CHAPTER 2

REVIEW OF LITERATURE

This chapter provides a comprehensive review of the relevant literature regarding fundamental principles, theories, and frameworks across the following fields: occupational therapy, psychology, and special education. The literature review includes the following major topics:

1. Attention-Deficit/Hyperactivity Disorder (ADHD)
2. Executive Functions
    - 2.1. Executive Functions and the Brain
    - 2.2. Executive Functions and Deficits in Students with ADHD
    - 2.3. Executive Functions and Measurement Tools
    - 2.4. Executive Functions and Intervention in ADHD
        - 2.4.1. Cognitive Remediation Approach
        - 2.4.2. Cognitive Compensating Approach
3. Person Environment Occupation Performance Model (PEOP Model)
4. Future Search Conference (F.S.C.)
5. Collaborative Program Team Members and Roles
    - 5.1. Occupational Therapists
    - 5.2. Parents
    - 5.3. Teachers and the School Principal
    - 5.4. Peers
6. Plan-Do-Check-Act (PDCA) Cycle

1. Attention-Deficit/Hyperactivity Disorder (ADHD)

The causes of ADHD are still unknown. However, it is assumed by different studies that the causes can be divided into three major factors: biological, genetic, as well as social and environmental causes. With regard to biological factors, in addition to the anomalous condition in the frontal lobe in the brain, neurotransmitters, dopamine and norepinephrine, turnover rate remain within a normal range. Although nurture is a social and environmental factor, and not a core consideration of the disorder, lack of nurturing tends to severely incite signs of the disorder among children with ADHD. Individuals with ADHD may have difficulties maintaining attention, performing basic executive functions and working memory (4,46,47).

Without question, many scientists today concede that ADHD is a complex syndrome. This syndrome is not only a disorder of behavior but also a developmental impairment of executive functions. This syndrome influences the prefrontal cortex of the brain's management system, including the ability to sustain attention, organize tasks, inhibit impulsive behavior, control emotions, and utilize working memory. In addition, ADHD is chronic, and significantly interfere with functioning in many aspects of the person's daily life (48). The previous studies in ADHD indicated that the students with ADHD demonstrated significantly lower scores on academic achievement tests in reading, spelling and math. Similarly, these ADHD students have been shown to receive lower grades, struggle with poor academic performance, and in many cases drop out of high school before graduation (49,50).

The Diagnostic and Statistical Manual of Mental Disorders, Fifth edition, (DSM-5)(4), mentions making the diagnosis of ADHD, that children must have six or more symptoms of the disorder. In people 17 and older the DSM-5 states that patients must have at least five symptoms. The criteria of symptoms for a diagnosis of ADHD are:

1. Inattentive presentation:
   - Fails to give close attention to details or makes careless mistakes.
   - Has difficulty sustaining attention.
   - Does not appear to listen.
   - Struggles to follow through on instructions.
   - Has difficulty with organization.
   - Avoids or dislikes tasks requiring a lot of thinking.
   - Loses things.
   - Is easily distracted.
   - Is forgetful in daily activities.

2. Hyperactive-impulsive presentation:
   - Fidgets with hands or feet or squirms in chair.
   - Has difficulty remaining seated.
   - Runs about or climbs excessively in children; extreme restlessness in adults.
   - Difficulty engaging in activities quietly.
   - Acts as if driven by a motor; adults will often feel inside like they were driven by a motor.
   - Talks excessively.
   - Blurts out answers before questions have been completed.
   - Difficulty waiting or taking turns.
   - Interrupts or intrudes upon others.

3. Combined inattentive & hyperactive-impulsive presentation:
   - Has symptoms from both of the above presentations.

In the DSM-5 for the diagnosis of ADHD, the individual's ADHD symptoms can now occur by age 12 rather than by age 7. However, with the new edition of the DSM-5, in order to be meet the diagnostic criteria, several symptoms of ADHD must be present in more than one setting (4).

In the school setting, students with ADHD often present difficulties following instructions. They may initiate a school task or a test rapidly, but may not complete all of the questions. They may react before everyone else in their classroom, have a short attention span, be unable to concentrate, seem easily distracted, or lack organization and emotional control, as well as may have memory deficits.

At home, people with ADHD are often sensitive to accidents and struggle to organize and regulate the time needed to complete their homework. Students with ADHD often have difficulty complying with their parents' instructions. Finally, they tend to exhibit difficulties in emotional control and impulsive behavior (1).

2. Executive functions

While there are various ways to identify executive functions, one of the most commonly employed way states that executive functions reflect activity in the prefrontal cortex of the brain. Like a conductor in a symphony orchestra who directs musicians to play each instrument to create a sweet melody, it is the cognitive task of higher-level brain to effectively plan so that behavior and achievement follow (51). Researchers classify executive function skills into 3-8 types (52-55). For example, Gioia, Isquith, Guy and Kenworthy (10) divided them into eight parts: inhibition, shift, emotional control, initiation, working memory, planning, organization of materials, and self-monitoring. Diamond (56) proposed three core executive functions; namely, inhibition, working memory, and cognitive flexibility. Figure 2.1 below visually presents more details of the three core executive functions and related terms.

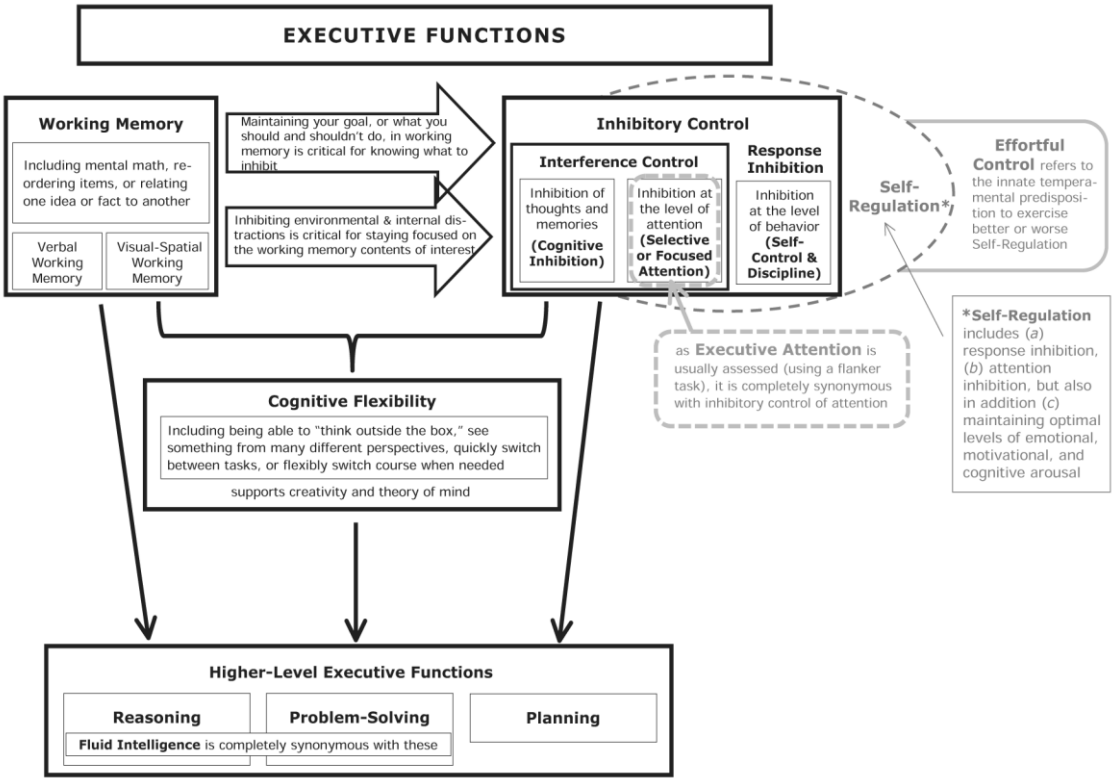

Figure 2.1. Executive Functions and Related Terms (56).

