Development of velcro gloves as an educational tool to enhance catching skills in Kasti learning for elementary school students

Desarrollo de guantes con velcro como herramienta educativa para mejorar las habilidades de agarre en el aprendizaje del Kasti para estudiantes de primaria

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Abstract

Introduction: Difficulties in catching the ball and the lack of innovative instructional media remain common problems in elementary school physical education learning, particularly in kasti games.
Objective: This study aimed to develop, validate, and evaluate the feasibility of Velcro Gloves as an innovative instructional medium to support ball-catching activities and enhance student participation during elementary school physical education learning.
Methodology: The study employed a Research and Development (R&D) approach using the ADDIE model. Participants included 25 fourth-grade elementary school students, physical education teachers, and 13 expert validators. Data were collected through observations, interviews, questionnaires, and product validation procedures.
Results: The Velcro Gloves achieved a feasibility score of 89.3% and were categorized as highly feasible for use in learning activities, with validity and reliability coefficients of 0.70 and 0.60, respectively. During the pilot implementation, ball-catching task success increased from 40% to 76%, active student participation increased from 60% to 92%, and learning enthusiasm increased from 56% to 88%. In addition, students appeared more confident and actively involved during learning activities.
Conclusion: The findings suggest that Velcro Gloves are feasible, practical, and easy-to-use instructional media that may support ball-catching activities, student participation, and positive learning experiences during elementary school kasti learning. However, the findings should be interpreted as preliminary evidence of media feasibility and classroom acceptance rather than conclusive evidence of long-term motor skill improvement.

Keywords

Physical Education; velcro gloves; *Kasti* learning; ball-catching skills; game-based learning.

Resumen

Introducción: Las dificultades para atrapar la pelota y la falta de medios didácticos innovadores continuaron siendo problemas frecuentes en el aprendizaje de la educación física en la escuela primaria, especialmente en los juegos de kasti. Estas condiciones redujeron la participación y la motivación de los estudiantes durante las actividades prácticas.
Objetivo: Este estudio tuvo como objetivo desarrollar, validar y evaluar la viabilidad de los Velcro Gloves como un medio didáctico innovador para apoyar las actividades de recepción de la pelota y fomentar la participación de los estudiantes durante las clases de educación física en la escuela primaria.
Metodología: El estudio empleó un enfoque de Investigación y Desarrollo (I+D) utilizando el modelo ADDIE. Los participantes incluyeron a 25 estudiantes de cuarto grado de educación primaria, docentes de educación física y 13 expertos validadores. Los datos se recopilaron mediante observaciones, entrevistas, cuestionarios y procedimientos de validación del producto.
Resultados: Los Velcro Gloves obtuvieron una puntuación de viabilidad del 89,3%, siendo clasificados como altamente viables para su utilización en actividades de aprendizaje, con coeficientes de validez y fiabilidad de 0,70 y 0,60, respectivamente. Durante la implementación piloto, el éxito en las tareas de recepción de la pelota aumentó del 40% al 76%, la participación activa de los estudiantes aumentó del 60% al 92% y el entusiasmo por el aprendizaje aumentó del 56% al 88%. Además, los estudiantes mostraron una mayor confianza y una participación más activa durante las actividades de aprendizaje.
Conclusiones: Los resultados sugieren que los Velcro Gloves constituyen un medio didáctico viable, práctico y fácil de utilizar que puede apoyar las actividades de recepción de la pelota, la participación estudiantil y las experiencias positivas de aprendizaje durante las clases de kasti en la escuela primaria. Sin embargo, estos hallazgos deben interpretarse como evidencia preliminar de la viabilidad y aceptación del recurso en el contexto educativo, y no como evidencia concluyente de una mejora a largo plazo de las habilidades motrices.

Palabras clave

Educación Física; guantes con velcro; aprendizaje de *Kasti*; habilidades para atrapar la pelota; aprendizaje basado en juegos

Introduction

Physical education plays an important role in supporting elementary school students' physical, motor, social, and emotional development through structured and enjoyable movement activities (Alcaraz-Muñoz et al., 2020; Kliziene et al., 2021). In physical education learning, students not only learn about sports activities but also develop basic skills that support daily activities and body coordination development. One of the essential basic skills that should be developed at the elementary school level is manipulative skills, particularly throwing and catching (Pratiwi et al., 2024). Ritonga et al. (2024) explained that throwing and catching skills are part of fundamental movement skills that significantly influence students' motor abilities during physical education learning activities. In addition, Satria et al. (2024) stated that game-based learning effectively improves elementary school students' hand-eye coordination, making basic movement learning more effective and easier to understand during practical activities.

Among the various game-based activities implemented in elementary school physical education, kasti is one of the traditional Indonesian striking-and-fielding games frequently used to develop students' fundamental movement skills (Karisman et al., 2020). The game requires students to perform a combination of locomotor and manipulative skills, such as running, throwing, catching, and striking, within a dynamic game environment. Through these activities, students are encouraged to improve hand–eye coordination, object-control skills, movement accuracy, and teamwork. Due to its emphasis on catching and throwing activities, kasti provides valuable opportunities for developing motor competence and active participation among elementary school students.

