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# Designing and Validating an Executive Function Training Program for Elementary School Teachers

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**Abstract**: Executive functions play an essential role in the cognitive and social development of individuals. In recent years, executive functions have been studied as one of the most important neuropsychological variables affecting the reform and development of teachers' professions and as a result, better academic and social performance of students. This study aimed at designing and validating an executive function training program for elementary school teachers. The qualitative research method was used for the design and development part. To validate the program, the face validity method and the content validity method with a panel of 10 experts were used. To calculate the content validity, two relative content validity coefficients (CVR) and content validity index (CVI) were used. The minimum and maximum CVR for each item or component of the program were calculated. They were 0.80 and 1, respectively. Also, the minimum and maximum CVI rates for each item or component of the program were 0.80 and 0.93, respectively. Finally, the average content validity index for the whole program was 0.85. The results showed that the executive functions training program for primary school teachers has face and content validity and has the necessary validity for use in educational centers, in-service courses, and for research, and extracurricular classes in schools.

**Keywords:** Executive function, training program, teachers, validity

## Introduction

Among the academic courses, the primary course, as the main period of growth and flourishing of talents, has an important impact on the academic and social performance of students in higher courses. Paying attention to this sensitive period of growth, identifying and investigating the factors that lead to the poor performance of students in this period, is one of the most basic research topics in the education system, the researchers and administrators of this system must identify the basic factors and facilitate learning and education by controlling or eliminating them.

Undoubtedly, schools and teachers play the main role in promoting educational goals in society. Teachers are in contact with a wide range of students' needs and they are expected to respond to this variety of needs, but few have paid attention to whether teachers have the necessary ability to address this role as one of their daily duties or not. (Schleicher, 2016). According to the research and interviews conducted with teachers (Guy & Schipper, 2018; Van, 2016), it has been determined that teachers have problems to face with the various needs of students, their individual and interpersonal differences, and how to properly respond to these needs and differences; They do not have enough self-confidence,

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general and content pedagogical knowledge, so they feel that they are not prepared enough to work with students.

In a world where globalization, international competition, and new technologies have led toward neoliberal education policies, it is common to claim that school systems are only as good as the teachers who are there (Gleeson & O'Flaherty, 2016). Teachers in society play an important role in transferring concepts and helping learners in shaping the received content. Nowadays, the role of teachers is not only to convey the content; beyond that, they should step in line with the goals of society and teach the material (Mihami &Bastan, 2019). Teachers lead the way in the country's education and guide scholars in the educational community; therefore, the teachers of the society do not only spread science and knowledge because their influence goes beyond these matters (Mihami &Bastan, 2019). In general, all countries have mentioned improving the quality of teacher education as the general goal of teacher education and have focused on teacher education programs.

Shabani (2004) considers the selection of teachers, the decrease in the professional level of teachers, educational deficiencies, and the curriculum of teacher training centers, as the most important inadequacies and problems of teacher training programs in Iran. The fact is that the situation of teachers, both in terms of research and scientific development and in terms of education, is not desirable and lack of motivation and spirit of cooperation are some of the factors that create such a situation (Taghizade, Gholizade, & Javidi, 2017). Such weaknesses in the field of teacher training programs make it feel necessary to educate and train graduates who can improve the status of teachers and give it the identity that this profession deserves. Therefore, by giving importance to education and using effective educational programs as the most important means of education, the education system can fulfill its important mission in the field of education of competent, responsible, and numerous graduates. Therefore, according to what has been said, the first step to changing the educational system of the country is to focus on teachers.

On the other hand, according to the development of cognitive science, which examines the mechanisms through which humans acquire, process, and apply knowledge (Talkhabi & Kharazi, 2018), and the use of technologies derived from it, it is expected that a change can be made in the educational system. In this way, the traditional methods of teaching based on memorizing the contents are changed to methods that are suitable for the functions of the brain, and the new findings of teaching-learning sciences are used to witness the mental growth and creativity of our country's students.

On the other hand, advances in neuroimaging techniques have greatly improved our understanding of how the human brain works and have also influenced the way educational researchers approach research questions and conduct research. As the connection between neuroscience and education becomes more apparent, an interdisciplinary field commonly referred to as "educational neuroscience" has emerged (Ching, So, Kai Lo, & Wong, 2020). Regarding the effect of neuroscience on education (Bruer, 2008; Ching et al, 2020; Willis, 2008), It has been accepted that neuroscience can make extensive contributions to education (Gabrieli, 2016; Howard-Jones, Franey, Mashmoushi, & Liao, 2016). Researchers in the field of educational neuroscience have called for more formal training of teachers in the biological fields



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of learning and cognitive skills (Sparks, 2012), so that teachers can become more aware of neuroscience and education and the relationship between them and perform better in situations and cognitive processes (Purdey, 2008; Willis, 2008).

