Effects of I AM TAP Program on Executive Function of Children 3–5 years in Bangkok Metropolitan Region Residential Care Homes: A Quasi-experimental Study

Kulpariya Pewdee, Lawan Singhasai, Panadda Thanasetkorn, Tipawan Daramas*

Abstract: Executive function is important to the success of an individual. Children who have a history of being abused mentally and physically before entering a residential care home may have executive function deficits. They often face fear, stress, and a lack of interpersonal interaction, which affects their executive function. This quasi-experimental study aimed to increase children's executive function through the I AM TAP Program. This program integrates sensory and physical activities, including working memory, inhibitory control, and cognitive flexibility. Two residential care homes of young children aged 3-5 years in the Bangkok Metropolitan Region were randomly assigned to experimental and control groups. Then, 36 children from each setting and 11 caregivers were selected according to the inclusion criteria. The experimental group received I AM TAP Program training twice weekly for 9 weeks, 20-30 minutes each session. The control group attended the routine activities provided in a residential care home. Executive function was assessed with the Mahidol University Executive Function-101 instrument. The data were analyzed using independent t-tests, paired t-tests, and covariance analysis.

The results of this study, a testament to the effectiveness of the I AM TAP Program, revealed a significant increase in the mean scores of executive functions on 3 subscales in the experimental group. These scores not only improved from the pre-program levels but also surpassed those of the control group, as measured one week after program completion. This promising outcome suggests that the I AM TAP Program has the potential to enhance executive function in young children. Nurses can potentially apply this program to promote executive function, and caregivers can be equipped with information on how to support the children in the residential care home. However, it is crucial to conduct further testing with various groups of children in different settings before considering widespread implementation.

Keywords: Children, Cognitive flexibility, Executive function, Inhibitory control, Residential care home, Working memory

Received 21 May 2024; Revised 23 May 2024; Accepted 24 June 2024

***Kulpariya Pewdee**, RN, MNS in Pediatric Nursing (Candidate), Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Thailand. E-mail: kulpariya_41_33@hotmail.com*

***Correspondence to: Lawan Singhasai,** *RN, PhD (Nursing), Assistant Professor, Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Thailand. E-mail: lawan.sin@mahidol.ac.th*

***Panadda Thanasetkorn**, PhD (Early Childhood Education), Assistant Professor, National Institute for Child and Family Development, Mahidol University, Thailand. E-mail: 101panadda@gmail.com*

***Tipawan Daramas**, RN, PhD (Nursing), Assistant Professor, Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Thailand. E-mail: tipawan.dar@mahidol.ac.th*

Introduction

Executive function (EF) is a process connected to the work of the prefrontal cortex, or a higher level of brain function, to manage, direct, and control one's thoughts, emotions, and behavior to achieve goals.[1] Children with good development of EF have a good working memory. Moreover, children with good EF learn better at school because they have a comprehensible vocabulary.[2] In contrast, children with deficits in EF may have aggressiveness and impulsive behavior,[3] which are particularly associated with inhibitory control,[3-4] delayed language development and an

https://doi.org/10.60099/prijnr.2024.269322

inability to read appropriately according to age, which is related to working memory[5] and cognitive flexibility.[6] These children tend to steal things from others due to their unwillingness to wait patiently for things to arrive. They also struggle to manage their emotions, which makes it easy for them to fight with their peers. Children with deficits in EF can also not maintain their attention on projects for extended periods, solve urgent issues, or make plans for the future. Long-term effects may include difficulties interacting with others in society, health issues that impair performance at work or school, and reduced quality of life.[7]

In Thailand, a survey of EF among 2,986 children aged 2–6 years old found that 28.32% had overall development of EF from slightly delayed to very late, and more than 30% of children of this age had behaviors that caused problems with EF.[7] In addition, a survey of Thai children aged 3–6 years in the Bangkok Metropolitan Region found that 18.5% had deficits in core EF or 3 subscales of EF.[8] The development of EF is very important in children aged 3–5 years.[9] This age range is a window of opportunity for the development of EF.[10] This is the time when nerve fibers and connections between neurons are fully developed and mature.[11] If children aged 3–5 years are properly promoted in EF, this may help them develop better EF, be able to succeed in education and work and have a good quality of life.

Many studies revealed that children who have experienced abuse or neglect in the past and are in foster care or child residential care homes have poor EF.[12-14] In Thailand, there are eight residential care homes for children from birth to six years old. The majority of children were orphaned by abandoned parents or guardians (27.64%).[15] Children who have experienced physical, mental, and sexual abuse often experience fear, stress, and anxiety in their minds, which affects their EF.[16] Additionally, the environment in the residential care home has an effect on the EF, especially in parenting and activities for the development of the EF of the residential care home.[17] In residential care homes, one caregiver takes care of 4–6 children, which differs from the care of children in families and not in care.[18] As a result, caregivers cannot provide comprehensive care and responsiveness to children's needs, leading to a lack of love, empathy, and interpersonal interaction.[19] When children lack interpersonal interaction, EF can be affected.[20] Thus, this study intends to evaluate the effectiveness of a program to promote EF in children aged 3–5 years old in a residential care home.

