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Design of Interactive Animated Learning Media as a Stimulus for Improving Fine Motor Skills of Children Aged 5–6 Years at TK Bungong Jeumpa

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A B S T R A C T

Fine motor skills play a significant role in early childhood development, particularly in supporting children's ability to perform activities that require coordination between the eyes and small muscles of the hands and fingers. Adequate stimulation is essential during the ages of 5–6 years, as this developmental stage influences children's readiness for various learning activities. Preliminary observations conducted at TK Bungong Jeumpa indicated that several children experienced difficulties in activities involving hand–eye coordination, object manipulation, and control of finger movements. In addition, classroom learning activities were still dominated by conventional media that provided limited opportunities for interactive learning. This study aimed to design an interactive animated learning media to stimulate the fine motor skills of children aged 5–6 years at TK Bungong Jeumpa. The study employed a Research and Development (R&D) approach using the ADDIE model, limited to the Analyze, Design, and Development stages. Data were collected through observations, interviews with teachers, and a literature review to identify learning needs and determine appropriate media characteristics for early childhood education. The resulting product is an interactive animated learning media with the theme "Feeding Animals." The media integrates animated visual elements, audio instructions, and interactive activities such as drag-and-drop games, line tracing, shape matching, and simple puzzle arrangements. These activities were designed to provide opportunities for children to practice hand–eye coordination, finger movements, and object manipulation. The developed media was evaluated through expert validation rather than direct trials with children. The media expert validation obtained a feasibility score of 100%, while the material expert validation obtained a feasibility score of 95%, both categorized as very feasible. These results indicate that the developed interactive animated learning media is highly feasible as a learning resource designed to support fine motor stimulation for children aged 5–6 years. However, the effectiveness and actual use of the media by children were not evaluated in this study and require further testing.

INTRODUCTION

Early childhood represents a critical period of growth and development during which children experience significant progress in physical, cognitive, emotional, social, and motor domains. During this stage, appropriate educational stimulation is essential to support children's overall development and prepare them for future learning experiences [1]. Among the various developmental aspects, fine motor skills play an important role because they enable children to perform activities that require precise coordination between the eyes, hands, and fingers. These skills are fundamental for tasks such as drawing, writing, cutting, arranging objects, and manipulating learning materials [2]. Therefore, providing effective stimulation for fine motor development is an important responsibility in early childhood education.

Children aged 5–6 years are in the preschool stage, where learning activities should be designed according to their developmental characteristics. At this age, children tend to learn more effectively through engaging, interactive, and play-based experiences that encourage active participation [3], [4]. Learning environments that provide opportunities for exploration and direct interaction can help children develop both cognitive abilities and motor coordination simultaneously. Consequently, the selection of appropriate learning media becomes an important factor in supporting the achievement of learning objectives and developmental outcomes.

Based on preliminary observations conducted at TK Bungong Jeumpa, 5 of the 28 children aged 5–6 years demonstrated difficulties in fine motor activities, including tracing lines accurately, controlling writing instruments, and manipulating learning objects requiring precise hand–eye coordination and finger movements. Furthermore, classroom learning activities were still dominated by conventional media, such as worksheets and printed materials, which provided limited opportunities for interactive engagement. As a result, children were less actively involved in learning activities, and the stimulation of fine motor skills was not optimally facilitated [5], [6].

Advances in digital technology have created new opportunities for developing innovative learning media that can support children's developmental needs. Interactive animated learning media combines visual elements, audio instructions, animation, and user interaction within a single learning environment [7], [8]. Unlike conventional learning resources, interactive media encourages children to participate directly in learning activities rather than acting solely as passive observers. Features such as drag-and-drop activities, line tracing, object matching, and puzzle-solving tasks can provide meaningful learning experiences while simultaneously stimulating hand–eye coordination and fine motor control [9], [10].

Previous studies have demonstrated the potential of animation-based learning media in supporting children's learning and development. Yuniarni et al. reported that the interactive multimedia-based animated exercise video developed for 40 early childhood learners was considered highly feasible for use in learning activities [11], [12]. The study also found that 100% of the children showed attention and interest in the learning activities by directly practicing the movements presented in the multimedia. Similarly, Rahmawati and Suryana found that animated learning media supported the development of children's fine motor skills, particularly in activities involving hand–eye coordination, object manipulation, and finger movement control through visual and activity-based learning experiences [13].

