

Development of Program to Enhance Executive Function and Motor Competency of Students

Parichat Pragobmas^a, Dr.Suthana Tingsabhat^b

^a Faculty of Education, Chulalongkorn University, Thailand.

^b Assoc. Prof., Faculty of Education, Chulalongkorn University, Thailand.

Abstract

Enhancement of executive function and motor competency among students should be focused on the implementation of activities and the formation of the body of knowledge through a variety of activities, allowing physical movement and advanced thinking. This study aims to develop a program that promotes executive function and motor competency for upper elementary school students, by using the concept of creative dance with storyline approaches. The development consists of 4 steps; Step 1: Study of concepts, theories, and research related to executive function and motor competency; Step 2: Analysis and synthesis of the concepts, theories, and research through creative dance and storyline approaches, leading to activities for the executive function and motor competency enhancement program; Step 3: Develop the executive function and motor competency enhancement program for elementary school students; and Step 4: Quality inspection of the executive function and motor competency enhancement program for upper elementary students. Activities within the Program consist of 1) Pirates on the Treasure Island 2) The Conditions of the Big Bear 3) Blazing Flame 4) Giant Spider the Gatekeeper 5) White Rhino by the Stream 6) Fruit Jelly Wall 7) Red Circle Symbol and 8) Celebration Dance. The components for each activity include name, objectives, concepts, procedures, media/equipment, and evaluation.

Keywords: Executive function, motor competency, creative dance, storyline approaches.

1. Introduction

Physical activities for Thai children and youth are the most concerned compared to other age groups. Between 2012 - 2019, approximately 1 out of 4 children adequately participated in physical activities as recommended by World Health Organization (2010), with an average increment of -0.06% per year. Children and juveniles aged 5-17 years should participate in moderate to intense physical activities for at least a total of 60 minutes per day. The trends of physical activity participation between 2012-2015 among Thai children and juveniles were also highly fluctuated, oscillating with an average of 4% each year. In 2016-2019, however, the level of fluctuation went down to 1-2%, with the level of physical activity participation remaining constantly low. Conversely, the trends associated with sedentary behavior had prompted some concerns, with Thai children and juveniles being sedentary for an average of 13.5 hours per day in 2012 and 2017. Furthermore, the duration of sedentary behavior had expanded to more than 14 hours per day in 2018-2020 (Thailand Physical Activity Knowledge Development Centre, 2020).

Participation in moderate to intense physical activities stimulates the efficient functioning of the brain and nervous system, allowing better learning of more complex movements (Trudeau & Shephard, 2008; Fransen, Pion, Vandendriessche, Vandorpe, Vaeyens, Lenoir, & Philippaerts, 2012). The ability to efficiently control physical movement affects the participation in physical activities of the children in the present and in the long run, including maintaining good physical health through physical activities (Capio, Sit, Eguia, Abernethy, & Masters, 2015) and the acquisition of motor skills as a result of the participation in various forms of physical activity (Chinapong, Maphong, Promjun, & Amornsriwatanakul, 2021). The development of motor competency in children also influences other areas (Oliver, Schofield, & Kolt, 2007; Williams, Shoo, Isaac, Hoffmann, & Langham, 2008). Definitions of motor competency (MC), as provided by scholars, are consistent. Herrmann & Seelig (2017), for example, argued that MC is the functional performance disposition and guarantees that children are qualified to participate in sports and exercise. Moreover, MC can be learned in the long run and developed through physical practices, depending on the context and the environment, as well as specific needs (Herrmann, Seelig, Ferrari, & Kühnis, 2019).