Kasti games are commonly used in physical education learning activities to train elementary school students' manipulative skills, especially ball-catching abilities. However, in practice, many students still experience difficulties in performing proper catching techniques during learning activities. Initial observations conducted at SDN 02 Pondok Bambu and SDN 1 Rangkasbitung Timur revealed that approximately 60% of students still struggled to catch the ball correctly. Some students appeared afraid of receiving the ball, lacked confidence, and were unable to coordinate hand movements with the direction of the incoming ball effectively. Furthermore, learning activities were still conducted conventionally without the support of innovative instructional media, resulting in low student engagement during practical sessions. These conditions caused *kasti* learning activities to be less effective and prevented students from actively participating in physical education practice sessions at the elementary school level.

The issue of low student engagement in physical education learning has also been identified in several previous studies. Riswanda et al. (2025) reported that game-based learning increased students' active participation from 63.3% to 93.3% during throwing and catching learning activities. In addition, Dese et al. (2025) found that game-based learning significantly improved elementary school students' learning motivation and fundamental motor skills through more active and enjoyable learning activities. Similarly, Wiyarko and Adhi (2025) demonstrated that game-based learning produced better learning outcomes and student engagement compared to conventional instructional methods. Nevertheless, most of these studies mainly focused on game-based learning models or instructional approaches and have not extensively developed simple instructional media that directly assist students in overcoming difficulties in catching the ball during practical learning activities in elementary schools.

Although previous studies have reported improvements in participation, motivation, and learning outcomes through game-based learning approaches, these outcomes should be interpreted carefully (Fuster-Guilló et al., 2019). Participation refers to students' involvement in learning activities, while motivation reflects their willingness and enthusiasm to engage in those activities. Task success refers to the ability to successfully complete a specific activity, such as catching a ball during practice. In contrast, skill learning involves relatively permanent improvements in motor performance resulting from practice and experience (Kantak & Winstein, 2012). Therefore, increased participation, motivation, or task success during learning activities should not automatically be interpreted as evidence of motor skill acquisition. Distinguishing these concepts is important when evaluating the educational value of instructional media designed to support motor skill development.

Several previous studies have attempted to develop innovative instructional media to improve elementary school students' fundamental movement skills. Wardhana et al. (2025) developed flash

card-based instructional media for throwing and catching activities and reported improvements in students' performance following the implementation of interactive visual media. Similarly, Budiman (2026) found that interactive digital learning media enhanced students' motor skills, motivation, and engagement during physical education lessons. Gumantan et al. (2025) further demonstrated that the integration of Augmented Reality (AR) technology into traditional games created more active and engaging learning experiences for elementary school students. These findings suggest that innovative instructional media can support motor skill development and increase student participation during physical education activities. However, many of these approaches rely on digital or technology-based resources that require supporting facilities, which may not be readily available in all elementary school settings (M. Y. Pratama et al., 2025; Setiawan, 2026). In addition, some instructional media are less practical for direct use during ball-catching activities in physical education lessons.

Supriadi et al. (2022) demonstrated that the use of ball-thrower instructional media improved elementary school students' throwing and catching performance and increased their interest in learning activities. Likewise, Alfath et al. (2025) reported that creative game-based media enhanced student engagement, collaborative learning, and fundamental movement skills during physical education lessons. Despite these promising findings, studies focusing on the development of simple Velcro-based instructional media specifically designed to assist ball-catching skills in elementary school kasti games remain limited. Furthermore, there is insufficient evidence regarding the feasibility, safety, and practical implementation of such reception-assistance media in physical education settings. Most previous studies have emphasized instructional approaches or technology-based learning tools rather than evaluating simple, affordable, and easy-to-use instructional devices that can directly support students during catching practice. Therefore, the development and evaluation of practical, safe, and accessible Velcro-based instructional media are needed to support elementary school students' participation and learning experiences in kasti activities.

Based on these problems and research gaps, this study aims to develop and evaluate the feasibility of Velcro gloves as an innovative instructional medium for *kasti* learning in elementary schools. The instructional media were designed using lightweight elastic fabric and Velcro adhesive adjusted to the size of elementary school students' hands to support ball-catching activities during practice sessions. The development of this media is intended to provide a simple, safe, practical, and easy-to-use instructional tool that can facilitate students' participation and learning experiences in *kasti* activities. Furthermore, this study seeks to contribute to the development of innovative instructional media that support more active, interactive, and enjoyable physical education learning environments in elementary schools.