However, most previous studies have focused on animation-based videos that primarily function as passive learning media. Children generally act as viewers and imitate the content presented on the screen. Limited studies have developed interactive animated learning media that enable children to actively participate through direct manipulation of digital objects, such as tracing, dragging, matching, and arranging activities specifically designed to stimulate fine motor skills. Therefore, the development of interactive animated learning media remains necessary to provide more engaging learning experiences and support fine motor development among children aged 5–6 years [14].

Based on the identified problems and the findings of previous studies, there is a need for learning media that not only presents visual and audio content but also enables children to actively interact with learning objects. Interactive animated learning media offers opportunities for children to perform activities such as tracing, dragging, matching, and arranging objects directly on the screen [15]. These interactions are closely related to fine motor stimulation because they require hand–eye coordination, finger control, and precise object manipulation. Therefore, the development of interactive animated learning media is considered a suitable alternative to support fine motor skill stimulation among children aged 5–6 years.

Based on these considerations, this study focuses on designing an interactive animated learning media aimed at stimulating the fine motor skills of children aged 5–6 years at TK Bungong Jeumpa [16]. The media integrates animation, audio guidance, and interactive activities designed to encourage active participation and improve hand–eye coordination. The objective of this study is to design and develop an interactive animated learning media that is suitable for early childhood learning and supports fine motor skill stimulation among children aged 5–6 years. The findings of this study are expected to provide teachers with an alternative technology-based learning medium and contribute to the development of innovative learning media in early childhood education [17].

METHOD

This study employed the Research and Development (R&D) approach to design an interactive animated learning media intended to stimulate the fine motor skills of children aged 5–6 years at TK Bungong Jeumpa. Research and Development is a systematic method used to produce educational products and improve their quality through a structured development process [18], [19]. This study adopted the ADDIE development model. However, the research was limited to the Analyze, Design, and Development stages, followed by expert validation before producing the final product. This limitation was applied because the primary objective of the study was to design and develop an interactive animated learning media prototype.

During the needs analysis stage, observations were conducted involving 28 children aged 5–6 years at TK Bungong Jeumpa. In addition, one classroom teacher served as the material expert, and one lecturer from the Department of Information Technology Education served as the media expert to validate the developed product. Data were collected through observations, interviews, and literature review. Observations were conducted to identify children's fine motor abilities and learning conditions in the classroom. Interviews with teachers were carried out to obtain information related to learning challenges, media requirements, and classroom practices. In addition, a literature review was conducted to strengthen the theoretical foundation concerning fine motor development, interactive multimedia learning, and early childhood education [20].

The development process began with the Analyze stage, which focused on identifying learning problems, children's developmental characteristics, and the need for technology-based learning media capable of supporting fine motor stimulation. Information obtained during this stage served as the basis for determining the learning objectives and media specifications.

The Design stage involved planning the structure and visual appearance of the media. Activities conducted during this stage included storyboard development, interface design, character selection, activity planning, navigation design, and preparation of audio instructions. The learning activities were designed to encourage children's active participation through interactive tasks appropriate for their developmental level.

The Development stage focused on producing the interactive animated learning media based on the storyboard and interface design prepared during the Design stage. The development process utilized several software applications, including Canva for designing visual assets such as backgrounds, icons, illustrations, and interface components, and Visual Studio Code as the programming environment for developing the web-based application. The media was implemented using HyperText Markup Language (HTML), Cascading Style Sheets (CSS), and JavaScript. HTML was used to organize the structure and learning content, CSS was applied to create colorful layouts, animations, and responsive interfaces suitable for early childhood learners, while JavaScript was employed to implement interactive features such as drag-and-drop activities, line tracing, shape matching, color matching, number puzzle arrangements, navigation controls, scoring mechanisms, and visual feedback.

