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IDENTIFICATION OF ADAPTIVE PLAY MODELS FOR COGNITIVE AND FINE MOTOR STIMULATION IN CHILDREN AGED 4-6 YEARS: DIGITAL CONTENT ANALYSIS AND PRACTICAL RECOMMENDATIONS

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ABSTRACT

The preschool period (ages 4-6) is a crucial period for the integration of cognitive and fine motor skills, yet current physical education activities are often dominated by gross motor development. As a result, educators often struggle to select holistic games. This study aims to identify, classify, and evaluate adaptive game models on digital platforms that have the potential to stimulate children's cognitive and fine motor domains. This study used a qualitative descriptive design with a digital content analysis approach. Data were sourced from videos on YouTube and TikTok platforms selected using a purposive sampling technique. Analysis was conducted on four selected videos (Gross motor skills for Pre-primary kids, Pompom Sorting and Counting Activity, Apple sensory bag, and Color finger lift) based on the inclusion criteria instrument for child development indicators. The results showed that all four games have the potential to stimulate cognitive (color/symbol recognition, concentration, decision-making) and fine motor skills (eye-hand coordination, finger control). Among the four, the Pompom Sorting and Counting Activity game was identified as the most comprehensive model because it simultaneously integrates visual-spatial skills, pattern observation, and manipulative movement control. In conclusion, adaptive play based on visual, sensory, and manipulative elements has been shown to be an effective alternative stimulation method. These findings provide practical recommendations for educators and parents on utilizing digital educational content and simple media to design meaningful physical learning.

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INTRODUCTION

The preschool years, particularly between the ages of 4 and 6, are crucial for the integration of cognitive function and fine motor skills (Flores et al., 2023). During this phase, children begin to develop symbolic thinking, simple problem-solving, and precise hand-eye coordination (Brofman et al., 2023;Cankaya et al., 2023;(Flores et al., 2023). Fine motor and cognitive development do not occur separately; they are neurobiologically interdependent (Flores et al., 2023). Good fine motor skills, such as the ability to manipulate small objects with their fingers, provide children with more opportunities to explore their environment, which in turn directly stimulates their cognitive development (Jylänki et al., 2022).

Play is the most natural and effective approach for early childhood to learn and develop in both domains (Yee et al., 2022; Widayati et al., 2019). Through play, children do not feel like they are being evaluated or given rigid instructions, but rather feel free to explore (Nilsson et al., 2018). Sports-based games or modified (adaptive) physical activities offer a particularly rich medium for stimulation (Liu et al., 2025). In addition to improving physical fitness, this type of play requires children to understand instructions, remember rules, develop strategies, and control detailed movements simultaneously (Jylänki et al., 2022; Bao et al., 2024).

Although various forms of play have been implemented in Kindergarten (TK) and Early Childhood Education (PAUD), physical education activities are often dominated by gross motor development such as running, jumping, and throwing large pompoms (Escápite et al., 2022; Aisyah et al., 2024). Games that specifically bridge dynamic physical activity with fine motor challenges and cognitive problem-solving are often not well identified or mapped by educators (Pacheco et al., 2025; Dewi et al., 2023). As a result, teachers often struggle to select the right type of play to provide holistic stimulation within a single physical education session.

Previous research by (RUKMINI et al., 2019) demonstrated that tactile play interventions such as playdough effectively reduced fine motor delays by 20.6% in children aged 5-6 years. These findings suggest that educational games involving object manipulation have significant potential to support fine motor and cognitive development in early childhood. However, this research focused on a single type of play, and little has been done to examine variations in adaptive sports play models that combine physical activity, cognitive stimulation, and fine motor skills simultaneously.

There has been limited research discussing, identifying, and comparing various adaptive game models available on digital platforms, which can be used as learning inspiration for parents and educators (Behnamnia et al., 2023). However, advances in digital technology have provided numerous examples of educational game models that can be modified to suit the characteristics and developmental needs of early childhood.

This research provides a novel approach by identifying and comparatively analyzing several adaptive game models obtained from digital platforms using a content analysis approach. Different from previous research by (Sutapa et al., 2021) which only evaluated one type of play model, this study attempts to map the characteristics of cognitive and fine

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motor stimulation of several play models which will later produce practical recommendations that can be used by educators and parents in choosing play activities that are appropriate to the developmental stage of children aged 4-6 years.

