ผลของโปรแกรม I AM TAP ต่อทักษะการคิดเชิงบริหารของเด็กปฐมวัย

THE IMPACTS OF THE I AM TAP PROGRAM ON THE PRESCHOOL CHILDREN'S EXECUTIVE FUNCTION SKILLS

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บทคัดย่อ

การคิดเชิงบริหาร (Executive Function) หรือทักษะสมอง EF คือ กระบวนการทำงานของสมองระดับสูง ที่ควบคุมความรู้สึก การรู้คิดและพฤติกรรม ให้ประสบความสำเร็จตามเป้าหมายโดยอาศัยประสบการณ์เดิมมาช่วยในการตัดสินใจ ทักษะพื้นฐานของการคิดเชิงบริหารที่สำคัญคือ การยับยั้งชั่งใจ ความจำเพื่อใช้งาน และการยืดหยุ่นความคิด งานวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาผลของโปรแกรม ไอ แอมแท็ป ต่อทักษะพื้นฐานของการคิดเชิงบริหารของเด็กปฐมวัย โปรแกรม ไอแอมแท็ป เป็นโปรแกรมการใช้กิจกรรมกลุ่มจำนวน 10 กิจกรรม สำหรับใช้ร่วมกับแผนการเรียนการสอนในห้องเรียนเด็กปฐมวัย เพื่อส่งเสริมทักษะพื้นฐานของทักษะสมอง EF ในเด็กปฐมวัย แต่ละกิจกรรมถูกพัฒนาขึ้นตามแนวทางการจัดกิจกรรมตามแนวทาง EF Guideline ซึ่งเป็นหลักการวางแผนจัดประสบการณ์ที่พัฒนาขึ้นตามหลักการทำงานของสมองและทักษะมอง EF งานวิจัยชิ้นนี้เป็นการวิจัยกึ่งทดลอง แบบมีกลุ่มควบคุมและมีการทดสอบก่อน และหลังการทดลองกลุ่มตัวอย่างทั้งหมด คือเด็กปฐมวัยอายุระหว่าง 4–6 ปี จำนวน 68 คน ที่เรียนอยู่ในโรงเรียนอนุบาลสังกัดกระทรวงศึกษาธิการ แบ่งเป็นกลุ่มทดลอง จำนวน 31 คน และกลุ่มควบคุม จำนวน 37 คนเด็กในกลุ่มทดลอง จะได้เข้าร่วมกิจกรรมกลุ่มในโปรแกรมไอแอมแท็ป จำนวน 18 ครั้ง ครั้งละ 20–30 นาที 2 ครั้งต่อสัปดาห์ เป็นระยะเวลา 9 สัปดาห์ ส่วนเด็กในกลุ่มควบคุม เข้าร่วมกิจกรรมตามแผนการเรียนการสอนตามปกติ เครื่องมือที่ใช้เก็บรวบรวมข้อมูล คือ แบบประเมินพัฒนาการด้านการคิดเชิงบริหาร (MU.EF–101) และสถิติที่ใช้ในการวิเคราะห์ข้อมูลคือ การทดสอบความแตกต่างค่าเฉลี่ยของกลุ่มตัวอย่าง 2 กลุ่มไม่อิสระ(paired sample t-test) และการทดสอบค่าเฉลี่ยของกลุ่มตัวอย่าง 2 กลุ่มที่มีความเป็นอิสระต่อกัน(independent sample t-test) ตามลำดับ

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ผลการวิจัยพบว่า 1) เด็กกลุ่มทดลองมีค่าเฉลี่ยคะแนนทักษะการคิดเชิงบริหารหลังเข้าร่วมโปรแกรม I AM TAP สูงกว่าก่อนเข้าร่วมอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.001 และ 2) เด็กกลุ่มทดลองมีค่าเฉลี่ยของพัฒนาทักษะการคิดเชิงบริหารสูงกว่าเด็กในกลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.001

คำสำคัญ: การคิดเชิงบริหาร โปรแกรมส่งเสริมทักษะการคิดเชิงบริหาร เด็กปฐมวัย

ABSTRACT

Executive function (EF) is a set of higher - orderofmental processes for regulating emotions, cognition and behaviors to achieve goal–directedbehaviorsby accomodating previous experience. The basic skills of EF include inhibitory control, working memory and shifting. The purpose of this research was to investigate the I AM TAP program on children's basic EF skills. I AM TAP program is a set 10 group activities developed for integrating to the preschool's regular lesson plans in in order to promote the basic EF skills. Each activity was develpped based on EF Guideline, the principles of EF activating for planning learning experiences. Quasi–experimental research with control group and pre-test and post-test was designed. The total sample was 68 children aged 4 to 6 years old, studying in a public kindergarten. The sample was divided into 2 groups including the experimental group (n = 31) and control group (n = 37). The children in the intervention group participated in I AM TAP program for 20-30 minutes each time, 2 times a week for 9 weeks. The children in the control group participated in the regular school activities. The Assessment of Executive Function in Early Childhood (MU.EF–101) was utilized to evaluating the sample'sEFskills. Paired sample t-test and independent t-test was utilized to analyze the data.

