

### Statistical Analysis

The data analysis technique in this research consists of several stages and its findings are pivotal for refining product development. The first stage used descriptive analysis consisting of qualitative data from the teachers accompaniment in badminton matches and the results of learning media observations at school. Qualitative descriptive analysis was employed for product development related to feasibility or validity criteria, which was carried out rationally and structuredly on balanced instruments. On the other hand, quantitative data analysis involved the examination of numerical data from distributing test questionnaires in small groups. Quantitative descriptive analysis used percentage analysis related to product quality (conformity with theory and accuracy). The next stage was testing product effectiveness with a normality test by using the Liliefors formula to determine whether the scores on each variable were normally distributed. Then, the researcher proceed with testing the effectiveness of the product using the T-test.

### Results

This research proves the hypothesis that the development of badminton instructional video media for deaf children provides an effective solution in improving children's understanding of learning badminton. This learning video development research was developed using the ADDIE model so that its development went through stages, namely: (1) Analysis stage, (2) Design stage, (3) Development stage, (4) Implementation stage, and (5) Evaluation stage.

#### Analysis stage

Needs analysis: This stage made observations during the West Sumatra Paralympic Week 2021 competition, and then interviews were conducted with several sources related to the problems experienced in badminton matches.

Other information related to the facilities and infrastructure owned by special schools was also observed. The results reveal that several errors in short serves give an advantage to the opponent. Further research found that no valid information media available could be used to help convey information related to the rules of the badminton game, especially in the implementation of short serves. This media is needed by schools with special needs for people who are deaf or hard of hearing to get precise information in implementing proper service rules. So, in badminton matches, there are no longer experience service fouls, which result in easy points being lost. This is the basis for the fact that not all schools have teachers who clearly understand the game of badminton.

#### Design Stage


Based on the initial information that has been processed and the core information obtained, namely the need for media to convey information regarding mistakes often made in short serves, resulting in service fouls. Five service errors were identified, namely 1. stepping on the line, 2. the shuttlecock exceeding the height of 115 when serving, and 3. The racket head is higher than the racket shaft when impacting the shuttlecock, 4. The serve is not hitting the cork of the racket, 5. The racket flies when starting the serve, not continuously.

Moreover, the process of designing this product is carried out through three stages. The first was to create a development flowchart to visually illustrate every development process. Secondly, the researcher determined the software used, which consisted of Adobe Premiere Pro, Corel Draw, Microsoft Office Word 2021, and Nero. The last process was designing the script of the video that will be developed.

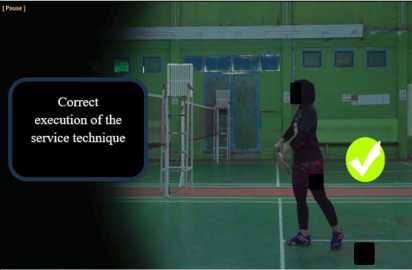
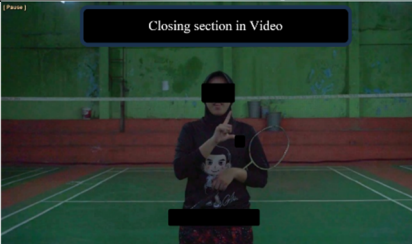
#### Development Stage

This stage is the stage for compiling the prepared materials for making learning videos, followed by the video editing process until finishing the product. Table 1 below depicts information about the result of the development stages.

Table 1.  
Product Development Stages

Stages	Video View	Information
Opening Video		At the video's opening, the title, aim, and objectives of the video and the people who contributed to the research are introduced.