From Figure 2.1 (56), executive functions are comprised of three components: inhibition, working memory, and cognitive flexibility. The definition and relations among three components are explained below:

1. Inhibition or inhibitory control is the ability to control attention, thoughts, behavior and/or emotions to appropriately respond or act. Inhibition includes response inhibition (self-control) and interference control (selective attention and cognitive inhibition).

2. Working memory is the ability to holding information in one's mind and mentally working with it (56,57). It is divided into two types: verbal and visual-spatial working memory.

Inhibition and working memory are closely related, as working memory and inhibitory control support one another. Working memory supports inhibitory control. For example, people must hold their goal in mind to guide an appropriate behavior and also inhibit inappropriate or erroneous behavior. Inhibitory control supports working memory by inhibiting or suppressing environmental and internal distractions to allow people to focus on one thing. Inhibitory control also helps people to keep mental workspace available in one's working memory by deleting irrelevant information from the capacity workplace.

3. Cognitive flexibility is the ability to change perspectives spatially or interpersonally. Changing perspectives needs to inhibit the previous perspective while it recalls a different perspective (working memory). Therefore, cognitive flexibility requires inhibitory control and working memory. In addition, cognitive flexibility is the ability to "think outside the box" (56) that is overlap with creativity, set shifting.

Three core executive functions included inhibition, working memory, and cognitive flexibility were related with higher-level executive functions (reasoning, problem solving, and planning that stated above in Figure 1 (56).

While Brown (9) proposed six parts of executive functions; activation, focus, effort, emotion, memory and action, in this study, executive functions were defined by the Behavior Rating Inventory of Executive Function [BRIEF (10)]. According to BRIEF, executive functions consists of the following:

1**.** Inhibition is the ability to control or hold restless behavior in proper time. The child who lacks this ability behaves inappropriately in words and actions. He/she reacts to stimuli so extremely that he/she annoys others or interrupts a group activity.

2. Shift is the skill of moving information from a certain situation or activity to another. In other words, it is an ability to solve problems by applying or adjusting information from relevant experiences into similar and different situations. The child who lacks this ability is so inflexible or sticks to the familiar condition so strongly that he/she cannot adjust him/herself when confronting an immediate situation.

3. Emotional Control is the capacity to control proper emotional actions in each situation. The child lacking this ability is poor in controlling emotions or behaves inappropriately for his/her age. He/she has frequent emotional changes, which are mostly negative ones, such as anger and frustration.

4. Initiation is the ability to start productive activities. It is the ability to respond to situations and to solve problems before taking actions. The child lacking this ability has difficulties starting activities or is unable to begin activities on his/her own. In some cases, help or instructions are needed before starting activities, such as doing homework, exercising and other activities in everyday life.

5. Working memory is the ability to receive and maintain information, as well as to apply the information in activities, especially ones that include many steps or complicated procedures. The child lacking this ability may have difficulties memorizing things such as telephone numbers, directions, and methods of activities. The child does not remember the total procedure of activities and often needs repetition of instructions.

6. Planning is the ability to handle present and future situations. It is the ability to prepare for the future by setting the target and plotting the plan to achieve the goal. The child without this ability has difficulty doing activities that require multi-stepped plans, or may be unable to achieve the activity's goal due to improper time management. This deficit also affects skills of speaking, writing and comprehending the main idea of the stories, which the child is reads or hears.

7. Organization of Materials is the child's competence to take care of belongings, like personal objects used in everyday life at school and at home. The child without this ability is deficient in maintaining personal hygiene as well as tidiness of personal objects and equipment, such as the study desk, school bag, locker, bedroom and apparel.

8. Self-monitoring is the ability to monitor one's own actions during and after activities, such as checking the answers during and after the school exercise or homework. The child with this ability is able to detect his/her mistakes and fix them. He/she can also examine his/her behavior towards other people. For the child who has

problems with this, his/her performance is careless. He/she might behave and talk badly to other people.

2.1. Executive Functions and the Brain

The term *executive functions* refers to higher-level brain functions, which have been shown to be regulated by the prefrontal cortex (PFC) located in the frontal lobes in the brain (58). The prefrontal cortex is the key structure for performing executive functions. It monitors the activities in other cortical and subcortical structures and controls their operations by sending top-down signaling to control information processing (59). The particular regions of the prefrontal cortex that is associated with executive functions shown in Figure 2.2. (60).

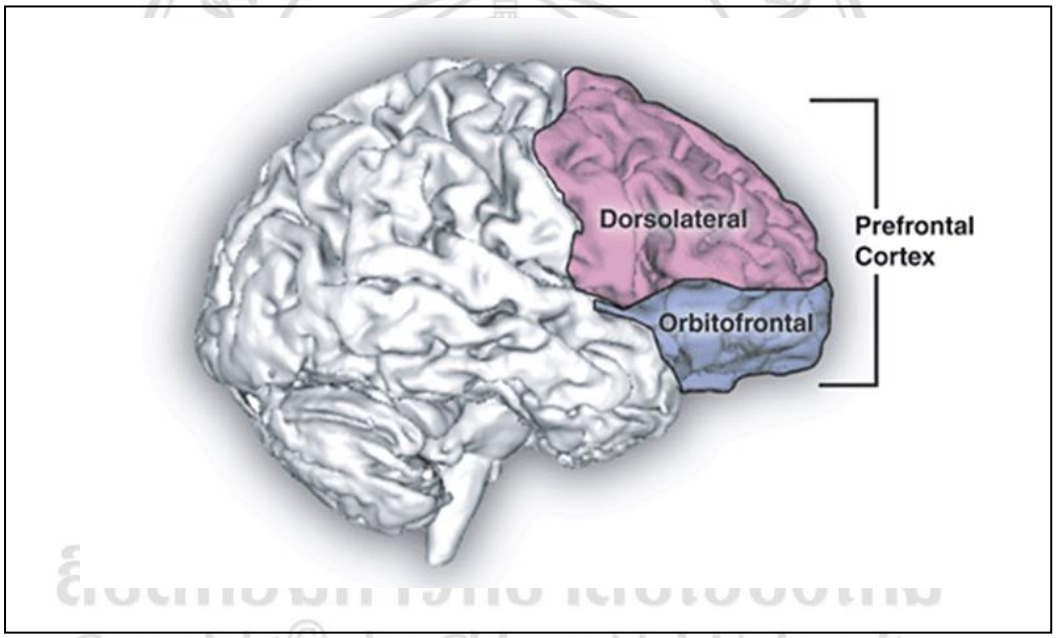

Figure 2.2. The particular regions of the prefrontal cortex that is associated with executive functions (60).

More specifically, the particular regions of the prefrontal cortex that are most often associated with executive functions include the dorsolateral prefrontal cortex (DLPFC) and the orbitofrontal cortex (OFC) (58). The dorsolateral prefrontal cortex is related to online processing of information (61). This area has been found to play an important role in working memory, planning, set shifting, response inhibition,

organization, problem solving, abstract thinking, and reasoning (58). The orbitofrontal cortex plays numerous vital roles related to impulse control, self-control and monitoring of appropriate behaviors, emotional control, understanding the value of rewards associated with sensory stimuli, and also related social behavior (61,62). In addition, the other particular region of the prefrontal cortex that is involved with executive functions is the anterior cingulate cortex (ACC). This area is associated with executive functions related to inhibition, motivational behaviors, and decision-making (63).