The development process began by preparing multimedia assets based on the storyboard. The visual assets designed in Canva were exported and integrated into the application interface developed in Visual Studio Code. HTML and CSS were then used to construct the learning interface, while JavaScript was programmed to manage user interactions, validate children's responses, control page navigation, and provide immediate feedback after each activity. Finally, functional testing was conducted to ensure that all menus, animations, audio instructions, and interactive activities functioned properly before the product was evaluated by media and material experts [21].

After the development stage was completed, the interactive animated learning media was validated by one media expert and one material expert. The media expert, a lecturer from the Department of Information Technology Education, evaluated aspects related to interface design, navigation, interactivity, visual appearance, and usability. Meanwhile, the material expert, a kindergarten teacher, assessed the suitability of learning content, learning objectives, and its relevance to fine motor skill stimulation for children aged 5–6 years. The validation results showed a feasibility score of 100% from the media expert and 95% from the material expert, indicating that the developed media was categorized as very feasible. Suggestions and feedback from both validators were used to improve the product before producing the final version.

Research Ethics

The initial observation involving 28 children aged 5–6 years was conducted after obtaining permission from TK Bungong Jeumpa and coordinating with the teachers. The observation was conducted to identify learning conditions and needs related to fine motor stimulation. No personal or identifying information about the children was collected or reported in

this study. The observation followed the school's procedures and considered the privacy, safety, and well-being of the children.

The overall stages of the media development process based on the ADDIE model are illustrated in Figure 1.

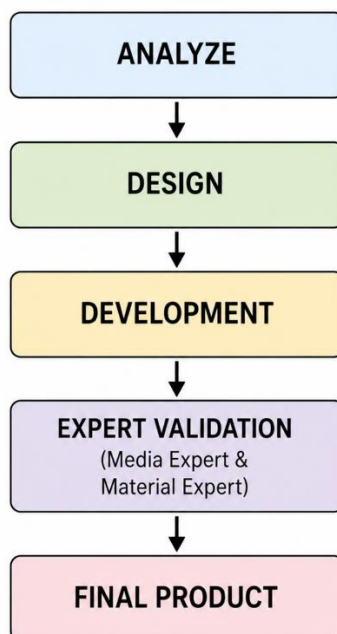


Figure 1. Development Process of Interactive Animated Learning Media Using the ADDIE Model

Data Analysis Technique

The data obtained from observations and interviews were analyzed descriptively to identify learning needs and problems related to children's fine motor skills. Validation data from media and material experts were analyzed using descriptive quantitative techniques. The feasibility percentage was calculated using the formula:

Feasibility Percentage = (Total Score Obtained / Maximum Score) × 100%

The resulting percentages were interpreted using feasibility criteria, where 81%–100% = Very Feasible, 61%–80% = Feasible, 41%–60% = Fairly Feasible, 21%–40% = Less Feasible, and 0%–20% = Not Feasible.

RESULTS AND DISCUSSION

The result of this study is the design of interactive animated learning media intended to stimulate fine motor skills among children aged 5–6 years at TK Bungong Jeumpa. The developed media was designed according to the characteristics of early childhood learners by integrating colorful visual elements, simple animations, audio instructions, and interactive activities that encourage active participation during the learning process [22].

The interactive animated learning media consists of several learning activities designed to support the development of children's fine motor skills through direct interaction with digital objects. The activities include line tracing, shape matching, color matching, number puzzle arrangement, and letter tracing. These activities require children to perform actions such as tapping, dragging, dropping, tracing, and arranging objects, which can help improve hand–eye coordination, finger control, and movement precision [23].

The visual appearance of the media was designed using bright colors, cartoon-style characters, attractive animations, and simple navigation suitable for children aged 5–6 years. Audio instructions and visual feedback were also integrated into the media to assist children in understanding learning tasks and maintaining their engagement throughout the activities [24].

The media development process began with storyboard preparation and interface design planning. The storyboard served as a guideline for determining the sequence of learning activities, object placement, navigation flow, animation effects, and interactive components. Based on the approved storyboard, visual assets such as illustrations, cartoon characters, icons, backgrounds, and interface elements were designed using Canva. These assets were subsequently integrated into a web-based application developed in Visual Studio Code using HTML, CSS, and JavaScript. HTML was utilized to organize the learning content and page structure, CSS was responsible for creating colorful layouts, animations, and responsive user interfaces, while JavaScript enabled interactive learning activities,

navigation, scoring, and immediate feedback based on children's interactions. The resulting media provides an enjoyable and child-friendly learning experience while supporting fine motor stimulation activities.

