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Learning media innovation with assistive devices to improve motor skills of students with special needs and visual impairment

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Abstract

This study addresses the limited variations in tactile movement learning, mobility, and jumping exercises that support the cognitive, psychomotor, and affective abilities of blind students with special needs. The purpose of this research is to enhance students' movement, mobility, and jumping skills through the use of embossed mat media in a frog-jumping exercise. A development method was employed, involving a small-scale trial with 3 students and a large-scale trial with 11 students. The study utilises descriptive percentage analysis and qualitative analysis methods to examine recommendations and rationales for response selection. Data from the small-scale trials show the following results: adaptive PE expert 1 at 89.33%, adaptive PE expert 2 at 93.33%, and learning expert at 80.00%. On a larger scale, adaptive PE expert 1 rated 93.33%, adaptive PE expert 2 rated 89.33%, and the learning expert rated 82.66%, yielding an average score of 88.44%. The percentage results for the embossed mat indicate that the product meets the "good" criteria based on the data analysis. The study concludes that the embossed mat media can be effectively used to teach frog jumping to blind students with special needs. It is recommended that teachers adopt this media and consider incorporating additional variations in PE learning for students with special needs.

Keywords: Frog jump learning, embossed mat, visually impaired.

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INTRODUCTION

Learning for visually impaired students has its own challenges due to their visual limitations, requiring special modifications to optimise the learning process. Learning modifications for visually impaired students are essential to ensure their cognitive, psychomotor and affective development

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is well underway. Cognitive learning modifications for visually impaired students aim to provide equal access to subject matter that is often delivered visually. Visually impaired students need an approach that focuses more on other senses, such as hearing and touch, to understand abstract concepts and complex material (Afrizal & Rizal, 2022; Wardhana et al., 2023). Visually impaired students can utilise teaching materials in the form of 3D models, raised maps, or Braille writing to learn concepts that are usually conveyed visually (Jariono et al., 2022). In physical education, learning is a form of introducing cognitive activities in a physical format (such as movement activities) by utilising tools that can be used to help students understand motion learning as a support for their cognitive development.

Tactile learning provides a tangible learning experience and facilitates deeper understanding through physical exploration (Bagus Endrawan, 2022). This modification is very important as it helps visually impaired students to understand lessons independently and improve their cognitive understanding, especially in areas that require visualisation. The development of psychomotor skills is an important aspect that should be considered in the education of visually impaired students. Modified physical activities, such as balance training, jumping, or orientation movements, can help students develop gross and fine motor skills (Rojas & Hodge, 2024). Orientation and mobility (O&M) programmes are designed to train visually impaired students to move independently in their surrounding environment (Fitri et al., 2022; Sydoruk et al., 2021).

Adaptive Physical Education is a service for students with disabilities who should have the same privileges as other students in receiving education and learning at every level of education (Güvendi & İlhan, 2017; Pratiwi et al., 2020). Likewise, according to Afrizal et al. (2023), adaptive physical education is a form of service in education so that the potential of students with disabilities can grow and develop optimally. So far, the dimensions of disability in Indonesia have received little attention from both the government and society and discrimination still occurs. "One of the disabilities that often occurs in SLB is visual impairment. Blind people are

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those whose eyesight cannot function in education without the use of special materials or other special assistance (Solihin et al., 2020). What is meant by blind people is not just blind people. It also includes those who can see, but it is very limited and cannot be used for daily life needs, which is the main thing in learning. The visually impaired group includes children with partial vision, low vision, or nearsightedness. Visual impairment directly reduces developmental characteristics and motor perception abilities because a person cannot see normal visual improvements (Taufan et al., 2018). Blind children have the following limitations: 1) limited experiences and concepts, 2) limited interaction with the environment, and 3) limited mobility (Ishtiaq et al., 2016). Therefore, education for blind people must refer to 1) requirements for having much experience, 2) requirements for coordinated insight, and 3) requirements for acting and working in learning.

Observation studies that have been conducted previously at Sekolah Luar Biasa Negeri Surakarta show that in this school, there is learning for children with special needs who are blind, totalling 4 elementary and junior high school students. The results of the observation reported that in sports learning, especially in frog jumping, there are several things that must be considered, many students have not dared to jump frogs because there are doubts about making jumps, students can only practice movements based on instructions and do not know the limits in performing frog jumping movements so that preferably in performing frog jumping learning movements blind students must feel in doing the movement. So that in making movements, blind students must use their sense of touch in making jumping movements; in supporting they must use a mat that has an elevated tent on the cross-section of the mat.