Previous research in the literature has shown that people with prefrontal damage exhibit a lack of insight, decreased ability to plan or organize, poor judgment, poor decision-making ability, and poor working memory (64). Damage of the dorsolateral prefrontal cortex was linked specifically to deficit in the working memory component of executive functions; notably that damage in this area impacted the person's ability to manipulate verbal and spatial information in the working memory, as well as impacted the ability to manipulate information needed for cognitive reasoning (65). While the damage of orbitofrontal cortex leads to deficits in the decision-making process as well as emotional control, the orbitofrontal cortex alone does not mediate decision-making because decision-making is also related to other cortical and subcortical components of the brain (66).

As indicated above, executive functions are closely related to the prefrontal cortex's functions (59). Children who have lesion on the prefrontal cortex such as children with ADHD have impaired regulation of cognition, working memory, attention, planning, emotion, as well as struggle in learning and behavior problems (64,66).

2.2 Executive Function Deficits in ADHD

According to 83 studies using the meta-analysis method to review the relationship between the ADHD and the Executive Functions of the brain, it was found that children with ADHD present weaknesses in several key executive function domains. Moreover, some relationships, such as inhibition, vigilance, working memory and planning are highly correlated (67). The model in Figure 2.3 demonstrates how executive functions are impaired in a person with ADHD. This model was developed by Brown (48,68).

Executive Functions Impaired in ADHD

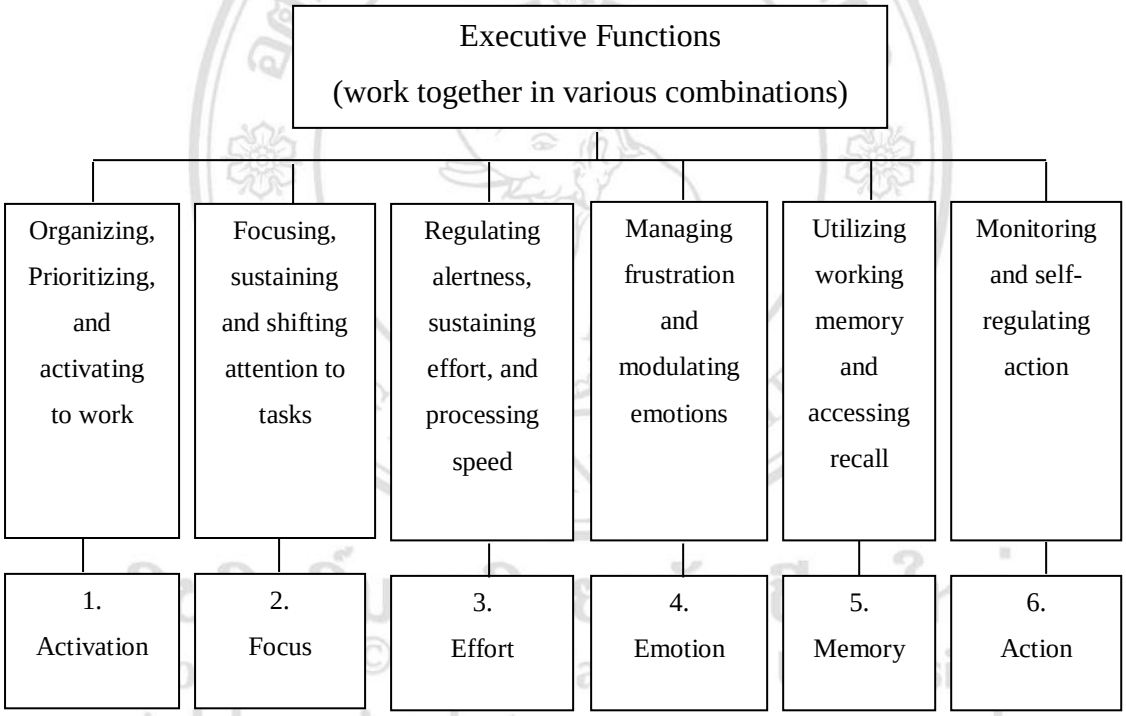

Figure 2.3. Executive Functions Impaired in ADHD (48,68).

Brown's model above presents six clusters that reflect impairments or characters of executive functions in people with ADHD; namely, activation, focus, effort, emotion, memory, and action (48,68). Each of these components will be explained below.

1. *Activation* is the ability to organize or prioritize tasks, and activate work. Children with ADHD who lack this ability have trouble getting start on tasks and often times face difficulty in planning the steps needed to complete their work.

2. *Focus* is the ability to sustain and shift attention to various tasks. Children with ADHD who lack this ability may not be able to sustain attention, may be unable to shift to another task, and may be distracted easily.

3. *Effort* is the ability to regulate alertness, sustain effort, and process speed. Children with ADHD lacking this ability usually have difficulties in completing tasks on time.

4. *Emotion* is the ability to manage frustration and modulate emotions. Children with ADHD who lack this ability behave inappropriately and struggle to manage their emotions, and struggle especially to control their levels of frustration.

5. *Memory* is the ability to utilize working memory and to access recall. Children with ADHD who lack this ability have difficulty remembering or holding information on tasks.

6. *Action* is the ability to monitor and self-regulate action. Children with ADHD who lack this ability have difficulty regulating their actions or behaviors, as the child fails to modify behavior in appropriate response.

Many previous studies indicate that the three most common executive function deficits found in the children with ADHD are working memory, planning, and self-monitoring (10,15-20). Based upon Brown's model's terminology in this present study, "Memory" refers to working memory, "Activation" refers to planning, and "Action" refers to self-monitoring.

Working memory is a core deficit in children with ADHD+EFDs and has a close relationship with ADHD symptoms (19). Working memory deficit in children with ADHD is demonstrated by difficulty remembering information necessary to complete academic tasks that understandably impact academic performance in school (69). While many researchers have found that working memory impairments greatly affect executive functions in children with ADHD (70,71), research has shown that training the working memory can be an effective treatment for these symptoms in children with ADHD (16).

Children with ADHD+EFDs who have planning problems are most apparent in educational settings as these deficiency are frequently manifested through difficulty in planning for completing complex tasks in their school work, difficulty in organizing assignments or homework that have many steps to complete, and in time management (69,72,73). Moreover, these problems impact academic and occupational performance (74). However, researchers found that improvements in organizational skills may reduce the symptoms of ADHD and enhance academic performance (73).

Monitoring or self-monitoring in children with ADHD+EFDs is manifested by a failure to control themselves (75). In a school setting, researchers found that improving self-monitoring increases the student's academic performance, their level accuracy in their schoolwork, as well as their attentional behavior (76).

As discussed above, the three most common executive function deficits in children with ADHD+EFDs are working memory, planning and self-monitoring. Each of these common executive deficits impact occupational performance and academic achievement in school. For instance, poor grades, poor academic standardized test scores, increased grade retention, and educational problems (77) are all common among students with deficits in these three common areas of executive function deficit. Underlying the International Classification of Functioning, Disability and Health (ICF) conceptual framework, children with ADHD+EFDs have impairments of body function: poor memory and organization. Because of the limitations in activities, they may have disabilities in reading, writing, and calculating. As such, academic performance, including completing school tasks or homework and managing one's own behavior may be impaired. Moreover, children with ADHD+EFDs are limited in their ability to

participate one of the most major areas of their life education, since their success in an educational program may be limited (78).

This research started with an evaluation process with assessment tools, continued to engagement in appropriate interventions, and ended with outcome measurements when the treatment programs were completed.

2.3 Executive Function Measurement Tools

Presently, there are different standard executive function measurement methods to determine strength in various parts of executive functions. Examples of executive function assessment tools, which measure working memory, planning and self-monitoring are shown in Table 2.1.