The results showed that the children in the experimental group significantly had higher posttest–mean scores than theirpretest–mean scores on allthebasic EF skills ($p < 0.001$). The analysis of independent t–test showed that the children in the intervention group significantly had higher mean scores on allthebasic EF skill development, comparing to the childrenin the control group ($p < 0.001$).

Keywords: Executive Function Skills, EF Skills, Program, Intervention, Preschool

Introduction

According to Mr. Teerakiat Charoensettasin (2016), in the era of Thailand 4.0 or 21st century, education should go beyond preparing learners to be content smart. Instead, the significant skills, such as habit of learning, morality, analytical skills, and the ability to live with others, should be instilled [1]. In addition, the 21st century skills, including 3R (reading, writing, and arithmetic) and 4C (Critical Thinking, Communication, Collaboration and Creativity) should also be taught for preparing 21st century citizen [2]. According to Randy Kulmand (2017), EF is the basis of learning and innovation skills in 21 century. For example, in order to be capable of create something, cognitive flexibility or shift is required [3]. Thus, EF skills need to be promoted for supporting the 21st century skills. The golden period for EF development is the age of 2 – 6. During this period, the neural growth rate (Synapse) is the fastest, comparing to the other age. The most

densely neural network is occurred around age of 4-6 years old. After the golden period in early childhood, neural network are redundant and don't contribute a lot of output. They were removed from the neural network. This process called "Pruning", for organize neural network to be effective. [4]Therefore, 2-6 years are important period for preparing EF skills to the laerners.

EF skills are a set of higher - orderofmental processes for regulating emotions, cognition and behaviors to achieve goal–directedbehaviorsby accomodating previous experience[5, 6].Rebecca Branstetter (2016 compared EF skills with the chief executive officer (CEO), who plans to achieve success [7].EF skills are the processes that use previous experiences to make a decision [8].In addition, EF skills are necessary in life because they are related to school achievement, positive behaviors, good health and success in career and relationships [10]. According to Adele Diamond and Kathleen lee (2011), the core of the EF skills included inhibitory control, working memory and shifting [9].Inhibitory control is the ability to control desires, stop inappropriate behavior that causes others to suffer and inhibit thinking that will affect the work [5, 9].Working memory is the ability to store and retrieve relevant information stored in our brain in situations such as problem solving, conversation, learning and test [5, 9].Shifting is the ability to change vision, thinking or the ability to think outside the box. It is used to find a variety of solutions to problems and change focusing attention from one activity to other activity [5, 9].

In Thailand, Nuanchan (2015) found in her research in a survey of 243 children aged 3 to 6 years, using the standardized test MU.EF-101 that 18.5% of children had problems in EF skills; especially in Inhibitory control, Working Memory and Cognitive flexibility/Shift [6]. The results of EF dysfunction by MU.Ef-102 showed that more than 30 % of the children at age 2 to 6 years had EF dysfunction. Boy had more behavioral problems than girl. The behavioral problems included the behaviors related to self-regulation and inhibitory control, impulsive behaviors and distraction. Previous research stated that EF skills was related to school readiness and academic achievement, Children with low EF skills were at considerable risk to academic failure [6]. Therefore, an effective intervention program promoting Thai children's EF skills is needed

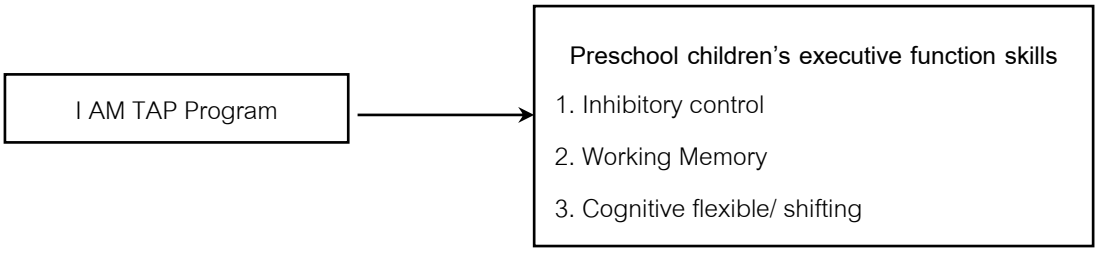
Previous research studied many programs and activities for promote EF skills in early childhood development and education, such as computerized training program, hybrid of computer and non-computer games, aerobic exercise and sports, martial arts and mindfulness practices and classroom curricula. The researchers gathered the research based best practices and synthesized to find the key for promote EF skills. We found that the key principle for promoting EF skills was challenging activities with clear goal and secure learning environment [9]. For promoting each specific EF domain, previous research studied intervention program for promoting inhibitory control. Qian Liu, Xinyi Zhu and Jiannong Shi (2012) used the computer game (fruit ninja) for improving inhibitory control in the preschooler [11]. The Center on the Developing Child Harvard University (2017) found that non-computer games, such as red-light, green-light and Simon say could promote children's inhibitory control [10]. For promoting working memory, Lisa