Jumping learning at that time only focused on the psychomotor aspect, whereas in learning, the cognitive, affective and mobility aspects of blind students must also be considered. At that time, they were only taught to jump forwards, backwards and sideways. Jumping learning is taught by the teacher using the instruction method, and the teacher stands next to the student while holding the student's hand and then gives instructions to the

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student to do the jumping movement. The development of embossed media is one of the solutions to learning jumping for visually impaired children (Sobarna & Hambali, 2020). The texture of this embossed mat is soft and textured, so it aims to provide tactile learning and mobility skills for visually impaired children in schools (Heryati et al., 2023). This embossed mat media is safe to be applied in adaptive physical education learning, especially for students with special needs who are blind, because this media is soft, so it has a low risk of injury (Fridayati et al., 2022). Developing frog jumping learning media with an elevated mat, it is hoped that it can improve the psychomotor aspects of students through the movements they make and the cognitive aspects of students through the process of understanding during student learning, while the affective aspects can be achieved from the process of student activeness and enthusiasm during learning and gaining sensory sensory abilities for blind special needs children.

In this study, researchers want to make a product in the form of media that will be used by blind students in learning activities. Based on the above problems, the researcher is interested in conducting research.

METHOD

This development research design uses a research and development design (Umar et al., 2023) with embossed mat media. The following is a description of the research: First, a needs analysis will be conducted, which includes a literature study, observation, and field perception. To obtain preliminary data to conduct development research. Second, an initial product design should be developed by making media models and materials according to the needs. Third, expert evaluation using two experts on physical education learning and one adaptive learning expert, as well as small-scale trials at the Surakarta State Special School, using questionnaires and consultation and evaluation, which were then analysed. Fourth, the first product revision was carried out based on the results of expert assessment and small-scale trials. Revisions are used to improve the initial product that researchers have made. Fifth, conduct a large-scale

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field test with Frog Jumping learning material using an elevated mat during learning that has been modified based on previous small-scale trials. After the large-scale trial, an evaluation was conducted to determine the final results of the frog jump learning development model using elevated mat media.

The types of data in this research are quantitative and qualitative data generated from interviews with physical education teachers in SLB and physical education teacher questionnaires. As well as important data and suggestions from experts in the field of physical education as input for revising the product. The sample in this research of developing embossed mat media for frog jump learning totalled 11 students with a random sampling process from 2 schools, namely SLB N Surakarta and SLB A YKAB Surakarta. This study also involved two adaptive physical education experts, one physical education teacher and one sports and health teacher. This study collected data using questionnaires and interviews based on psychomotor and affective cognitive aspects by researchers and validated by experts in the field of physical learning, as well as scoring sheets in frog jumping learning. The data analysis technique used in this development research is descriptive analysis technique in the form of percentages. The qualitative analysis method is used to examine data in the form of recommendations and reasons for choosing answers.

Product Design

This frog jumping lesson uses a raised mat for blind children. The mattress media that will be used is made as easy as possible so that it can be used by children with special needs who are blind, and material regarding mobility aspects can be achieved. The mat that is made is 300 cm long, divided into 6 squares measuring 50x50 cm like the squares in the engklek game, and in each square, there are a number of circles that are raised to mark the student's jump distance with a size of 1 cm. The lines on the mat are embossed, measuring 2 cm, to stimulate students to jump on the media. Below is a picture of an embossed jumping frog mat for children with special needs who are blind.

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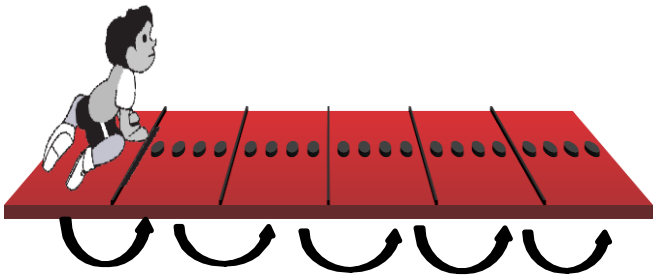

Figure 1. Embossed Mattress Media

Notes:

: The boundaries of each square on the mat and above are marked with a string as a tactile identification mark.

: Small embossed circles serve as markers for how far the student has jumped in each square.

: Mat

The learning movements in this research are explained as follows:

1. Students are first taught an introduction to frog jumping, then each student touches one of the frog jumping demonstrations to understand the movements.
2. When fingering, students are given a verbal explanation regarding the position of their body parts during the frog jump movement, starting from the initial movement to the final movement.
3. Blind students are introduced to the embossed mat media used for learning frog jumping.
4. Students feel with the palms of their hands or feet on the tool and are given a verbal explanation of what the dividing lines and circles on the mat mean.
5. After knowing the characteristics of the tools to be used, students are asked to practice frog jumping movements with the teacher providing guidance.
6. Students are asked to squat like a frog in square one, after that students are asked to feel forward until they find the boundary of the box in the

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form of a raised line, after holding the raised line students are asked to move their hands to the next square. After that, the foot that is still on the previous square is asked to jump to the next square or the next numbered square. Next, the researcher recorded the length of the student's jump by looking at the footrest that landed on the raised circle mark in each box. This is done continuously until the child jumps five times on the last box.