A. Expert Validation Results

Before the final product was finalized, the developed interactive animated learning media was evaluated by one media expert and one material expert. The media expert assessment focused on interface design, navigation, interactivity, visual appearance, and usability. The validation result showed a feasibility score of 100%, indicating that the media was categorized as very feasible. Meanwhile, the material expert assessment focused on content suitability, learning objectives, and the relevance of the activities to fine motor skill stimulation. The validation result obtained a feasibility score of 95%, which was also categorized as very feasible. These findings indicate that the developed media is appropriate for use as a learning medium to support fine motor skill stimulation among children aged 5–6 years.

Table 1. Expert Validation Results

Validator	Percentage	Category
Media Expert	100%	Very Feasible
Material Expert	95%	Very Feasible

B. Home Screen Design

The use of colorful visual elements and animated characters was intended to attract children's attention and increase learning motivation. Simple navigation was selected to ensure that children aged 5–6 years could easily access learning activities independently. This design is consistent with the characteristics of early childhood learners who respond positively to visually engaging and easy-to-use learning environments. Technically, the home screen was implemented using HTML and CSS to create an attractive and responsive interface suitable for early childhood learners. JavaScript was used to control navigation buttons that connect users to each learning activity. The combination of colorful illustrations designed in Canva and web programming technologies provides an engaging interface that is easy for children to operate independently.

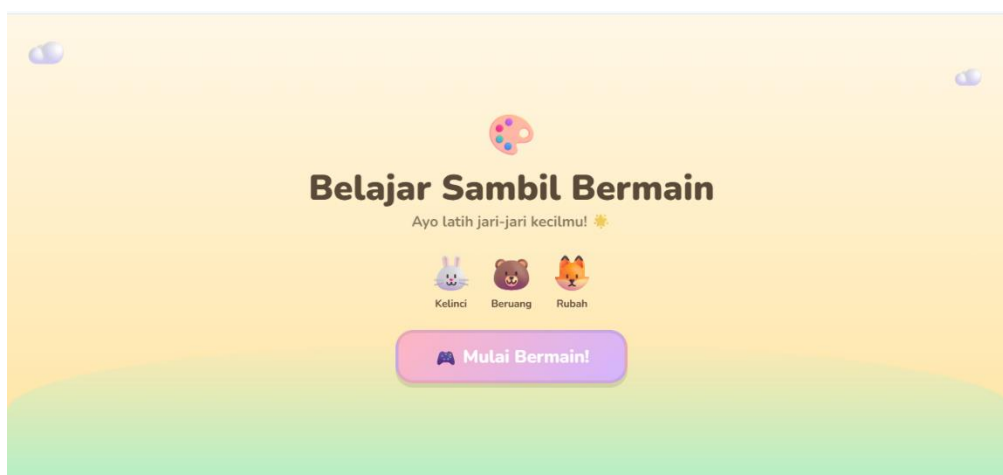


Figure 1. Main Interface of Interactive Animated Learning Media

C. Line Tracing Activity

The line tracing activity requires children to follow a predetermined path using touch or mouse interaction. This activity was designed to improve finger movement control, hand–eye coordination, and pre-writing skills. Tracing activities are important in early childhood learning because they train children to control hand movements accurately while following visual guides. According to previous studies on fine motor development, activities involving tracing can strengthen finger muscles, improve movement precision, and support children's readiness for writing activities. Therefore, the line tracing feature was incorporated into the media as a practical approach to stimulate fine motor development through interactive learning experiences. The home screen serves as the main navigation interface that connects users to all learning activities. Technically, the line tracing activity was implemented using JavaScript by detecting mouse or touch movements along predefined tracing paths. The program records the user's movement and provides visual feedback when the tracing task is completed successfully. This interactive mechanism allows children to practice controlled finger movements while following visual guides on the screen.



