THE ROLE OF THE MOBILE APPLICATIONS FOR DEVELOPMENT OF THE EXECUTIVE FUNCTIONS FOR THE CHILDREN WITH LEARNING DISABILIY

D. Levterova [1] DSc, Prof., Mileva [2] N., PhD, Prof.
Faculty of Education[1] – Plovdiv University "Paisii Hilendarski", Bulgaria
Faculty of Physics and Engineering Technologies[2] – Plovdiv University "Paisii Hilendarski", Bulgaria,

doralg@uni-plovdiv.bg

nmileva@uni-plovdiv.bg

Abstract: *The article interpretes the possibilities of the mobile applications to favorably influence the development of the executive functions in pupils with learning disability. There are options for the use of different mobile applications in school and therapeutic activities as well as in the results of the empirical research.*

Keywords: *MOBILE APPLICATIONS, EXECUTIVE FUNCTION, SPECIFIC LEARNING DISABILITIES.*

1. Introduction

To the infringements of the ability to learn are included general and specific violations. Common distortions of the learning ability is present in the behavioral plan, while to the specific disorders of the ability to learn /specific learning difficulties/ are referred dyslexia, dysgraphia and dyscalculia. These infringements are not only a problem of primary school age. The problems do not occur solely at the level of higher mental functions and mental processes, and in the integrity of cognitive functioning, which includes the implementation of executive functions:

The term executive function is used to describe the capacity that allows us to control and coordinate our thoughts and behaviour (Luria, 1966; Shallice, 1982). There is no universally accepted definition of executive function. Executive function (EF) has been defined as a multifaceted construct that involves a variety of high-level cognitive abilities (De Frias, Dixon, &Strauss, 2006).

According to Brown (2006) „executive function as the management system of the brain's cognitive functions. The conductor of a symphony orchestra. Each musician has the potential to play his instrument very well but it is the conductor's ability to synchronize the different parts into a perfect whole, that makes the music great."

The term "eexecutive function" is an umbrella term for a brain-set of high-level mental processes that control and regulate other abilities and behaviours. Although there is no common understanding of the executive functions, students with EF deficits have difficulty: getting started and finishing work, remembering chores and assignments, executing rote memory tasks, writing essays, remembering what is read (comprehension), accurately judging the passage of time, being organized, using self-talk to guide actions, controlling emotions, analyzing and problem solving, planning for the future (Burgess, Veitch, de Lacy Costello & Shallice, 2000).

Executive functions can be categorized into two main groups:

- ✓ *core executive functions*: inhibitory control (self-control), working memory, cognitive flexibility;
- ✓ *higher order executive functions*: problem solving, reasoning, planning, мmetacognitive strategies, time management, positive reinforcement to motivate.

2. Prerequisites and means for solving the problem

Usually in therapeutic and educational practice for students with specific learning difficulties, are applied methods, linked to improving the efficiency of the cognitive processes. Relatively less attention and time is spent on the formation and improvement of the executive functions. In case of insufficient efficiency in executive functions there is a tendency for a lower productivity and success in school and in life. Students with specific learning difficulties are experiencing difficulties in the implementation of executive functions and often have problems with:

- Solving problems not only from the educational content, but also from everyday life;
- with the organization, motivation and performance of the tasks of different order and a different context of the environment.
- Behaviors in unstructured situations and others.

They accept the failures as a disappointment as difficulties or began to reject activities because they begin to perceive them as not as interesting and unattractive. They begin to lose interest in learning and school.

Today's generation of students with specific learning difficulties are born in the digital era. Their preferences for exchange of information are related to the use of computers, tablets, mobile devices. However, in some cases, are realized partial models of electronic training and therapy. Despite the availability of mobile applications for the development of cognitive processes and executive functions and preferences of students with specific learning difficulties, usually in the school space they find no application. Special teachers and resource teachers do not show interest in their application. In this plan, appeared the general question: "What is the role of mobile applications for development of the executive functions in children with specific learning difficulties" addressed to the professionals working with students with specific learning difficulties. Important for effective practice is the understanding of experts - therapists and educators.