Literature review of the definitions of MC (Herrmann, Gerlach, & Seelig, 2015; Herrmann, Bund, Gerlach, Kurz, Lindemann, & Rethorst, 2015; Herrmann & Seelig, 2017; Scheuer, Bund, Becker, & Herrmann, 2017; Gerlach, Herrmann, Dania, Heim, Jidovtseff, Quitério, & Scheuer, 2018; Herrmann, Heim, & Seelig, 2019; Herrmann, Seelig, Ferrari, & Kühnis, 2019; Scheuer, Herrmann, & Bund, 2019) concluded that MC is the body's ability to perform functions related to physical movement which can be clearly demonstrated, acquired from the participation in physical activities, exercise, and sports. Studies on the components of MC by scholars (Herrmann & Seelig, 2020) suggested a total of 8 components related to MC, including 1) throwing 2) catching 3) bouncing 4) dribbling 5) balancing 6) rolling 7) jumping and 8) running.

MC does not only involve the development of physical movement, but also cognitive processes (van der Fels, te Wierike, Hartman, Elferink-Gemser, Smith, & Visscher, 2015; Ludyga, Mücke, Kamiyo, Andrä, Pühse, Gerber, & Herrmann, 2019), mental development (Rose, Larkin, Parker, & Hands, 2015), and social skills. Executive function (EF), on the other hand, also plays an important role in the demonstration of MC. Studies on the development of MC and athletic skills (Vestberg, Gustafson, Maurex, Ingvar, & Petrovic, 2012; Belling & Ward, 2015; Vestberg, Reinebo, Maurex, Ingvar, & Petrovic, 2017) show that peak physical and athletic performance are related to the cognitive function and cognitive performance. On the other hand, the cognitive performance is also related to the MC and athletic skills. Those with excellent MC tend to have better cognitive performance; able to focus and better at paying attention, possess better inhibitory control, working memory, cognitive flexibility, creativity, and process information faster (Woo & Yongtawee, 2018).

EF is the brain function that involves self-management; the ability to control cognition, action, behavior, and emotion, which are required to manage various aspects of life. These functions are controlled by the frontal lobe. Definitions of EF, as provided by academic experts, are consistent. Elliott (2003), for example, argued that EF is the umbrella of thought processes that controls and manage cognitive processes such as planning, working memory, focus and attention, problem solving, verbal reasoning, inhibitory control, cognitive flexibility, and shifting between tasks. Gilbert & Burgess (2008), in the similar vein, referred to the EF as the advanced thought process of the frontal lobe that facilitates the development of new behaviors and enables a person to cope with unfamiliar

situations, as every daily situation tends to be different from what one has experienced before. The EF, therefore, manages the cognitive process and leads to new and different behaviors, such as planning for the future, changing of actions, or self-restraint to accomplish things and allow a person to have a purpose in life.

Blair (2016) recently stated that EF involves working memory, inhibitory control, and cognitive flexibility. These cognitive abilities are critical to behaviors and actions for achieving life goals. Similarly, Prager, Labarthe, Caggiano, & Lorenzo-Arribas (2016), argued that EF is the advanced cognitive ability required for self-control, self-restraint against inappropriate expressions, cognitive flexibility, and working memory. These skills begin to develop in childhood and affect other skills that will follow later on. This is consistent with the definition given by Thibodeau, Gilpin, Brown, & Meyer (2016), which explain that EF is the advanced cognitive ability that allows individuals to think and act accordingly, and adapt and respond better. The studies on the components of EF by scholars (Diamond, 2013; Center on the Developing Child at Harvard University, 2014; Zelazo, 2015; Blair, 2016; Prager, Labarthe, Caggiano, & Lorenzo-Arribas, 2016; Thibodeau, Gilpin, Brown, & Meyer, 2016) suggested a total of 3 components related to EF, including 1) working memory 2) inhibition and 3) cognitive flexibility.