B. Thorell and Sofia Lindqvist and Sissela Bergman Nutley, Gunilla Bohlin & Torkel Klingberg (2009) used cog-med intervention program for promoting working memory in ADHD child and normal Children [12]. In addition, Satya Prakash Purohit and Balaram Pradhan (2017) found that yoga could also promote working memory in adolescents in an orphan home [13]. Adele Diamond and Kathleen lee (2012) found that martial arts (tae-kwon-do) could improve working memory in children aged 5-11years [9]. The Center on the Developing Child Harvard University (2017) showed that card board game, guess game and mazes game could promote shifting skills. [10] Steven masley, Richard Roetzheim and Thomas Gualtieri (2009) And Exercise research said the duration and frequency exercise are positive correlation with the ability of shifting [14]. The researchers gathered the research based best practices and synthesized to find the key for promote EF skills. We found that the key principle for promoting EF skills was challenging activities with clear [9].

In Thailand, an ongoing research since 2009 in the impact of the 101s Positive Discipline program on teachers' interaction skills and children's EF skills, conducted by Panadda Thanasetkorn and her colleagues suggested that positive interaction practices could promote children's EF skills. Pitchada Sutipan (2012) studied the impact of 101 positive discipline techniqueson children's EF skills in Thailand. The result suggested that when teachers used the 101 positive discipline technique, the children had better scores on the EF skills [15]. In 2016, Panadda Thanasetkorn developed EF guideline, a tool for helping preschool teachers to plan lesson plans to promote children's EF skills. The tool was implemented in preschool classrooms and the children's EF skills were investigated [20, 21]. The results showed that the children in the experimental group whose teachers plan learning experiences based on EF Guideline significantly had higher scores on the EF skills than did the children in the control group whose teachers used regular learning experiences. The researchers concluded that the EF guideline was an alternative tool for helping preschool teachers to plan learning experiences for promoting EF skills in preschoolers. Since the EF guideline guided the teachers to have well–planned teaching processes that engaged children in meaningful learning, the teachers were able to set emotional support but challenging environment. As a result, the children were encouraged to try their best to make good choices [8].

In this research, I AM TAP program was developed to promote EF skills in kindergarten classrooms. The name of the program came from two important keys to success in promoting the EF skills. The first key is I AM, meaning that the participants are the one who regulates their own self to the their own directed goal. The second key is TAP, a square-shape equipment for standing and jumping to get to the goal. The core components of the EF skills, including inhibitory control, working memory and cognitive flexibility/shift [9] were the main focus of the current research because those skills were reported as the lowest scores in Thai children [5, 6] . The main purpose of this study was to investigate the impacts of the I AM TAP program on the preschool children's EF skills.

Frame of reference



The objectives of the research

1. To investigate the differences between the pre–test and post–test scores on the EF skills of the children within the experimental group after participating the I AM TAP program.

2. To investigate the differences between the EF development of the children in experimental and control groups. (EF development is the total score of posttest score minus pretest score on the MU.EF–101).

Research Hypothesis

1. After participating in the I AM TAP program, the children in the experimental group significantly had higher post–test scores on the EF skills, comparing to their pre–test scores, as measured by MU.EF–101.

2. After participating in the I AM TAP program, the children in the experimental group significantly had higher EF development scores, comparing to the scores on EF development of the children in the control group, as measured by MU.EF–101.

Methodology

1. Population and Sample: The accessible population in this study was 4 – to 6 – year – old children studying in public schools in Putthamonton District, Nakorn Pathom Province. The participants were purposive selection, a non–probability method was utilized based on the inclusion and exclusion criteria for selection. The following was the inclusion and exclusion criteria. Inclusion criteria for selection: Four to six – year – old boys and girls who never participated in any integrated – curriculum intervention program for promoting development and EF skills, and whose parents agreed to participate to this program and signed the consent form. Exclusion criteria: Four to six – years – old boys or girls with physical disability such as deaf, blind and handicap, and whose parents did not agree to participate in this research. Therefore, the total number of the sample was 68 children in the two kindergarten classrooms. One classroom was selected to be experimental group and the other was control group. The sample in the experimental group was 31. The sample in the control group was 37. The sample in the experimental group received the I AM TAP program while the sample in the control group participated in regular school activities. The sample in the control group would receive the I AM TAP program after the current research was completed.