Method

This study employed a Research and Development (R&D) method using the ADDIE development model, which consists of five stages: analysis, design, development, implementation, and evaluation (Richey & Klein, 2014). The ADDIE model was selected because it provides systematic development procedures and is considered appropriate for developing instructional media in physical education. The study was conducted at SDN 1 Rangkasbitung Timur and SDN 02 Pondok Bambu, involving 25 fourth-grade elementary school students as research participants. The participants consisted of 13 boys and 12 girls aged 9–10 years who regularly participated in physical education classes, including *kasti* learning activities. Students were included in the study if they were actively enrolled in Grade 4, attended physical education lessons regularly, and obtained parental permission to participate in the research. In addition to students, physical education teachers and expert validators were also involved to evaluate the feasibility of the developed instructional media. The primary focus of this study was to develop, validate, and evaluate the feasibility of Velcro Gloves as an innovative instructional medium for elementary school *kasti* learning. The developed media were intended to support ball-catching activities and provide a more active, safe, practical, and enjoyable learning experience during physical education lessons.

The analysis stage was conducted through observations and interviews to identify problems related to *kasti* learning in elementary schools. This stage aimed to examine students' initial conditions, learning difficulties, and the need for instructional media suitable for elementary school students' characteristics.

Furthermore, the design stage involved designing the shape of the Velcro Gloves, determining product dimensions, and selecting materials that were safe, lightweight, and comfortable for students to use. The product was developed using elastic fabric and hook-and-loop Velcro fasteners adjusted to the size of elementary school students' hands to facilitate the ball-catching process. A lightweight soft ball was used to ensure student safety during practice activities. During the development stage, a prototype of the Velcro Gloves was produced and subjected to expert validation before implementation. The implementation stage was conducted as a pilot implementation during regular physical education lessons and consisted of two learning sessions, each lasting 20 minutes. Students were introduced to the Velcro Gloves and participated in structured ball-catching activities designed to familiarize them with the instructional media and support catching practice. Physical education teachers supervised all activities and provided instructions, demonstrations, and feedback throughout the learning process to ensure proper use of the media. The evaluation stage aimed to determine the feasibility and practicality of the developed instructional media through observations, expert validation, and questionnaires administered to students and physical education teachers.

Research data were collected through observations, interviews, questionnaires, expert validation, and documentation. Observation sheets were used to assess students' performance during ball-catching activities, including hand positioning, focus on the ball, movement coordination, confidence, ball-catching task success, and active participation during learning activities. Observations were conducted by physical education teachers during the implementation phase using structured assessment sheets. Interviews were conducted with physical education teachers to obtain information regarding learning difficulties and the need for instructional media in elementary schools. Expert validation instruments consisted of 20 assessment items covering product appearance, safety, comfort, functionality, durability, and suitability with physical education learning objectives. The validation process involved 13 validators consisting of 10 physical education teachers with teaching experience in elementary schools and 3 experts in instructional media and learning design. Validators assessed the product using a five-point Likert scale ranging from 1 (very poor) to 5 (excellent) and provided recommendations for product improvement before implementation.

The feasibility score was calculated as a percentage and interpreted using predetermined criteria, with scores above 81% classified as highly feasible (Creswell, 2014). In addition, student and teacher response questionnaires consisting of 15 items were distributed to examine students' learning motivation, learning enthusiasm, interest, and perceptions regarding the ease of use of the developed instructional media. The questionnaire employed a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating more positive responses toward the instructional media. The research data were analyzed using descriptive statistics in the form of frequencies and percentages. Validity testing was conducted to determine the appropriateness of the instrument content, while reliability testing was performed to assess instrument consistency. The obtained reliability coefficient of 0.60 indicated an acceptable level of consistency for the pilot implementation stage of the study, and the observation and questionnaire results were subsequently used to evaluate the feasibility, practicality, and classroom acceptance of the developed Velcro Gloves instructional media (Gozali & Nasehudin, 2012).

Results

Needs Analysis and Product Development

Initial observations were conducted at SDN 02 Pondok Bambu and SDN 1 Rangkasbitung Timur to examine the learning conditions of *kasti* games among fourth-grade elementary school students. The observation results indicated that most students still experienced difficulties in performing basic ball-catching techniques. Of the 25 students observed, 10 students (40%) were able to catch the ball correctly, while the remaining 15 students (60%) still experienced difficulties related to movement coordination and catching accuracy. In addition, physical education learning activities were still conducted conventionally without the support of innovative instructional media (Killian et al., 2022). These conditions resulted in low student engagement during practical activities, causing the learning

process to be less effective. The results of the initial observations on *kasti* learning activities are presented in Table 1.