Literature Review and Conceptual Framework

The conceptual framework of this study was based on Piaget's cognitive development theory[21] and development of EF.[1] Piaget[21] proposed that cognitive development occurs through interaction between the individual and the environment. This begins with assimilation, or the process of the brain receiving information from learning through new experiences. After that, children will undergo cognitive restructuring (accommodation), which is the combination of information received with the original information to create a balance in the child's thinking and understanding processes (equilibration). Subsequently, it has been found in neuroscience that children learn new things through challenging experiences with clearly defined goals,[22-23] and interacting with the environment increases the function of connections between neurons and increases myelin membranes.[24] When myelin membranes increase, neural fibers can conduct nerve signals more quickly. Therefore, the function of the prefrontal cortex is more efficient,[24] which has a relationship with EF.[1] EF is consistent with Piaget's cognitive development theory.[24] The challenging experiential learning process and interactions with the environment correspond to the assimilation period. The process of forming myelin membranes and connections between neurons corresponds to the stage of cognitive restructuring (accommodation), and the process of developing EF in relation to the prefrontal cortex function corresponds to the balance in the child's cognitive processes (equilibration).

The three elements of core EF consist of 1) working memory, which is the memory of the brain that can remember information from learning things around, 2) inhibitory control is a behavior that children can express appropriately and can be patient,[22] and 3) cognitive flexibility is the ability to think outside the box, or know how to work successfully according to goals.[25] Core EF can only be developed when children learn through challenging circumstances with clear and specific objectives,[22-23] and interaction with the environment.[24] Children from 3 to 5 years are in the preoperational stage, where they begin to think their own thoughts, to be able to think, to analyze, to connect events together, and to know how to classify colors or objects.[21] To promote the EF of children at this age, the focus should be on learning through challenging activities and interaction with others. In addition, the nature of children at this age is to learn through the senses.[26] Sensory learning contributes to cognitive development,[27] so children should be encouraged to learn through sensory activities as well.

Numerous studies have been conducted in order to create initiatives that support core EF, including music training,[28] mindfulness or meditation,[28-29] play-based,[28,30] aerobic exercise or physical activity.[31-32] In addition, computer game programs also help promote inhibitory control.[32-33] Bingo games, parts matching games, and other games that change the rules back and forth can promote cognitive flexibility,[34] including imaginative play.[35] Finally, role-playing activities can enhance inhibitory control and working memory.[33]

Furthermore, physical activity-based sensory integration programs can improve EF: 1) the Executive Function Training Program in Preschool (EFE-P), a program that promotes core EF, emotional control, planning and organizing. The program includes storytelling, Lego building, drawing and group game activities, which can develop EF in all five areas;[4] and 2) the I AM TAP program,[36] which consists of activities that integrate sensory and physical activity and aim to develop core EF. Considering the program details, the I AM TAP program is more challenging than the EFE-P program. The study by Tamaekong et al.,[36] with 68 children aged between 4-6 years from a public school in a province near Bangkok, Thailand, revealed that the I AM TAP program could increase inhibitory control, working memory, and cognitive flexibility.[36]

In this study, we used the I AM TAP program to promote EF because this program is based on the EF guidelines, with a tool for analyzing and designing early childhood experience plans to promote EF. Activities based on the use of EF guidelines are clear with the goal of promoting EF.[37-38] Activities in this program also create interaction between people. A study on children without EF dysfunction living in their own homes indicated that the I AM TAP program could promote core EF in young children,[36] but no studies were done on children living in residential care homes with low core EF.[12-14] The children in residential care homes often lack interpersonal interaction.[19] When children perform activities in each aspect of core EF, they develop accommodation and equilibration until they can develop core EF. Finally, the I AM TAP program has not been used to promote EF for children in residential care homes in Thailand; hence, this study was conducted on children aged 3-5 years.

Hypothesis

Children in the experimental group receiving the I AM TAP program would have mean scores on inhibitory control, working memory, and cognitive flexibility higher than before receiving the program and higher than those of the control group measured one week after program completion.

Methods

Design: A quasi-experimental design with a two-group, pretest-posttest design was used. This report follows the Transparent Reporting of Evaluation with Non-randomized Designs (TREND) checklist as a guideline.

Sample and Setting: The settings were two child residential care homes in the Bangkok Metropolitan Region with similar characteristics in parenting services, promoting physical and mental development, and recreational activities. The child residential care homes were randomly assigned to the experimental group (Babies Home A) and the control group (Babies Home B). The samples in this study were children aged 3–5 years old and caregivers who cared for the children. There were 47 children in Babies Home A and 60 children in Babies Home B.

The inclusion criteria of the children were: able to understand and communicate Thai. The exclusion criteria were: 1) having vision problems such as color blindness; 2) having hearing problems such as deafness; 3) being diagnosed by a physician with a medical condition that may interfere with their participation in activities, such as heart disease, asthma, attention deficit hyperactivity disorder (ADHD), autism, Down syndrome, or children with a history of traumatic brain injury; 4) children participating in Montessori activities or other activities that promote EF; or 5) were unable to participate in every step of the program as specified in the research plan. The inclusion criteria of the caregivers were they would be able to understand and communicate in Thai. They were excluded if they cared for a child less than 3 months.

A large effect size of 0.80 was used to calculate the sample size according to Cohen's power analysis.[39] The parameters for t-test statistical analysis were determined to be two independent t-tests, one-tailed type, and the power of the test, $1-\beta$. From the accepted standard value, at least the level of significance (α) = 0.05 was determined using the G*Power version 3.1.97.[40] The sample size was 35 children per group. However, this study has a small group of activities, with the primary investigator (PI) organizing a small group of 6 children. Then, the sample size for the intervention and control groups was 36 children per group, a total of 72. Convenience sampling was used to obtain the participants according to the inclusion and exclusion criteria.