Figure 2. Line Tracing Activity

D. Shape Matching Activity

The shape matching activity utilizes a drag-and-drop mechanism in which children match geometric shapes with their corresponding targets. This activity helps children develop object manipulation skills and visual-motor coordination. The drag-and-drop interaction requires children to coordinate finger movements with visual perception while accurately placing objects in designated areas. Such activities are closely related to fine motor stimulation because they encourage precise hand control, finger dexterity, and hand-eye coordination. As a result, the activity not only supports cognitive recognition of shapes but also contributes to the development of fine motor skills. The shape matching activity applies a drag-and-drop mechanism implemented in JavaScript. Each object is programmed to recognize its corresponding target area and automatically provide feedback when the correct match is achieved. This implementation enables children to interact directly with digital objects while practicing hand-eye coordination and object manipulation skills.

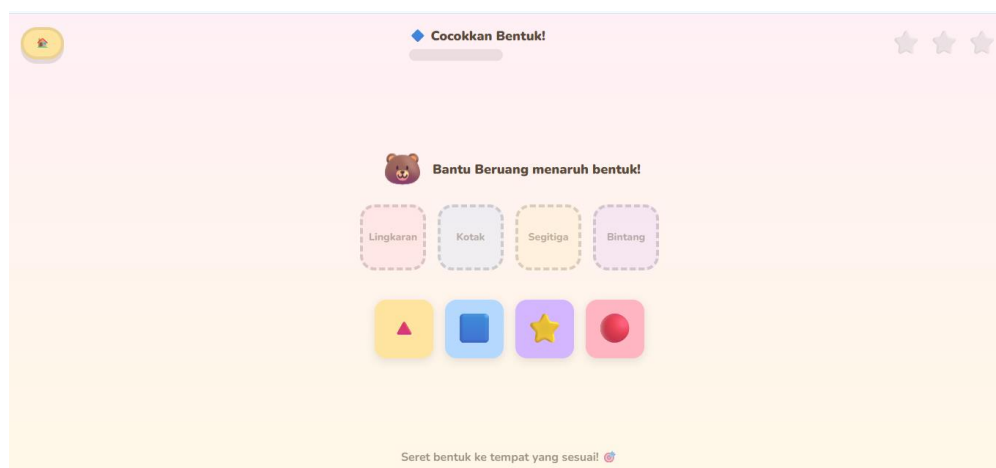


Figure 3. Shape Matching Activity

E. Color Matching Activity

The color matching activity combines cognitive recognition with motor interaction through object selection. Children are required to identify colors and interact directly with learning objects on the screen. This process stimulates finger control and visual attention while encouraging active participation in learning activities. The integration of cognitive and motor tasks is expected to provide meaningful learning experiences that support fine motor development. The color matching activity was programmed using JavaScript event handlers that detect user selections and evaluate the correctness of the selected object. After a selection is made, the application provides immediate visual feedback, allowing children to recognize correct and incorrect answers during the learning process.

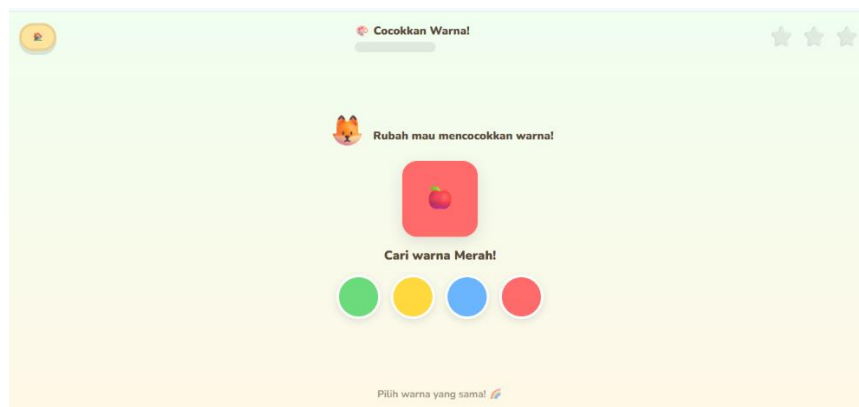


Figure 4. Color Matching Activity

F. Number Puzzle Activity

The number puzzle activity requires children to arrange numbers in the correct order through dragging and placing objects. This activity stimulates fine motor skills by encouraging children to perform controlled finger movements and accurately manipulate digital objects. In addition, puzzle-based activities can increase concentration and problem-solving skills while simultaneously improving hand-eye coordination. The number puzzle activity utilizes JavaScript to control object movement and verify the correct arrangement sequence. When children place the puzzle pieces in the appropriate order, the system automatically checks the arrangement and displays completion feedback. This feature encourages active interaction while supporting concentration and fine motor coordination.