2. Research variable :

2.1 Independent Variable: I AM TAP program

2 .2 Dependent Variable: Inhibitory control, Working memory and shifting

2.3 Confounding Variable: Age and Gender

3. Data collection:

3.1 After the research ethics got approved, the informed letters were sent to the faculty of Graduate Studies to get a letter of recommendation and permission for data collection.

3.2 The letter of recommendation and permission for data collection were sent to school directors of the targeted school of this research. The researcher contacted the school, introduced self and explained objectives, expected benefits, and data collection process of this research.

3.3 The consent forms and the questionnaires were sent to the parents of the children who signed the consent forms.

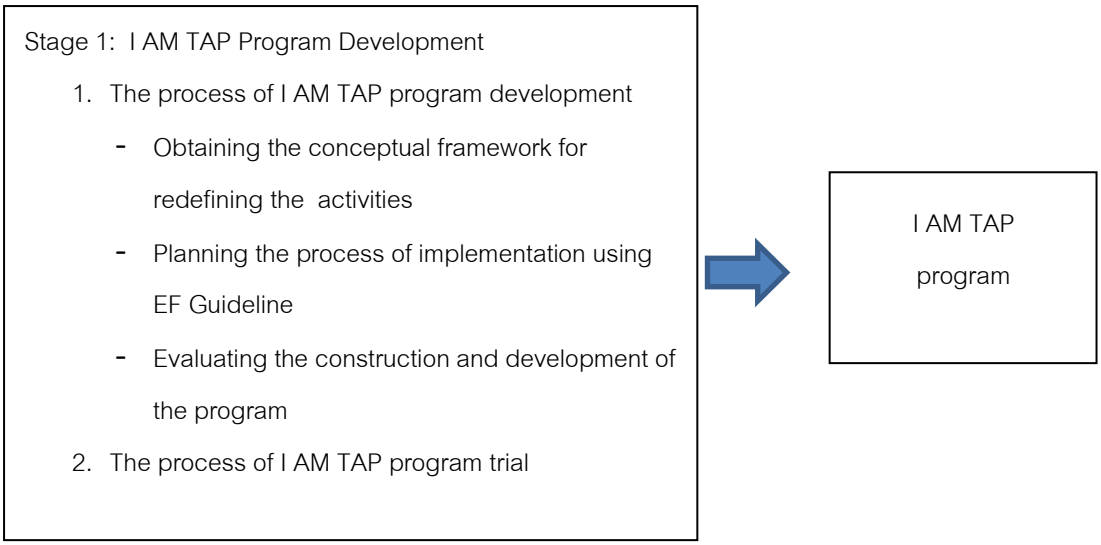
3.4 The teachers in both experimental group and the control group evaluated the children's EF skills, using MU–EF 101 before implementing the program for pretest. MU.EF–101 is rating scale assessment of executive function in 2– to 6 – year – old children. The results are reported as t–score. And The reliability was 0.936 for the inhibitory control items, 0.661 for the working memory items, and 0.969 for the shifting items [5].

3.5The children in the experimental group participated in the I AM TAP program for 9 weeks whereas the children in the control group participated in the regular school curriculum and activities.

3.6 After 9 weeks, the teachers in the experimental group and the control group evaluated the children's EF skills, using MU–EF 101 for post–test.

4. Instrumert development: For I AM TAP program, there were 2 stages of the intervention program development: program intervention development and program intervention implementation. For stage 1, program intervention development explains how I AM TAP program was developed and how the construction and development of the I AM TAP program was evaluated. There were 2 processes of the program intervention development, including the process of I AM TAP program development and the process of I AM TAP trial (see Figure 1)..

Figure 1. The Processes of the Program Intervention Development



For stage 2, program intervention implementation explains how to implement the program, The process of the I AM TAP Program development included 3 steps. The first step was to obtain the conceptual framework of the activities and program for promoting EF skills to determine and define the focus and goals of the I AM TAP program. Regarding the gaps from previous research, the conceptual framework of the I AM TAP program was obtained from the theoretical–based and research–based best practices in appropriate–aged development, relationship–based learning, and the key elements of EF skills. Table 1 illustrated the conceptual framework of the program and the I AM TAP program principles for developing the activities.