Ethical Considerations: This study was approved by the Human Research Ethics Committee of the Faculty of Medicine Ramathibodi Hospital, Mahidol University (MURA2022/611). The PI sent a letter to the Director-General of the Department of Children and Youth Affairs and then the directors of the two homes, asking for permission to conduct the research. Parents or legal representatives were asked to sign a consent form to participate in the study. An anonymous numerical code was used instead of specifying the child's name, surname, and nickname. The participants' personal information was kept confidential and securely stored. The research results were presented for academic purposes only.

Research Instruments: These consisted of two instruments for data collection and the intervention program.

Two General Information Questionnaires **a**sked about a) the demographic characteristics of the children, consisting of gender, date of birth, age, weight, height, underlying disease, physical disabilities, eye problems, hearing problems, development, reason for accepting a child into the care homes, and length of stay; and b) the caregivers' gender, age, work experience in the care home, and length of care for the child in the study.

The Executive Function Assessment Form (MU.EF-101) was developed by Chutabhakdikul et al.,[7] and is used to assess EF in children. This form is copyrighted by Mahidol University and was used with permission after purchase. This assessment can be done by caregivers. The questions in MU.EF-101 comprise five skills: inhibitory control, working memory, cognitive flexibility, emotional control, and planning and organization. However, this study assessed only the core EF: 1) ten inhibitory control items, such as joining a queue and waiting patiently; 2) six items of working memory, such as when ordering two or three jobs according to age, children remember and act correctly and completely; and 3) five items on cognitive flexibility, such as adapting to new situations within a short time. A 5-point rating scale is used for

each item, from 0 = never engaged in the behavior at all to 4 = having the behavior every day. The scores on the individual parts range from 0-40, 0-24, and 0-20 for inhibitory control, working memory, and cognitive flexibility, respectively. A higher score indicates a higher EF in that dimension.

The quality of the assessment from MU.EF-101 was checked, and the content validity was reviewed by 10 experts. The index of item objective congruence (IOC) was between 0.67 and 1.0.[7] The construct validity was examined by comparing the assessment of MU.EF-101 with the Behavioural Rating Intervention of Executive Function-Preschool Version (BRIEF-P), which is a questionnaire that assesses negative behaviors in daily life for children aged 2 to 5 years and 11 months.[7] The MU.EF-101 was significantly negatively correlated with BRIEF-P.[9] Test-retest reliability was utilized to evaluate the stability of the MU.EF-101 at 1-week intervals. The intraclass correlation coefficient (ICC) of the inhibitory control, the working memory, and the cognitive flexibility were 0.72, 0.76, and 0.71, respectively.[7] The reliability test in this study showed that the inhibitory control had an ICC of 0.85, the working memory had an ICC of 0.76, and the cognitive flexibility had an ICC of 0.83.

The I AM TAP program was developed by Tamaekong et al.[36] and integrates sensory and physical activity. There are three activities in the program that promote core EF: inhibitory control, working memory, and cognitive flexibility

(1) *Inhibitory control activities* (week 1-3: every Saturday and Sunday, 20-30 minutes per session): these allow children to play three different games while being given commands. The PI instructs each child to run to the colored position indicated by the command heard in the first game. Each child must sprint in the second game to the colored position denoted by the red or green symbol. Each child had to sprint to alternate positions in the third game, which did not follow the PI's instructions.

(2) *Working memory activities* (week 4-6: every Saturday and Sunday, 20-30 minutes per session) are exercises that allow children to play games based on colors. According to the PI's instructions, each child was required to either look at the image or hear the music. Afterward, each child was instructed to jump onto the color tap pad according to what they saw or heard, then jump backward from the last color to the first color.

(3) *Cognitive flexibility activities* (week 7-9: every Saturday and Sunday, 20-30 minutes per session) allow children to imitate the behavior of animals. The PI shows the children photographs of animals, in which they have to guess which animal it is and emulate the behavior of that animal. The child is then instructed to behave differently from their peers and the animal in the picture. The following game shows one child an image of an animal and asks him to imitate the behavior of that animal while other friends are instructed to guess what kind of animal it is. The last game lets the child pick up the animal model from the position where the animal image is. There is a rule that the child must only move on the tap pad.

The validity of the I AM TAP program was examined by three experts, two early childhood teachers and a neuroscientist. The IOC score was 0.93.[36] In addition, the program's efficiency was checked by giving it a tryout. The Efficiency of Process/ Efficiency of Product (E1/E2) scores of the I AM TAP program was 78.72/81.20.[36] However, the operators of the I AM TAP program must undergo a workshop from an expert on this program. The PI completed the program workshop with Apirak Tamaekong, the program developer, in September 2022. During the training, the PI was evaluated to determine whether they could carry out activities in the program appropriately and completely at every step.