Additionally, research evidence shows that learning neuroscience can improve teachers' goal-setting skills, patience, self-confidence, use of neuroscience in classrooms, and more (Dubinsky,2010; Hook & Farah,2013). In their research, Ching et al. (2020) state that there is a lot known about the brain and neuroscience, which should play an essential role in teacher preparation programs, however, neuroscience is rarely included as a part of initial teachers' education or professional development. In recent years, executive functions have been studied as one of the most important neuropsychological variables affecting the professional development and improvement of teachers and, as a result, better academic and social performance of students. It has also been supported by much experimental research such as Corcoran & O'Flaherty (2017), Walk, Evers, Quante, & Hille (2018), Bardack & Obradović (2019), and Keenan, Conroy,O'Sullivan,& Downes (2019).

Also, research have shown that the classroom environment can affect the development of executive functions and teachers act as the main actors in empowering students' executive functions by providing support and targeted scaffolding. Therefore, it is very important to raise teachers' awareness of executive functions and their awareness of obstacles to supporting executive functions (Kinan et al, 2019). Anderson (2002) suggests that in their professional activities, teachers often deal with high-level decisions about curriculum content, choosing appropriate teaching methods, inclusion/exclusion, individual differences among students, and school discipline. Therefore, one of the most essential competencies of teachers in the classroom is their ability to understand and regulate possible cognitive processes.

McCloskey, Perkins, and Divner (2009) have defined executive functions as the neural mechanisms responsible for stimulating, coordinating, and directing different aspects of perception, emotion, cognition, and action in a person. In general, executive functions are considered organizational and regulatory processes that are an important foundation for thinking, behavior, and emotion (Eslinger, Flaherty-Craig, & Chakara, 2013); In other words, the executive functions system controls and manages the other systems, abilities, and cognitive processes.

By reviewing the background of the research, we realized that various theories have been proposed about executive functions; Among these, in the current research, we chose the McCloskey model as the base model for several reasons: 1. This model identifies and selects the main components of executive functions and introduces the sequence of development of the components in different age groups (McCloskey & Perkins, 2016, 2012); 2. This model is a prescriptive model in the sense that it describes the types of executive functions and provides practical guidelines for the implementation and production of the executive functions training program (McCloskey, 2016) and 3. This model is comprehensive, optimal, Hierarchy, and holistic. The perceptual framework of the current research is based on the integration of the level of self-regulation in McCloskey's model of executive functions, four broad areas



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of executive control, including perception, cognition, emotion, and action, and the way self-regulation executive functions are involved in the symbol system.

The framework presented by McCloskey et al. (2009) describes a hierarchical model of executive functions. This model classifies executive functions in five levels, which are: 1. Self-activation, 2. Self--regulation, 3. Self-determination, 4. Self-generation, & 5. Trans-self-integration. The first level, self-activation, precedes the levels of self-control and describes how executive functions are activated after an unconscious state such as sleep. The second level is self-regulation, which consists of at least 23 separate executive functions. Recently, this list of self-regulatory executive functions has been expanded from 23 to 31 (McCloskey et al., 2010).

These executive functions include, but are not limited to, the ability to measure, control, maintain, change, manipulate, organize, retrieve, and monitor, also guide people's perceptions, cognitions, emotions, and actions consciously and unconsciously. The third level includes self-realization and self-determination. Self-knowledge includes self-awareness and self-analysis through reflection. By having a better understanding of oneself, a person is also able to understand the "self" of others around her/him, and self-determination requires setting goals and planning for the future. Aspects of self-determination allow people to create, monitor, and modify long-term goals. The fourth level, self-generation, allows a person to examine life more deeply and philosophically. At this level, the person asks questions such as "Why do I exist?" and "Do we have a purpose in life?" The fifth and last level is the trans-self-integration. Executive functions at this level mediate a state of consciousness in which a person perceives himself as one with the world. People do not reach this stage easily. McCloskey and his colleagues (2016) have suggested that people do not need to have completely passed the first level to move on to the other levels. As previously mentioned, executive functions of self-regulation guide performance in the fields of cognition, perception, emotion, and action.

Executive functions of self-regulation are independent of each other and all develop from birth. A person may effectively use one or more executive functions at the same age in an appropriate manner but have difficulties effectively using other executive functions. It is also possible that executive functions differ in the effectiveness of use across the world in the four domains of perception, emotion, cognition, and action. For example, an executive function may be effectively used at an appropriate age to guide cognitions, but not to guide emotions. This model also discusses the variety of use of executive functions based on four areas of conflict (intra-personal, interpersonal, environmental, and symbolic system area). McCloskey's model of executive functions is probably the most comprehensive in the history of this field. His model provides a description of a wide range of executive functions for managing life tasks.

As research and writing on executive functions continue to expand, conceptual frameworks have focused on different subsets of executive functions. These frameworks have targeted teachers and parents as their target audience to increase awareness of the role of executive functions in the classroom and at home. Kaufman (2010), in his book titled Executive Functions in the Classroom, presented a perspective focusing on two basic factors of executive functions, which are metacognition and social-emotional regulation. The metacognitive factor includes goal setting, planning/strategy, sequencing, material



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organization, time management, executive/goal-oriented attention, task continuity, working memory, and set-shifting. The social/emotional regulation factor includes response inhibition (impulse control), emotional control, and adaptability.