Table 1: The Conceptual Framework and I AM TAP Program Principles

The Conceptual Framework	The I AM TAP Program Principles
Appropriate – aged development	Physical movement and sensory integration (i.e., proprioceptive and vestibular systems) based activities for promoting working memory, inhibitory control, and shifting skills
Relationship – based learning	101s positive discipline techniques for creating positive dialogue, safe rules, instruction, and communication, and secure environment
The key elements of EF skills: –Challenging situations –Goal – directed behaviors	 – Increasing levels of difficulty or complexity of the activities – EF Guideline for implementation planning

For appropriate–aged development, physical and sensory activities were utilized in the I AM TAP program, such as jumping and balancing (stand one leg). For relationship–based learning, the 101s positive discipline techniques were utilized to create positive dialogues, safe rules and directions, and secure environment. For the key elements of EF skills, the activities in the I AM TAP program were designed to serve the concept of challenging situations for promote EF skills. The activities contained levels of difficulty or complexity, ranging from easy to difficult. Together, the concept of goal–directed behaviors was focused. For the implementing plan, EF Guideline, an evidence based best–practice was utilized as the tool for setting clear and consistent objectives and processes of the activities [8].

Taken from the conceptual framework, it could be concluded that I AM TAP Program was a collection of physical movement and sensory integration based activities for promoting the three components of the EF skills, including inhibitory

control, working memory and shifting, in normal, suspected delayed, and delayed development children.

For the Inhibitory Control Part, there were 3 activities, including Running Tap, Running Tap (Green/Red) and Running Tap (Except). These activities were combined the concepts of the research based best practices, including Simon say, Red light, Green light, sensory integration and computer game [9, 14, 20], and adjusted to fit in the conceptual framework of the I AM TAP program. In the Running Tap activity: the player(s) changed a position when the teacher said “Go”. In the Running Tap (Green/Red): the player(s) changed a position when teacher said “Go” and showed “Green Color Tap”. Running Tap (Except): the player(s) changed a position when the teacher said “Go” and they did not go to except color.

For the Working Memory Part, there were 4 activities, including Memory Tap (visual), Memory Tap (auditory), Backward Memory Tap (visual) and Backward Memory Tap (auditory). These activities were combined the concepts of the research based best practices, including physical activity and computer game [5, 6, 8, 9, 10, and 25]. In the Memory Tap (visual) the player(s) looked at the colors on the memory cards in orders and jumped on the tap pads following the orders of the colors seen on the memory cards. In the Memory tap (auditory), the teacher shouted the names of colors in orders and the player(s) had to listen to the teacher and jumped on the tap pads following the orders of the colors heard from the teacher. In the Backward Memory Tap (visual), the player looked at the colors on the memory cards in orders and jumped on the tap pads in backward orders of the colors seen on the memory card. For example, if the players saw red, yellow and blue, they had to jump on the blue, yellow, and red tap pads. In the Backward Memory Tap (auditory), the players listened to the names of colors the teacher shouted in orders and jumped on the tap pads in backward orders of colors the teacher shouted.

For the Cognitive flexibity/Shifting part, there were 3 activities, including Animal Pose, what am I, and Animal Bridge. These activities were combined the concepts of the research based best practices, including Maze game and Guess game [5, 6, 8, 9]. In the Animal Pose, the player looked at the animal pose cards and pose following the animal pose on the cards. Then, the player created a different pose of the animal on the cards. In What am I, the player looked at animal cards and imitated the animals for the other players to guess. In the Animal Bridge, the player had to tap pads and moved the tap pads to his animal. However, the player had to stay on the tap pads only.

The second step in the process of I AM TAP program development was to plan the process of program implementation. EF guideline was utilized to set clear and consistent goals and expected behaviors of each activity. Then, the activity procedures were planned and checked step by step to make sure that they were clear and consistent to the stated goals and expected behaviors. Moreover, the 3 types of environment in the EF Guideline were also considered. First, for the safety environment, an empty room size 4x4 meter was provided for implementing throughout the program. Second, for the mental environment, the 101s positive discipline techniques were

integrated into rules, instructions and communication to create positive dialogues and secure environment. 4 techniques of the 101s positive discipline techniques were used in this programs; including I–message, Make a Big Deal, When/Then and Take a Break. Third, for the enrich environment, the media and environment were set to stimulate children to be curious and engaged in learning. The third step was to evaluate the program construction and development. Three experts including two preschool teachers and one neurologist were asked their opinion on the congruence of the activities and the EF skill items, using the Index of item objective congruence (IOC). Prasopchai pasunon (2015) said if IOC of tools have more than 0.5, the content validity of tools were accepted. So The IOC of the I AM Tap program was 0.93. identifying that the content validity was accepted[19]. I AM TAP program tryout, 16 children (4–6 years old) were participated. Chaiyong Promvong (2014) introduced The Developmental Testing of Media and Instructional Package for evaluate the efficiency of the I AM TAP program. The formula used for calculation was E1/E2. E1: Transitional behavior, E2: Terminal behavior [15]. E1: E2 score of I AM TAP program was set at 80/80 and E_1/E_2 of I AM TAP program was 78.72/81.20 that was calculated by the formula of E1 and E2. The results showed that the scores of the I AM TAP program were not significantly different from the E1/E2 setting score (80/80). Therefore, the hypothesis E1/E2: 80/80 of the activities were accepted; indicating that I AM TAP program was effective. $E_1/E_2$of the I AM TAP program.