Table 2.1: Descriptions of Executive Functions Assessment Tools in Working Memory, Planning and Self-monitoring

Assessment tools	Description	EF construct	Reliability	Validity	Clinical utility to ADHD	Training required	Strengths	Weaknesses
1. Tower of London	The goal is to move a stack of objects from one position to another in the fewest possible moves while adhering to specific rules.	Planning	moderate test-retest reliability	good construct validity	good clinical utility to ADHD	X	a well-known used for assessing and detecting deficits in planning	moderate standard test test-retest reliability
2. Porteus Mazes (PMT)	The individual must plan ahead to reach the only exit from a series of mazes without backtracking or crossing any lines.	Planning	high test-retest reliability	moderate construct validity	-	X	specifically designed to examine ability in planning	weak association with IQ
3. The Behavioural Assessment of the Dysexecutive Syndrome in children (BADS-C): Zoo Map Task	The subject is encouraged to see different animals without a pre-formulated plan (version 1) and has to follow instructions that are formulated (version 2).	Planning	low test-retest reliability	good ecological validity	-	X	used for assessing specific domains of the planning function	low test-retest reliability

Table 2.1: Descriptions of Executive Functions Assessment Tools in Working Memory, Planning and Self-monitoring (continued)

Assessment tools	Description	EF construct	Reliability	Validity	Clinical utility to ADHD	Training required	Strengths	Weaknesses
4. Wechsler Intelligence Scale for Children-Revised (WISC-R; Digit Span subtest)	The subject repeats a series of digits in the reverse of the order that they were presented.	Verbal Working Memory	high test-retest reliability	good convergent validity	good clinical utility to ADHD	√	a standard test used for assessing in working memory	needs a neuropsychologist to operate the tool
5. Cambridge Neuropsychological Test Automated Battery (CANTAB)	The subject searches spatial locations to find tokens while remembering not to return to any locations where tokens were previously found.	Spatial Working Memory	low test-retest reliability	good construct validity	-	X	a standard administered by a non-neuropsychologist	low test, re-test reliability and expensive as requiring a touch screen monitor
6. Behavior rating inventory of executive function (BRIEF): Working Memory, Planning, Monitoring	Parent and teacher use a scale to rate their child's behavior.	Inhibit, Shift, Emotional Control, Initiation, Working Memory, Planning, Organization of Materials, Monitoring	high test-retest reliability	good content validity good construct validity	good clinical utility to ADHD	X	a standard test for assessing executive functions in everyday behavior and most often used to assess ADHD	moderate correlations between the parents and the teachers

Note: √ = test characteristic reported required, X = test characteristic reported not required, - = test characteristic not reported

In this present study, the researcher selected three executive function measurement tools for evaluating three parts of function: working memory, planning and self-monitoring. These are as follows: the Behavior Rating Inventory of Executive Function (BRIEF), Tower of London, and Digits Span from WISC-R (subtest). These three measurement tools are well accepted and popularly used in the academic community as standard tests to measure the data that this study sought to measure. Also, these instruments were accessible to the researcher and have been shown to assess or detect specific domains of working memory, planning, and self-monitoring. The instruments' validity also contributed to the researcher decision to utilize these tools in this present study. For example, the BRIEF instrument demonstrates high test-retest reliability, good content, and strong construct validity. Likewise, the Tower of London test manifests clinical utility and is sensitive and highly specific to ADHD (10, 67,79–85). Finally, the target group of this study is students in upper primary school grades 4-6. As such, the relevant measurement tools used to estimate the abilities and specific problems in the selected group of children are authoritative, well known, commonly used and universally cited.

There are three executive function measurement tools for parents and teachers to evaluate the children. Each of these instruments will be explained next.

1. Behavior Rating Inventory of Executive Function (BRIEF) is a questionnaire for parents and teachers to assess the eight domains of executive function behaviors (10). This research will focus on three domains: working memory, planning, and self-monitoring. The researcher was granted the permission by PAR - Psychological Assessment Resources, Inc. to reproduce up to a total of 20 (paper) copies each of the Thai versions of the Behavior Rating Inventory of Executive Function (BRIEF) Parent and Teacher Forms for use in this dissertation.

2. Tower of London is a tool used for assessing p l a n n i n g ability and planning detecting deficits in children (79).

3. Digits Span: WISC-R (subtest) is a tool used to assess the ability of the working memory in the children (86).

2.4 Executive Functions Intervention in ADHD

In treating and helping to develop children's executive functioning ability through cognitive training or cognitive rehabilitation, occupational therapists generally choose and integrate one of the two following approaches (87):

2.4.1. Cognitive remediation approach

2.4.2. Cognitive compensating approach

2.4.1 Cognitive remediation approach

The remediation approach or "bottom-up" approach is a specific skill training method to improve certain problems. The principal of this technique is to provide an opportunity for the child to learn and practice frequently through activities specifically designed to address questions or to provide task-specific training. While this approach helps stimulate changes in neuronal activity (88), it also seeks to assess and treat the components of function, such as sensory processing, and cognitive functions, which are considered pre-requisites for successful occupational performance (89). Accordingly, the interventions focus on direct training for the components of executive functions (90).

Two laboratory-type approaches commonly used in occupational therapy are employed in this present study to assess specific intervention techniques and to provide specific skill training; namely, a computerized training programs and paper and pencil activities (90). Both of these approaches include the remediation approach specifically for the planning and working memory components of executive functions.

This study will apply the remediation interventions in two executive functions components, working memory and planning, as the activities in this approach help to enhance neural activity in the brain (91). The cognitive remediation techniques are effectively applied to patients with frontal pathology, specifically found in children with ADHD. Moreover, research has shown that computerized training programs, by any means, can help improve the executive functions (19,92). In fact, computers are essential materials that use multiple sensory modalities such as visual and auditory stimuli and provide immediate feedback about response accuracy which can be effective

in sustaining attention, enhancing motivation, and improving the work performance of children with ADHD (93-95). Moreover, computer-based training programs are effective in improving academic skills, as well as in enhancing other areas of development (96, 97).

A careful read of the literature shows that a large number of studies include computer-based tasks intervention activities that specifically target the working memory of children with ADHD+EFDs. For example, Klingberg, Forssberg, and Westerberg (19) used a computerized training program to train the working memory in children with ADHD; their training program included four subtests: a visuo-spatial working memory task, backwards digit-span task, letter-span task, and choice reaction time task. However, another working memory task, which was a mixture of a reaction-time task and a go-no-go task was also used. Another study by Back, Hanson, Puffenberger, Benninger, and Benninger (98) evaluated the efficacy of working memory training for children and adolescents with ADHD. They also used a visuo-spatial working memory task and a backwards digit-span task. Shiels et al. (99) also used a computerized spatial span task with 21 children (aged 7-10) with a diagnosis of ADHD. This program was designed to assess the storage of visual-spatial information (forward span) and the manipulation of the stored information (backward span).

Other studies have explored working memory using paper and pencil exercises. Hoekzema, Carmona, Tremols, Gispert, Guitart, Fauquet, et al. (91) used word list recall exercises to stimulate working memory. However, for paper and pencil activities, research exploring the effectiveness of planning treatment in children is sparse. One of the paper and pencil exercise that remains to be effective in enhancing the planning performance in children with ADHD+EFDs is labyrinths tasks (91). Moreover, some research demonstrated that the strategy instruction approach was effective in improving planning problems (100). Additionally, another activity that could enhance planning skills for children is a maze game, as this activity promotes a child's planning ability by practicing, anticipating, and navigating mazes to reach the goals in the game (101).

2.4.2 Cognitive Compensating Approach

The American Occupational Therapy Association (AOTA) practices a compensating approach or "top-down" approach, which begins with developing an occupational therapy profile and analysis of occupational performance (102). The framework tends to employ the training strategy, appropriate strategies, in which the children are trained to solve problems or control themselves to behave properly (88). The strong point of this process is its focus on the person in the whole context, and the relevance between clients and occupational dysfunction rather than medical conditions. Furthermore, it concentrates on adaptation, compensation, prevention, accommodation, and skill acquisition (103).

