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The Development Executive Functions for Early Childhood in 21st Century

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Abstract

Developing executive functions (EF) is a crucial issue in early childhood development which is also important in 21st-century learning. EF guideline was developed by Permsubhirunya and co to provide a guide for teachers who seeks to develop learning activities that could improve executive functions in children under the age of 6. The purpose of the study was to investigate the effect of the utilization of the EF guideline on the development of early childhood teachers' abilities in designing learning experiences for EF development. The study was conducted with a qualitative approach. The participants were 65 teachers in public early childhood centers in Thailand. The participants were purposively selected using the criteria of their work status and experience. The instruments were the EF guideline, an evaluation form for learning management design ability and learning material selection, and an interview form. The data were analyzed using content analysis and thematic analysis. The results of the study were in the descriptive presentation. The findings could be summarized that the use of the EF guideline was beneficial in developing teachers' knowledge of the early childhood executive functions, abilities to design learning management, and ability in selecting or creating learning material. The findings also suggested that teachers perceived the EF guideline as potential learning material that help them make a connection between the plan, activities, and evaluation. Therefore, it also helped them control the process of learning management and contribute to a meaningful learning environment.

Keywords: executive function, EF guideline, early childhood education

1. Introduction

Early childhood education is critical to a child's future success as skills gained during the education lay the groundwork for lifelong learning habits, which in turn provide a solid foundation for a child's learning abilities, social skills, and cognitive development. Therefore, Early childhood education namely kindergarten, nursery school, and preschool have developed into a critical and robust component education system worldwide (Shaughnessy & Kleyn, 2012). Additionally, Vandenbroeck et al. (2018) suggested that the benefit of early childhood education extends beyond the children involved, but also to society as a whole. For children themselves, participation in high-quality early childhood education and care is associated with increased earnings, increased educational attainment, improved social integration, and improved health (Gomez, 2016). For parents, it is discovered that it encourages labor market participation, particularly among mothers, in addition to educational and other benefits (Hornby, 2012). There are numerous potential benefits at the societal level as well, ranging from reduced welfare spending and lower crime rates to increased tax revenues and improved social cohesion. In other words, the benefits are widespread and sustainable.

It should be noted that the development of executive function (EF) is considered one of the main goals of early childhood education. According to Garon et al. (2008), the executive function can be defined as a collection of abilities that result from the coordination of three distinct cognitive processes: cognitive flexibility, working memory, and inhibitory control. These abilities assist us in planning, concentrating, remembering instructions, and completing tasks. Executive function is critical throughout life and begins to develop at a young age. The Education Hub (2020) indicates that cognitive flexibility refers to the capacity to pay attention and shift attention between tasks. Moreover, working memory enables children to retain and process information mentally (Gathercole, 2008). Moreover, children need Inhibitory control to enable them to halt an impulse and respond appropriately (Dowsett & Livesey, 2000). This set of skills is crucial for children and becomes a focus of

discussion in studies related to early childhood development.

However, the development of EF in pre-school could be a challenge for teachers of early childhood education. It should be noted that an individual is not born with EF abilities but rather, they develop over time, from birth to adulthood. However, there is no consensus yet as to which EFs are present early and which develop later. Similarly, there is no agreement as to whether the core elements of EF are fully dissociable (Gibb et al., 2021). Therefore, teachers need to comprehend the nature of EF and develop their learning experiment management skills to design curricula, learning activities, and learning material that matches the needs of EF development.

At a contextual level, it was found that EF is also considered the skill needed in the 21st century by the Thai government (Nopakhun, 2018). However, Thai pre-school teachers still lack the comprehension of EF development. Considering the fact that most Thai children started their education in early childhood centers provided by the local government, it should be recognized that teachers' ability to develop children's EF may have a long-term effect on their future. With this rationale, the EF guideline was developed to educate preschool teachers on the concept of EFs and the possibilities to develop their students' executive function. According to Permsubhirunya et al. (2018), the EF guideline is beneficial in encouraging systematic thinking in the design of learning activities. This would help learners to connect plans, activities, and assessments to help learners develop executive functions.

In summary, it could be seen that EF development starts from the developing teachers' knowledge of the ideas and their abilities to manage the learning experience which is one of the crucial problems found in the context. The current study, therefore, aims to enhance public early childhood schoolteachers' abilities in managing learning experiences and designing learning activities. The EF guideline was hypothesized to be beneficial for teacher development and pre-school students' executive function.

2. Literature Review

2.1 Executive Functions

Various frameworks have been proposed over the years to conceptualize executive functions and how they operate. Luria (1973) is one of the first who put attempted to conceptualize the EF model. He hypothesized that problem-solving behavior is contingent on several overarching abilities, or EFs, that are dependent on the proper functioning of the frontal lobes. Later, executive functions were conceptualized in various aspects such as the performance of tasks (Lezak, 1995), behaviors in doing life activities (Sohlberg & Mateer, 2001), and functional neurology (Badre & D'Esposito, 2007). The components of executive function could be summarized in 9 qualifications in 3 main components as follows.