5. **Data analysis**: The statistical analysis used in this research was descriptive statistic and inferential statistic. For confirming the hypothesis 1, “After participating in the I AM TAP program, the children in the experimental group has significant higher post–test scores on EF skills, comparing to their pre–test scores, as measured by MU.EF–101”, paired sample t–test was performed to investigate the significant differences between the posttest mean scores and pretest mean scores on the EF skills within group. For hypothesis 2, “After participating in the I AM TAP program, the children in the experimental group has significant higher the scores on EF development, comparing to the scores on EF development of the children in the control group, as measured by MU.EF–101”, an independent sample t–test was performed to investigated the significant differences between the scores on EF development of the children in the experimental and control groups.

Results

The results are divided into sections. Frist section explains the general information of the sample. Then, the following sections show the results of the research.

General information of sample

Descriptive statistical analysis was utilized to explain the background of the sample in the experimental group and control group as shown in Table 1.

Table1: Number and percentage mean of Demographic Characteristics of students (n = 68)

General Characteristics	Group Number (%)		
	Experimental group (n = 31)	Control group (n = 37)	Total (n = 68)
Gender			
Boy	19 (61.29%)	16 (43.24%)	35 (51.47%)
Girl	12 (38.70%)	21 (56.76%)	33 (48.53%)
Mean Age (Month)	62.60 ± 3.81	63.12±4.14	62.21±3.51

Table 1 shows that the total number of the sample was 68 students, with 51.47% boys and 48.53% girls. The sample was divided into two groups, the experimental group had 31 students, with 61.29% boys and 38.70% girls and the control group had 37 students, with 43.24% boys and 56.76% girls. The averaged age of the children in the experimental group was 62.60±3.81and the control group was 62.6 ± 3.81 and 63.12 ± 4.14.

The impact of I AM TAP program to Executive function in experimental group

Paired sample t–test was performed to conform the hypothesis 1, *"After participating in the I AM TAP program, the children in the experimental group has significant higher post–test scores on EF skills, comparing to their pre–test scores, as measured by MU.EF–101".* Before performing, the assumption of the paired sample t–test was tested. The result of the tested assumption showed that there were interval scale and normal curve; therefore, the pair simple t–test could be performed.

According to the **table 2**, the results showed that there were significant differences between the pretest and posttest mean scores on inhibitory control, working memory, and cognitive flexible/shift within the experimental group(t =13.30,13.02 and 15.14, p< .001, respectively). After participating in the I AM TAP program, the posttest scores of the children in the experimental group on inhibitory control(M = 52.96, SD=5.32), Working Memory (M= 48.58, SD=5.03) and Cognitive flexible/Shift (M=53.64,SD = 4.02) were significantly higher than their pretest mean scores on inhibitory control (M=40.19,SD=7.68), Working memory (M=34.77, SD=5.12) and Cognitive flexible/Shift (M = 40.32, SD = 6.77). The findings indicated that the IAM TAP Program had positive impacts on children's EF skills. Therefore, the children in the experimental group significantly had higher posttest mean scores than their pretest mean scores on the EF skill.

Table 2 The impact of IAM TAP program to Executive function in experimental group

	Pretest			Posttest			t	P–value
	Max	Min	Mean	Max	Min	Mean		
Experimental Group								
Inhibitory control	57	28	40.19±7.68	68	46	52.96±5.32	13.30	0.000
Working memory	44	26	34.77±5.12	60	42	48.58±5.03	13.02	0.000
Shifting	57	33	40.32±6.77	66	48	53.64±4.02	15.14	0.000

The comparison between the executive function development of experimental group and control group

Independent t–test was performed to confirm the hypothesis 2, "*After participating in the I AM TAP program, the children in the experimental group has significant higher the scores on EF development, comparing to the scores on EF development of the children in the control group, as measured by MU.EF–101"* Before performing an independent t–test, the assumption of the independent t–test was tested. The result of the tested assumption showed the interval scale and normal curve; the refore, the in dependent t–test was performed.