The concept for organizing activities to promote EF and MC is consistent with the concept of creative dance (CD) (Vessawasdi & Khayankij, 2015; Chatzopoulos, Doganis, & Kollias, 2018; Jaiwang, Leesattrupai, & Piasai, 2019; Oppici, Frith, & Rudd, 2020; Matias, Carrasco, Ramos, & Borges, 2020; Rudd, Renshaw, Savelsbergh, Chow, Roberts, Newcombe, & Davids, 2021). CD affects students' EF and MC as it allows children to express their thoughts and feelings through physical movement, leading to self-satisfaction (Masturah, Handini, Hartati, & Yetti, 2018). Synthesis of papers and research related to CD (Vessawasdi & Khayankij, 2015; Gilbert, 2016; Chatzopoulos, Doganis, & Kollias, 2018; McGowan, 2018; Joung & Lee, 2019; Matias, Carrasco, Ramos, & Borges, 2020; Rudd, Renshaw, Savelsbergh, Chow, Roberts, Newcombe, & Davids, 2021) suggests that CD combines the skills of physical movement with the expression of ideas, facial expressions, and gestures. The synthesis shows the four components of CD as follows: 1) Space 2) Time 3) Force and 4) Body.

Storyline approaches also encourage students to think (Laohapanpong, 2008; Pinnate, 2013; Tuengjai, Isarapreeda, & Burachart, 2014; Lahoya, Soipetkasem, & Di-sawat, 2016; Natchanakun & Weeranakin, 2018; Rodsut, Lertamornpong, & Somchaipeng, 2019; Matias, Carrasco, Ramos, & Borges, 2020) as it is a learning process that integrates knowledge and experience in which the learners create their own stories. The teachers are responsible for laying out the path for the story by dividing the story into chapters. Each chapter consists of sub-activities linked by key questions, consisting of four elements: 1) Setting the Scene 2) Character 3) A Way of Life and 4) Events, Incidents, or Real problems to be solved.

Looking at the issues and importance mentioned above, it can be said that EF and MC are critical to the students. There is a need to establish enhancement programs for upper elementary school students. The researcher, therefore, develops a program to promote EF and MC for upper elementary school students using creative dance concept together with storyline approaches. Data gathered can be used as a guideline to encourage the students to develop their physical abilities, gain control of their thoughts, actions, emotions, and behaviors which are crucial for them to achieve the goals.

2. Method

2.1 Design

This qualitative research is done by reviewing related documentary research to develop an enhancement program to promote EF and MC for upper elementary school students through creative dance together with storyline approaches. The researcher conducted a content analysis of the creative dance concept, storyline concept, and related research to synthesize an activity for the enhancement program.

2.2 Research Process

Development of the enhancement program to promote EF and MC of upper elementary school students through creative dance together with storyline approaches consists of 4 steps:

Step 1: Study of concepts, theories, and research related to EF and MC.

Step 2: Analysis and synthesis of the concepts, theories, and research through creative dance and storyline approaches, leading to activities for the EF and MC enhancement program.

Step 3: Develop the EF and MC enhancement program for upper elementary school students.

Step 4: Quality inspection of the EF and MC enhancement program for upper elementary students by experts, and improve the quality of the program.

2.3 Analysis of Data

The quality assessment of the EF and MC program for upper elementary school students using creative dance concept together with the developed storyline approaches by experts and improve the quality of the developed program, is done as follows:

1. The program will be inspected by 5 experts, who are knowledge able and are experts in physical education or related fields. These experts shall hold an educational background of not lower than a Master's degree. The assessment is a 5-point scale assessment, with criteria as follows: most suitable (5 points), very suitable (4 points), moderately suitable (3 points), less suitable (2 points), and least suitable (1 point). The results will be interpreted as follows: 4.20 points or above means most suitable; 3.40-4.19 points means very suitable; 2.60-3.39 points means moderately suitable; 1.80-2.59 points means less suitable; less than 1.80 points means least suitable.

2. Consider the suitability of each component of the activities, namely their names, objectives, concepts, steps for implementation, media/equipment, and evaluation, and improve according to the recommendations of the experts.