The treatment approaches are grouped by the type of manipulation or strategy employed and the type of disorder (104). The effective intervention techniques, which are commonly used in occupational therapy include environmental adaptation and strategy training (43,87,90,105).

In a school setting, the intervention techniques that are usually most effective for students with ADHD are environmental adaptation and strategy training. Both of these intervention techniques are described below.

Environmental adaptation or classroom accommodation and modifications is an intervention technique that has been found to be quite effective. Classroom structure is one of the most important environments that influences school performance of students with ADHD. Several suggestions to help organize the classroom structure for the students follow (106-108):

- Reducing external distraction in the classroom.
- Seating the child near the front of the classroom or the teacher and a role-model student, who provides the opportunity for children with ADHD to learn appropriate behaviors.
- Providing a quiet place away from visual and auditory distractions areas of the classroom.

- Setting a distance between the child's desk and the classmates' desks to diminish the chance of distraction.

Strategy training for students with ADHD in a school setting that can help them improve their school performance specifically in working memory, planning and self-monitoring follow: (106-109)

- Using a clock or wristwatch for appropriate time management.
- Using a calendar and a planner in a routine schedule to remind children with ADHD at the end of the day and to prepare materials needed for the next day.
- Taking notes of the key concepts when the teacher has been teaching.
- Using an assignment and homework checklist.
- Teaching or encouraging the students to underline or highlight the important words of paragraph.
- Using the monitoring checklist after completing on assignment or after class.
- Providing reinforcement for children with ADHD who are modeling appropriate behavior.
- Applying a token system.
- Providing instructions in small steps or breaking assignments down and checking students' understand.
- Giving on outline of the lesson.
- Training skills of time management.
- Teaching self-instruction or repeating orally the information.
- Teaching how to organize information techniques by using categories.

A cognitive compensating approach for students with ADHD+EFDs in this study integrates all of these techniques; for instance, using a self-monitoring checklist to monitor the behavior in the classroom. Both self-instructional techniques and compensatory strategies were also used.

Based upon a review of relevant research literature about students with ADHD+EFDs, numerous intervention activities, which promote compensating approaches specifically in self-monitoring and planning components of executive functions, are designed:

1. Self-monitoring: The previous research has indicated that many strategies can be used to improve self-monitoring problems in children with ADHD+EFDs. For instance, Shimabukuro, Prater, Jenkins and Edelen-Smith (76) evaluated the efficacy of self-monitoring in academic productivity and its accuracy in academic performance. The children were taught to self-monitor and self-graph their academic performance in reading, mathematics, and writing. Moreover, a study by Reid, Trout, and Schartz (110) mentioned the results of a meta-analysis in literature in self-monitoring interventions program for children with ADHD. One of the treatment techniques that these researchers highlighted was self- recording accuracy in students' work or during students' tasks. Mirnasab, and Bonab (111) studied the effect of self-monitoring techniques in students with ADHD. The students in this study used a self-monitoring card to self-monitor their own behavior in the classroom setting.

2. Planning: A great amount of research uses a multicomponent intervention approach for children with ADHD by using parent training or parent-therapist collaboration for evaluation and intervention. For example, Pfiffner et al. (112) used home-school behavioral treatment program for children with ADHD. They trained the parents of the children with ADHD in effective means for using home management and plans, including homework management training. Hahn-Markowitz, Manor, and Maeir (38), evaluated the efficacy of the Cog-Fun program in children with ADHD. They used goal-oriented behavioral training for planning problems in children as well as worked with the students' parents; after the training, the parents investigated their child's development in the homework management training in the home context.

This research was applied to treatment programs for children with ADHD+EFDs based on a cognitive compensating approach in two activities; namely, planning and self-monitoring. In planning, the therapist picked a homework checklist and a planning form, as well as used a self-monitoring checklist to facilitate various self-monitoring activities.

In treatment programs based on a cognitive remediation approach, visuo-spatial working memory tasks, backwards digit-span, letter-span tasks, and word list recall in working memory were used in this present study. Additionally, for planning remediation maze games were utilized.

School-based occupational therapists apply both adaptive and remedial approaches in their interventions to assist students to function successfully in the educational environment. For example, they provide the children with a therapeutic program to develop some skills while they also modify the classroom environment and train students to use appropriate strategies in their tasks (113).

However, strategy training and environment adaptation, such as teaching strategies like verbal self-instruction, rehearsal or grouping techniques in digit span tasks, can also be applied in working memory and planning tasks. External strategies are, for example, taking notes during class. Children may also use a daily planner and assignment book to record homework or assignments. Moreover, teaching a problem-solving skill while a child has difficulty doing a maze game is an important way to encourage their performance (106-109). In addition, modifications of classroom environment including decreasing visual stimulation, and acoustic quality are important too.

In this study, the relevant principles and key players of the remedial approach and the compensatory approach have been applied. These include the following: parents, teachers, the school principal, occupational therapist, peers, and students with ADHD+EFDs. In monitoring, the compensatory approach was employed in the process of assessment and the treatment program for students with ADHD+EFDs. For working memory and planning, the remedial and compensatory approach was used. Overall, four treatment programs were chosen;

1. Therapeutic program in executive functions for students with ADHD+EFDs
2. Strategy training and a home program for parents
3. Strategy training and a classroom management program for teachers
4. Peer training program through the Buddy Program and classroom peer training

3. Person Environment Occupation Performance Model (PEOP Model)

Person Environment Occupation Model was applied as the theoretical framework of this study. It is one of the most popular models in occupational therapy practice, and it includes frames of reference, models, and approaches, which clearly highlight the interrelationships among the person, the environment, and occupations.

The PEOP model is a client-centered model. This model has four major components that include the person, the environment, occupation, and performance. The model further showcases the transactional relationships among four components that affect occupational performance and participation in people's lives (44).

The *person* component in the PEOP model is comprised of physiological, psychological, emotional, neurobehavioral, cognitive, and spiritual characteristics that are intrinsic in nature (44,114).

The *environment* component in the PEOP model includes cultural values, social support, social interaction, political, economic system, institutional, environment and technology, natural environment, and physical components. All of these environmental components are extrinsic in nature. In this model, it is believed that these environmental factors influence human behavior (44,115).

The *occupation* component of the PEOP includes the acts of an individual, which are driven by intrinsic needs for self-expression according to role and specific environmental contexts. Moreover, the occupation component includes valued roles, functional tasks, self-directed activities for certain ages, and activities that people want or need to do in their daily life which help the person fulfill social accepted personal roles unique to various age ranges (44,115).

The *performance* component of the PEOP includes the meaningful activities where people care for themselves, work, play, or otherwise participate in their daily life.

Participation in this model is defined and relevant to the concept under the International Classification of Functioning, Disability and Health (ICF) (World Health Organization WHO). It refers to the involvement in life situations that includes an

understanding of health that incorporates a relationship between people's daily life and health (116). An occupational therapy perspective on participation focuses on the interaction between health and the occupation in everyday life, as well as the ability to engage in occupation and to support participation across various contexts (117).

Occupational performance and participation are the outcomes or results of transactional relationships amongst the child, occupation, and the environment. This relationship is experienced in nature and is determined by the person who is engaged in a purposeful occupation within a specific environment. The performance is shaped by the transaction, which occurs among the person, environment and occupation (114,115). The balance of the person, the environment and his or her occupations will influence the success of the occupational performance and one's participation in life. The occupational therapist has to facilitate balancing these three components and enhance a child's ability to successfully participate in different occupations in school and their home (42) as shown in Figure 2.4.