According to the **Table 3**, the results showed that there were significant differences between the EF development of experimental group and control group mean scores on inhibitory control, working memory, and cognitive flexible/shift within the experimental group (t=6.458, 6.681 and 8.290, p<.05, respectively). After participating in the I AM TAP program, the EF development of children in the experimental group on inhibitory control (M = 14.35, SD=10.01), Working Memory (M=14.64,SD = 8.18) and Cognitive flexible/Shift (M=15.03, SD=11.04) were significantly higher than the EF development of children in the control group on inhibitory control (M=2.35, SD=4.82), Working memory (M=2.27,SD=3.61) and Cognitive flexible/Shift (M=1.89,SD= 4.25).The findings indicated that the I AM TAP Program had positive impact on children's EF skills. Therefore, the children in the experimental group significantly had higher EF development mean scores than the children in control group.

Table3 The comparison between the executive function development of experimental group and control group

Executive function skills	Experimental group: (Mean of Executive function development)	Control group: (Mean of Executive function development)	t	P–value
Inhibitory control	14.35±10.01	2.35±4.82	6.45	0.000
Working memory	14.64±8.18	2.27±3.61	6.68	0.000
Shifting	15.03±11.04	1.89±4.25	8.29	0.000

Discussion

From the first hypothesis, after participating in the I AM TAP program, the children in the experimental group significantly had higher post–test scores on EF skills, comparing to their pre–test scores, as measured by MU.EF–101. The findings confirmed the alternative hypotheses. It could be possible to conclude that the I AM TAP program was an effective program for promoting children's EF skills in preschool classrooms since it was carefully developed from multidisciplinary research–based best practices. The key grounded concepts of the I AM TAP program included age–appropriate developmental tasks, physical–based play group, positive relationship, and the key elements of EF.

For age–appropriate developmental tasks, the I AM TAP program targeted the children at age 3 to 6 years old since it was the period for the window of opportunity for promoting brain development and EF skills [10]. The activities in the I AM TAP program integrated physical activities to provide children with opportunities for movement, and sensory integration. For example, in the activity 1 (running tap), the players had to run and stop in the assigned spot. Therefore, they receipted proprioceptive sense and Vestibular sense [17].

For positive relationship, previous research had long showed that when children's feelings were safe and secure, they were ready to learn and well behaved. [8] An ongoing research studies on the impact of the 101 positive discipline techniques had shown that they were an effective tools for creating safe, secure environment and building positive relationship with children, resulting in promoting the children social–emotional and EF skills [8,15].When implementing I AM TAP program, some techniques of the 101 positive discipline were utilized, including I–message, Make a Big Deal, When/Then, and Take a Break, for setting game rules and agreement and interacting with the children. As a result, the children in the experimental group acquired the 101s positive techniques and used the techniques with their peers. Therefore, the scores on their inhibitory control and shifting were marked higher.

The key element of the EF skills included challenging situation and goal– directed behaviors. Previous research showed that EF would be motivated when being in a new, challenging situation [9]. All activities in the I AM TAP program contained the ranges of difficult and complex levels. For example, the activity 4 (memory tap), the players had to memorize only 2 colors for the first step, and then, they needed to memorize 3 colors, and 4 colors for the next steps. Moreover, goal–directed behaviors were also one of the significant keys of the EF skills. Therefore, EF guideline was utilized in the current research as the tool for planning goals and implementing processes and making sure that the key elements of the EF were covered [8]. The activities in the I AM TAP program were goal–oriented.

For the second hypothesis, after participating in the I AM TAP program, the children in the experimental group has significant higher the scores on EF development, comparing to the scores on EF development of the children in the control group, as measured by MU.EF–101. It is accepted by result of research. Even though children's EF skills could be developed by age [18] and gender, [5] the findings from this research suggested that well–designed intervention containing age–appropriate

activities could help children develop their EF skills to their full potential. It was evident in the current research that even though the children in the control group significantly had higher posttest scores on EF skills than their pre-test scores. But their EF development scores of control group were significantly lower than the scores on EF development of the children in the experimental group. It could be possible to discuss that because the activities in the I AM TAP program were age–appropriate developmental tasks, physical – based play group, positive relationship, and the key elements of EF. So the children in the experimental group were enthusiastic to participate. As a result, they had more chances to practices EF skills. But Control group, the lesson plans were not concern EF development of student. In the classroom, teacher can't use the positive disciplinary techniques and she use the negative techniques .in order to the activities in classroom was little physical activity and movement then positive disciplinary techniques and physical activities are The key element of the EF skills [8,15 and17]. So EF development in control have lower than EF development in experimental group.

In summary, the conceptual framework for developing I AM TAP program was based on age–appropriate developmental tasks, positive relationship and the key elements of EF skills. All activities were well–designed and planned based on EF Guideline. All attempts provided children with opportunities to engage in meaningful learning activities. As a result, the I AM TAP program had positive impacts on the children's EF skills.

