



Enhancing Cognitive Development of Special Need Students through the E-Moszle Web-Based Learning Tool

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ABSTRACT

Traditional sports in Indonesia represent an important cultural heritage. However, in the modern era, children rarely participate in these activities, particularly those with special needs. This study aimed to develop and evaluate E-Moszle (Electronic Module Traditional Sports and Games Puzzle), a web-based medium to enhance cognitive development in children with mild intellectual disabilities through traditional sports. The research employed a Research and Development (R&D) approach using the 4D model, consisting of the Define, Design, Develop, and Disseminate stages. The participants consisted of 2 teachers and 20 students from two different special education schools (SLB). Data were collected through observations, interviews, and expert validation questionnaires, and analysed by using descriptive quantitative techniques based on the Likert scale to determine the feasibility of the product. The feasibility test showed an average score of 95.42%, indicating that the product was highly appropriate for educational use. Furthermore, the implementation of E-Moszle resulted in a 50% increase in the student cognitive abilities within a short period. These findings suggest that E-Moszle is a highly feasible and effective instructional medium for enhancing the cognitive development of children with mild intellectual disabilities, while also serving as innovative means to preserve and introduce traditional sports in contemporary education.

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INTRODUCTION

Traditional sports provide learning outcomes comparable to physical education, fostering the development of cognitive, affective, and psychomotor domains (Houser & Kriellaars, 2023). Globally, a significant decline in child participations in physical activities has been reported. A recent comparative analysis of international physical activity guidelines found that most children worldwide do not meet the recommended daily level of physical activity necessary for the optimal physical and cognitive development, mainly due to the increasing shift toward digital-based recreational activities (Hu et al., 2024).

Through traditional sports, students gain an understanding of the meaning and historical background of the games, the process of playing, as well as the development of systematic motor behaviours (Martínez-Santos et al., 2020). This global trend is also reflected in Indonesia, where traditional sports are increasingly marginalized in the school-based physical education and daily activities, especially among children with special needs (Jariono et al., 2022; Pratiwi et al., 2020). Furthermore, the implementation of traditional sports has been proven to play an important role in the field of education. The application, which is generally carried out within the community, provides children with practical opportunities to engage in physical activities through games, which in turn has been shown to improve health levels (Saura & Zimmermann, 2021).

The implementation of physical education in schools is the right of every student, including those with special needs (Pratiwi et al., 2020). Traditional sports are integrated into adaptive physical education, where teachers can develop and simplify movements according to the specific abilities of each student, thereby ensuring that their physical activity needs are adequately met (Jariono et al., 2022). In the cognitive domain, children with special needs, particularly those with mild intellectual disabilities, require a stimulation to support the development of their cognitive functions. One effective approach is the use of engaging educational games, such as puzzles (Hakim, 2018). In addition to the cognitive domain, the motor skills of children with special needs also need to be improved. Research findings have shown that game-based sport approaches are effective in enhancing student gross motor skills, thereby making them a viable instructional method for use in schools (Nur'anisah et al., 2024).

Previous studies have shown that the implementation of traditional sports provides a positive impact on both learning and physical development, demonstrated that integrating traditional games into instructional settings increases the student motivation and physical activity levels (Saura & Zimmermann, 2021). Previous research also reported that traditional sports could improve systematic motor behavior and help students recognize cultural identity across regions (Martínez-Santos et al., 2020). In the context of special education, a study found that modified traditional games are effective in supporting adaptive physical education for learners with special needs (Jariono et al., 2022). More recently, previous research also confirmed that sport game-based approaches significantly enhance the gross motor skills of children with mild intellectual disabilities (Nur'anisah et al., 2024). These include the knowledge of the physical education curriculum, instructional planning, physical education learning models, adaptive physical education (for students with special needs), sport testing and measurement, as well as the evaluation of physical education instructions (Hadiana et al., 2023). However, although the evidence has strongly supported the educational benefits of traditional sports, no previous research has developed or evaluated a digital or web-based learning medium that integrates traditional sports specifically to support the cognitive

development of children with mild intellectual disabilities. Therefore, this study sought to fill this gap through the development of E-Moszle, a web-based learning tool introducing traditional sports while simultaneously stimulating the student cognitive development.