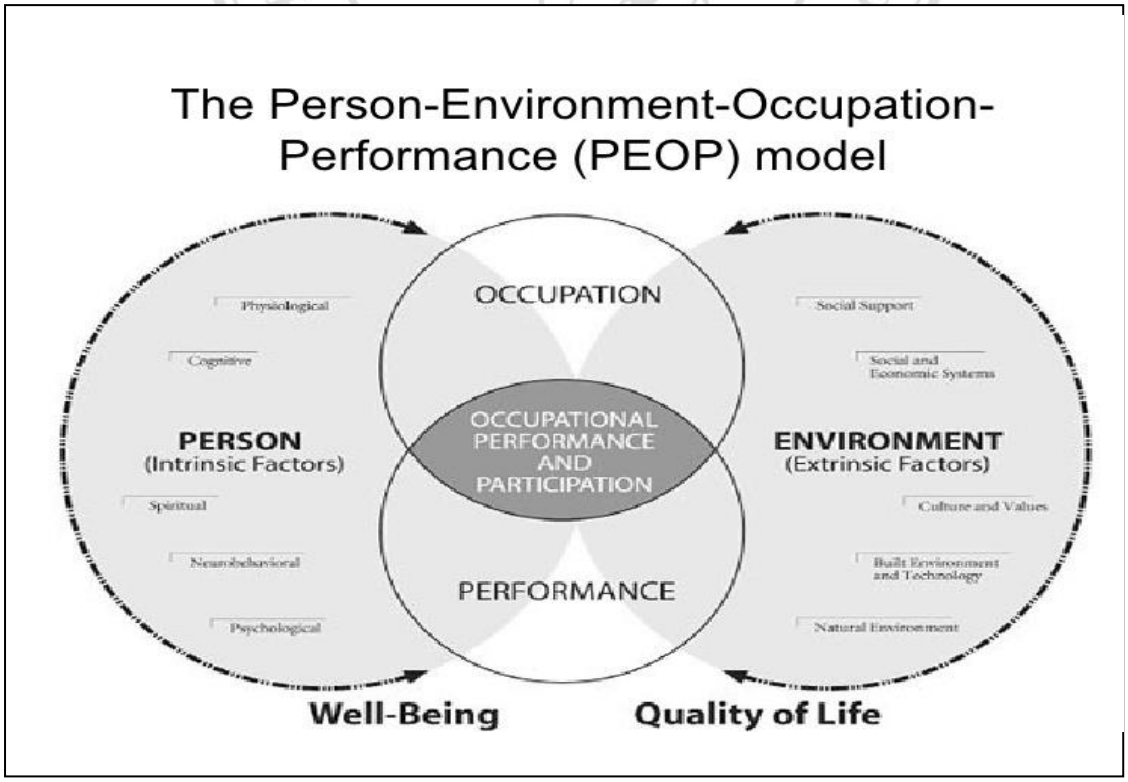

Figure 2.4. The Person Environment Occupation Performance Model (44)

This present study is based on the conceptual ideas of the Person Environment Occupation Performance Model. The *person* component of this model in relation to this present study consists of children who have ADHD with executive functions impairment in the specific areas of working memory, planning and self-monitoring. The *environment* component of this model in relation to this present study consists of parents, teachers, occupational therapist, and peers. Finally, the *occupation* component of this model in relation to this present study includes behavior management in functional tasks, as well as the goal that the child needs or wants to accomplish in his or her life. In this study, "participation in students with ADHD" is defined as involvement in their everyday, real-life situations. These real-life situations include daily occupations in the school setting, as well as the environmental factors at home. It is important to note that the interventions were provided not only for students with ADHD, but also for others with whom the students are currently involved, including parent, teachers, and peers. Then, the success of the inter-relationship of these elements leads to proper occupational performance, which potentially supports educational development among the students. This support facilitates the students' academic achievement in school and helps them to function well in a regular classroom. When children successfully participate in different occupations in school and their home, it means that they will successfully participate in their life situation and have a good quality of life, which corresponds to the purpose of WHO and to the overall goals of the field of occupational therapy. The conceptual ideas of this present research as based upon the PEOP model is presented in Figure 2.5 below.

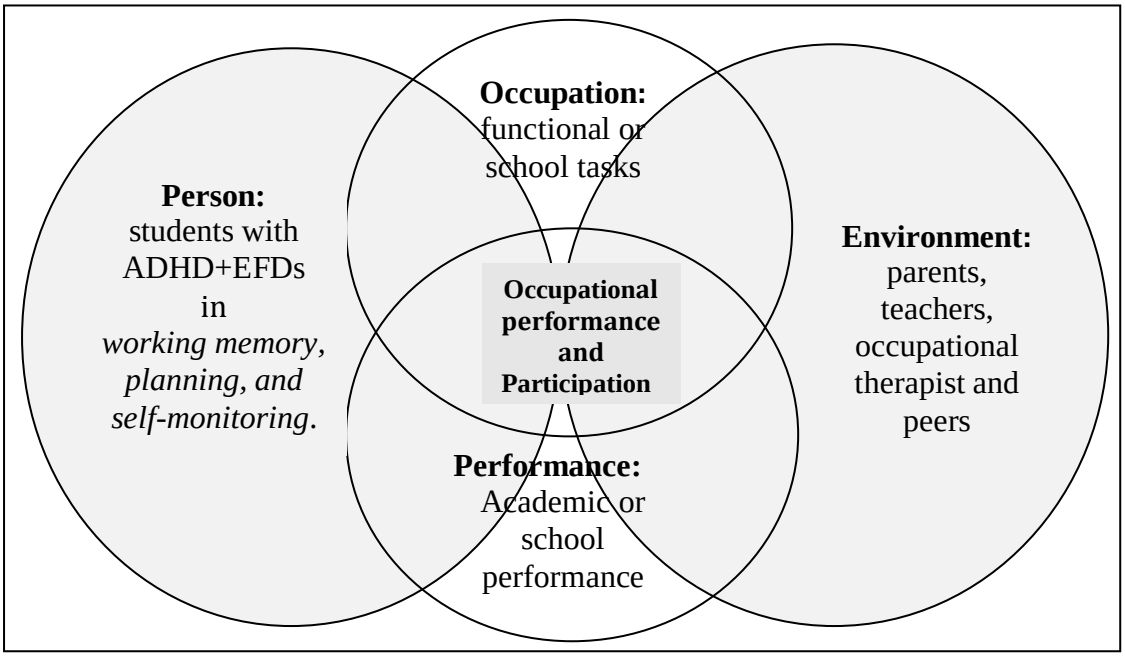

Figure 2.5. The Conceptual Ideas of This Research
[Adapted from the PEOP Model (44)]

4. Future Search Conference (F.S.C.)

Future Search Conference (F.S.C.) is a participation method and an operative conference of representatives from different groups concerning a certain issue to make future plans and design organizational changes that include strategic planning, systems thinking, and various within group communication (45,107). The representatives cooperatively share their experience to generate a collaborative procedure in order to achieve the established goal and to identify strategic directions and vision for change to effect a desired future. It is a process in which the task's target is the prospective future instead of problems and resolutions, which generally cause contention. As such, F.S.C. instrumentally helps clarify the objective as well as the progress of the work plan. The major purpose of this process is to collaboratively and conceptually present continual situations from the past which tend to affect the future, to mainly apply present situations, to pass resolutions, to engage in partnerships with a common vision for the future, and to brainstorm concepts, perception, and primary information, as well as to suggest operative plans for the future. This tool is quite useful as the compatible

perception of elements in the past situation, which affects the present condition and future trends, pragmatically generates common vision for the future (118).