Dawson & Guare (2010) have similarly described executive function skills as those processes that help us regulate our behaviors. They have divided executive skills into two groups, which is similar to the description by Kaufman (2010). The first group includes planning, organization, time management, working memory, and metacognitive skills, which help us create and achieve goals and find solutions to our problems. The second group includes response inhibition, emotional control, sustained attention, initiative, flexibility, and purposeful persistence, which help people direct their behavior toward their goals and solutions to their problems.

In McCloskey's model of executive functions, the level of complexity of executive functions increases with increasing its levels. Also, the development of executive skills is introduced in each of the components of the five levels, in the four areas of perception, cognition, emotion, and action. In addition, the four areas of intrapersonal, interpersonal, environmental, and symbol systems are considered possibilities and grounds for strengthening and developing the components of executive skills (Talkhabi et al., 2019). McCloskey (2016) while presenting a comprehensive, optimal, and hierarchical holistic model of executive functions, at the self-regulation level of this model, proposed 31 special executive functions under the title of self-regulation executive function; These functions are used in different degrees and combinations for understanding, thinking, feeling, and acting, and they are not only different from each other but also the control level of each one is different from the other.

The executive functions of self-regulation, due to their influence on the way and quality of the formation of people's experiences and daily actions, can play an important role in the formation of psychological states such as self-concept, personal agency, and self-efficacy beliefs; therefore, to empower teachers, it is better to start training from the self-regulation level of the McCloskey model.

The research findings of Corcoran and O'Flaherty (2017) show that raising the level of teachers' executive functions should be embedded in their educational programs and it is not only being considered as entry criteria for the teaching profession. Also, Diamond (2016) suggested in research that the factors in the classroom environment can influence the learning of executive functions of students and that teachers have a fundamental role in providing psychological support and evidence-based interventions to improve executive functions.

Therefore, according to what has been said, the first step to changing the educational system of the country is to focus on teachers. On the other hand, according to the new era and its increasing complexities, and as a result, changes in the type of learning, education, desires, and needs of people, and..., attention to cognitive science as one of the new sciences is essential. In recent years, the cognitive empowerment of teachers to make fundamental changes in the education process has created the ground for providing a coherent and practical program to improve the cognitive abilities of teachers and, accordingly, students.

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Since the main education providers can fulfill their important mission in the field of educating competent, responsible, and numerous graduates by using effective educational programs as the most important educational tool; The purpose of the present study is to design and present an executive functions training program that, while explaining and describing executive functions, describes how to develop those functions and turn them into skills. Also, considering that teachers' professional conditions for decision-making and classroom management require high executive skills, in this article we are looking for an answer to the question of what kind of programs are needed to develop the executive functions of teachers and to what extent this program has the necessary validity.

## Material and Methods

The current research is applied type and according to the adopted approaches, it is qualitative. Qualitative research is "a set of activities such as observation, interview, extensive participation in research activities, each of which somehow helps the researcher in obtaining first-hand information about the subject of research" (Delavar, 2016).

This research has been implemented in two general stages. In the first stage of the research, a descriptive-analytical method and the educational design model of ADDIE Gustafson and Branch (2002) were used to design and develop the executive functions training program. This model is a general and methodical step-by-step framework that emphasizes the unique conditions of different educational environments as well as the suggested trends for the educational design process.

This model gives the experts and educational designers the ability to create a more basic and effective education. Therefore, for the educational design according to the ADDIE model, one must go through five stages or steps, and each step is considered as a type of input for the next step (Ahmadi, 2015). Gustafson and Branch (2002) described the stages of this educational design model as 1-analysis; 2-Design; 3- development; 4- implementation; and 5-evaluation.

In the second stage of the research, after reviewing and modifying the designed and developed program, in order to validate it, formal and content validity methods were used. In order to quantitatively examine content validity, two relative coefficients of content validity (CVR) and content validity index (CVI) were used.

Lawshe method (1975) was used to calculate CVR. Considering the number of 10 people in the panel group, the minimum acceptable value to confirm the content validity of the program components was considered to be 0.62 (Lawshe, 1975). To calculate the content validity index (CVI), the method of Waltz and Bausell (1981; quoted by Hosseini, Ghorbani, & Ahmadi, 2014) was used. The content validity index can be calculated both at the level of each item of the instrument (I-CVI) and at the level of the entire instrument (S-CVI) (Zamanzadeh, Garhamian, Rasouli, Abbaszadeh, Alavi, & Nikanfar, 2015). To calculate this index, three criteria of relevance or specificity, simplicity or fluency, and clarity or transparency were examined using a four-part Likert scale for each program item. Formula (1) was used to calculate the content validity index (Davis, 1992). In this method, the total CVI for each item of



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the program includes the average of the total scores of the three criteria regarding that item of the program.

Formula (1)

$$CVI = \frac{numbers\ of\ agreement\ answers\ with\ each\ item\ for\ the\ 4th\ \&\ 3rd\ ranks}{total\ number\ of\ answers\ for\ \ each\ item}$$

In this method, items with a score higher than .79 are proper; between .70-.71 need to be modified and less than .70 are unacceptable and should be removed ( Hyrkas, Appelquist & Oksa,2003). Finally, the average content validity index was presented to check the content validity of the entire program (S-CVI/Ave).