Recommendation

This research aimed to investigate the impacts of the I AM TAP program on EF skills of preschooler. The results showed that the program could support EF skills. Integrating I AM TAP program into the regular curriculum would be the recommendation. The activities could be applied in classroom routines so that preschool children are provided with opportunities to practice their EF skills.

Suggestions

1. The sample size of this study was from only one school in country which might not represent the whole population and could not be generalized. Therefore, the suggestion for future research is to conduct similar study with different age and area.

2. This study, the researcher trained the sample. For the future research the protocol of theI AMTAP program could be implemented by the kindergarten teachers.

3. The sample study was mostly normal child. Children with special needs would be the sample for future research.

Reference

Adele Diamond and Kathleen lee. (2011). *Intervention shown to aid executive function development in children 4–12 years old*. Science, 959–964.

Ayres, A. J. (1979).*Sensory integration and the child*. Los Angeles:Western Psychological Services.

Chatchanan Arsan, Patcharin Seree, panadda Thanasetkorn . (2018). *The impact of learning experiences based on EF Guideline on children's executive function skills: A case study of a school in Tak province*, *INTED2018 Proceedings*, pp. 5780-5786.

Chaiyong Promvong. (2014). Developmental testing of media and instructional package. *Silpakorn Educational Research Journal Vol 5*,(7–20).

Elizabeth R. Sowell, Paul M. Thompson, Christiana M. Leonard, Suzanne E. Welcome,1 Eric Kan, & Arthur W. Toga. (2004). Longitudinal mapping of cortical thickness and brain growth in normal children. *Journal of Neuroscience. 24* (38), 8223–8231.

Lisa B. Thorell and Sofia Lindqvist and Sissela Bergman Nutley, GunillaBohlin & TorkelKlingberg. (2009). *Training and transfer effects of executive functions in preschool children*. Developmental Science, 106–113.

Nuanchan Jutha Phakdeekkun, Panadanan Sutthikarn & OrapinLertdasatrakul. (2017). *Tool development and evaluation criteria for assessment of executive functionin early childhood, Mahidol University*. Nakhon Pathom.

Nuanchan Jutha Phakdeekhun. (2015). *The 8th teacher education professional development. executive function and early childhood learning disabilities*, 14 October 2015, IMPACT Arena (Hall9), Muangthongthani, Bangkok Thailand.

Pitchada Sutipan.(2012).*The impact of the 101s positive discipline teacher training on teacher practices and preschoolers' executive function skills*. Master degree Mahidol University. NakhonPathom.

Prasopchai Pasunon. (2015). Validity of Questionnaire for Social Science Research. *Jornal of Social Science Srinakharinwirot University Vol 18*,(375-396)

Qian Liu, Xinyi Zhu and Jiannong Shi. (2012). *The effect of inhibitory control training for Preschool on reasoning ability and neural activity*. Scientific Report 5, Article number: 14200.

Randy Kulman. (2017). *21st Century skills: why you want your child to improve executive functioning, 25 september 2017*, http://learningworks forkids. com/2013/10/10/21st-century-skills-why-you-want-your-child-to-improve-execu tive-functioning/.

Rebecca Branstetter. (2016). *Executive functioning disorder*. Ohio: F+WMedia,1–5.

Sakol Suwanpinit. (2017). *New future skills: how to learn in the 21st century 25 september 2107*. http://www.qlf.or.th/home/Contents/417.

Teerakiat Charoensettasin. (2016). Education *reform & entrance 4.0, 5 November 2016, Siam Oasis Branch 13th floor Chulalongkorn University Book Center, Bangkok Thailand*.

The Center on the Developing Child Harvard University. (2017). *Enhancing and practicing executive function skillswith child renfrominfancy to adolescence*. 30 September 2017. http://developingchild.harvard.edu/resources/activities-guide-enhancing-and-practicing-executive-function-skills-with -children-from-infancy-to-adolescence/.

The Center on the Developing Child Harvard University. (2011). *Building the Brain's "Air Traffic Control" System: NATIONAL FORUM ON EARLY CHILDHOOD POLICY AND PROGRAMS*." Neurologia. 27(6), 370–375.

Satya Prakash Purohit and Balaram Pradhan. (2017). Effect of yoga program on executive functions of adolescents dwelling in an orphan home: a randomized controlled study. *Journal of Traditional and Complementary Medicine. 7*,(1), 99–105.

Stevenmasley,RichardRoetzheim and Thomas Gualtieri. (2009). *Aerobic exercise enhances cognitive flexibility*. Psychol Med Settings Vol. 16(2), 186–93.

Sutthirat Permsubhirunya,Patcharin Seree and Panadda Thanasetkorn . (2018). The *impact of the learning experiences based on ef guideline on children's executive function skills: a case study of a Kindergarten in Bangkok*, *Inted2018 Proceedings*, pp. 5357-5364.