The process helps expand the network and creates partnerships, in which everyone understands one another, while it also fosters conceptual unity. It is clear that all partners in the process are aware that they should maintain a common focus in order to cooperatively address the common goal.

4.1 The principles of F.S.C.

4.1.1 To create a totally open strategy in the conference. Every stakeholder, or their representative, including others from related sectors, is present at the meeting, which allows the attendants to hear and understand different viewpoints from different sectors.

4.1.2 To brainstorm a common future. Although conference members share a common concern about the complications in the issue, problems are not mentioned by conference. In contrary, the group members focus on generating a collaborative future.

4.1.3 To find unity. By establishing strong partnerships, contention is generally diminished. The conference members focus on positive points and confidence in the collaborative problem solving ability of the group.

4.1.4 To create a holistic view of the world. This conference approach focuses on generating a conceptional understanding of the whole world and society's attitudes towards an individual, as well as the importance of an individual's viewpoint about his or herself towards society and the world as a whole. This perception is derived from analyzing facts and future analysis.

4.1.5 To let everyone work independently. Partners need to be able to utilize their respective skills and strengths in the cooperative effort of problem solving. As everyone has his/her specific strength, the democratic-based convention uplifts the sense that people and their ideas are equally valuable and that no one should rely exclusively on others.

4.1.6 To set the collaborative target. It is important to collectively develop specific plans and to track progress in achieving goals.

4.1.7 To apply Claesen's psychological theory that an inspired human starts with his/her inner changes.

4.2 The Meeting

The total meeting to implement F.S.C. takes approximately 2-3 days. An acceptable number of participants is 50-60 people from different or all relevant sectors or organizations. A smaller number than this lessens the variation of opinions and experiences that is needed for the process to be effective. On the contrary, an excessive number of participants unnecessarily extends the time of the meeting, which makes it hard for the instructors to manage the program and treat each participant adequately. The program begins with cell meeting with no more than 10 participants. The cell meeting can be divided into two types; the mixed group, in which attendants are from different social statuses and backgrounds, and the specific group, in which participants share a common background, such as the same social status, sex, occupation and educational level. In some activities, every participant discusses issues using a participative process, in which attendants exchange their opinions, information as well as experiences from every point of view. Then, the attendants draw conclusions by determining present condition of the issue and plot the hope for future together. At the end, this cooperative effort focuses on strategies and procedures for the future

4.3 The Participant's Roles

4.3.1 Seek information, provide information as well as share experiences and analyze the information.

4.3.2 Participate in completing missions by the due time.

4.3.3 Create a collaborative concept of a favorable future.

4.3.4 Find "the common idea" of the group.

4.3.5 Plan activities to apply "the common idea" in action.

4.3.6 In the small group meeting, choose a chairperson to encourage everybody to suggest his/her idea, a secretary to record the discussion, a timekeeper, and an assistant manage the flip chart.

4.4 Three Major Elements in F.S.C. Process

4.4.1To analyze situations in the past, then link them to present conditions and trends.

4.4.2 To analyze and synthesize current conditions for the perception of direction as well as dominating factors that make up the main idea of the conference.

4.4.3 To imagine an agreeable future as the major issue of the conference, and to generate common ideas and practical procedures together.

A brief overview of the procedures in F.S.C. is illustrated in Figure 2.6.

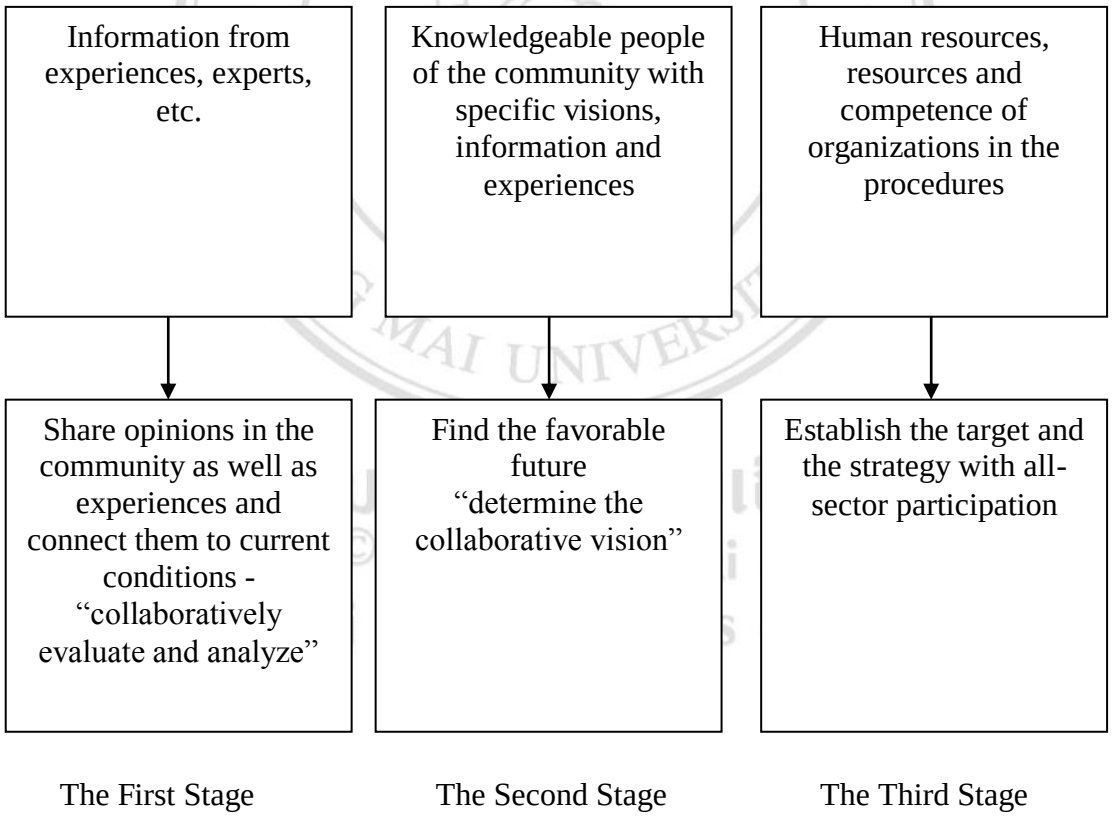

Figure 2.6. The Procedures in the F.S.C. (118)

F.S.C. method is applied in this research to brainstorm and develop integrated educational strategies for children with ADHD+EFDs. Some steps in the conference are omitted due to time limitation, school factors, and a number of the participants, such as teachers, parents and peer students (35).

5. Collaborative Program Team Members and Roles

Collaborative Programs

"Collaboration is the development and maintenance of positive, respectful, egalitarian relationships and includes mutual problem-solving and shared decision-making" (119). This is the process of team members to share their knowledge, experience, and perspectives to identify needs and develop appropriate interventions (40). Collaborative program is the cooperation between at least two voluntarily people in communication, decision-making, problem discussion, goal setting, and learning from one another (120). As the students have their daily life both at home and school, the collaborative practices with personnel who directly work or contact with them is very important. In a collaborative team, the occupational therapist builds collaborations to accommodate every member with their certain perspectives. The therapist also considers the need for therapy for the students based on the results of the child's evaluation on academic, developmental, and functional needs onto a child's general education program (121). Effectiveness of collaboration amongst teachers, parents, peers, and an occupational therapist starts with creating good attitude, potent team cohesion and organization, as well as good relationships, identifying problems and goal, and designing evaluation and intervention program (122,123). Three necessary collaborative practices are team meetings, progress review and goal establishment (124).

In educational setting, collaborative program is essential for successful inclusive education, which is very important to the occupational therapist, who works in school to enhance academic achievement of students (125). The number of collaborative team members depends on the students, families, educational and related personnel who directly work or contact to students in schools (35,126). In this study, the team is formed with an occupational therapist, parents, teachers and school principal and peers.