Data Collection: This study was conducted from January to April 2023 after study approvals. After that, the PI met the caregivers in the care homes to ask for cooperation in both groups. In the control group (Babies Home B), the PI carried out the normal child residential care home activities. In the experimental group (Babies Home A), the PI divided the I AM TAP program activities into small groups. The sample group consisted of 36 children, divided into groups of 6

children, a total of six groups, performing activities twice a week, every Saturday-Sunday, 20-30 minutes per session, taking a total of nine weeks to complete the activities. In addition, in the last week, the PI organized an additional storytelling activity about separating to prepare the children before the end of the activity. This method is based on the principle of preventing separation anxiety in children. After completing the program, the PI distributed leaflets with information on EF promotion methods to the home caregivers. Thus, caregivers could apply the information obtained from the brochures to further enhance children's EF. One week after completing the I AM TAP program activities, the PI met with caregivers to request cooperation in completing the post-test. When the data were collected from both groups, the PI used the three subscales' scores of EF to analyze the data.

Data Analysis: Descriptive statistics were used to analyze demographic characteristics. Using statistical chi-square and Fisher's exact test, the general characteristics of the experimental and control groups were compared. Normal distribution data were analyzed using an independent t-test, and all assumptions were met. The paired t-test was used to compare the average inhibitory control, working memory, and cognitive flexibility scores within the group, and the analysis of covariance (ANCOVA) was used to compare between groups.

Results

This study's participants were 11 caregivers and 72 children in residential care homes, the experimental group (n = 36) and the control group (n = 36). The data of the two groups of caregivers and children were not significantly different ($p > .05$), as shown in **Table 1.**

Table 1. Comparison of general characteristics of the sample using the chi-square test and Fisher's exact test

General characteristics	Experimental group		Control group		Test value	p-value
	Number	%	Number	%		
Children (n = 72)						
Gender						
Boy	20	55.60	18	50.00	.223	.637[a]
Girl	16	44.40	18	50.00		
Development						
Normal	36	100	35	97.20		1.00[b]
Suspected delayed	0	0	1	2.80		
Reasons for accepting child into care home						
Abandoned	9	25.00	5	13.90	1.419	.234[a]
Maltreated	11	30.65	16	44.40	1.481	.224[a]
Imprisoned parents	11	30.65	13	36.10	.250	.617[a]
Parents are not ready to take care of the child	5	13.90	2	5.55		.429[b]
Caregivers (n = 11)						
Gender						
Male	1	14.3	0	0		1.00[b]
Female	6	85.7	4	100		

Note. a = Pearson Chi-square, b = Fisher's exact test

In addition, the t-test was used to test the age of the caregivers and children, the duration of the child's stay in the residential care home, and the caregivers' work experience. The data of the two groups were not significantly different ($p > .05$), as shown in **Table 2.**

Table 2. Comparison of general characteristics of the sample using independent t-test

General characteristics	Experimental group			Control group			t	p-value
	min-max	Mean	SD	min-max	Mean	SD		
Children (n = 72)								
Age (months)	37-68	53.50	10.16	36-70	54.92	10.69	-.576	.566
Duration of child's stay in care home (months)	8-62	35.00	14.31	8-67	30.75	13.98	1.275	.207
Caregivers (n = 11)								
Age (years)	26-57	45.43	9.87	42-58	50.75	6.90	-.946	.369
Work experience (years)	5-34	18.86	10.16	11-26	18.75	6.34	.019	.985

Before the I AM TAP program, groups differed in inhibitory control and cognitive flexibility. The mean scores of the core EF were compared using a paired t-test. After receiving the I AM TAP program, the experimental group had the mean scores of core EF: inhibitory control, working memory, and cognitive flexibility higher than those before receiving the program with statistical significance ($p < .05$) (**Table 3**).

Table 3. Comparison of the mean score of core EF before and after receiving the program in both groups using paired t-test (n = 72)

Executive function	Before receiving the program		After receiving the program		t	p-value
	Mean	SD	Mean	SD		
Inhibitory control						
Experimental group (n = 36)	53.14	6.04	60.47	5.28	-8.726	< .001
Control group (n = 36)	50.03	4.92	54.03	2.90	-7.208	< .001
	t = 2.395, p = .019		t = 6.419, p < .001			
Working memory						
Experimental group (n = 36)	49.44	7.22	57.78	6.56	-7.470	< .001
Control group (n = 36)	50.06	6.60	52.56	3.44	-3.128	.004
	t = -.375, p = .709		t = 4.231, p < .001			
Cognitive flexibility						
Experimental group (n = 36)	52.69	7.23	59.22	6.64	-6.409	< .001
Control group (n = 36)	48.86	4.33	52.31	3.58	-6.622	< .001
	t = 2.728, p = .008		t = 5.501, p < .001			

Results of the pre-test revealed that the scores of inhibitory control and cognitive flexibility before receiving the program in the groups were significantly different ($p < .05$). Therefore, the pre-test score was used as a covariate in ANCOVA, and the results showed that the experimental group had significantly higher inhibitory control ($F = 35.13$, $p < .05$), working memory ($F = 16.08$, $p < .05$) and cognitive flexibility ($F = 24.32$, $p < .05$) than the control group (**Table 4**).

Table 4. Comparison of average inhibitory control, working memory, cognitive flexibility after receiving the I AM TAP Program between groups using ANCOVA (n = 72)

Source of variation	Sum of square	df	Mean square	F	p-value
Inhibitory control					
I AM TAP program	1,366.13	4	341.53	35.13	< .001
Pretest	140.78	1	140.78	14.48	< .001
Error	651.37	67	9.72		
Total	238,002.00	72			

Table 4. Comparison of average inhibitory control, working memory, cognitive flexibility after receiving the I AM TAP Program between groups using ANCOVA (n = 72) (Cont.)