3. Findings

The analysis and synthesis of the essence of the creative dance concept, together with the storyline approaches as an activity to promote EF and MC for upper elementary school students can be summarized as follows:

Activity 1, “Pirates on the Treasure Island”, is derived from the analysis and synthesis of concepts related to creative dance and storyline approaches. Center on the Developing Child at Harvard University (2014) had been studying EF and MC enhancement through the storytelling of continuous events and dancing along with the music. Rudd, Buszard, Spittle, O'Callaghan, & Oppici (2021) also examined how physical movement combined with dance lead to EF and MC, as shown in Table 1.

Table.1. Activity 1 “Pirates on the Treasure Island”

Related theories, documents, and research	Analysis of the concept, related theories, documents, and research	Synthesized activity
Concept of Storyline Approaches	The narrative relates to people, time, and places, taking on adventurous settings.	Pirates on the Treasure Island
Concept of Creative Dance	Body movement combines with dance to create an expression using space, energy, time, and different parts of the body.	
Center on the Developing Child at Harvard University (2014)	Promotion of EF and MC through the storytelling of continuous events and dancing along with the music.	
Rudd, Buszard, Spittle, O'Callaghan, & Oppici (2021)	Physical movement combines with dance, leading to EF and MC.	

Activity 2, “The Conditions of the Big Bear”, is derived from the analysis and synthesis of concepts related to creative dance and storyline. Taschanchai & Chuthapisith (2016) mentioned that storytelling activities, physical movement, and dance influence EF and MC. Olga, Georgios, Ioannis, Dimitrios, & Maria (2018) also examined activities that promote cognitive skills, body control, and body balance through dance, as shown in Table 2.

Table.2. Activity 2 “The Conditions of the Big Bear”

Related theories, documents, and research	Analysis of the concept, related theories, documents, and research	Synthesized activity
Concept of Storyline Approaches	The characters lead the story, allowing new experiences, followed by settings where the characters are involved.	The Conditions of the Big Bear
Concept of Creative Dance	Body movement through dance, using space, time, energy, and the body to create expression.	
Taschanchai & Chuthapisith (2016)	Storytelling activities, body movement, and dance, leading to EF and MC.	

Olga, Georgios, Ioannis, Dimitrios, & Maria (2018)	Activities for the promotion of cognitive skills, body control, and body balance through dance.	
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Activity 3, “Blazing Flame”, is derived from the analysis and synthesis of concepts related to creative dance and storyline. Matias, Carrasco, Ramos, & Borges (2020) studied the enhancement of MC through storyline activities and creative dance, while Oppici, Rudd, Buszard, & Spittle (2020) studied the improvement of EF in terms of working memory and MC through activities involving physical movement and dance, as shown in Table 3.

Table.3. Activity 3 “Blazing Flame”

Related theories, documents, and research	Analysis of the concept, related theories, documents, and research	Synthesized activity
Concept of Storyline Approaches	The story consists of linear narrative.	Blazing Flame
Concept of Creative Dance	Body movement and dance with the arts of thought, facial expressions, and gestures, which use space, energy, time, and body parts.	
Matias, Carrasco, Ramos, & Borges (2020)	Promotion of MC through storyline activities and creative dance.	
Oppici, Rudd, Buszard, & Spittle (2020)	Promotion of EF in terms of working memory and MC through physical activities and dance.	

Activity 4, “Giant Spider the Gatekeeper”, is derived from the analysis and synthesis of concepts related to creative dance and storyline. Center on the Developing Child at Harvard University (2014) had been studying EF and MC enhancement through the storytelling of continuous events and dancing along with the music. Saengsawang, Langka, Utairatanakit, & Semheng (2016) also examined the promotion of EF through team activities that focus on an individual's body control and movement, as shown in Table 4.

Table.4. Activity 4 “Giant Spider the Gatekeeper”

Related theories, documents, and research	Analysis of the concept, related theories, documents, and research	Synthesized activity
Concept of Storyline Approaches	The narrative is divided into chapters, taking into account the four elements: scene, character, lifestyle, and important event	Giant Spider the Gatekeeper
Concept of Creative Dance	Dance using body movement, both remaining in the same position and changing of position.	