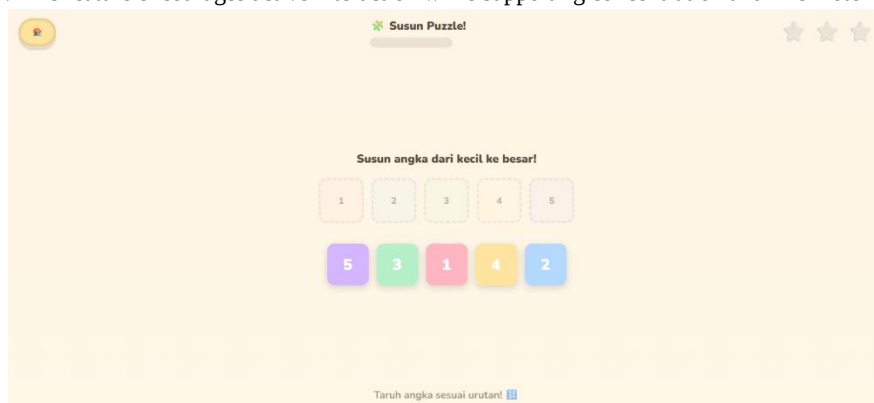


Figure 5. Number Puzzle Activity

G. Letter Tracing Activity

The letter tracing activity was designed to support early writing readiness by providing opportunities for children to practice tracing alphabet letters. This activity requires precision in finger movement and visual coordination, which are essential components of fine motor development. Repeated tracing activities can help children improve movement control and develop the motor skills needed for future writing tasks. The letter tracing feature records user movements and compares them with predefined tracing paths. JavaScript is used to monitor tracing accuracy and provide feedback during the activity. This implementation supports children in practicing precise finger movements and improving hand-eye coordination as preparation for early writing skills.

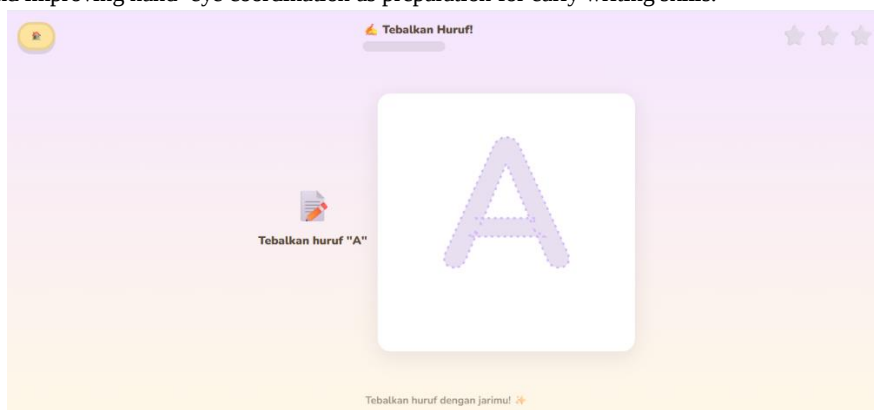


Figure 6. Letter Tracing Activity

H. Completion Screen

After completing all activities, children are presented with a completion screen displaying rewards, stars, and congratulatory messages. This feature was designed to increase motivation and provide positive reinforcement during learning. The completion screen was implemented using HTML, CSS, and JavaScript to display rewards, stars, and congratulatory messages after children complete all learning activities. JavaScript controls the display of completion feedback based on the user's progress, providing positive reinforcement that encourages children to participate actively in the learning process.