Source of variation	Sum of square	df	Mean square	F	p-value
Working memory					
I AM TAP program	1,180.24	4	295.06	16.08	< .001
Pretest	241.89	1	241.89	13.18	.001
Error	1,229.76	67	18.36		
Total	221,532.00	72			
Cognitive flexibility					
I AM TAP program	1,689.41	4	422.35	24.32	< .001
Pretest	628.58	1	628.58	36.19	< .001
Error	1,163.58	67	17.37		
Total	226,745.00	72			

Discussion

The I AM TAP program in this study was found to be helpful in increasing children's core EF. This may be because the program integrates sensory and physical activities, and each activity would be challenging. Moreover, this program has a clear pattern of activities and is based on the EF guideline,[36] a tool for analyzing and designing an activity plan to promote EF.[37-38] It is also an activity that creates interaction between people among children in the child residential care home who lack interpersonal interaction.[19] Activities in the I AM TAP program should be made per the directions of the PI and the rules of the group. However, children may talk or exchange ideas while doing activities to solve game problems. According to Piaget's cognitive development theory, children learn and develop their cognitive skills by adapting to their surroundings.[21] Child interaction is the activation of nerve fibers to transmit information and connect neurons, including an increase in the myelin sheath,[24] causing the brain to transmit nerve signals faster. Therefore, the function of the prefrontal cortex is more efficient in line with the development of EF.[24]

The I AM TAP program concept is consistent with the Center on the Developing Child at Harvard University,[34] which proposes that games with rules that are not too difficult for children to play, including having an appropriate level of challenge, will help develop inhibitory control.[34] Games that require problem-solving skills can train children on working memory and cognitive flexibility.[34] Additionally, backward digit span and storytelling principles can develop working memory.[34]

Previous findings support our study; for example, a study in Italy[33] found that playing games through storytelling and role play increased inhibitory control and working memory in children aged 4-6 years.[33] Role-playing and physical activity games have a similar basic nature to the I AM TAP program in increasing the difficulty level and challenging activities that would enable them to develop EF.[23] A study in Spain[4] focusing on integrating physical and sensory activities like the I AM TAP program found that the program was effective in reducing five areas of deficiencies in EF in children aged 5-6 years. Also, a Thailand study[36] found that the I AM TAP program activities effectively promoted EF among children aged 4-6 years.

However, this study differed from the previous study[36] because the samples of this study were children in residential care homes. This group of children were easily frightened. In addition, observing children during activities in the experimental group found that this group adapted quite slowly. The PI, therefore, had to do additional activities for the children to familiarize themselves and build relationships with them, such as songs about hello and animals. Moreover, the 9-week

period of activities with the children may have allowed them to become familiar with and bond with the PI. However, when the activities were completed, the PI was no longer in contact with them. This might cause separation anxiety in children, which can occur during this age group. Since these children were a vulnerable group, the PI organized storytelling activities, such as playing peekaboo, parting, and farewell songs, so they could learn how to meet and separate.

When considering the results in the control group, it was found that the post-test scores of EF were also higher than the pre-test scores of the experimental group. It may be due to age-related brain growth as children get older, which is related to neural circuit connections in the prefrontal cortex, with the prefrontal cortex being associated with EF.[11] The activity of the prefrontal cortex is linked to the activity of different brain regions that are key components of EF.[16] In addition, from observing the daily routines of children in both residential care home settings during data collection, the PI found that the children performed the same routines of daily activities. The caregiver would take care of and train the child to be able to help themselves as much as possible. Most children can help themselves, for example, by putting on clothes and shoes, eating, and putting dishes in place after eating. Training the child to be able to do activities by themselves, in addition to promoting social development and self-care, also promotes working memory skills. Training children to put their dishes in place after eating also promotes working memory and inhibitory skills.

Furthermore, the activities within the care homes were conducted according to the children's age, such as tracing dotted lines, drawing, coloring, telling stories, dancing, and exercising.[18] Some activities may help to promote EF, such as storytelling. This not only improves children's concentration but may also improve working memory in children.[34] Other activities, such as dancing, may promote working memory and inhibitory control.[34] However, there should be a clear form of activity arrangements to promote EF. Goals should be set for each activity, and activities should be challenging; they should be organized to effectively promote EF.[23,36] This is seen in the I AM TAP program that, after receiving the program, the experimental group had a higher mean difference score of EF in inhibitory control, working memory, and cognitive flexibility than those of the control group.

Limitations

This study is limited in generalizability because only two child residential care homes in the Bangkok Metropolitan Region, Thailand, were selected. Before starting this research, the PI submitted a letter requesting preliminary information from the Department of Children and Youth Affairs about the childcare model, child caregivers, and activities provided to children in both homes. The preliminary information showed that the children in the experimental and control groups had no different characteristics. However, data were collected during the COVID-19 outbreak, causing the ratio of caregivers to children to differ between the experimental group (1:4) and the control group (1:5-6). The caregivers' personal reasons, including being ill, made them unable to care for the children in the control group during the study period. Thus, the threat to internal validity could not be avoided.