<p>Introduction to sign language</p>		<p>The direct introduction was carried out by a badminton athlete with special needs who understands and can communicate using sign language as a form of everyday language.</p>
<p>How to grip the racket correctly</p>		<p>At this stage, special attention is paid to correctly holding the racket so that the strokes made during serve, backhand, smash, and forehand reach the maximum level. This racket-holding technique is essential, especially for beginner players. It is recommended that the middle finger, ring finger, and little finger be placed on the racket grip. Next, the index finger is placed slightly further away from the three fingers, and the thumb is placed between the index and three fingers. In this way, the hand's position will resemble the hand's position during a handshake, which is very important for achieving optimal hitting results.</p>
<p>Five badminton short serve technique mistakes</p>		<p>A brief explanation of five mistakes that often occur on short serves made by badminton players</p>
<p>Mistake 1 is stepping on the line.</p>		<p>When a player prepares to serve but steps on the center horizontal line or service execution line, this action is considered a service error so that the point will be transferred to the opponent.</p>
<p>Mistake 2 Shuttlecock when hit beyond a height of 115cm</p>		<p>A player who serves but swings his racket with the shuttlecock beyond a height of 115 cm, this action is considered a service error. As a result, points will be transferred to the opposing party.</p>
<p>Mistake 3: The racket head is higher than the racket shaft</p>		<p>A player who serves but hits the shuttlecock with the racket head bent upwards is considered a service error. As a result, points will be transferred to the opposing party.</p>
<p>Mistake 4: Service does not hit the cork first</p>		<p>When executing the badminton short-serve technique, the player must ensure that his shot hits the cork of the shuttlecock, not the feathers. Serving by hitting the feathers of the shuttlecock is considered a service error in badminton and will result in a point being awarded to the opponent.</p>
<p>Mistake 5. Service is not continuous</p>		<p>In implementing the badminton short serve technique, if a player makes repeated strokes or does not do so continuously with one stroke, the referee will declare it a service fault, and the points will be transferred to the opponent.</p>

<p>Correct implementation of the badminton short serve technique</p>		<p>The correct implementation of a badminton serve is to pay attention to the five short service technique errors, also known as service faults. These errors involve the player stepping on the line of service, making short serves that exceed 115 cm from the floor, short serves that do not hit the cork but hit the feather, and finally, serving without repetition or not continuously. If a player succeeds in avoiding these five mistakes, he is considered free from service faults per general badminton playing standards.</p>
<p>Interactive video closing</p>		<p>In the closing part, the message is conveyed that all errors in the short serve have been discussed, and the need to practice them repeatedly is emphasized to avoid these errors.</p>

### Implementation Stage

In product implementation, the following stages are carried out: (a) product trials, which include media experts, expert tests for children with special needs, badminton game experts, small group trials, and field trials; (b) implementation of videos of short service techniques on the field to measure the effectiveness of the product being developed.

### Expert Validation

Table 4 shows the results of expert validation consisting of learning media experts, experts on children with special needs, and badminton experts with assessment indicators of clarity, accuracy, suitability, convenience, and attractiveness.

### Small group trials

Table 5 shows data on the results of small-group trials on the products being developed. The results obtained for the product feasibility test were fairly promising. The attractiveness criteria obtained a percentage of 84% which is considered as very valid. Correspondingly, the ease

criteria received a score of 81%, the clarity criteria acquired a score of 88%, the feasibility criteria obtained a score of 82%, and the appropriateness criteria received a score of 84% - all of which are very valid scores. In order to provide a better understanding of the percentages, the data from the small group trial results are presented in Table 5 as follows:

Table 4. Validation Result Data By Experts

No	Indicator	Badminton Game Expert		Expert on Children with Special Needs		Media expert	
		(%)	Information	(%)	Information	(%)	Information
1	Clarity	75.4%	Fairly Valid	80%	Fairly Valid	95%	Fairly Valid
2	Accuracy	100%	Very Valid	100%	Very Valid	100%	Very Valid
3	Suitability	100%	Very Valid	97%	Very Valid	100%	Very Valid
4	Convenience	100%	Very Valid	100%	Very Valid	100%	Very Valid
5	Attractiveness	96%	Very Valid	100%	Very Valid	95%	Very Valid
Average		%	Very Valid	%	Very Valid	%	Very Valid

Table 5. Small Scale Test Results For Product Development

Rated aspect	Tsev	Tmax	%
Accuracy	121	144	84%
Clarity	126	144	88%
Attractiveness	321	384	84%
Convenience	351	432	81%
Appropriateness	79	96	82%
Average			84%

### Product Effectiveness

Table 6. Different T-Test Results

Pair	Test	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretest - Posttest	-4.25000	1.48477	0.42862	-5.19338	-3.30662	-9.916	11	0,000

Table 6 presents the results of different tests using paired t-tests. Based on this test, results between the pre-test and post-test were obtained T count amounting to -9.916 with an absolute value of 9.916, which is greater than the T table of 1.796, with a significant value of 0.000, which is smaller than 0.005, which means Ho is rejected. Thus, it can be concluded that interactive video intervention has proven to be efficient in improving understanding along

with the ability of deaf children to perform better badminton short serves.