To validate the executive function training program for teachers, two researcher-made questionnaires were used, 1) a questionnaire for determining the relative coefficient of content validity (CVR) and 2) a questionnaire for determining the content validity index (CVI).

**Questionnaire to determine the relative coefficient of content validity (CVR)**

The questionnaire for determining the relative coefficient of content validity (CVR) of the program was made by the researcher and corresponds to the elements of the executive functions program of primary school teachers. This questionnaire evaluates the necessity of each of the elements or items determined for the program. Some of the items mentioned in this questionnaire are: 1) Are the goals of this educational program related to the research topic? , 2) Are the strategies in this educational program related to the research topic?, 3) Is this educational program useful for elementary school teachers?, 4) Is the number of training sessions appropriate and effective?, 5) Is innovation observed in this training program?, And 6) according to the needs of people in the current era and the progress of cognitive sciences, how the implementation of this educational program can be effective?. Each of the items of this questionnaire is scored based on a three-level spectrum of high, somewhat, and low. Also, this questionnaire was designed with a response question to obtain the opinions of experts regarding the elements and components of the program. The face validity of the questionnaire was checked and confirmed by 2 experts in educational psychology, 3 expert teachers in elementary school, and 1 curriculum planner.

**Questionnaire to determine the content validity index (CVI)**

The questionnaire for determining the content validity index (CVI) of the program was made by the researcher and corresponds to the elements of the program of executive functions of primary school teachers. To calculate the content validity index (CVI), the method of Waltz and Bausell (1981; quoted by Hosseini, Ghorbani, & Ahmadi, 2014) was used. The content validity index can be calculated both at the level of each item of the instrument (I-CVI) and at the level of the entire instrument (S-CVI) (Zaman-zadeh, Garhamian, Rasouli, Abbas-zadeh, Alavi & Nikan-far, 2015). To calculate this index, three criteria of relevance or specificity, simplicity or fluency, and clarity or transparency were examined using a four-part Likert scale for each program item. Also, this questionnaire had a response question designed to obtain the opinions of experts regarding the elements and components of the program. The

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face validity of the questionnaire was checked and confirmed by 2 experts in educational psychology, 3 expert teachers in elementary school, and 1 curriculum planner.

The study community of the program design and development department included internal and external written documents related to the research topic, including books, scientific and research articles, treatises, and internet sites. Related content was selected and this work continued until the theoretical saturation was reached.

The statistical population related to the validation of the program includes all experts and specialists in the fields of cognitive science, educational psychology, and curriculum planning, as well as Farhangian University teachers who were primary school teachers in Yazd province. They were selected by the targeted sampling method based on the criterion sampling method. The 10 experts (1 in the field of curriculum planning, 3 in the cognitive field, 4 in the field of educational psychology, and 2 teachers) were selected as samples and members of the accreditation panel. These experts had scientific works and experiences in their field of study and most of them had enough experience working with teachers and students.

**Principles governing the design and development of educational programs**

To create powerful learning experiences, it is useful to understand how the brain works. Therefore, Shane Lueck (2020) has proposed five principles by which brain information is processed and puts people on the path to improve their learning and development initiatives:

1. The unconscious mind, rules the conscious mind

An experiment shows what happens when the conscious and unconscious battle it out. Seated in a chair, extend your dominant leg and make small clockwise circles with the foot. While continuing to perform this motion, with your dominant hand, draw the number six in the air with your index finger. What happened? For most people, either their foot freezes or reverses direction while the hand completes the task. Why the confusion? Drawing the number six is a learned behavior that you can do automatically. Making foot circles requires conscious thought and energy. This explains why it's often difficult to pick up a new habit or learn a new behavior. Until the behavior becomes automatic, it requires more mental energy. And making a behavior automatic requires practice and repetition. It's an effective instructional design strategy to use repetition to hardwire the answers into the mind of the learner, shifting the conscious act to the unconscious.

2. The brain is weird to find the patterns

The brain is constantly on the hunt for patterns. Patterns help us make sense of the world around us. We form narratives and seek an order to calm the chaos. What often separates experts from novices is proficiency in recognizing patterns related to the job, even if finding a pattern is a subconscious act. The task of instructional designers is to uncover the critical patterns experts use and convert that into training for novices. In general, patterns can be used in different ways to grow and learn more; For example, using arrows and grouping information in logical patterns informs the brain on how to interpret the flow of information.

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3. Confusion is good for learning

When possible, the brain will operate on autopilot. Although the brain weighs only about three pounds, it uses 20 percent of the body's energy. It would be exhausting to apply conscious thought to all activities engaged during the course of a day. To truly learn something, you need to consciously think about it. The feeling of confusion propels us to learn. When the brain becomes confused, it receives a hit of dopamine, resulting in a sense of bewilderment that forces the brain to pay close attention.