	Movements are changed according to space, energy, time, and body parts.	
Center on the Developing Child at Harvard University (2014)	Promotion of EF and MC through the storytelling of continuous events and dancing along with the music.	
Saengsawang, Langka, Utairatanakit, & Semheng (2016)	Promotion of EF through team activities using body control and body movement.	

Activity 5, “The White Rhino by the Stream” is derived from the analysis and synthesis of concepts related to creative dance and storyline. Matias, Carrasco, Ramos, & Borges (2020) studied the enhancement of MC through storyline activities and creative dance. Joung & Lee (2019) also examined the activities that enhance body balance and body control through body movement and a dance, as shown in Table 5.

Table.5. Activity 5 “The White Rhino by the Stream”

Related theories, documents, and research	Analysis of the concept, related theories, documents, and research	Synthesized activity
Concept of Storyline Approaches	The main questions act as the narrator, or as the story opener.	The White Rhino by the Stream
Concept of Creative Dance	A dance that requires moving different parts of the body, in relation to the space, energy, time, and body.	
Matias, Carrasco, Ramos, & Borges (2020)	Promotion of motor competency through storyline activities and creative dance.	
Joung & Lee (2019)	Promotion of body balance and body control through activities that involve body movement and dance.	

Activity 6, “Fruit Jelly Wall” is derived from the analysis and synthesis of concepts related to creative dance and storyline. Taschanchai & Chuthapisith (2016) mentioned that storytelling activities, physical movement, and dance influence EF and motor competency. Chatzopoulos, Doganis, & Kollias (2018) argued that creative dance leads to the ability to recognize movement, rhythm, and body balance, as shown in Table 6.

Table.6. Activity 6 “Fruit Jelly Wall”

Related theories, documents, and research	Analysis of the concept, related theories, documents, and research	Synthesized activity
Concept of Storyline Approaches	The main questions direct the story's progression, allowing students to think and act which leads to the activities	Fruit Jelly Wall
Concept of Creative Dance	A unique dance that uses space, energy, time, and body parts, combined with movement skills and the art of expression.	
Taschanchai & Chuthapisith (2016)	Storytelling activities, body movement, and dance, leading to EF and MC.	
Chatzopoulos, Doganis, & Kollias (2018)	Creative dance leads to the ability to recognize movement, rhythm, and body balance.	

Activity 7, “Red Circle Symbol”, is derived from the analysis and synthesis of concepts related to creative dance and storyline. Center on the Developing Child at Harvard University (2014) had been studying EF and MC enhancement through the storytelling of continuous events and dancing along with the music. Jaiwang, Leesattrupai, & Piasai (2019) also studied the promotion of EF through creative dance, as shown in Table 7.

Table.7. Activity 7 “Red Circle Symbol”

Related theories, documents, and research	Analysis of the concept, related theories, documents, and research	Synthesized activity
Concept of Storyline Approaches	The main questions connect each chapter of the story and allow the students to think and act.	Red Circle Symbol
Concept of Creative Dance	The movement of the body through dance to create the expression along with the music, providing an opportunity to use energy, space, time and body movement.	
Center on the Developing Child at Harvard University (2014)	Promotion of EF and MC through the storytelling of continuous events and dancing along with the music.	
Jaiwang, Leesattrupai, & Piasai (2019)	Promotion of EF through creative dance.	

Activity 8, “Celebration Dance”, is derived from the analysis and synthesis of concepts related to creative dance and storyline. Matias, Carrasco, Ramos, & Borges (2020) studied the enhancement of

MC through storyline activities and creative dance. Pavlidou, Lokosi, Sofianidou, & Kosmidou (2018) also stated that physical activities through dance lead to MC as shown in Table 8.