Table 1. Initial Observation Results of Kasti Learning Activities

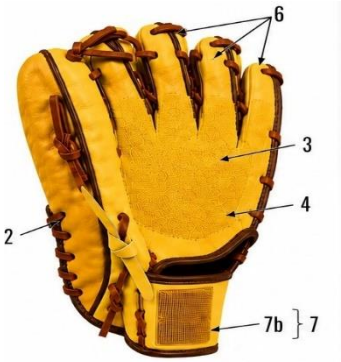
Observation Aspect	n/N	Percentage
Students able to catch the ball correctly	10/25	40%
Students experiencing difficulty catching the ball	15/25	60%

The interview results with physical education teachers revealed that *kasti* learning activities in elementary schools still faced several challenges during practical sessions. Teachers explained that many students felt afraid and lacked confidence when catching the ball because they worried about failing or being hit by the ball thrown by their classmates. Furthermore, the learning process still relied on conventional teaching methods without the support of engaging and interactive instructional media. Approximately 85% of teachers stated that the learning process required simple supporting media that could help students understand basic ball-catching techniques more easily and enjoyably. Teachers also explained that the use of innovative instructional media could help improve students' motivation, active participation, and engagement during physical education learning activities in elementary schools.

Based on the observation and interview findings, the researcher developed instructional media in the form of Velcro gloves as a supporting tool for *kasti* learning activities. The product was specifically designed to help students catch the ball more easily through the use of Velcro adhesive attached to the palm area of the glove. The gloves were made from lightweight elastic fabric that was comfortable for elementary school students to wear and equipped with Velcro adhesive that was safe to use during learning activities. In addition, the glove size was adjusted to fit the hand size of fourth-grade students to avoid restricting movement during throwing and catching activities. The media development process also considered aspects of safety, comfort, and product durability so that the instructional media could be used repeatedly during physical education learning activities in elementary schools.

The product development stage began with designing the initial prototype of the Velcro gloves according to the needs of *kasti* learning activities in elementary schools. The product was developed using a combination of elastic fabric and Velcro adhesive placed on the palm area of the glove. In the product design, the main adhesive components are indicated by numbers 3 and 4, which function to help the ball stick more easily during the catching process. In addition, the fastening strap indicated by number 7 functions to ensure that the glove remains securely attached to students' hands during learning activities. The design of the Velcro gloves developed in this study can be seen in Figure 1 below.

Figure 1. Design of Velcro Gloves as Instructional Media for Kasti Learning



The product development results indicate that the Velcro gloves have strong potential as innovative instructional media for *kasti* learning in elementary schools. The developed media addressed the needs of teachers and students for instructional tools that are simple, safe, and easy to use during practical activities. In addition to helping students improve their ball-catching skills, the use of Velcro gloves is also expected to enhance students' learning motivation and active participation during physical

education learning activities. The development of this instructional media represents an initial step toward creating a more engaging, interactive, and enjoyable learning process for elementary school students before proceeding to the product validation and implementation stages in *kasti* learning activities.

Product Validation, Implementation, and Evaluation

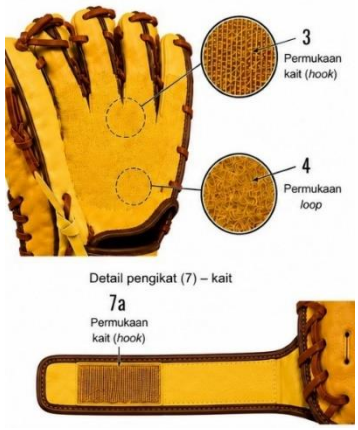
The validation stage was conducted after the Velcro glove prototype had been fully developed. The purpose of this stage was to determine the feasibility of the instructional media before its implementation in *kasti* learning activities at the elementary school level. The validation process involved 13 validators consisting of 10 physical education teachers and 3 experts in instructional media and learning. The product was evaluated based on several aspects, including product appearance, safety, student comfort, media functionality, and suitability with physical education learning objectives. The validation results showed that the Velcro gloves obtained a feasibility percentage of 89.3%, which categorized the product as highly feasible for use in learning activities. In addition, the validity test yielded a score of 0.70, while the reliability test produced a score of 0.60, indicating that the research instruments and instructional media demonstrated acceptable levels of consistency (Ghozali, 2006). The product validation results are presented in Table 2 below.

Table 2. Validation Results of the Velcro Glove Product

Assessment Aspect	Result	Category
Product Feasibility	89.3%	Highly Feasible
Validity	0.70	Valid
Reliability	0.60	Reliable

Based on the validation results, the validators provided several suggestions for product improvement, particularly regarding the Velcro adhesive section and the comfort of the gloves during use. Revisions were made by adjusting the size of the adhesive area to ensure that the ball could stick more effectively during catching practice activities. In addition, the fabric material was modified to become lighter and more elastic to improve students' comfort during learning activities. In the detailed product design, number 3 indicates the hook surface, while number 4 indicates the loop surface, both of which function to help the ball stick to the glove during the catching process. Meanwhile, the fastening strap indicated by number 7a functions to keep the glove securely attached to students' hands during learning activities. The detailed Velcro adhesive components of the product can be seen in Figure 2 below.