METHODS

This study employed a Research and Development (R&D) approach utilizing the 4D model, encompassing four sequential stages namely Define, Design, Develop, and Disseminate. The Define stage involved conducting a situational analysis to identify needs and contextual challenges. In the Design stage, activities included the selection of appropriate media, the development of instructional contents, and the creation of an initial prototype of the E-Moszle learning tool. The Develop stage comprised expert validation, pilot testing, and subsequent evaluation of the prototype to ensure its feasibility and effectiveness. The last, the Disseminate stage entailed the implementation and broader distribution of the research outcomes for practical application (Solikin et al., 2019).

Participants

The participants in this study consisted of 2 (two) teachers who did not have a background in Physical Education but were teaching Physical Education, Sports, and Health (PESH) at Special Needs Schools, as well as 20 (twenty) students with mild intellectual disabilities from two different schools. The first research site involved 14 students from SLBN Taruna Mandiri, while the second site included 6 students from SLB B YPALB Perwari. These schools were selected based on specific considerations, including their willingness to facilitate research activities and the willingness of participants to engage in the study. All research sites were located in Kuningan Regency, West Java Province.

Sampling Procedures

Participants were selected by using purposive sampling based on specific inclusion criteria. The study involved two teachers teaching Physical Education, Sports, and Health without a formal PE background and twenty students with mild intellectual disabilities from two Special Needs Schools, namely SLBN Taruna Mandiri and SLB B YPALB Perwari. Only students meeting the criteria were included to ensure the relevance to the study objectives. These schools were chosen for their willingness to support research activities and the participant consent. All research sites were located in Kuningan Regency, West Java Province.

Materials and Apparatus

The main material of this study was the E-Moszle device, developed to support teaching and learning, particularly for enhancing cognitive abilities in children with mild intellectual disabilities. The device included interactive modules and exercises designed to stimulate cognitive development operated by using a tablet/computer with supporting software for data recording and analysis. Data were collected through the product feasibility evaluation by three experts in Adaptive Physical Education, Special Education, and IT/Web Development, as well as through classroom observations, interviews, and questionnaires administered to the PESH teachers. Cognitive assessments of the students were conducted based on the Vineland approach (Goldberg et al., 2009).

Procedures

The study was conducted to evaluate the development and the feasibility of the E-Moszle device and its impact on the cognitive abilities of children with mild intellectual disabilities. Participants, including two PESH teachers and twenty students with mild intellectual disabilities, engaged in structured activities using the E-Moszle, with the researchers facilitating the sessions and providing instructions. Data were collected through classroom

observations and the Vineland approach to assess the student cognitive outcomes, as well as through interviews with the teachers to gather information on both cognitive and motor development (Goldberg et al., 2009). Questionnaires were also administered to evaluate the device usability and effectiveness. All participants, including student guardians, provided informed consent prior to the study, ensuring ethical compliance throughout the research process.

Design or Data Analysis

The data in this study were analysed by using a quantitative descriptive analysis to determine the feasibility level of the E-Moszle product as a web-based learning media (Rusdi, 2018). The validation was conducted by three experts, including specialists in Adaptive Physical Education, Special Education, and Information Technology/Web Development. Each validator assessed the aspects of appearance, content, language, and media usability using a Likert scale. Scores for each item were summed to obtain a total score, which was then compared to the maximum possible score to calculate a feasibility percentage. The percentage was subsequently converted into feasibility categories based on the following criteria: 85–100% (very valid), 70–84% (valid), 55–69% (moderately valid), 40–54% (less valid), and < 40% (not valid). The product was considered feasible if the percentage fell within the valid or very valid categories (Umbara et al., 2019). The validation results were presented in tables to provide a comprehensive overview of each validator evaluation. Findings from the validators served as the basis for product refinement in the subsequent development stage.