This information gap drives the need for a study to identify adaptive sports game models currently rapidly developing on digital platforms. Identifying various game elements that incorporate cognitive challenges (such as color recognition, shape recognition, or counting) combined with tool manipulation (such as stacking blocks while moving quickly or moving small objects in a race) is a crucial step in evaluating their effectiveness (Schmitt et al., 2025).

By mapping and evaluating these games, educators can determine which models are most optimal for the developmental characteristics of children aged 4-6 years. This mapping also serves to distinguish game models that risk overburdening children from those that are purely stimulating and enjoyable.

This research aims to identify, classify, and evaluate various adaptive sports game models that have the potential to stimulate cognitive and fine motor skills in children aged 4-6 years. The results of this identification will then be analyzed to formulate practical recommendations for early-level physical education teachers and parents, so they can select or adapt games that are most effective and appropriate for their children's developmental stages.

METHODS

This study employed a qualitative descriptive design with a digital content analysis approach. The analysis of selected digital content was systematically conducted to identify and classify adaptive game models that have the potential to stimulate cognitive and fine motor development in children aged 4-6 years. This study focused solely on analyzing educational game content available on digital platforms, therefore, it did not involve direct observation or intervention with human participants.

Participants and Sampling

Data was taken from adaptive game videos obtained from YouTube and TikTok. The video selection was conducted using keywords related to adaptive games and stimulating cognitive development and fine motor skills in children aged 4-6 years. Specific keywords used in the search included fine motor skills games for preschoolers, cognitive games for 4-6 years, and cognitive fine motor games. The search and data collection were conducted in May 2026. In the initial search phase, six videos from YouTube and three videos from TikTok were obtained that align with the research objectives.

These videos were then selected using purposive sampling, a sampling technique based on specific considerations tailored to the research objectives.

The criteria for the adaptive game models used were as follows:

1. The games were designed for children aged 4-6 years.
2. The games could stimulate cognitive and fine motor skills in children aged 4-6 years.

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3. The games involved fine motor activities that require finger, hand, or visual-motor coordination.
4. The videos captured clearly demonstrate the procedures and implementation of the game.
5. The videos captured are publicly accessible and educational in nature.

Based on these criteria, four adaptive game models were selected for identification, consisting of three videos from YouTube and one video from TikTok. The identified videos are:

1. Gross Motor Skills for Pre-primary Kids
2. Pompom Sorting and Counting Activity for Preschoolers
3. Apple Sensory Bag
4. Color Finger Lift

Ethical Considerations

This research used a publicly available digital platform and did not involve human participants, collection of personal data, or direct interaction with children. Therefore, ethical approval and informed consent were not required. All sources have been appropriately cited in accordance with the principles of academic integrity.

Instruments and Apparatus

The research instrument consisted of inclusion criteria developed by the researchers based on cognitive and fine motor development indicators for children aged 4-6 years. These inclusion criteria served as guidelines for the video selection process and served as a reference for identifying adaptive play models.

The inclusion criteria used included:

1. Cognitive stimulation
2. Fine motor stimulation
3. Hand and finger coordination
4. Classification skills
5. Attention and concentration
6. Visual-motor coordination
7. Finger movement control
8. Movement precision and accuracy

These criteria served as the basis for identifying and interpreting the potential for developmental stimulation in each selected adaptive play model. To maintain the objectivity of the analysis, video content was evaluated repeatedly and compared with applicable standard early childhood development indicators.

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Procedures / Data Collection

Data collection was carried out through the following stages:

1. Searching for educational game content on YouTube and TikTok using keywords related to adaptive play, preschool activities, cognitive stimulation, and fine motor development for children aged 4-6 years.
2. Selecting videos based on the established inclusion criteria. Based on the selection results, four videos met the criteria: one video from the YouTube channel LET'S LEARN 360 DEGREE, two videos from Happy Kids at Home, and one video from the TikTok account Babycloud SA Store.
3. Observing and repeatedly viewing each video were conducted to understand the game procedures, learning objectives, and characteristics of the activities within the game.
4. Identifying and classifying the characteristics of each game model based on the cognitive and fine motor development aspects of children aged 4-6 years, and then interpreting the potential developmental stimulation contained within each game model.