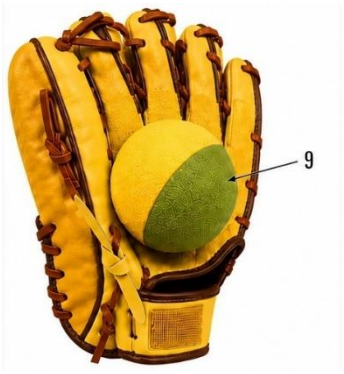
+Figure 2. Detailed Velcro Adhesive Components of the Instructional Gloves



The implementation stage was conducted with 25 fourth-grade students at SDN 1 Rangkasbitung Timur during *kasti* learning activities. During this stage, students used the Velcro gloves directly in throwing and catching activities on the school field. The learning activities began with an explanation of the basic ball-catching techniques, followed by practical exercises using the developed instructional media.

Throughout the implementation process, students appeared more active and enthusiastic compared to previous lessons conducted without instructional media. The use of the Velcro gloves helped students catch the ball more easily because the ball could stick to the adhesive surface on the palm area of the glove. These conditions increased students' confidence and reduced their fear of failure when attempting to catch the ball during physical education learning activities in elementary schools.

Figure 3. The Function of Velcro Gloves in Assisting Ball-Catching Activities



The product trial results demonstrated positive changes in students' performance during the implementation of the Velcro Gloves in *kasti* learning activities. Based on observation sheets completed by physical education teachers, ball-catching task success increased from 10 out of 25 students (40%) before implementation to 19 out of 25 students (76%) after implementation. Student participation, which was also assessed through classroom observations, increased from 15 students (60%) to 23 students (92%). In addition, learning enthusiasm, as measured through student response questionnaires, increased from 14 students (56%) to 22 students (88%) (see Table 3). These findings suggest that the use of Velcro Gloves was associated with higher levels of task success, participation, and learning enthusiasm during the implementation activities. However, these results should be interpreted as preliminary indicators of media feasibility and classroom acceptance rather than as evidence of long-term motor skill acquisition. In Figure 3, number 9 indicates the ball surface that can adhere to the Velcro component attached to the glove's palm area, helping students perform ball-catching activities more easily during practice sessions.

Table 3. Results of the Velcro Glove Product Trial

Indicator	Before	After	Change
Ball-Catching Task Success	10/25 (40%)	19/25 (76%)	+36%
Active Student Participation	15/25 (60%)	23/25 (92%)	+32%
Learning Enthusiasm	14/25 (56%)	22/25 (88%)	+32%

In addition to improving ball-catching skills, the use of Velcro gloves also had positive effects on students' motivation and self-confidence during learning activities. Based on classroom observations, most students appeared more willing to attempt catching the ball compared to before the implementation of the instructional media. Students also demonstrated greater interest in the learning process because the media were considered attractive and easy to use. Physical education teachers stated that the use of the media helped create a more active and interactive learning atmosphere during practical activities. Evaluation results obtained through questionnaires showed that approximately 90% of students felt that learning activities became more enjoyable after using the Velcro gloves, while around 85% of teachers considered the media effective for *kasti* learning activities in elementary schools. Overall, the results of the validation, implementation, and evaluation stages indicate that the Velcro gloves are suitable for use as innovative instructional media in elementary school physical education learning activities.

Discussion

The Role of Velcro Media in Supporting Ball-Catching Activities

The initial observation results showed that elementary school students still experienced various difficulties in learning *kasti* games, particularly in catching activities. Of the 25 students observed, approximately 60% still had difficulty catching the ball correctly, while only 40% were able to perform proper catches during practical activities. These difficulties were reflected in poor hand coordination, inaccurate hand positioning when receiving the ball, and students' fear of catching balls thrown by their peers. In addition, PE teachers explained that learning activities were still conducted conventionally without instructional media that could help students gradually understand basic skills. These conditions indicate that elementary school students may benefit from learning media capable of supporting participation and providing a safer, easier, and more enjoyable learning experience during physical education lessons at school.

These findings are consistent with Bailey (2006), who stated that physical education plays an important role in supporting students' physical development, motor skills, and self-confidence at the elementary school level. Similarly, Lubans et al. (2010) explained that basic skills such as throwing and catching are part of fundamental movement skills that must be developed from an early age through activities appropriate to children's developmental characteristics. In this study, students' difficulties in catching the ball indicated that previous learning processes had not fully supported the development of manipulative skills optimally. Therefore, the Velcro glove was developed as an alternative instructional medium capable of providing students with a simpler and more gradual learning experience. The use of instructional media aligned with elementary school students' characteristics is expected to support participation and provide opportunities for students to engage more actively in catching activities during physical education learning.

The implementation of the Velcro glove in this study was associated with higher levels of ball-catching task success during *kasti* learning activities. Before using the media, 10 out of 25 students (40%) successfully completed the catching task, whereas after implementation the number increased to 19 students (76%). These findings suggest that the developed instructional media may have supported students during catching activities by reducing task difficulty during practice sessions. The Velcro adhesive placed on the palm area enabled the ball to adhere more easily during catching activities, which may have helped students experience more successful attempts during practice. In addition, the media reduced the possibility of the ball slipping from students' hands during catching exercises. However, these findings should be interpreted as indicators of task success during implementation rather than as evidence of long-term motor skill acquisition.