4. Mirror neurons allow us to learn from others

One of the best ways to learn something is by watching others engage in the process. This explains why people are increasingly turning to train videos to teach them how to accomplish a task. Data published by Google revealed searches related to "how to" on YouTube are growing 70 percent year over year, and at the point, the data was published, more than 100 million hours of how-to content had been watched in North America so far that year.

**The reason that learning by watching others is effective is because of mirror neurons.** When we read a story or watch someone go through an experience, our brain activates in the same region as the person experiencing. Mirror neurons provide a key to understanding the behavior of others. This explains why storytelling is such a powerful way to learn. Through stories, we can project ourselves into situations without having to experience them.

5. Feeling drive behavior

The feeling brain is the driver of our actions while the thinking brain is the backseat observer. Long-standing traditions assume that logical, rational thought is the preeminent approach to learning and development, but recent neurobiological discoveries challenge these assumptions. Instead, research finds that feelings and emotions are essential for meaningful learning to occur in the brain, which is why the use of stories, metaphors, and engaging illustrations to illuminate technical ideas yields better results than slides loaded with information. Understanding learner motivation is critical to the success of a learning initiative. A training needs assessment before training can inform you if learners have the proper motivation, and if not, where you should focus your time.

**Designing and compiling the training program**

The descriptive method and educational design model of ADDIE Gustafson and Branch (2002) were used to design and compile the executive functions training program. This model is a general and methodical step-by-step framework that emphasizes the unique conditions of different educational environments as well as the suggested trends for the educational design process. This model gives the experts and educational designers the ability to create a more basic and effective education. Therefore, for the educational design according to the ADDIE model, one must go through five stages or steps, and each step is considered as a type of input for the next step (Ahmadi, 2015).

Gustafson and Branch (2002) described the stages of this educational design model as 1-analysis; 2-Design; 3- development; 4- implementation; and 5-evaluation. At first, according to the educational design model and its first stage, which is analysis, the boundaries and scope of the selected research were determined. The desired criteria for searching written documents were: 1) related to the last 15



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years; 2) include all the countries of the world; 3) in the field of teaching executive functions to adults and especially to teachers, as well as the 31 components of the self-regulation level of McCloskey's model; 4) the search language is Farsi and English; 5) the research should be of the type of experimental, descriptive, and qualitative studies.

Then, the criteria for selecting and refining the documents collected from the previous stage, which include taking the pattern of designing and developing the program, dealing with teachers, especially from the perspective of cognitive functions, dealing with the issue of improving teachers' cognitive skills and compatibility with the theoretical foundations of McCloskey model of executive functions were determined, then the keywords and databases to be searched were selected. Then, practical documents related to the present study were collected and selected through critical analysis and systematic review of research and theoretical literature related to that field.

Then, in the second stage, according to the results of the investigation and study, the researcher designed and compiled relevant and creative headings for each of the components of the self-regulation level, and the most important tool for collecting information in the design section of the program were taking samples from different sources, which were used to collect, summarize and classify the data.

Also, in the development stage, the researcher designed and introduced interesting educational activities or tasks related to the topic of that session. The general approach or orientation of this program is a competency-based, and in this program, each of the executive functions of self-regulation is considered a basic executive competency that teachers need to improve their abilities in this training course.

Also, as was said before, the general goal of this program is the acquisition of basic cognitive skills by the teacher and their self-regulation in the effective and efficient use of these skills to stimulate, direct and coordinate thoughts, feelings, perceptions, and apply oneself in different personal and professional situations and turning this into executive traits in teachers' behavior. In this program, two types of content or learning opportunities are provided: 1) The educational part of the program or theoretical opportunities for learning, which introduces and discusses the topic in this part and includes three preliminary stages, the first, and second levels, and 2) the practical opportunities for learning which is the basis for action and gaining experience in different situations.

The first part is related to the implementation time of the educational part of the program, which consists of 15 lessons or 45–50-minute sessions. The second part is related to the implementation time of the practical part of the program about 25 to 30 minutes, which is done with the participation of teachers and lecturers, depending on the type of executive function, and the teachers are asked to do those assignments.

This program is an educational package designed by an expert and experienced instructor along with power shows, educational videos, and expressions of real-life situations. The teacher needs a space that has easy access to a video projector, computer, and smart or regular board; also, in this space, teachers can move freely and it is possible to arrange a group so that the teacher can witness more effective group participation. In this program, three types of diagnostics, formative, and summative evaluation programs have been prepared. Diagnostic evaluation includes a pre-test, summative evaluation includes post-test,



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and formative evaluation includes analysis of assignments done by teachers. Also, to evaluate, 4 computer tools and worksheets are used according to the proposed tasks.

In the implementation phase, the lesson plan of all the sessions was compiled by the program instructor, and in order to validate the executive functions training program, the compiled program was provided to the specialized members of the present study panel.

In the evaluation stage, to carry out the preliminary study; the training program was implemented for 5 participants; in this way, the content of the educational program was presented at a specific point in time, and after that, cognitive functions, the content of the program, and its effectiveness were evaluated.