7. If the student's hand has landed on the next box and is holding the circle that appears, then the foot that is still on the previous box is asked to jump to the next box or the next numbered box. This is done repeatedly until the child jumps five times according to the circles in each box.
8. After one child has finished, continue with the next child with continued guidance from teachers and researchers.
9. After introducing the media with the guidance of teachers and researchers, students were asked to do the frog jump again under the supervision of teachers and researchers.

RESULT

1. Presentation of Small-Scale Trial Results Data

After conducting interviews, filling out questionnaires, and observing the physical education learning process, especially frog jumping at SLB Negeri Surakarta, referring to the psychomotor, cognitive, and affective aspects contained in the questionnaire and interviews, the following results from small-scale trials were obtained.

Table 1. Table of recapitulation data for small-scale trial students

NO	Assessment Aspects	Number of Students	Percentage
1	Cognitive	3	**79.99 %**
2	Affective	3	**78.66 %**
3	Psychomotor	3	**82.22 %**
	Total		**240.87 %**
	Average		**80.29 %**

From the results of the observation assessment in the field and interviews regarding the learning model using embossed mats based on

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three aspects, namely cognitive, affective, psychomotor, carried out by researchers and experts, the following results were obtained from the cognitive aspect of 79.99% from the affective aspect of 78.66% then from the psychomotor aspect of 82.22% so that the total of the three aspects is 240.87% and with an average of 80.29%, the use of embossed mats in frog jump learning for students with special needs who are blind is said to be "good".

Based on the evaluation results conducted by physical education experts and learning experts based on the trial process and the results of small-scale tests, there are several obstacles, including students often overdoing the movement because the embossed marks on the mat are not raised enough so that they often cannot be felt. So, the Embossed Mat media that needs to be improved is the boundary mark so that students can touch and understand more clearly, and the circle mark is made shorter so as not to injure themselves when landing.

2. Presentation of Large-Scale Trial Results Data

Large-scale testing carried out by researchers and experts in the field of adaptive education regarding the development of emerging matlass in leapfrog learning media for blind students covering 2 special schools in Surakarta shows good results from various aspects of learning. The following is data on cognitive, affective, and psychomotor aspects from the results of large-scale trials through interviews conducted by researchers.

Table 2. Large-scale trial student recapitulation data table.

No.	Assessment Aspects	Number of Students	SLB Surakarta State	SLB A YKAB Surakarta	Percentage (%)
1	Cognitive	11	**86.66 %**	**85%**	**85.83%**
2	Affective	11	**83.99 %**	**88.06 %**	**86.58%**
3	Psychomotor	11	**86.66 %**	**87.58 %**	**88.48%**
			Total		**260.89%**
			Average		**86.96%**

From the results of field observation assessments and large-scale interviews regarding the learning model using raised mats based on three aspects, namely cognitive, affective, and psychomotor, conducted by

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researchers and experts at two SLBs, namely SLB N Surakarta and SLB A YKAB Surakarta totalling 11 students, the following results were obtained from the cognitive aspect of 11 students of 85.83% from the affective aspect of 11 students of 86.58% than from the psychomotor aspect of 88.48% so that the total of the three aspects is 260.89% and with an average of 86.96%, the use of raised mats in frog jump learning for blind special needs students is said to be "good".

DISCUSSION

This research and development produced an emerging Matlas product for learning frog jumping for students with special needs who are blind. To improve the motor skills and physical participation of blind students, this research developed a learning product in the form of an embossed mat for frog jumping practice. This mat is designed to help visually impaired students overcome coordination and spatial orientation challenges during physical activities. In adaptive learning, especially for visually impaired students, the use of tactile media is very important to support the learning process (Stephenson et al., 2022). Tactile media refers to tools or materials that can be touched by visually impaired students, allowing them to access information through their sense of touch (Rodríguez-Cano et al., 2022).

The use of tactile media helps visually impaired students more easily master concepts that are usually explained visually (Bagus Endrawan, 2022). It gives them the opportunity to follow lessons at the same pace as other students. Tactile media also plays an important role in increasing the learning independence of visually impaired students (Rosmi & Jauhari, 2022). With access to learning materials in a physical, tactile form, students can learn without always relying on a companion or assistance from others. For example, using embossed maps in geography lessons or 3D models in science lessons allows students to learn independently and understand the material better (Solihin et al., 2020).

The use of tactile media significantly impacts the effectiveness of learning for visually impaired students. Tactile media helps them understand

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abstract concepts, increases learning independence, supports multisensory learning, and develops fine motor skills (Hiremawati et al., 2024). However, for the benefits of this media to be fully realised, there is a need for curriculum adjustments and appropriate teacher training, so that tactile media can be truly integrated into effective adaptive learning (Vinne et al., 2018; Zöllner et al., 2011). Thus, the use of tactile media is not just a tool, but an integral part of an inclusive and empowering learning strategy for students with visual disabilities.