Table.8. Activity 8 “Celebration Dance”

Related theories, documents, and research	Analysis of the concept, related theories, documents, and research	Synthesized activity
Concept of Storyline Approaches	Organize a variety of activities requiring the students to think and act in order to find answers to the main questions.	Celebration Dance
Concept of Creative Dance	Creation of movement through dance, which combines the principles of dancing, and expresses feelings through body movement using space, energy, time, and the body.	
Matias, Carrasco, Ramos, & Borges (2020)	Promotion of MC through storytelling activities and creative dance.	
Pavlidou, Lokosi, Sofianidou, & Kosmidou (2018)	Physical activities through dance lead to motor competency.	

4. Results, Discussion and Recommendations

The researchers have created a program to promote EF and MC for upper elementary students using the creative dance concept together with storyline approaches. The analysis and synthesis of the concept and the storyline, as well as research related to the promotion of EF and MC, were used to develop activities that promote EF and MC. The components of each activity are their names, objectives, concepts, steps to apply the activity, media/equipment, and evaluation. This newly developed program for upper elementary school students will be conducted over a period of 8 weeks, 3 times a week, and 50 minutes for each session. The evaluation of the program's suitability shows that the program is highly suitable. The average suitability score is 4.60, with details as shown in Table 9.

Table.9. Average Suitability of Activity 1-8

Activity	Average Score	Level of Suitability
Activity 1 Pirates on the Treasure Island	4.57	Highest
Activity 2 The Conditions of the Big Bear	4.60	Highest
Activity 3 Blazing Flame	4.57	Highest
Activity 4 Giant Spider the Gatekeeper	4.67	Highest
Activity 5 The White Rhino by the Stream	4.47	Highest
Activity 6 Fruit Jelly Wall	4.53	Highest
Activity 7 Red Circle Symbol	4.73	Highest
Activity 8 Celebration Dance	4.63	Highest

In addition, the experts have provided suggestions to improve activities in the programs. Details of each activity are as follows:

Activity 1 Pirates on the Treasure Island - the experts suggested some modifications to the activity, saying that “every phase of the activity should address questions based on the components. Also, there should be a reflection on the issues as well as a solution.” The researchers have modified the activity accordingly.

Activity 2 The Conditions of the Big Bear - the experts suggested some modifications to the activity, saying that “every phase of the activity should address questions based on the components. Also, there should be a reflection on the issues as well as a solution.” The researchers have modified the activity accordingly.

Activity 3 Blazing Flame - the experts suggested some modifications to the activity, saying that “every phase of the activity should address questions based on the components. Also, there should be a reflection on the issues as well as a solution.” The researchers have modified the activity accordingly.

Activity 4 Giant Spider the Gatekeeper - the experts suggested some modifications to the activity, saying that “every phase of the activity should address questions based on the components. Also, there should be a reflection on the issues as well as a solution.” The researchers have modified the activity accordingly.

Activity 5 The White Rhino by the Stream - the experts suggested some modifications to the activity, saying that “the activity would be more interesting if issues were introduced by the White Rhino” and “every phase of the activity should address questions based on the components. Also, there should be a reflection on the issues as well as a solution.” The researchers have modified the activity accordingly.

Activity 6 Fruit Jelly Wall - the experts suggested some modifications to the activity, saying that “the students would be more into the activity if the words match with the story when using the tennis ball” and “every phase of the activity should address questions based on the components. Also, there should be a reflection on the issues as well as a solution.” The researchers have modified the activity accordingly.

Activity 7 Red Circle Symbol - the experts suggested some modifications to the activity, saying that “every phase of the activity should address questions based on the components. Also, there should be a reflection on the issues as well as a solution.” The researchers have modified the activity accordingly.

Activity 8 Celebration Dance - the experts suggested some modifications to the activity, saying that “every phase of the activity should address questions based on the components. Also, there should be a reflection on the issues as well as a solution.” The researchers have modified the activity accordingly.

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