5.1. Occupational Therapist

World Federation of Occupational Therapists (WFOT) defines occupational therapy "Occupational therapy is a client-centered health profession concerned with promoting health and well-being through occupation. The primary goal of occupational therapy is to enable people to participate in the activities of everyday life. Occupational therapists achieve this outcome by working with people and communities to enhance their ability to engage in the occupations they want to, need to, or are expected to do, or by modifying the occupation or the environment to better support their occupational engagement" (127)

From the domain and process of an occupational therapy framework (40) that focuses on the distinct value of occupation and occupational therapy in supporting to people's health, well-being, and participation in their life. Occupational therapists have purposed of facilitating or enabling the patient to successfully participate in roles, habits, and routines in home, school, workplace and other settings. The therapists are concerned to promote and enable engagement of children in their occupations that facilitate the development of performance skills through adaptations and environmental modifications in their everyday life (40). Pediatric occupational therapy focuses on the children is successful participation in their occupations and also encourages them in positive behaviors in educational setting and their home (42).

The occupational therapist helps with the evaluation, intervention and outcome processes. Not only does the therapist work directly with the children, he/she adequately cooperates with the student's parents, teachers, a school principal, peers as well as others in the medical multidisciplinary team (34). Moreover, the therapist also, essentially, encourages the student's performance skills, performance patterns, educational context, activity match and individual student factors (40). The occupational therapist focuses and plays an important role as the facilitator to support children with ADHD+EFDs to participate in their daily life situation (117, 128). In a school setting, the occupational therapist also informs or constructs good attitudes and collaborate with their parents, teachers, a school principal and peers, which is critical for the success of the interventional process for children with ADHD+EFDs (34).

In the evaluation process, the first step of the inclusive education, the occupational therapist analyzes and selects the tools relevant to the children and the school's environment. The assessment tools help evaluate individual's characteristics, performance skills, performance patterns and educational context effectively for the most competent treatment, which helps the children achieve educational goals and study with peers in school adequately. Moreover, when the therapist finds problems or difficulties using the measurement tools, the students are immediately analyzed, and plans are developed to use the applicable intervention through the program (129).

The occupational therapy and the evaluation result in occupational performance, student's satisfaction, role competence, health and wellness, and quality of life in an educational environment (13). In a school-based occupational therapy perspective, students should have participation in their life in a learning environment. The therapist pays attention to students' academic achievement or educational goals and educational outcomes, for instance, academic performance or school function assessment that is considered from student's Grade Point Average or GPA, as well as teachers' and parents' satisfaction (130).

5.2. Parents

The most effective evaluation, intervention and outcome processes derive from the collaborative efforts of the children and the people related to them, specifically the parents throughout the processes at home (131). Research has suggested that by working or collaborate with their parents, therapists can focus on giving knowledge about symptoms and also providing information in a helpful way (132). Therapists should be trained in a specific program for parents or a home program that will assist the child in solving problems and promote proper behaviors (109). The importance roles of parent participation in the collaborative program include encouraging and supporting their child to be successful in school, such as providing appropriate strategies in the home environment, using appropriate communication skills and encouraging activities that help to improve their behaviors (119). The collaborative program with parents starts with identifying problems, sharing goals, planning strategies and rewards, and cooperating with teachers and therapist to enhance appropriate behavior (133). Moreover, parents can involve in homework interventions at home such as monitor

homework completion, decide the appropriate location, provide necessary materials and promote a positive attitude towards homework or assignments (134,135). In addition, the research from Meyer and Kelley (136) in 2007 has stated that parent's monitoring of homework behavior increases the percentage of homework turned in and reduces homework problems.

5.3. Teachers and school principal

In the inclusive educational classrooms, teachers have important roles to teach the skill and knowledge following the school curriculum, to instruct the student to exhibit appropriate behaviors in cultural and social expectations, to change their classroom environment and to apply proper strategies (137,138). Moreover, they have to write the Individualized Education Program (IEP) with IEP team for their children with disability in a general educational environment (124).

The school principals of inclusive school play an important role in school's provision and management focusing on collaborative educational inclusion to involve special children into education with other children. Moreover, the principal collaborate with the teachers, the students, the parents and other school staff to develop the school's instruction for the future. In this term, the principal assists the teachers and other school staff to review and adjusts the teaching plan. The principal is an authority who makes a decision on events at school, such as educative events and personnel matters (35,126)

The effectiveness of collaboration between teachers, school principals and occupational therapists includes giving information, identifying goals, planning to facilitate student success in an educational setting and academic goals (120). Moreover, that can enhance positive attitude of the teachers towards the children with ADHD + EFDs in the class. Therefore, the therapist has to collaborate with teachers, a school principal to enhance the children's educational performance (34).

5.4. Peers

Peers are an important factor in a school environment because positive relationships with peers in classroom can decrease the children's risk of future problems such as negative social interactions and academic difficulties (139). The occupational therapist informs and constructs positive attitudes among peer students. Quality friendship from peers is important and impacts positive functioning for children with ADHD in school. As a "buddy", peers can provide special chance to establish a skill of friendship (122). In the school setting, peers play an important role of facilitating a positive response of the ADHD students by providing guidance and immediate feedback in the class, enhancing students with ADHD to complete class assignments and paying attention on tasks in the classroom (52,108).

From previous research, all of the members in collaborative program have important roles to enhance children with ADHD+EFDs success in school. This study, information is applied to specify their roles in preparation stage, operation stage and evaluation stage in collaborative program's process.

6. Plan-Do-Check-Act (PDCA) cycle

Plan-Do-Check-Act Cycle (PDCA), introduced by Dr. William Edwards Deming, who developed it from the initial idea of Dr. Walter Andrew Shewhart, is a four-step cycle - plan, do, check and act--for continuous project improvement. It is a fundamental activity for effective work operation. The details of each step are described next (140-142):

1. ***Plan*** means to set up the goal as a guideline when plotting steps of the project. It involves establishing a goal, the framework, the procedures, the time period and the authorities. This step also includes developing innovations and solving problems. The plan includes potential events, as well as the amended current situations. A quality plan integrates knowledge, experience, and the capacity of human resources to achieve the established goal.

2. ***Do*** refers to following the prescribed plan. This is a process of practice, as it includes tracking and plotting the plan's progress and procedures. In this stage, the performance is evaluated frequently to assess whether the person is progressing in the proper direction.

3. ***Check*** means to evaluate the practice to see whether it is on track with the plan and that there are not any obstacles, which may prevent the person from achieving the target effectively. This step is done hand in hand with the project operation in order that the project is promptly improved by the most recent information derived. Accordingly, the result gleaned from this *check* stage of the cycle is used in the final step.

4. **Act** refers to ways to improve and to resolve problems that were found during the check stage efficiently and to prevent these problems from re-occurring in the future. Importantly, determination about what should be checked, how it should be checked, as well as how often evaluations should be performed must be determined based upon a solid, clearly articulated scheme. Developing the results of the evaluation into a plan could be done by analyzing the work structure or procedures and by improving them to perfectly fit into the plot to achieve the set goal. Simply stated, once issues are identified, then plans can be modified to incorporate the necessary solutions to address the presenting problems.

Deming, the PDCA's founder, accurately states that continuous and systematic efficiency and quality development helps spawn effective and quality productivity and service.

In conclusion, as this review of literature has demonstrated, much is already known about ADHD and executive function deficiencies. However, there are still many gaps in the literature regarding useful programs and interventions that can specifically target areas of executive functing such as working memory, planning, and self-monitoring. As such, this present study endeavors to contributed to this field of research by integrating what is already known to develop a effective model in the Thai context. Chapter 3 will provide a comprehensive overview of this present study's methodology.