RESULTS

Define Stage

The initial stage of this study, conducted by using the Research and Development (R&D) 4D model, was the Define stage which involved a needs analysis through observation. The purpose of the observation was to collect data related to the indicators required by children with mild intellectual disabilities, particularly in enhancing their cognitive abilities through the use of instructional media. The observations, carried out at SLBN Taruna Mandiri and SLB B YPALB Perwari in Kuningan Regency, revealed that the integration of technology in the teaching and learning process, especially in Physical Education (PE) classes, remained limited. Furthermore, it was found that some teachers responsible for teaching PE did not have an academic background in physical education. In reality, teaching physical education requires specialized knowledge and skills. The results of the observation also indicated that 80% of students with mild intellectual disabilities had neither been introduced to nor ever played traditional sports. This finding highlights the urgency of innovation in the teaching and learning process to optimize learning outcomes. Every child, including those with special needs, has the same right to become familiar with and participate in traditional sports as other developing children. Traditional sports can naturally foster the development of multiple domains within the child, such as the cognitive domain. Although children with mild intellectual disabilities tend to have lower cognitive levels, but they still possess the potential to be educated and trained. Therefore, based on the needs analysis concerning cognitive aspects, teacher qualifications, and the importance of both education and the revitalization of traditional sports, there is a pressing need for the development of appropriate learning media to facilitate both teachers and students in the teaching and learning process.

Design Stage

The Design stage, which represents the second phase of the 4D model, consists of four essential steps including constructing criterion-referenced tests, media selection, format selection, and initial design. The design developed in accordance with the needs analysis

resulted in the creation of E-Moszle (Electronic-Module Traditional Sports and Games Puzzle), a web-based learning tool specifically designed to support physical education for children with mild intellectual disabilities. This tool integrates elements of traditional games and sports into an interactive digital module, structured in the form of puzzles that are easily understood by students with intellectual limitations. In addition, E-Moszle is equipped with instructional modules, user guidelines, and video-based learning features related to traditional sports. The design of this tool is illustrated in Figures 1, 2, 3, 4, 5, and 6.



Figure 1. The Front-Page Display of E-Moszle



Figure 2. Game Options in E-Moszle

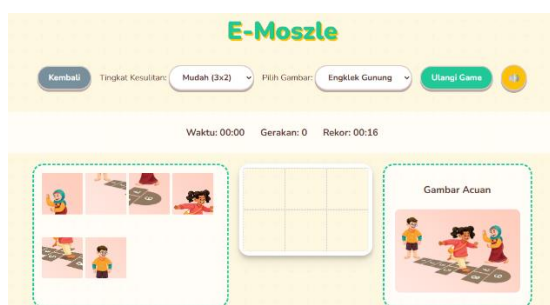


Figure 3. Displays of Game Features in E-Moszle



Figure 4. Displays of Learning Video Feature in E-Moszle

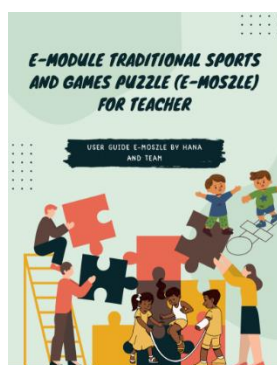


Figure 5. The Module Cover and User Guide of E-Moszle



Figure 6. The Module Feature Display in E-Moszle

Develop Stage

The third stage in the development of the web-based E-Moszle device was the stage aimed at producing a developed product. This stage consisted of expert validations accompanied by revisions, and developmental trials.

Product Revision and Trial Results

Product revisions were carried out to improve the developed product based on discussions with expert validators during the feasibility testing stage. The E-Moszle device, a web-based

instructional medium, underwent several revisions before it could be implemented in the field. Feedbacks from the expert validators suggested, first, the removal of the shadow image feature in the puzzle game so that it would not resemble a picture-matching activity, but instead focus more on the puzzle itself. The second revision concerned the addition of historical contents on traditional sports, which was recommended to be incorporated into the learning module.

Expert Validations

The validation was conducted by providing the draft version of the E-Moszle device to both teachers and students as a medium to support cognitive improvement for children with mild intellectual disabilities. This process aimed to assist the researchers in obtaining recommendations, both orally and in writing, through discussions with the validators. The results of the product feasibility testing are presented in Table 1.