**Table 1.** Executive functions training program for primary school teachers

| Training sessions | Target cognitive functions | Contents heading | Activities |
|---|---|---|---|
| 1 | Perceive | - Introduction of executive functions<br>- Importance and application of executive functions<br>- Highlighting the role of executive functions in the teaching profession<br>- Introducing the methods of cognitive empowerment and the functioning of the training course | -Presenting the challenges of real-life situations<br>- Use of discussion time<br>- Providing tangible experiences |
| 2 & 3 | Initiate/ energizing | - Reasons for poor self-initiation<br>- familiarity with the concept of procrastination; How it creates and strategies to deal with it<br>- Getting to know the obstacles to performing activities on time<br>- Familiarity with the role of emotions in the implementation of activities<br>- Familiarity with prioritization and goal setting | -The assignment to know the value of the activities<br>-Preparation to start the task<br>-Daily routine task<br>Self-talk task |
| 4 & 5 | Attention and sustain | - Familiarity with selective attention, concentration, and types of attention<br>- Familiarity with internal and external distractions<br>- Getting to know the principles of managing distractions<br>- Using sustainable attention empowerment strategies | -Fragmentation of information<br>-Choose right<br>-Attention network task<br>-Dot matrix task |
| 6 & 7 | Estimate/adjust/balance<br>Monitor/Correct | - Getting to know the concept of self-awareness<br>- Getting to know the concepts of self-monitoring and self-evaluation<br>- Familiarity with thoughts, emotions and behaviors, and how to control them<br>- Getting to know the needs and their diagnosis<br>- Getting to know the principles of mindfulness and its techniques | -Practicing radical acceptance<br>-Cognitive reappraisal<br>-Body scan task<br>-Deep breathing task |
| | Stop/interrupt/inhibit/pause and continue | - Familiarity with the concept of response<br>- Model presentation/patterning | -Stroop color task<br>-Stop signal task<br>-Conflict resolution task |

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| | | | |
|---|---|---|---|
| 8 | | - Training to follow instructions<br>- Teaching the ability to stop<br>- Teaching the ability to remove irrelevant stimuli and pay attention to specific stimuli | |
| 9 | flexibility/change | - Familiarity with flexible thoughts<br>- Getting to know the ways to achieve focused thinking<br>- Getting to know the benefits of flexibility<br>- Familiarity with the dynamic mindset and its role in the teaching profession | - Switching task<br>- Using alternatives task<br>- Brainstorming technique |
| 10 | manipulation and keeping the information in the mind/storage and retrieval | - Familiarity with the concept of working memory and its role in professional practice<br>- Getting to know the factors that lead to a decrease in working memory capacity | -Running span task<br>-Symmetry span task<br>-Verbal serial recall task and changing the order of reminders |
| 11 | Speed/routine performance/ time/execute | - Familiarity with time management and knowledge<br>- Familiarity with ways to increase the efficiency of the used time<br>- Getting to know the disruptive factors in time management<br>- Getting to know the principles of time budgeting<br>- Getting to know the technique of optimal use of time | - Daily planning<br>- Dedicating time to each activity in the day |
| 12 | Forecast and estimate time/measure, analyze and evaluate/organize and plan | - Familiarity with short-term and long-term goals<br>- Familiarity with prioritizing and setting goals<br>- Break large activities into smaller achievable goals<br>- Drawing a road map to achieve goals<br>- Getting to know the principles and steps of efficient planning<br>- Modeling | - Setting daily goals<br>- The task of using the reminder sheet<br>- Presenting real-life situations and planning for it |
| 13 & 14 | Associate and solve/prioritize and decision-making/product | - Familiarity with metacognition<br>- Modeling of strategies<br>- Getting to know the principles and steps of optimal decision making<br>- Getting to know the principles and steps of problem-solving | Using a strategy reflection sheet<br>Using strategy notebook<br>- Brainstorming technique<br>- Using the checklist |
| 15 | Summarize the contents and review the worksheets | | |

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**Table2**. Lesson plan for one session of executive functions training program including theoretical and practical part

| | |
|---|---|
| Title | The third session/self-initiation |
| Summary | Self-initiation is the beginning of applying perception, feeling, thinking, and action. |
| suggested time | 75 minutes |
| learning goals | Getting to know the obstacles to performing activities on time<br>Familiarity with the role of emotions in the implementation of activities<br>Familiarity with prioritization and goal setting |
| Required resources | The active presence of teachers in the classroom, Power presented by the teacher, pencil, and notebook, Presentation of assignments |
| Implementation steps (learning activities) | |
| Theoretical part: Education begins by challenging teachers, diagnostic evaluation, and preparing them to accept a new subject. In this way, the teachers are asked to imagine the situations in which they neglected to perform the activities on time and to answer the question of what factors prevent them from performing the activities on time in their opinion. Then, the teacher explains the barriers to self-initiation and the role of emotions in the implementation of activities and then introduces prioritization and goal setting to teachers. Also, during training, paying attention to modeling, and presenting real-life situations and concrete examples is emphasized. Practical part: assignments are presented and supplementary and clear explanations are given by the teacher along with concrete examples, and then the teachers are asked to do the assignments as homework. | |
| Learning assessment | The amount of teachers' participation in class discussion/ review and analysis of assignments |
| Tasks | Daily routine task & Self-talk task |
| Attachments | Useful self-talk; The way you talk to yourself can help you achieve your goals or hinder you from achieving them. The way you talk to yourself can help you be and behave the way you want. So, minimize negative self-talk; Like, "I have to be perfect," and change it to, "I will do the best I can with my available time, energy, and other priorities."<br>Daily routine; The purpose of doing this task is to help people establish stability over time. When there is already a specific time and plan for your work, you follow up on doing the work and you don't postpone it anymore. For this activity, you can use the self-initiated task worksheet.<br>self-initiated task worksheet<br>Date What should I do? When should I do it? Where should I do it? I did!!! |