The intervention results can be seen in the proliferation of the score before and after the intervention, achieved by showing an interactive video demonstrating the badminton short-serve technique. It also suggests that employing interactive video can be a valuable tool for improving the skills of deaf children in badminton.

## Discussion

The advantage of these teaching materials lies in the diversity of media used since images, videos, and text provide variety in conveying information and making the material more enjoyable and easy to understand. Video media has considerable potential as a learning tool for people with disabilities. Other research shows the effectiveness of video media, especially in the form of cartoons or animations, as a learning medium for children with mild to moderate intellectual disabilities. The research findings highlight the potential benefits of using visually appealing content to meet the learning needs of individuals with mild to moderate intellectual disabilities (Dewi et al., 2022) in line with this research. The results show that badminton playing skills trained through audiovisual media are generally superior to non-audiovisual methods (Chaeroni et al., 2023). Furthermore, other researchers discussed using accessible games as learning tools for people with dyslexia, showing the potential of utilizing interactive and visually stimulating video media to support individuals with specific learning challenges. Then another research finding from Kakdokia et al. also have proven that the accessibility of YouTube videos for individuals with disabilities, highlighting the importance of ensuring that digital learning media, including videos, are inclusive and accessible to all students (Kadokia et al., 2022).

When providing learning video content for children with disabilities, it is imperative that the material is customized to cater their needs and abilities. Physical education teachers must be sensitive and have a positive attitude toward children with special needs in developing learning media (Torres-Paz et al., 2023). Media development should also focus on learning media design and emphasize the need for innovative approaches to meet diverse learning needs of individuals with disabilities (Mandala, 2022). The results of other research show that the development of learning media specifically designed for students with moderate intellectual disabilities highlights the importance of using concrete and exciting media, such as teaching aids, to support their learning (Puspasari et al., 2021). Hence, it is essential to conduct thorough research that examines the experiences of children with disabilities in using digital media, including video, and evaluates the effectiveness of assistive technologies to meet their learning needs. It also underscores the importance of understanding the specific requirements and experiences of children with disabilities when they are engaging with digital learning media (Toquero, 2020).

Myriad research focuses on improving the learning experience for individuals who are Deaf or Hard of Hearing (DHH) through the use of multimedia, technology, and sign language (Almalhy, 2022). Previous research have indicated that the video tutorial method adapted to the learning needs of DHH students is in line with the cognitive theory of multimedia learning (Adnyani et al., 2021). There is also a

need to develop multimedia-based materials designed explicitly for DHH children due to the importance of meeting their unique learning needs (Adnyani et al., 2021). From the results of this research and several references, it is concluded that it is essential to develop learning media for children with special needs.

Developing learning media needs to know the specifics of children with hearing loss. Research conducted by Aljedaani et al. investigated the challenges and concerns deaf students faced during the sudden shift to online learning, highlighting the need for inclusive and accessible online educational resources (Aljedaani et al., 2021). Additionally, the co-design of content by deaf students and their tutors was highlighted as an essential aspect (Gillen et al., 2023); more emphasized by other researchers is the importance of the involvement of DHH individuals in the development of learning materials (Adigun & Nzima, 2020). In line with references and development findings, involving deaf children as models is an advantage of this research.

The paper has discussed the implications of using digital components in learning outcomes for deaf students, emphasizing the importance of overcoming barriers to effective learning and utilizing digital resources to enhance the learning experience (Manga & Masuku, 2020) while also highlighting the challenges faced in educational environments (Manga & Masuku, 2020). The reference also underscores the importance of sign language as a primary form of communication for individuals who are deaf or hard of hearing. These efforts aim to facilitate effective communication and learning experiences for DHH individuals. Additionally, machine learning technology and artificial intelligence, to improve sign language recognition and educational practices for DHH individuals is an integral part of the development of learning media (Pirdayanti et al., 2022). The use of technology in research is a promising key to improving accessibility and learning outcomes for individuals who are deaf or hard of hearing.

## Conclusion

In Conclusion, developing badminton learning video media for children with special needs provides an effective solution in improving the understanding of deaf children in learning badminton. This research has proven that successful learning in the digital era is influenced by technological assistance and the unique experiences of children with disabilities. The implication of this research is to contribute to developing inclusive learning strategies that meet the needs of individuals with hearing and speech impairments in sports education.

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