RESULTS

Based on the four games identified from digital platforms, they differ in their cognitive and fine motor skills (Table 1). These differences can be seen in the type of physical activity, level of motor coordination, complexity of instructions, and concentration skills required during the game.

The first game, Gross Motor Skills for Pre-Primary Kids, demonstrates strong stimulation of the ability to identify visual symbols and follow simple instructions. During the game, children must observe the shape of an open and clenched palm symbol and then adjust their hand movements according to the visual instructions provided. This game trains basic concentration, hand-eye coordination, and simple motor skills. From a fine motor perspective, this game helps children practice finger and palm coordination through repeated opening and clenching of the palms (DEGREE, 2023).

The second game, Pompom Sorting and Counting Activity for Preschoolers, demonstrates a higher level of complexity than the other games. Through this game, children are not only challenged to recognize colors but also to control the direction of the ball's movement following the line patterns, which range from straight lines to zigzag waves and curves. The variety of path shapes demands visual-spatial skills, precision, and stable movement control. Therefore, this game is the most effective way to develop fine motor coordination and hand manipulative control. It also requires a high level of focus and attention, as children must keep the ball on the correct path (Home, 2024).

The third game, the Apple Sensory Bag, provides powerful sensory stimulation through the use of water in a transparent plastic bag. The resistance caused by water pressure forces children to adjust their finger strength and thrust as they move the pom-poms toward the box with the appropriate color. This game gradually develops color classification skills, visual-motor coordination, and finger control. Compared to other games, this game emphasizes sensory development and the ability to match objects by color (Home, 2022).

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The fourth game, the Color Finger Lift, demonstrates the most stimulation in concentration and visual response speed. Through this game, children must quickly process color information and determine the correct finger to lift according to the card that appears. This game requires children to be meticulous, focused, and able to make simple decisions quickly. In terms of fine motor stimulation, this game trains individual finger movement control, which plays a crucial role in the coordination of small hand muscles in early childhood (Store, 2025).

Of the four games identified, the Pompom Sorting and Counting Activity for Preschoolers demonstrates comprehensive stimulation characteristics, supporting the cognitive and fine motor development of children aged 4-6 years. This is because this game simultaneously involves various aspects of development, from the ability to recognize colors, maintain concentration, understand visual patterns, to control precise and directed hand movements. This game has a higher level of complexity than other games, so children not only perform simple manipulative activities but also require simultaneous coordination of vision and hand movements. The activity of directing pompons along specific paths such as straight lines, zigzags, curves, and waves helps train hand-eye coordination, small muscle control, and precision in movement. Furthermore, the variety of patterns in the game provides visual-spatial stimulation that can support the development of thinking skills and simple problem-solving in early childhood.

Tabel 1. Adaptive Game Model Based on Cognitive and Fine Motor Skills

Name	Goal	Cognitive aspects	Motor aspects	Age	Game categories	Reference
Gross motor skill for Pre-primary kids	Train the ability to recognize symbols and follow a sequence of visual instructions.	Symbol recognition, concentration, attention span, response speed, understanding of game rules.	Clenching and unclenching the palms, hand-eye coordination, finger control.	4-6 years	Adaptive Visual-Motor	You Tube
Pompom Sorting and Counting Activit	Practice the ability to follow paths and match colors.	Color recognition, pattern observation, simple problem solving and	Shifting and controlling pompons, hand and	4-6 years	Visual sensory and fine motor skills.	You Tube

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y for Preschoolers		concentration.	finger coordination, precision of movement.			
Apple sensory bag	Practice the ability to group colors through sensory activities.	Color classification, attention focus, understanding instructions, simple decision making.	Pressing, sliding and controlling pompons in sensory bags, eye and hand coordination.	4-6 years	Visual sensory and fine motor skills	You Tube
Color finger lift	Trains quick response to color stimuli and finger coordination.	Color recognition, attention, concentration, speed of information processing and decision making.	Lifting fingers individually, small hand muscle control, bilateral coordination.	4-6 years	Visual response and finger coordination	Tiktok

DISCUSSION

The findings of this study indicate that adaptive play can integrate cognitive and fine motor development stimulation within a single play activity (Sari et al., 2025; Adhe et al., 2023). This is in line with early childhood development theory, which states that the learning process in preschool occurs optimally through direct experiences involving physical activity, environmental exploration, and simple problem-solving (Suryaningsih, 2024). Therefore, adaptive play not only functions as a recreational activity but also serves as a learning medium capable of simultaneously developing various aspects of a child's development (Nilsson et al., 2018).