Conclusions and Implications for Nursing Practice

This study demonstrated that the I AM TAP program effectively increased EF in residential care homes for young children. This program is based on the EF guideline and includes a tool for analyzing and designing early childhood experience plans to promote EF. Nurses can apply this program to promote EF and can also provide information on promoting EF to caregivers for children in residential care homes. Caregivers who understand EF guidelines can utilize

knowledge and skills to design daily routine activities for their children.

However, before utilizing the I AM TAP program to arrange activities for children, the nurse must receive workshop instruction from an expert on the program and pass an evaluation to appropriately and completely carry out the program activities. Additionally, further testing with various groups of children in various settings with randomized controlled trials is needed before the program can be widely used.

Acknowledgments

We are grateful to all the children and caregivers who participated in this study. The publication of this study was supported by the School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University.

References

1. Anderson P. Assessment and development of executive function (EF) during childhood. Child Neuropsychol. 2002;8(2):71-82. doi:10.1076/chin.8.2.71.8724.
2. Yan S, Li M, Yan Z, Hu B, Zeng L, Lv B. Associations among teacher-child interaction, children's executive function and children's comprehensible vocabulary. Front Public Health. 2023;11:1077634. doi:10.3389/fpubh.2023.1077634.
3. Romero-López M, Quesada-Conde AB, Bernardo GA, Justicia-Arráez A. The relationship between executive functions and externalizing behavior problems in early childhood education. Procedia Soc Behav Sci. 2017;237:778-83. doi:10.1016/j.sbspro.2017.02.121.
4. Romero-López M, Pichardo MC, Justicia-Arráez A, Cano-García F. Effect of the EFE-P program on the improvement of executive functions in early childhood education. Revista de Psicodidáctica. 2021;26(1):20-7. doi:10.1016/j.psicoe.2020.09.001.
5. Cortés Pascual A, Moyano Muñoz N, Quílez Robres A. The relationship between executive functions and academic performance in primary education: review and meta-analysis. Front Psychol. 2019;10:1582. doi:10.3389/fpsyg.2019.01582.
6. Filipe MG, Veloso AS, Frota S. Executive functions and language skills in preschool children: the unique contribution of verbal working memory and cognitive flexibility. Brain Sci. 2023;13:470. doi:10.3390/ brainsci13030470.
7. Chutabhakdikul N, Thanasetkorn P, Lertawasdatrakul O, Ruksee N. Tool development and evaluation criteria for assessment of executive function in early childhood. Nakhon Pathom: Research Center for Neuroscience, Institute of Molecular Biosciences, Mahidol University; 2017 (in Thai).
8. Chutabhakdikul N, editor. Executive function and learning readiness in early childhood. Education fair for teacher development no. 8; 2015 Oct 14; Impact Forum (Hall 9), Muang Thong Thani. Institute of Molecular Biosciences, Mahidol University; 2015 (in Thai).
9. Marulis LM, Nelson LJ. Metacognitive processes and associations to executive function and motivation during a problem-solving task in 3-5 year olds. Metacogn Learn. 2021;16(1):207-31. doi:10.1007/s11409-020-09244-6.
10. Ooppakarn D, Yanachai O. What principle should we use to enhance learning development of early childhood children: "brain-based learning" or "executive function" Veridian E-Journal, Silpakorn Univ. 2018;11(1):1635-51. Available from: https://he02.tci-thaijo.org/index.php/Veridian-E-Journal/article/view/120112/91769 (in Thai).
11. Homsuwan R. Executive functions (EF) promotion in early childhood. NU J Nurs Health Sci. 2021;15(2):27-37. Available from: https://he01.tci-thaijo.org/index.php/NurseNu/article/view/250065/169502 (in Thai).
12. Cohodes EM, Chen SH, Lieberman AF, Bush NR. Examination of the associations between young children's trauma exposure, trauma-symptomatology, and executive function. Child Abuse Negl. 2020;108:104635. doi:10. 1016/j.chiabu.2020.104635.
13. Johnson D, Policelli J, Li M, Dharamsi A, Hu Q, Sheridan MA, McLaughlin KA, Wade M. Associations of early-life threat and deprivation with executive functioning in childhood and adolescence: a systematic review and meta-analysis. JAMA Pediatr. 2021;175(11):e212511. doi:10.1001/jamapediatrics.2021.2511.
14. Lunda JI, Toombs E, Radford A, Boles K, Mushquash C. Adverse childhood experiences and executive function difficulties in children: a systematic review. Child Abuse Negl. 2020;106:104485. doi:10.1016/j.chiabu.2020.104485.