Table 1. The qualifications of executive functions

Qualification	Definition	Benefits
Basic skills		
Working memory	The capacity to retain information and then apply it in certain ways	Retaining information, and then using that information to execute tasks
Inhibitory control	Monitoring adaptive actions such as withholding or suppressing irrelevant responses (e.g., go/no-go task) or preventing the recovery of irrelevant information from memory (e.g., directed forgetting).	Self-control in learning and in life
Cognitive Flexibility	A distinguishing feature of human thought, allowing for the ability to adapt in the face of environmental change and to generate new ideas that drive innovation and promote growth and discovery	Be able to switch tasks associated with inhibitory control and working memory
Self-control skills		
Focus/attention	The ability to focus and pay attention to certain activities without being distracted by surroundings	Learning and doing activities
Emotional control	The ability to control emotions such as stress and frustration at a certain level and the ability to express emotions	Adaptability in education and life
Initiating	The ability to start doing what is planned in mind	Being able to test hypothesized knowledge
Practical skills		
Plan and organizing	A higher-order cognitive activity entails EF processes that involve the formulation, appraisal, and selection of activities necessary to accomplish a goal.	Doing tasks using systematically thinking
Goal-directed persistence	Diligence in doing tasks and activities	Being able to practice controlling emotions in successfully finishing tasks

2.2 The EF Guideline

The EF guideline was developed by Permsubhirunya et al. (2018). The main objective is to guide teachers of early childhood education in managing experience for their students. The EF guideline is designed to be a form in which teachers have to fill in information guided by leading questions in designing learning management plans for preschool education. The components of the EF guideline are objectives, activities, and post-activity records. In detail, in the objective session, the teachers are guided to identify the objective of the learning activities. The expected outcomes of attitudes, skills, actions, concepts, EF qualifications, and expected behaviors need to be labeled. In the activities session, the leading questions in the guideline focus on gathering information about students' previous abilities, expected outcomes, the process of the activities, purposes of each process, teaching material, and learning environment. In the last process, the guideline leads teachers to evaluate their activities. The questions focus on whether the activities fulfilled their purposes, difficulties in executing activities, possibilities of improvement, what teachers learned after doing activities, and possibilities in doing further activities. Therefore, the EF guideline should be beneficial for teachers of early childhood education as it helps them make a connection between the principle of knowledge management design, qualifications of executive function, and the evaluation of their actions. In other words, they could develop their knowledge of EF learning management by doing and evaluating their work.

2.3 Related Studies

It can be claimed that EF education plays a crucial role in early childhood education and the development of the skills rather starts with developing teachers' learning management abilities than applying instructional methods to early childhood classes. Consequently, studies have been conducted to develop early childhood teachers' abilities in managing EF education (e.g., Choi et al., 2016; Corcoran & O'Flaherty, 2017; Gilmore & Cragg, 2014; Manowaluilou, 2021; Mulcahy et al., 2021). What could be summarized from the result of the related studies is that the knowledge of executive function education is expected to be acquired by early childhood teachers. Techniques used in developing teachers' teaching abilities focus on the ability to manage learning experiences throughout the processes of planning, executing, and evaluating. These processes are related to the EF guideline. Therefore, the current study employed the EF guideline in an attempt to develop early childhood teachers' abilities in designing learning management. The purpose of the study was to investigate the effect of the utilization of the EF guideline on the development of early childhood teachers' abilities in designing learning experiences for EF development.

3. Methodology

3.1 Research Design

The current study was conducted with a qualitative approach. The participants took part in a practical workshop on using the EF guideline in designing learning management and choosing learning media to develop preschool students' executive function. The participants' abilities were analyzed using the evaluation form and an interview.

3.2 Participants

The participants were 65 teachers in public early childhood centers in Thailand. The participants were purposively selected using the criteria of their work status and experience. In detail, in Thailand, the government provides early childhood centers as free preschool education for children aged between 3–6 years old. There is an early childhood center in every subdistrict in the country. Therefore, it could be claimed that this public early childhood center is the first educational experience for most people in the country. 7 participants took part in the interview session to illustrate how they perceive the EF guideline.

3.3 Research Instruments

The instruments were the EF guideline, an evaluation form for learning management design ability and learning material selection, and an interview form. The interview questions are related to how the EF guideline enables them to design learning activities for developing early childhood students' executive functions.

3.4 Data Collection

65 teachers took part in a practical workshop on the EF guideline. In the training workshop, they were instructed on how the guideline is used. All participants were asked to create a lesson plan and present it to the class. 7 participants were selected to take part in an interview session, and the data were qualitatively analyzed.