Tasks:

- ✓ Approbating a questionnaire on the feasibility of the mobile applications in the educational and therapeutic practice for children with specific disorders of learning ability.
- ✓ Check the hypothesis of application of the mobile applications for the formation of executive functions in children with specific learning difficulties.

Hypothesis:

If the special teachers and resource teachers demonstrate understanding that the use of cognitive mobile applications will contribute to the development of the executive functions in pupils with specific learning difficulties, the development and implementation of mobile applications in working with students with specific learning difficulties will be effective.

Method of research

Participants in the survey were 37 students from the master program "Communication disorders" aged from 20 to 40 years.

Tools:

Method involving a questionnaire with 30 items, exploration and evaluation of freely selected mobile applications from study participants.

Procedure of the study.

A questionnaire comprising 30 questions is offered, 29 from which are answered with "yes" or "no", 30 - Your question is given the opportunity for open response.

The items are united into three groups:

⇒ First group with 6 items related to knowledge of the types of mobile applications suitable for educational and therapeutic work with children with specific learning difficulties.

After the results from the items from the first group a task is given: "to download, study and analyze free mobile applications, suitable for the development of executive functions in children with specific learning difficulties."

Prior guidance is not given for a specific mobile application.

⇒ Group Two with 10 items are aimed at knowledge of the specifics of mobile applications - rules and instructions mechanism, the effect of learning, hyper sensitivity to individual incentives and movements of characters, extreme responsibility to change objects, facts and models with or without the possibility of realization of creative approaches, etc. .;

⇒ A third group of 13 items are aimed at evaluation of the mobile applications against criteria - development of executive functions.

3. Results and discussion

Data from the first group of items shows that study participants known mainly mobile applications associated with encoding, decoding and processing information with different stimulus material.

- In Bulgarian: BG alphabet; BG words; Letters, numbers, colors; Children's songs; Animals for children; Animal sound and vocabulary; Easy reading; Mathematics - games for children; Mathematics for children; Musical instruments; Fairy tales and books; Stories and songs; they learn games to;

- English: Animal sounds; AutoMath; Math tricks; How to draw. Only 1.5 percent of survey participants know Brainwave Studio and Limosity.

Study participants accept that the marked mobile applications are suitable for use of children with specific learning difficulties. Another result is that 75% of survey respondents believe that mobile applications with English names are not available in Bulgarian and are not affordable i.e. free. Actually the marked mobile applications in almost all the series are universal in linguistic terms.

In the following of task: "to download, study and analyze free mobile applications, suitable for the development of executive functions in children with specific learning difficulties" 8 mobile applications are preferred by the study participants : Brain Studio, Limosity, Memory Training, Memory Trainer, Brain Test HD, Math Tricks, Sound of Relieve Stress и NeuroNations's.

Participants in the study noted, mobile applications that are narrowly focused on executive functions in specific learning disabilities, but are paid. In this sense, mobile applications from this group do not meet the condition of the task and were not analyzed. To this selection are included: Homework /Mango, LLC/, Homework Tracker w/Reminders, Kids Calendar /ConSept/, 4KidCal /4KidCal LLC/, Think Tree /mind mapping/, Popplet /Notion/.

It is clear that the investigated and referred mobile applications can be divided into three groups:

- Mobile applications for relaxation and stress relievetion /Brain Studio, Sound of Relieve Stress/;

- Mobile applications related to solving cognitive tasks and suggesting support cognitive functions /Limosity, Memory Training, Memory Trainer, Brain Test HD, Math Tricks/;

- Mobile applications relating specifically to the development of executive functions /NeuroNations's/.

This brief taxonomy is conditional because it is not possible to solve cognitive tasks without realization of executive functions such as:

- Understanding of the rules, regulations and enforcement;
- The involvement of working memory;
- No emotional- control skills;
- Without focusing attention;
- Without partially demonstrated organizational skills;
- Planning skills, etc.

After study of mobile applications survey was conducted with the second and third group items. The results of the responses of the second group of questions are presented in Table 1.