15. Department of Children and Youth Affairs. Report on the number of children protected and welfare of the Department of Children and Youth Affairs [Internet]. 2024 [cited 2024 June 4]. Available from: https://bi.dcy.go.th/views/DCY008/Dashboard (in Thai).
16. Chonchaiya W. Executive functions of the brain at a high level. 2020. In: Sucharitapong S, Rungpraiwan R, Hansakunachai T, Benjasuwanthep B, Fuengfoo A, Jutapisit J, Rojmahamongkol P, editors. Child development and behavior, Vol 4. Child Development and Behavior Club of Thailand, Department of Pediatrics, Faculty of Medicine, Chulalongkorn University; 2020, pp. 19-41 (in Thai).
17. Cardona JF, Manes F, Escobar J, Lopez J, Ibanez A. Potential consequences of abandonment in preschool-age: neuropsychological findings in institutionalized children. Behav Neurol. 2012;25(4):291-301. doi:10.3233/BEN-2012-110205.
18. Phanchan N. The children institutional care: role in socialization, case study: Rangsit Babies Home, Rangsit Sub-district, Thanyaburi District, Pathumthani Province. [bachelor's thesis]. [Nakhon Pathom]: Silpakorn University; 2017. Available from: http://www.sure.su.ac.th/xmlui/handle/123456789/15149 (in Thai).
19. Morales-Murillo CP, García-Grau P, Fernández-Valero R. Interpersonal relationships in early childhood. 2020. In: Levine MP, editors. Interpersonal relationships. IntechOpen; 2020, pp. 1-13. doi:10.5772/intechopen.94859.
20. Seamkhumhom D, Chaiyawut P, Wanngamwiset S, Thienphuridej T. Promotion to executive functions in preschool children. J MCU Nakhondhat. 2020;7(10):15-31. Available from: https://so03.tci-thaijo.org/index.php/JMND/article/view/247515 (in Thai).
21. Piaget J, Inhelder B. The psychology of the child. New York: Basic Books; 1969.
22. Diamond A. Executive functions. Annu Rev Psychol. 2013; 64:135-68. doi:10.1146/annurev-psych-113011-143750.
23. Diamond A. Ling DS. Conclusions about interventions, programs, and approaches for improving executive functions that appear justified and those that, despite much hype, do not. Dev Cogn Neurosci. 2016;18:34-48. doi:10.1016/j.dcn.2015.11.005.
24. Goldstein S, Naglieri JA. Handbook of executive functioning. Springer; 2014. doi: 10.1007/978-1-4614-8106-5.
25. Anderson PJ., Reidy N. Assessing executive function in preschoolers. Neuropsychol Rev. 2012;22(4):345-60. doi:10.1007/s11065-012-9220-3.
26. Brillante P, Mankiw S. A sense of place: human geography in the early childhood classroom. Young Child. 2015; 70(3):16-23.
27. Li P. Importance of play in early childhood (9 benefits & infographic) [Internet]. 2024 June 18 [cited 2024 June 20]. Available from: https://www.parentingforbrain.com/benefits-play-learning-activities-early-childhood/
28. Muir RA, Howard SJ, Kervin L. Interventions and approaches targeting early selfregulation or executive functioning in preschools: a systematic review. Educ Psychol Rev. 2023;35(1):27. doi: 10.1007/s10648-023-09740-6.
29. Khammee N, Haenjohn J, Sirithadakunlaphat S. Using neuro-linguistic programming for enhancing executive functions of the brain in early childhood. JRTAN. 2024; 25(1):319-27. Available from: https://he01.tci-thaijo.org/index.php/JRTAN/article/view/264888/181915 (in Thai).
30. Doebel S, Lillard AS. How does play foster development? A new executive function perspective. Dev Rev. 2023; 67(2):101064. doi:10.1016/j.dr.2022.101064.
31. Zeng N, Lee JE, Gao Z. Effects of home-based exergaming on preschool children's cognition, sedentary behavior, and physical activity: a randomized crossover trial. BBI - Integrative. 2023;1:100002. doi: 10.1016/j.bbii. 2023.100002.
32. Chen J, Zhou X, Wu X, Gao Z, Ye S. Effects of exergaming on executive functions of children: a systematic review and meta-analysis from 2010 to 2023. Arch Public Health. 2023;81(1):182. doi: 10.1186/s13690-023-01195-z.
33. Traverso L, Viterbori P, Usai MC. Effectiveness of an executive function training in Italian preschool educational services and far transfer effects to pre-academic skills. Front Psychol. 2019;10:2053. doi: 10.3389/fpsyg.2019. 02053.
34. Center on the Developing Child, Harvard University. Enhancing and practicing executive function skills with children from infancy to adolescence [Internet]. 2017 [cited 2024 May 18]. Available from: https://developingchild.harvard.edu/resources/activities-guide-enhancing-and-practicing-executive-function-skills-with-children-from-infancy-to-adolescence/
35. Putri AR, Djuwita E, Wiswanti IU. The role of age and imaginative play as predictors of cognitive flexibility in preschool-aged children. J Fam Sci. 2024;(Spec ed): 86-98. doi: 10.29244/jfs.vi.49946.

36. Tamaekong A, Thanasatkorn P, Seree P, Siripornpanich V. The impacts of the I AM TAP program on the preschool children's executive function skills. J Educ Res, Faculty of Education, Srinakharinwirot University. 2019;14(1): 182-96. Available from: https://ejournals.swu.ac.th/index.php/jre/article/view/11832/9830 (in Thai).
37. Thanasetkorn P, Pitaksinsuk T, Boonprakong K, Thanasetkorn P, Hanmethee S, Udomrati W. EF guideline, an analytical tool for designing "the experience that promotes EF brain skills" for early childhood teachers [Internet]. 2018 [cited 2024 Jan 28]. Available from: www.rlg-ef.com (in Thai).
38. Poowanna B, Sarnkong R, Wangsitthidet S, Srikula W, Nakunsong T. The development executive functions for early childhood in 21st century. EduLearn. 2022;11(4):193-9. doi: 10.5539/jel.v11n4p193.
39. Cohen J. Statistical power analysis for the behavioral sciences. 2nd ed. Lawrence Erlbaum Associates; 1988.
40. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods. 2009;41(4): 1149-60. doi: 10.3758/BRM.41.4.1149.