Table 1. Expert Validation Analysis of the E-Moszle Product Feasibility

Validator	Area of Expertise	Maximum Score	Obtained Score	Percentage	Category
Validator 1	Adaptive Physical Education	80	77	96.25%	Highly Valid
Validator 2	Special Education	80	76	95%	Highly Valid
Validator 3	Web Development/IT	80	76	95%	Highly Valid
Average			76.33	95.42%	Highly Valid

Based on the expert validation results, the web-based learning media E-Moszle obtained a score of 77 (96.25%) from the Adaptive Physical Education expert, 76 (95%) from the Special Education expert, and 76 (95%) from the Information Technology/Web Development expert. The analysis results were interpreted based on the following criteria: a product was considered highly valid if it achieved a validity level of 85–100%, valid if it reached 70–84%, fair if it was 55–69%, poor if it was 40–54%, and invalid if the validity level was below 40%. The percentages fell within the highly valid category, indicating that the product is feasible for use as a learning medium. The Adaptive Physical Education expert evaluated E-Moszle as highly appropriate for supporting adaptive physical education learning and stimulating the cognitive development of students with special needs. The Special Education expert confirmed that the content, language, navigation, and interactivity of the platform aligned well with the learning characteristics of students with special needs without causing cognitive overload. Meanwhile, the IT/Web Development expert concluded that E-Moszle fulfilled the standards of functionality, data security, system responsiveness, and multi-device accessibility, making it practical and safe for teachers and students to use. Overall, the average feasibility percentage of 95.42% indicates that E-Moszle is classified as highly valid and is appropriate for use without major revisions. Recommendations provided by experts are minor and relate mainly to interface refinement and user documentation enhancement. In addition, the analysis results from the three validators of the E-Moszle product can also be seen in the Figure 7 and Figure 8.

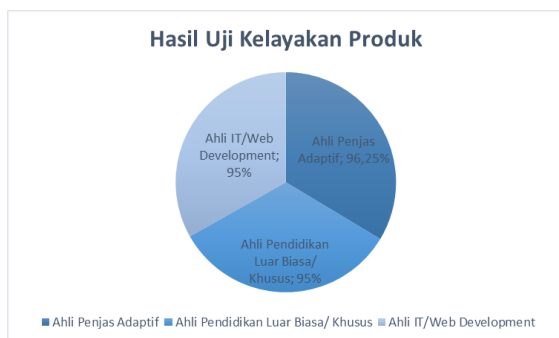


Figure 7. Product Feasibility Test Results from Expert Validators

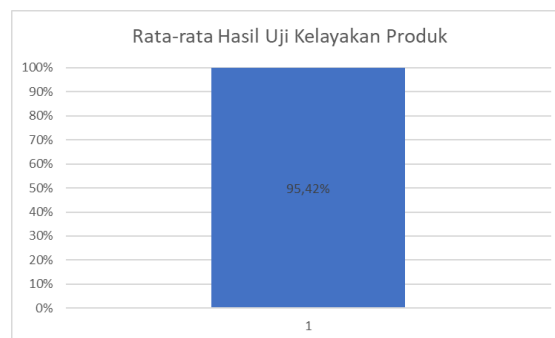


Figure 8. Average Product Feasibility Test Results from Expert Validators

In line with the analysis presented in the table, the results shown in the figures also indicate similar findings. It was found that the first indicator, namely the feasibility of adaptive physical education content, obtained a score of 96.25%. The second indicator, referring to the feasibility of special education content, achieved a score of 95%. The third indicator, concerning the feasibility of IT/Web Development, also obtained a score of 95%. As a whole, these results yielded an average score of 95.42% for the overall product feasibility. This indicates that each indicator assessed in the web-based E-Moszle learning device demonstrated very strong content validity.

Disseminate Stage

The fourth stage in the development of the web-based E-Moszle device was the dissemination stage, which involved distributing the product to schools. This stage aimed to promote the developed product so that it could be accepted and utilized by individuals, groups, or institutions. This dissemination stage comprised three key phases, namely the validation testing, diffusion, and adoption phases. During the validation testing phase, the revised product from the development stage was implemented with the target users, namely teachers and students, particularly students with mild intellectual disabilities. In the diffusion and adoption phases, the dissemination was carried out by providing access to the E-Moszle platform via a shared link along with a user tutorial. This process ensured that teachers and schools could understand (diffuse) and subsequently apply (adopt) the product more broadly.