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Based on the identification results, all games encompassed aspects of cognitive stimulation, such as color and symbol recognition, practicing the ability to follow directions, focus, and basic decision-making. These skills are essential for the cognitive development of preschool children (Rahmawati et al., 2025). Children begin to understand the relationship between symbols and meaning, identify patterns, and demonstrate increased focus on a single object between the ages of 4 and 6 (Lilawati, 2025). Therefore, games that combine physical activity and cognitive stimulation can be an effective medium to support children's cognitive and motor development (Varman et al., 2023; Muchamad Arif Al Ardha et al., 2018).

In terms of fine motor stimulation, all identified play models involved the small muscles of the hands and fingers in various forms of manipulative activities. Good hand-eye coordination is also essential for activities such as opening and clenching the palms, moving pompons through sensory media, and lifting fingers following color instructions (Kurniawati et al., 2026). These skills form the foundation for various academic activities children will encounter at subsequent levels of education, such as drawing, writing, cutting, and using various writing tools appropriately (Phillips et al., 2021; Widayati et al., 2019).

The Pompom Sorting and Counting Activity for Preschoolers exhibits the most comprehensive stimulation characteristics compared to other play models (Intrisilaras et al., 2025; Jubaedah & Setiawati, 2024). This is because this game not only requires children to perform manipulative activities but also integrates the ability to recognize colors, follow visual patterns, maintain attention, control precise hand movements, and simultaneously perform visual-motor coordination. The integration of these skills indicates that this game has the potential to provide a more complex learning experience than other games that focus more on a single developmental aspect. This finding aligns with previous literature (Tószegi et al., 2023; Fischer et al., 2022), which states that activities involving sorting and manipulating tools across the midline provide optimal cognitive load while also fostering visual-motor coordination.

Furthermore, the use of simple play media such as colored paper, pom-poms, and plastic bags filled with water demonstrates that stimulating children's development doesn't always require expensive media or sophisticated technology. Engaging learning experiences can be created through creativity in modifying play equipment to suit the developmental characteristics of early childhood (Maqother et al., 2024; Febriani et al., 2023). These findings have practical implications for parents and teachers in early childhood education (PAUD) and kindergarten (TK), who can utilize readily available media to create engaging, educational, and meaningful play activities (Fauziyah et al., 2025).

This study also demonstrates that digital platforms such as YouTube and TikTok can be a potential source of inspiration for developing adaptive play (Alam & Yusny, 2025). The wide range of educational content available allows parents and educators to obtain innovative and easily implemented game ideas for learning activities (Rinakit Adhe et al., 2025). However, the selection of games must be carefully selected and aligned with the developmental characteristics of early childhood, the learning objectives, and safety principles during play.

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Overall, the results of this study confirm that adaptive play, which emphasizes visual, sensory, and motor coordination, has significant potential to enhance the cognitive and fine motor development of children aged 4-6 years. Therefore, incorporating this game into the learning process and play activities at home can be an alternative stimulation strategy that is effective, fun and appropriate to the developmental needs of early childhood.

CONCLUSION

This study identified four adaptive game models taken from the digital platforms YouTube and TikTok: Gross Motor Skills for Pre-Primary Kids, Pompom Sorting and Counting Activity for Preschoolers, Apple Sensory Bag, and Color Finger Lift. All of these games have the potential to stimulate cognitive and fine motor development in children aged 4-6 years through play activities involving color and symbol recognition, hand-eye coordination, concentration, and finger and hand movement control.

Among the four games, Pompom Sorting and Counting Activity for Preschoolers has a higher level of integration of cognitive and fine motor stimulation than the other three. This is because the game simultaneously involves visual-spatial skills, hand-eye coordination, and fine motor control. These findings indicate that adaptive games based on visual, sensory, and manipulative skills can be used as a fun and beneficial alternative activity to support the development of cognitive and motor stimulation in early childhood.

Practically, the results of this study can serve as a reference for educators and parents in selecting or developing adaptive games that are appropriate to the developmental characteristics of children aged 4-6 years. Further research is expected to test the effectiveness of the game models that have been identified through experimental research so that empirical evidence is obtained regarding their influence on children's cognitive and fine motor development.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest regarding the publication of this article.

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