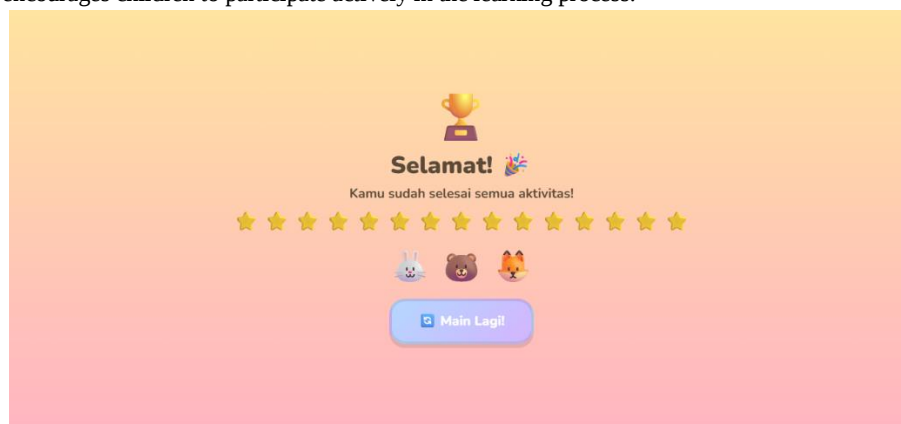


Figure 7. Completion Screen

The developed media incorporates various interactive activities, including line tracing, shape matching, color matching, number arrangement, and letter tracing. These activities require children to perform actions such as dragging, tapping, tracing, and arranging objects, which can support the development of hand-eye coordination and fine motor control. This interaction system was designed to create enjoyable learning experiences while simultaneously stimulating children's fine motor skills through active participation during learning activities [26].

The visual appearance of the media emphasizes simplicity and attractiveness suitable for early childhood learners. Bright colors, cartoon-style characters, large object sizes, and simple navigation were intentionally incorporated to facilitate children's understanding and interaction with the learning content. These design elements are important because young children tend to respond positively to visually engaging and interactive learning environments. Furthermore, the integration of multimedia components such as animations, audio instructions, visual feedback, and interactive objects can increase children's attention, motivation, and engagement during learning activities. Previous studies have indicated that interactive multimedia can create more meaningful learning experiences by encouraging children to actively participate rather than passively observe learning materials [27].

Based on the development results, the designed media has the potential to serve as an innovative technology-based learning medium for early childhood education. The media not only functions as entertainment but also as an educational tool that supports fine motor stimulation through direct interaction with learning objects [28]. Therefore, the developed media is expected to assist teachers in creating more engaging, interactive, and child-centered learning environments for children aged 5–6 years [29]. In addition, from a technical perspective, this study demonstrates that the combination of Canva, Visual Studio Code, HTML, CSS, and JavaScript can be effectively utilized to develop an interactive web-based learning medium. The integration of visual assets, animations, audio guidance, navigation controls, and interactive activities creates an engaging learning environment that supports fine motor skill stimulation among children aged 5–6 years.

CONCLUSION

This study successfully designed an interactive animated learning media intended to stimulate the fine motor skills of children aged 5–6 years at TK Bungong Jeumpa. The developed media integrates interactive activities such as line tracing, shape matching, color matching, number arrangement, and letter tracing, supported by animations, audio instructions, and visual elements suitable for early childhood learners. The activities were designed based on the learning needs identified through the initial observation and were intended to provide opportunities for fine motor stimulation through digital learning activities.

The feasibility of the developed media was supported by expert validation results, with a score of 100% from the media expert and 95% from the material expert, both categorized as very feasible. The 28 children involved in this study were included only in the initial observation as part of the needs assessment and were not involved in direct testing or implementation of the developed media. Therefore, this study does not claim the effectiveness, usability, or actual engagement of children with the media. Further research involving direct implementation with children is needed to evaluate the usability, engagement, and effectiveness of the media in stimulating fine motor skills.

Therefore, the developed interactive animated learning media has the potential to serve as an innovative educational medium for supporting fine motor stimulation in early childhood education. Future studies are recommended to continue the implementation and evaluation stages to examine the effectiveness of the developed media in improving children's fine motor skills in actual classroom settings. The developed media has also been published online, allowing teachers and researchers to access and evaluate the interactive learning media through the following link: <https://mediabelajar-anak-tk-bengong-jeumpa.my.canva.site/>

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