This embossed matlass media product can be used for blind students. This is based on the embossed mat media product used, which has the advantage of being in line with the needs of blind students in the form of embossed marks on the mat, which can train the jumping ability and tactical mobility of blind students with touching (Ilhan et al., 2020). In addition, blind students understand how to train their sense of touch (Solihin et al., 2020). With this emerging mat, students can practice jumping by feeling and can also train cognitive aspects in counting the number of boxes and knowing the boundary marks on the mat for jumping. This emerging matlass media also provides blind students with experience regarding frog jumping, learning frog jumping is a basic movement procedure for jumping (Timba & Yanuarius, 2021). This embossed mattress media is made from material that is not hard, so it is not dangerous and reduces the risk of injury to blind students. Sports facilities and infrastructure for the disabled must be made as friendly as possible to support their achievement (Fitri et al., 2022). This is in line with this embossed mattress product so that students with special needs who are blind can be more confident in their daily activities. In learning frog jumping for students with special needs who are blind using this raised mat, there is an improvement in various aspects, including an increase in the cognitive aspect, which arises because students can understand the movements being taught by feeling the part that will be used as a support and landing. From the affective aspect, students will always actively try without warning because they already understand the locations using the process of feeling the emergent mattress, and the psychomotor

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aspect will be achieved by frequently trying so they can get used to it and become proficient in doing it.

Overall, the emerging material media is very appropriate and effective in that it can improve students' cognitive and psychomotor factors; this is in line with the opinion (Rosmi & Jauhari, 2022) that appropriate media in the learning process can improve aspects of learning. The development of this embossed mattress media product is also able to overcome the problem of limited teacher facilities and infrastructure for learning for students with special needs who are blind. To make learning more interesting and students more enthusiastic, they must develop media and learning models (Syahni et al., 2021). The importance of developing media to support learning for students with disabilities in sports (Hudson, 2018; Kristén et al., 2022). Apart from that, determining learning models that are appropriate to the media must be interesting so that learning is more enjoyable (Afrizal et al., 2023; National Council for Special Education, 2018). With this emerging matlass media, it is hoped that more interesting learning models can be developed.

This product prototype is the final result of a large-scale evaluation conducted by physical education experts and learning experts. The product produced through this development research is the development of embossed mat learning media for frog jumping learning so that students with visual impairments in SLB Negeri Surakarta and SLB A YKAB Surakarta understand how to jump like a frog and train the sense of touch (tactual) so that students with visual impairments are able to jump like frogs in doing mobility activities. This embossed mat media is designed based on the learning needs, namely cognitive, affective, and psychomotor aspects. The embossed mat media produced and used for learning for students with visual impairments has a mat length of 300cm, divided into 6 boxes measuring 50x50 cm like a crankle field, and in each box, there are several embossed circles as a marker of student jumping distance. The lines on the mat are raised to stimulate students to perform jumping movements on the media. Based on this learning model, from the results of the initial evaluation

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to the large-scale trial, it shows some significant improvements, initially, students were hesitant to jump, but now, students are not hesitant because there is a mat that can be used to determine the limit of the jump. This frog jumping learning model is used because students' hands and feet can touch the floor so that their sense of touch touches the board more, and with the squatting style, students are not worried about falling when jumping. The results of this study are inseparable from some of the limitations faced in this study, including the relatively small number of samples, organising samples in research activities that are not perfect, and the number of material tools that are not perfect. Hopefully, this research can be developed again with more subjects and other long-jump learning models that are not harmful to students.

CONCLUSION

From this study, it was found that there was a raised mat media that had a major influence on the learning outcomes of frog jumps for special needs blind students, referring to tactile abilities, student mobility and variations in jumping learning that support cognitive, psychomotor and affective skills of blind students. With the development of raised mat media, frog jump learning for blind students will be easier because students will be more comfortable, safe, and enjoyable in the learning process. The direct impact of using raised mats in frog jump learning is that they can determine their jumping process using a tactile process that improves their tactile abilities. Learning frog jumps using raised mat media provides an overview to special needs and blind students about how to jump frog jumps. The raised mat media is made soft so that it does not endanger special needs students who are blind, revealing the role of self-confidence mediation in translating the benefits of jump height and reducing the negative impact of flexibility on shooting accuracy. This study contributes to the theoretical understanding of the factors that influence the learning process and offers practical implications for frog jump learning materials. Teachers and students can use this knowledge to tailor learning programmes focusing on increasing jump height, maintaining optimal flexibility, and building

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confidence to improve jump accuracy. In addition, this study provides a basis for further research on interventions or learning strategies for students with special needs that can improve jump mastery.

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