3.5 Data Analysis

The current study was conducted in a qualitative design. The data were analyzed using content analysis and

thematic analysis. The results of the study were in the descriptive presentation.

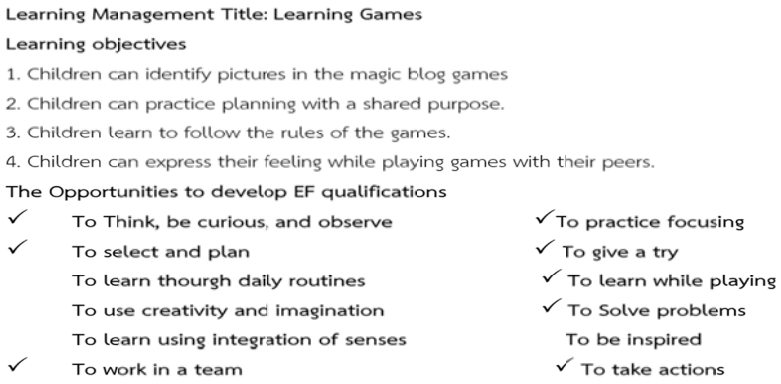
4. Results

The result of the study indicates that the participants taking part in a practical workshop could develop their learning management ability and learning material selection in developing early childhood students' executive function. The qualitative data gained from the evaluation could be summarized below.

4.1 The Benefits of the EF Guideline

4.1.1 Objectives

The first component of the EF guideline is the identification of the learning management objectives. It was found that the EF guideline assisted the participants to set the objectives that match the EF qualifications as the expected outcomes of the learning management.


Learning Management Title: Learning Games

Learning objectives

1. Children can identify pictures in the magic blog games
2. Children can practice planning with a shared purpose.
3. Children learn to follow the rules of the games.
4. Children can express their feeling while playing games with their peers.

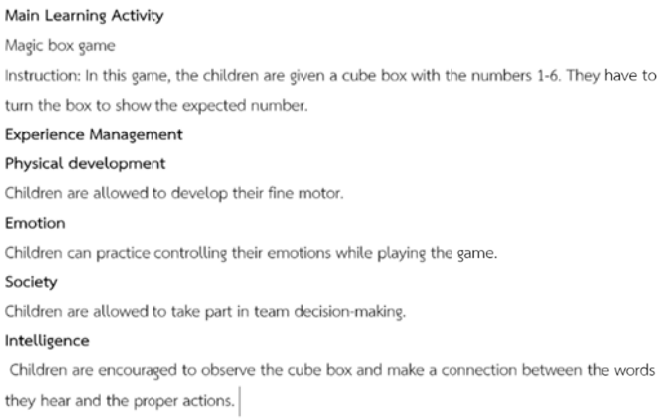
The Opportunities to develop EF qualifications

✓ To Think, be curious, and observe	✓ To practice focusing
✓ To select and plan	✓ To give a try
To learn thourgh daily routines	✓ To learn while playing
To use creativity and imagination	✓ To Solve problems
To learn using integration of senses	To be inspired
✓ To work in a team	✓ To take actions

Figure 1. The EF guideline—Objective session

It can be seen that the teachers were asked to set learning objectives for their learning management plans. They also had to complete a checklist of how their planned activities benefit learners' opportunities to develop EF qualifications. This would help them select learning activities and materials that are relevant to the objectives of learning management. The participants in the current study performed well after being instructed on how the EF guideline operates.

4.1.2 Activities


Main Learning Activity

Magic box game

Instruction: In this game, the children are given a cube box with the numbers 1-6. They have to turn the box to show the expected number.

Experience Management

Physical development

Children are allowed to develop their fine motor.

Emotion

Children can practice controlling their emotions while playing the game.

Society

Children are allowed to take part in team decision-making.

Intelligence

Children are encouraged to observe the cube box and make a connection between the words they hear and the proper actions.

Figure 2. The EF guideline—Activities session

In the activities session, the EF guideline demands users to provide information about the activities used in the learning management. They also have to describe the possibilities that the selected activities could develop EF qualifications. This helps them to design a meaningful learning atmosphere and provides the rationale for the selected learning material and activities.

4.1.3 Post-Activity Record

The last component of the EF guideline is the post-activity record which demands users to evaluate the benefits of the activities in developing learners' EF qualifications stated in the objective session. In this study, the participants were able to design rubrics used in the evaluation. Moreover, the EF guideline also encourages the discussion of how learning management could be improved. Similarly, the participants in the current study could also share comments and ideas on improving learning management.

Therefore, it could be summarized that the benefits of the EF guideline on the development of the participants' learning management design ability and learning material selection could be relevant to how it encourages systematical thinking in designing learning activities. From planning to evaluation sessions, learners are demanded to make a connection between the components of learning management and the possibilities in developing children's Executive functions. This, therefore, allow teachers to learn the concepts of EF and learning management design while trying to create one.