The findings of this study are in line with the research conducted by Ritonga et al. (2024), who developed a Teaching Games for Understanding (TGfU)-based throwing and catching learning model for elementary school students. Their study demonstrated that the learning model was associated with higher levels of student engagement during the learning process. Likewise, Supriadi et al. (2022) explained that the use of manipulative instructional media such as ball throwers was associated with improved performance during throwing and catching activities. Both studies indicate that appropriate learning media and practical learning approaches may help students engage more actively in manipulative skill practice. These findings support the results of the present study, suggesting that the Velcro glove may support participation and task success during catching practice by providing students with simpler, more interactive, and more supportive learning experiences during physical education activities.

The use of the Velcro glove was also associated with observable changes in students' movement behavior during learning activities. Before using the media, many students experienced difficulty adjusting hand movements to the direction of the incoming ball, causing frequent unsuccessful catching attempts. During implementation, students appeared more focused on the ball's direction and demonstrated greater willingness to engage in catching activities. These observations suggest that the instructional media may have provided students with additional opportunities to experience catching-related movements during practice sessions. Santoso et al. (2023) reported that motor ability significantly correlates with elementary school students' physical education achievement, with a

correlation value of 0.395. Furthermore, Morgan et al. (2013) explained that motor skill interventions can support movement coordination and manipulative skill development through gradual and repetitive practice activities conducted during physical education learning. Similarly, Ali et al. reported that a structured training program contributed to improvements in sport-specific physical abilities and skill performance, highlighting the importance of repeated practice and systematic learning experiences in supporting movement-related outcomes.

In addition to supporting students' participation in catching activities, the Velcro glove appeared to increase students' self-confidence during *kasti* learning activities. Before using the media, several students appeared hesitant and afraid to catch the ball because they worried about failing or being hit by the ball. After the implementation of the Velcro glove, students became more willing to repeatedly attempt catching activities during practice sessions. One possible explanation is that the Velcro adhesive enabled the ball to stick more easily to the glove, allowing students to experience successful catches more frequently throughout the learning process. These findings are supported by Popescu et al. (2025), who explained that game-based learning activities can significantly improve students' motivation and motor engagement in elementary physical education. Similarly, Dese et al. (2025) found that game-based learning approaches were associated with increased learning motivation and participation through active and enjoyable learning activities.

The instructional media developed in this study also contributed to creating a learning process that appeared easier for elementary school students to understand. The Velcro glove provided students with concrete learning experiences because they could directly observe the media's function while practicing throwing and catching activities. Moreover, the media helped students understand hand positioning and catching movements through direct practice during lessons. Mayer (2014) explained that instructional media facilitate students' understanding because information is delivered through visual experiences and hands-on practice. In addition, Budiman (2026) demonstrated that interactive learning media can support students' coordination, motivation, and engagement during physical education learning activities. These findings suggest that innovative instructional media may help students engage more actively in learning experiences compared to conventional teaching approaches.

The product validation results in this study demonstrated that the Velcro glove achieved a feasibility score of 89.3%, categorized as highly feasible for use in elementary school *kasti* learning. Furthermore, the validity test result reached 0.70, while the reliability result was 0.60, indicating that both the media and research instruments possessed acceptable levels of consistency. Validators also provided suggestions regarding the size of the adhesive area and the comfort of the glove to ensure better suitability for elementary school students' characteristics. These results indicate that the developed instructional media fulfilled aspects of safety, comfort, and functionality during practical learning activities. These findings align with studies emphasizing that learning media validation is essential to ensure product quality, safety, and usability before implementation in elementary school learning environments (Abdullah & Maladona, 2026; Ridwan et al., 2026).

The implementation of the Velcro glove also created a more active and enjoyable learning atmosphere for elementary school students. Based on classroom observations during implementation, students appeared more enthusiastic during practical activities compared to previous lessons conducted without instructional media. The use of the glove appeared to encourage students to repeatedly practice catching activities, gradually increasing their engagement during physical education lessons. These findings are consistent with Riswanda et al. (2025), who found that game-based learning increased students' active participation during learning activities. Similarly, Wibowo et al. (2025) reported that movement training and game-based approaches significantly improved primary school students' physical fitness and social skills, suggesting that active participation in structured movement activities can contribute to broader developmental outcomes. In addition, interactive instructional media in physical education can support student engagement and create more enjoyable learning experiences during practical activities at the elementary school level (Fanani & Widiadharma, 2026; Martín-Rodríguez & Madrigal-Cerezo, 2025).

Nevertheless, the observed findings should be interpreted with caution. The increases in task success, participation, and enthusiasm may not have been influenced solely by the instructional media itself. Several alternative factors may have contributed to the observed outcomes, including increased motivation, teacher guidance and feedback during implementation, repeated practice opportunities,

and the novelty effect associated with the introduction of a new learning tool. Furthermore, the mechanical assistance provided by the Velcro component may have reduced the difficulty of catching activities by helping the ball adhere to the glove surface during practice sessions. Therefore, the findings of this study should be interpreted as preliminary evidence of media feasibility, usability, and classroom acceptance rather than conclusive evidence of long-term motor skill acquisition.