ผลของโปรแกรม I AM TAP ต่อทักษะการคิดเชิงบริหารของเด็กอายุ 3–5 ปี ในสถานสงเคราะห์ เขตกรุงเทพมหานครและปริมณฑล : การศึกษากึ่งทดลอง

กุลปริยา ผิวดี ลาวัลย์ สิงห์สาย ปนัดดา ธนเศรษฐกร ทิพวัลย์ ดารามาศ*

บทคัดย่อ: ทักษะการคิดเชิงบริหารมีความสำคัญต่อการประสบความสำเร็จในชีวิตของแต่ละบุคคล เด็กที่มีประวัติถูกทารุณกรรมทางร่างกายและจิตใจก่อนเข้ามาอยู่ในสถานสงเคราะห์มักจะมีทักษะการคิดเชิงบริหารบกพร่อง เด็กมักเผชิญกับความกลัว ความเครียดและการขาดปฏิสัมพันธ์ระหว่างบุคคล ซึ่งส่งผลต่อการทักษะการคิดเชิงบริหาร การศึกษากึ่งทดลองนี้มีวัตถุประสงค์เพื่อพัฒนาทักษะการคิดเชิงบริหารของเด็กผ่านโปรแกรม I AM TAP โปรแกรมนี้เป็นโปรแกรมที่บูรณาการด้านประสาทสัมผัสและกิจกรรมทางกาย ซึ่งประกอบด้วยทักษะด้านความจำเพื่อใช้งาน ด้านการควบคุมและยับยั้งตนเอง และด้านการยืดหยุ่นทางความคิด สถานสงเคราะห์เด็กอายุ 3-5 ปี เขตกรุงเทพมหานครและปริมณฑล จำนวน 2 แห่ง ได้รับการสุ่มให้เป็นกลุ่มทดลองและกลุ่มควบคุม และคัดเลือกกลุ่มตัวอย่างเด็ก 36 คนจากแต่ละสถานสงเคราะห์ และผู้ดูแลเด็ก 11 คนตามเกณฑ์คัดเข้า กลุ่มทดลองได้เข้าร่วมโปรแกรมทั้งหมด 9 สัปดาห์ สัปดาห์ละ 2 ครั้ง ครั้งละ 20-30 นาที กลุ่มควบคุมได้รับการดูแลตามปกติของสถานสงเคราะห์ ทักษะการคิดเชิงบริหารถูกประเมินโดยใช้แบบประเมินพัฒนาการด้านการคิดเชิงบริหาร MU.EF-101 วิเคราะห์ข้อมูลด้วยสถิติ independent t-test, paired t-test และ covariance analysis

ผลการศึกษานี้ เป็นข้อมูลชี้ให้เห็นถึงประสิทธิผลของโปรแกรม I AM TAP พบว่า กลุ่มทดลองมีคะแนนเฉลี่ยทักษะการคิดเชิงบริหาร ในกลุ่มทักษะพื้นฐาน 3 ด้าน สูงกว่าก่อนเข้าร่วมโปรแกรม และสูงกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ โดยประเมินหลังจากสิ้นสุดโปรแกรม 1 สัปดาห์ ผลการศึกษานี้แสดงให้เห็นว่าโปรแกรม I AM TAP มีประสิทธิภาพที่พัฒนาทักษะการคิดเชิงบริหารในเด็กเล็ก พยาบาลสามารถใช้โปรแกรมนี้เพื่อส่งเสริมทักษะการคิดเชิงบริหาร และให้ข้อมูลกับผู้ดูแลเด็กเพื่อส่งเสริมเด็กในสถานสงเคราะห์ อย่างไรก็ตาม จำเป็นต้องมีการทดสอบโปรแกรมนี้เพิ่มเติมกับเด็กกลุ่มต่าง ๆ ที่อยู่ในบริบทแตกต่างกันก่อนที่จะนำโปรแกรมไปใช้อย่างแพร่หลาย

Pacific Rim Int J Nurs Res 2024; 28(4) 707-719

คำสำคัญ: เด็ก การยืดหยุ่นทางความคิด ทักษะการคิดเชิงบริหาร การควบคุมและยับยั้งตนเอง สถานสงเคราะห์ ความจำเพื่อใช้งาน

กุลปริยา ผิวดี *นักศึกษาหลักสูตรพยาบาลศาสตรมหาบัณฑิต สาขาวิชาการพยาบาลเด็ก โรงเรียนพยาบาลรามาธิบดี คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล E-mail: kulpariya_41_33@hotmail.com*

ติดต่อที่ : ลาวัลย์ สิงห์สาย *ผู้ช่วยศาสตราจารย์ โรงเรียนพยาบาลรามาธิบดี คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล E-mail: lawan.sin@mahidol.ac.th*

ปนัดดา ธนเศรษฐกร *ผู้ช่วยศาสตราจารย์ สถาบันแห่งชาติเพื่อการพัฒนาเด็กและครอบครัว มหาวิทยาลัยมหิดล E-mail: 101panadda@gmail.com*

ทิพวัลย์ ดารามาศ *ผู้ช่วยศาสตราจารย์ โรงเรียนพยาบาลรามาธิบดี คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล E-mail: tipawan.dar@mahidol.ac.th*