## Results

To validate the executive function training program for primary school teachers, 10 experts in the fields of cognitive science, educational psychology, and curriculum planning, as well as Farhangian University teachers who were primary school teachers in Yazd province were selected as the research sample purposefully. First, the training program was given to the members of the expert panel to check its face validity, and the members, while checking the face validity, announced their corrective opinions about the program in detail, and after applying their opinions, the modified program was given to them in a quantitative form, to check the content validity. Tables 3 and 4 show the findings related to determining the content validity of the program.

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**Table 3.** The results of determining the relative coefficient of content validity (CVR) of the executive functions training program

| Limit of agreement | Much | | Some extent | | Low | | Interpretation |
|---|---|---|---|---|---|---|---|
| Criterion | Person | Percentage | Person | Percentage | Person | percentage | |
| Theoretical Foundations | 8 | 0.80 | 2 | 0.10 | - | - | Appropriate |
| Target | 10 | 1 | - | - | - | - | Appropriate |
| Content | 8 | 0.80 | 2 | 0.10 | - | - | Appropriate |
| Strategy | 8 | 0.80 | 2 | 0.10 | - | - | Appropriate |
| Application | 10 | 1 | - | - | - | - | Appropriate |
| comprehensibility | 8 | 0.80 | 2 | 0.10 | - | - | Appropriate |
| comprehensiveness | 10 | 1 | - | - | - | - | Appropriate |
| Innovation | 10 | 1 | - | - | - | - | Appropriate |
| Suitability and usefulness | 10 | 1 | - | - | - | - | Appropriate |
| execution time | 8 | 0.80 | 2 | 0.10 | - | - | Appropriate |
| Materials and media | 10 | 1 | - | - | - | - | Appropriate |

As can be seen in Table 3, the minimum and maximum amount of CVR for each item or component of the program was calculated as 0.80 and 1, respectively. Considering the number of 10 people in the panel group and the minimum acceptable value to confirm the content validity of the program components, which was considered 0.62, the CVR value obtained for each program component or the item is suitable.

**Table 4**. The results of determining the content validity index (CVI) of the executive functions training program for primary school teachers

| Criterion | Relationship | Clarity | Simplicity | Whole item | Interpretation |
|---|---|---|---|---|---|
| Theoretical Foundations | 1 | 0.90 | 0.80 | 0.90 | Appropriate |
| Target | 1 | 0.80 | 0.80 | 0.86 | Appropriate |
| Content | 0.90 | 0.80 | 0.90 | 0.85 | Appropriate |
| Strategy | 0.80 | 0.80 | 0.80 | 0.80 | Appropriate |
| Application | 1 | 0.80 | 0.80 | 0.86 | Appropriate |
| comprehensibility | 0.90 | 0.80 | 0.70 | 0.80 | Appropriate |
| comprehensiveness | 0.90 | 0.80 | 0.80 | 0.85 | Appropriate |
| Innovation | 1 | 0.80 | 0.80 | 0.86 | Appropriate |
| Suitability and usefulness | 1 | 0.90 | 0.90 | 0.93 | Appropriate |
| execution time | 1 | 0.83 | 0.80 | 0.83 | Appropriate |
| Materials and media | 1 | 0.86 | 0.80 | 0.86 | Appropriate |
| Assessment | 1 | 0.93 | 0.80 | 0.93 | Appropriate |
| CVI | - | - | - | 0.85 | Appropriate |

As can be seen in Table 4, the minimum and maximum CVI values for each item or component of the program were obtained as 0.80 and 0.93, respectively, which shows that all components or items score above 0.79, so they have been recognized as suitable. Finally, the average content validity index for the whole program was 0.85.

## Discussion

The construct of executive functions has gained increasing popularity over the past 15 years and has a relatively large list of relevant literature (Cochran & Flaherty, 2017). There is evidence that the skills of regulating behavior and emotions, solving problems, using memory, organizing material, and



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monitoring success or failure are important for teachers, and this is special for beginning teachers and those in pre-service teacher education (Ching et al., 2020).

Therefore, it can be expected that in research and studies related to education, improving skills, and developing teachers, the main focus is on executive functions. But unfortunately, this is not the case; In fact, some argue that the main issue in the educational discourse is focusing on measurable behaviors and there is no focus on the process of teaching and learning. Relatively few researches in teacher education currently deal with executive functions, and the existing researches focus more on describing teachers' experiences, not on the skills teachers need to acquire those experiences (Cochran & Flaherty, 2017).