DISCUSSION

During the implementation phase, the E-Moszle (Electronic Module of Traditional Sports and Games Puzzle) served as an instructional medium designed to reintroduce various forms of traditional sports, including their nomenclature and rules of play. In light of the generational shift, the presence of traditional sports is increasingly marginalized. Nevertheless, traditional sports inherently foster respect, cooperation, solidarity, and prosocial behaviour, making their integration into educational settings particularly valuable (Nur et al., 2020; Saura & Zimmermann, 2021). The E-Moszle device also functions as a stimulus to enhance the cognitive aspects of children with special needs, particularly those with mild intellectual disabilities. Designed with an engaging interface tailored to children, E-Moszle is equipped with an audio mode to facilitate user interaction and operational ease. In addition, it includes video features to support the practical implementation of traditional sport activities in the field, thereby reinforcing the cognitive development of students with special needs. For the initial use, students are guided by teachers. Accordingly, the device is

supplemented with instructional modules and user manuals to assist educators in facilitating its application.

The use of the web-based E-Moszle device has proven to be highly effective in enhancing the cognitive abilities of children with special needs, particularly those with mild intellectual disabilities, primarily through its interactive puzzle-based games. Consistent with previous studies, educational games in the form of puzzles serve as a form of play therapy for students with special needs. When implemented regularly and systematically, puzzle-based activities can significantly improve a child cognitive functioning while simultaneously fostering enjoyment and reducing boredom during the learning process. This is especially important considering that the participation in enjoyable activities plays a crucial role in improving the quality of life, including for students with special needs (Hankle et al., 2022; Paschalia et al., 2024).

Furthermore, the implementation of the E-Moszle device as an instructional medium in Physical Education (PE) represents a novel and refreshing innovation, particularly given the limited integration of technology within PE learning processes. The presence of E-Moszle provides significant supports for both teachers and students in facilitating effective teaching and learning activities in schools. This claim is reinforced by research findings indicating that technology-based media play a crucial role in supporting individuals with disabilities. Moreover, studies have highlighted that teachers who are able to adopt technology-driven strategies, especially when working with students with special needs, can foster increased learning motivation, enjoyment, and enhanced mastery of knowledge among these students (Kim et al., 2017). This condition also applies to students with special needs, particularly those classified as having mild intellectual disabilities, who frequently demonstrate challenges in self-regulation and experience considerable difficulty in adhering to given instructions (Avi, et al., 2020).

However, the findings of this study also revealed several limitations and challenges. One of the selected traditional games, Gobak Sodor, was considered too complex to be practiced directly in the field. Nevertheless, its implementation within the E-Moszle website is not problematic, as the purpose of the game in this context is limited to the introduction of the traditional sport and its use as an educational and interactive learning medium. Furthermore, the variety of traditional games integrated into the E-Moszle device remains relatively limited and lacks diversity. Therefore, it is recommended that future development include a broader range of traditional games from various regions, particularly those with less complex rules, so that they may also be practiced in field settings in addition to their use through E-Moszle on a PC or smartphone. The researchers strongly expect that E-Moszle will serve as an innovative and user-friendly learning medium designed to enhance the cognitive development of students with mild intellectual disabilities, while also assisting teachers particularly those without a background in physical education in delivering learning in Physical Education subjects. Considering the wide-ranging benefits of E-Moszle, previous research has also demonstrated that puzzle-based play therapy positively influences short-term memory in students with mild intellectual disabilities, while simultaneously training logical reasoning, fostering patience, enhancing problem solving skills, and enhancing overall cognitive abilities (Permata, 2020; Sutinah, 2019).

Regarding cognitive performance, 50% of the students demonstrated progress, 45% maintained consistent scores (no change between pre-assessment and post-assessment), and 5% showed a decrease. The 5% decrease in performance was primarily due to fluctuations in the student mood. During the final data collection, these students were unwilling to follow

instructions from either the teacher or the researcher. This is an expected limitation, as children with special needs cannot be compelled to perform tasks when they are unwilling.

CONCLUSION

Based on the findings of this study, the developed product in the form of the E-Moszle device (Electronic Traditional Sports Games and Puzzle) has undergone product feasibility testing and demonstrated a high level of feasibility. The feasibility assessment was conducted by three experts, namely specialists in Adaptive Physical Education, Special Education, and Information Technology/Web Development. In terms of cognitive outcomes, the results indicated that 50% of students showed improvement, 45% of students maintained stable scores (with no increase or decrease between the pre- and post-implementation), and 5% of students experienced a decline. Nevertheless, the E-Moszle device remains feasible and appropriate for use as a learning medium in schools, particularly in Special Education settings, given its high feasibility rating and its capacity to generate significant improvements in both cognitive and motor aspects, even within a relatively short implementation period.

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AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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