The findings of this study are further supported by Widodo et al. (2023), who demonstrated that catch-ball game development was associated with improvements in elementary school students' motor skill practice experiences. Their study showed that approximately 80% of students achieved age-appropriate ball-catching skill development after participating in the developed learning activities. In addition to supporting catching practice, the catch-ball game also enhanced students' cooperation, critical thinking, and participation during learning activities. These findings are also consistent with the systematic review conducted by Corte et al. (2026), which highlighted that sports participation may contribute to greater teamwork, responsibility, engagement, and commitment among students. Their review further suggested that regular involvement in sport-related activities is associated with positive educational outcomes and student development. Therefore, the Velcro glove can serve as an innovative instructional medium that not only supports catching practice activities but also contributes to more active, enjoyable, and engaging physical education learning processes in elementary schools.

The Influence of Velcro Gloves on Students' Motivation and Engagement in Kasti Learning

Physical education learning in elementary schools is often perceived as enjoyable because it involves games and direct physical activities. However, in practice, not all students feel comfortable participating in PE lessons, especially when learning activities require basic skills such as catching a ball. Some students tend to become passive, lack confidence, and avoid active participation during practice sessions because they are afraid of making mistakes or feel incapable of performing the movements correctly. These conditions indicate that game-oriented learning does not automatically create student engagement without the support of appropriate instructional strategies and learning media. Therefore, the use of innovative learning media becomes important to help create a learning environment that is safer, more engaging, and more supportive of student participation during *kasti* learning activities in elementary schools.

The findings of this study showed that the use of Velcro gloves positively influenced student engagement during *kasti* learning activities. Before the implementation of the media, the learning process was still conducted conventionally, resulting in low student participation during practical sessions. After the implementation of the Velcro gloves, active student participation increased from 60% to 90%. This improvement indicates that the instructional media helped students become more actively involved in learning activities rather than merely listening to teacher instructions passively. The use of Velcro gloves encouraged students to repeatedly attempt catching the ball because the media reduced their fear of failure during practice. These findings suggest that interactive learning media can help create more active, participatory, and student-centered learning processes during physical education lessons in elementary schools.

The results of this study are consistent with the findings of Wiyarko and Adhi (2025), who reported that game-based learning significantly improved student engagement compared to conventional instruction, with a significance value of $p < 0.001$. In their study, students in the experimental group demonstrated higher levels of participation because game-based learning provided more interesting and interactive learning experiences. Similar findings were observed in the present study, where the use of Velcro gloves encouraged students to participate more actively in throwing and catching activities during learning sessions. Furthermore, the increase in student engagement found in this study also supports the findings of Ningsih (2024), who explained that game-oriented learning approaches in physical education can improve student participation and social interaction because learning activities become more enjoyable compared to monotonous teaching methods.

The use of Velcro gloves also influenced students' learning enthusiasm during *kasti* lessons. The research data showed that students' enthusiasm increased from 55% to 88% after the implementation of the instructional media. This improvement indicates that students became more interested in participating in learning activities because the media provided a different learning experience compared to previous lessons. During the implementation process, students appeared more

enthusiastic about repeatedly practicing throwing and catching activities with their classmates. These conditions suggest that attractive learning media can reduce boredom during learning activities. In addition, the Velcro gloves helped create a more relaxed and enjoyable learning atmosphere, allowing students to enjoy *kasti* learning activities more during practical sessions in elementary schools.

These findings are supported by the study conducted by Anggraini et al. (2025), which demonstrated that game-based learning media significantly increased students' interest and enthusiasm in physical education learning. Their study explained that students became more active, enjoyed the learning process more, and showed improved social interaction during learning activities. Similar results were found in the present study, where the use of Velcro gloves encouraged students to become more active and enthusiastic during practice sessions. Furthermore, Louk et al. (2024) reported that game-based learning improves students' learning experiences because lessons become more engaging and less monotonous. Similar conditions were observed in this study, where the use of Velcro gloves made students enjoy ball-catching activities more, resulting in a livelier and more enjoyable learning atmosphere during *kasti* practice sessions.

In addition to improving learning enthusiasm, the use of Velcro gloves also enhanced students' motivation during *kasti* learning activities. Before the implementation of the media, several students appeared hesitant when receiving the ball because they were afraid of failing to catch it. After the use of the Velcro gloves, students became more confident because the ball could stick more easily to the Velcro surface on the palm area. These successful experiences increased students' motivation to repeatedly attempt catching activities during learning sessions. Moreover, approximately 90% of students stated that learning activities became more enjoyable after the use of the media. These findings indicate that positive learning experiences significantly influence students' motivation during physical education learning activities in elementary schools.