Furthermore, while executive functions are often examined in elementary and secondary education to explain academic performance, they have never been reported longitudinally or during teacher preparation (Cochran & Flaherty, 2017). Keenan et al. (2019) suggested in their research that teachers should receive more comprehensive training to ensure an adequate understanding of executive function development and related issues. Past research has also highlighted the need for teachers' participation in the development of educational programs for classroom-based executive function interventions (Domitrovich, Gest, Gill, Jones, & DeRousie, 2009).

Wilson and Bai (2010) reported that teachers need both conceptual knowledge and executive function strategies. The evidence presented shows that executive function skills are useful for teachers and their students and it is worth paying attention to focus on such skills in teacher preparation programs. Therefore, the data presented in this article is useful because it highlights the skill areas that need the most attention. On the other hand, findings from the current data are useful for teacher preparation programs because they may help them select the content that supports the development of effective executive function skills (Hrbakov, Hladíkb, & Vavrov ac, 2012; Lai, 2011).

A large number of educational researchers and activists suggested that explicit and regular integration of executive functions in teacher education programs is necessary for the first line of efforts to revive teacher education (Cochran & Flaherty, 2017). Therefore, the current research was conducted to design and validate the executive functions training program for primary school teachers. In this research, the content of the educational program was compiled according to the ADDIE educational design model, the principles governing information processing in the brain, and the perceptual framework of McCloskey's model (2016). Based on this perceptual framework, self-regulation is an effective psychological component in the teaching profession through the direct effect of 31 executive functions of self-regulation on the formation of situations and practical mastery experiences or actual performances of teachers in different fields in the flow of their personal and professional life is formed or improved.

To conduct this research, a descriptive and analytical method was used and it was implemented in two stages. In the first stage, the educational program was designed and compiled according to the background and the conceptual framework of the research, and in the second stage, the validity of the designed program was checked and confirmed by the relevant experts.



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According to the reviews of the objective criteria, theoretical foundations, content, educational strategies, evaluation, application, comprehensiveness, comprehensibility, innovation, appropriateness and usefulness, implementation time and materials, and media in the designed educational program, with a high percentage was approved by experts. Therefore, it can be concluded that there is a logical connection between the criteria of the educational program and that the designed educational program has an orderly and logical course and has the necessary comprehensiveness, coordination, and integration.

In general, the results of this research show how by designing an appropriate educational program, teachers can be trained at the very beginning of their education and during it with executive functions and their application in their personal and professional lives and students' learning knowledge and clarify the role of executive functions in the learning process for teachers so that they are aware of their strengths and weaknesses concerning different components of the mind and different fields of knowledge. Therefore, getting the knowledge and familiarity of elementary teachers with these fields, cognitive skills, and their role in the process of teaching and learning is a solid and positive step towards empowering students in scientific and real life.

It is important to pay attention to elementary school and elementary school teachers from the point of view that during elementary school and before that, children not only make rapid progress in their executive functions but also seem to respond well to appropriate intervention programs. (Walk, Evers, Quante, & Hille, 2018).

According to what was discussed, the sustainable effectiveness of an intervention to improve executive functions is necessary for teachers who spend more time with students and their cognitive empowerment from the very beginning can be fundamental work to start cognitive development and improve executive skills in students of this level. The examples presented in the executive functions training program are in line with the findings of Diamond (2016), Walk et al. (2018), Bardack & Obradović (2019), Keenan et al. (2019) and Ching et al. (2020).

Unlike many programs, educational approaches, or past interventions that only emphasize the cognitive aspect of executive functions; this program pays attention to the perceptual, cognitive, emotional, and behavioral components of teachers in different fields. Therefore, this program by promoting self-regulation executive functions, not only plays a key role in the efficient and effective performance of all targeted academic, social, personal, and professional activities of teachers, but on the other hand, it will play a key role in the better academic and social performance of students and it will be beneficial for them as well.

In general, according to the special features of this program, such as its attention to the educational design model, new principles governing the program, theoretical foundations and certain logic, simultaneous attention to 31 executive functions of self-regulation and their simultaneous training in the theoretical and practical part, paying attention to the promotion of self-regulation executive functions in the executive fields of perception, cognition, emotion and action in all areas of the system of signs and also confirming its content validity from the point of view of experts can be considered as a



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comprehensive and approved program for promotion teachers' abilities in educational centers, in-service courses, or extracurricular classes in schools.

It is also suggested that this educational program be implemented for other teachers in different educational courses and its impact on improving their professional performance and mental health and the academic progress of their students be investigated. One of the other suggestions of this research is comparing this educational program with other programs in this field.

The limitation of the present research is the time allocated to the training of each of the components of the self-regulation executive functions; also, due to the busyness of teachers, it is difficult to get cooperation and coordination with them to allocate more teaching time. Another limitation of the research is the need for an experienced and efficient expert to cooperate in the training sessions, which is time-consuming and costly to obtain the cooperation and provide the training the experts need for each training session.

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