4.2 Teachers' Perceptions of the EF Guideline

Moreover, a thematic analysis of the participants' interviews could be summarized and discussed in the following issues.

4.2.1 The EF Guideline as Learning Material for Teachers

The first issue is discussing how the EF guideline is used as learning material for teachers. The interviewees reported that by reading the EF guideline manual, one could learn more about the concepts of executive functions and how they affect children's lives. For example, an interviewee replied

> "I knew the basic concept of the EF before but was not quite sure about their benefits on learners' daily routine. I learned about EF but was also not quite sure about the types, the benefits, and how to develop them. Using the EF guideline helped me understand more about the EF concepts" (Interviewee 1, December 2021).

Therefore, it could be seen that the manual, as well as the whole process of learning management development, could help teachers develop their knowledge of the executive functions of early childhood development.

4.2.2 Learning Activities and EF Development

Moreover, the participants also considered the EF guideline as a set of activities that help them connect the learning activities and the development of children's EFs. They reported that the guideline demands rationale for all activities stated in their teaching plans.

> "That the guideline asks me to set clear learning objectives, design rationale activities, and use systematic evaluation is very helpful. I learn how to make a connection between what I plan to do and how it affects my students' abilities" (Interviewee 2, December 2021).

Therefore, the benefits of the EF guideline is also related to how it encourages teachers to design learning activities that are relevant to the development of executive functions stated in the objective of learning management.

4.2.3 The EF Guideline and Teacher Metacognition in Teaching

The EF guideline is also found to be beneficial in developing teachers' metacognition in teaching. The participants reported that the guideline help them develop the ability to take control of their teaching design. For example, an interviewee replied

> "The guideline helped me realize that every action in teaching design needs a rationale. Therefore, the next time I develop learning material for my students, I will ask myself what are my teaching objectives?; why do I use these learning activities?; how can I assess the effectiveness of my design?" (Interviewee 5, December 2021).

At this point, the EF guideline was also beneficial in teachers' teaching progress as it encourages self-control ability in designing teaching material. This enables teachers to transfer their knowledge and understanding across tasks and contexts including learning management, selecting class activities, and asses students' abilities.

5. Discussion

The findings indicate that executive functions were also prioritized by Thai scholars. The EF guideline proved to be a potential alternative in developing teachers' knowledge of the concepts of the EFs and their abilities to design learning activities that would positively affect them. Therefore, the EF guideline provides an option to develop early childhood schoolteachers in the processes of executive function-related issues. Apart from using Teacher-Child Interactions (Choi et al., 2016), including EFs in the teacher training (Corcoran & O'Flaherty, 2017; Manowaluilou, 2021), and teaching early mathematics (Mulcahy et al., 2021), the EF guideline can also be used in EF education for teachers.

Moreover, teachers could develop their knowledge while taking part in designing learning management using the EF guideline. It was reported that the EF guideline helped teachers connect the components of learning management and take control of their curriculum design. Permsubhirunya et al. (2018) suggested that the EF guideline encourages teachers to think systematically and develop their metacognition in developing learning activities. How the EF guideline allows teachers to analyze their designated activities helped them both understand the concept of executive function and develop their learning management abilities.

In addition, the benefits of the EF guideline also rely on the way it offers learners a meaningful learning environment. According to Mystakidis (2021), an active, constructive, intentional, authentic, cooperative, or rational learning environment is important in creating meaningful learning. The EF guideline in this study encourages teachers to be active in developing learning management, constructive in selecting learning material, authentic in an analysis of students' needs, cooperative in sharing improvement possibilities, and rational in connective objectives, activities, and evaluation. This will enhance both the abilities of teachers and the growth of students' EF in the future.

6. Conclusion

In conclusion, the findings of the study could be summarized that the use of the EF guideline was beneficial in developing teachers' knowledge of the early childhood executive functions, abilities to design learning management, and ability in selecting or creating learning material. The findings also suggested that teachers perceived the EF guideline as potential learning material that help them make a connection between the plan, activities, and evaluation. Therefore, it also helped them control the process of learning management and contribute to a meaningful learning environment.

The results of the study could be implicated in teacher education settings. The EF guideline could be beneficial instruction material for teacher development workshops and training. Moreover, it could be used in teacher education as curriculum designers for early childhood teacher education could use the guideline in learning management designing activities. In terms of academics, more studies are encouraged to examine the benefits of the EF guideline on teachers' abilities in designing the curriculum of EF development in other educational settings. Both teachers' abilities and the effects on students' EF development are encouraged to be assessed. In addition, a quantitative approach is also recommended as it might provide statistical evidence to support the benefit of the EF guideline.

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