The findings of this study are in line with the research conducted by Ezeddine et al. (2025), who found that game-based learning significantly increased students' intrinsic motivation compared to conventional instruction, with a significance value of $p < 0.001$. Their study also revealed that students' motor engagement increased from 50.7 to 131.4 after the implementation of game-based learning activities. These findings support the present study because the use of Velcro gloves also improved students' motor engagement during practical learning activities. In addition, Dese et al. (2025) explained that game-based learning can improve students' learning motivation and fundamental motor skills through active and enjoyable learning activities. These findings strengthen the results of the present study, indicating that interactive instructional media can simultaneously improve students' motivation and engagement during *kasti* learning activities.

The implementation of Velcro gloves in this study also contributed to creating a more active and enjoyable learning environment. Before the use of the media, several students appeared uninterested in participating in practical activities because the learning process was repetitive and monotonous. After the implementation of the media, students became more relaxed, physically active, and socially interactive during learning sessions. Physical education teachers also reported that the media helped create a more dynamic classroom atmosphere and supported student engagement during practice activities. These findings indicate that innovative instructional media can help create a more positive learning environment, enabling students to feel more comfortable participating in physical education activities in elementary schools.

The results of this study are supported by Thi (2025), who found that game-based learning improves students' emotional, behavioral, and cognitive engagement during learning activities. The study explained that students became more confident, more comfortable, and better able to understand learning materials when game-based approaches were implemented. Similarly, Culajara (2022) reported that game-based learning increased student engagement through more innovative and interactive learning experiences. Comparable findings were observed in this study, where the use of Velcro gloves encouraged students to participate more actively because the media provided more enjoyable and less stressful learning experiences during *kasti* practice sessions in elementary schools.

The use of Velcro gloves also improved student involvement during practical learning activities. Throughout the implementation process, students appeared more active in repeatedly practicing throwing and catching activities compared to previous lessons. In addition to physical engagement,

students also demonstrated increased social interaction during learning sessions. Students worked together more frequently, supported one another, and practiced collaboratively within their groups during learning activities. These findings indicate that instructional media not only support students' motor skill development but also enhance their social engagement during learning activities. Therefore, instructional media designed according to elementary school students' characteristics can help create more active, collaborative, and enjoyable learning experiences during *kasti* lessons.

These findings are further supported by Omarov et al. (2024), who demonstrated that interactive instructional media significantly improved students' participation, motivation, and learning experiences compared to traditional learning approaches. In addition, Pratama et al. (2026) explained that game-based learning significantly improved students' intrinsic motivation, with an effect size value of d = 1.24 during sports learning activities. These findings reinforce the results of the present study, indicating that innovative learning media can effectively improve student engagement during learning activities. Nevertheless, the increase in students' motivation and engagement observed in this study may not have been influenced solely by the instructional media itself, but also by the novelty of the learning atmosphere, the teacher's instructional approach, and students' first-time experiences with interactive gameplay. These conditions suggest that the effectiveness of instructional media should be understood more broadly as part of the interaction between learning design, teacher facilitation, and students' learning experiences during physical education activities in elementary schools.

Conclusions

The results of this study indicate that the development of Velcro Gloves as instructional media for *kasti* learning activities produced a feasible and practical learning resource for elementary school physical education. The implementation of the media was associated with higher levels of ball-catching task success, student participation, and learning enthusiasm during classroom activities. The Velcro component attached to the glove's palm area enabled the ball to adhere more easily during catching practice, providing students with supportive and engaging learning experiences throughout the implementation process. In addition, the developed media contributed to creating a learning environment that appeared more active, safe, interactive, and enjoyable, encouraging students to participate more confidently in *kasti* learning activities. However, these findings should be interpreted as preliminary evidence of media feasibility and classroom acceptance rather than conclusive evidence of long-term motor skill acquisition or instructional effectiveness.

This study has several limitations that should be considered in future research. The limited number of participants and the implementation conducted in only two elementary schools restrict the generalizability of the findings to broader physical education contexts. Furthermore, the study focused primarily on ball-catching task performance and did not examine transfer effects, retention of learning, teamwork skills, tactical understanding, or long-term motor skill development. The relatively short implementation period also limits conclusions regarding sustained educational outcomes. In addition, the observed results may have been influenced by factors such as increased motivation, teacher feedback, repeated practice opportunities, novelty effects associated with the introduction of a new learning tool, and the mechanical assistance provided by the Velcro component during catching activities. Therefore, future studies are recommended to involve larger samples, comparison groups, longer implementation periods, transfer and retention assessments, and more comprehensive evaluations of learning outcomes in elementary school physical education settings.

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Ethics Statement

This study was conducted in accordance with ethical principles for educational research involving human participants. Permission to conduct the study was obtained from the participating schools. Parents or legal guardians were informed about the purpose and procedures of the study, and students participated voluntarily with their assent. Participant confidentiality and anonymity were maintained throughout the research process, and the collected data were used solely for research purposes.

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