Table 1. Knowledge of the specifics of mobile applications

	participants positions	% of responses to allegations on 8 selected mobile Applications	
		yes	no
2.1.	clear instructions and delivery mechanism	99 %	1 %
2.2.	suitable and convenient design	86 %	14 %
2.3.	probability of hypersensitivity to separate incentives and their movements	36 %	64 %
2.4.	without the possibility of realization of creative approaches	93 %	7 %
2.5.	extreme responsibility to change objects, facts and models	94 %	6 %
2.6.	opportunities to scientific data, facts and skill to be transferred in real environment	29 %	71 %
2.7.	effect of coaching learning	96 %	4 %
2.8.	settlement of default time limit performances.	38 %	62 %
2.9.	requirement of a period for adjustment	12 %	88 %
2.10.	allowing time synchronization for students with specific learning difficulties and professionals working with them	96 %	4 %

It is obvious that the participants in the study assessed aspects of the mobile applications that affect the effective work with children and students with specific learning difficulties. Categorically it is assumed that there are suitable and convenient design as well as clear instructions and mechanism of implementation and time synchronization performance between students and professionals.

Particularly impressive are the answers to items 2.3., 2.4, 2.5., 2.6. where to look for effects in behavioral plan for students with specific learning difficulties of implementation of tasks in the respective mobile applications. The third groups of items are presented in Table. 2.

Table 2. Evaluation of the mobile applications

№	participants positions	% of responses to allegations	
		yes	no
3.1.	MAPs mace the formal measurement and evaluation of student performance more difficult.	94%	6 %
3.2.	MAPs are not made for individual subgroups - dyslexia, dysgraphia and dyscalculia.	99 %	1 %
3.3.	MAP serve only for fun.	78 %	22 %
3.4.	MAPs can be used as therapeutic interventions with students with specific learning difficulties.	51 %	49 %
3.5.	MAPs contribute to the formation of better alertness in carrying out educational tasks and activities.	96 %	4 %
3.6.	MAPs limit the development of social skills.	98 %	2 %
3.7.	MAPs support encoding, decoding and processing information with different stimulus material.	86 %	14 %
3.8.	MAPs assist the training and development of the working memory.	93 %	7 %
3.9.	MAPs limit the frustrations tolerance for behaviors of others.	76 %	24 %
3.10.	MAPs enhance the skills for planning.	96 %	4 %
3.11.	MAPs can improve flexibility.	92 %	8 %
3.12.	MAPs support to overcome the extreme disorganization of materials, incentives and facilities.	74 %	26 %
3.13.	MAPs assist in regulating the emotional control in the implementation of educational and test tasks	76 %	24 %

*Note: MAPs - Mobile applications

The table shows that survey participants gave positive responses to the items. While items 3.1, 3.2., 3.3 and 3.6 present limits of the selected mobile applications, other items displayed positive aspects of the mobile applications and the relevance of their therapeutic application. Many executive functioning tasks have very low ecological validity (Ardila, 2008). The students have argued that these tasks are poorly correlated with daily life activities.

Items 3.5., 3.7., 3.8., 3.10., 3.11., 3.12. present positions of approval to the development of individual components of the executive functions. Each of these executive functions has a role in cognitive control, for example filtering out unimportant information, holding in mind a plan to carry out in the future and inhibiting impulses. According to Baddeley (1992), working memory is the brain system that temporarily provides storage and manipulation of information. Set-shifting is referred to as the ability to flexibly switch back and between tasks, operations, or mental sets (Miyake et all., 2000). Prospective memory is the ability to hold in mind an intention to carry out an action at a future time (Ellis, 1996), for example remembering to make a phone call at specific future time. Prospective memory is associated with frontal lobe activity (Burgess, Veitch, Costello, & Shallice, 2000) and has been shown to develop through childhood as we develop our future-oriented thought and action (Ellis & Kvavilashvili, 2000). The result of the item 3.10. is explane that planning is a complex construct, making it difficult to narrow down a specific set of brain regions or networks underlying this ability. For example, planning has been defined as a large category of responses and processes including, but not limited to, decision-making, judgments, and evaluation of one's own behaviors and the behaviors of others (Das & Heemsbergen, 1983).

Answers to items 3.9. and 3.13. demonstrate the positive opinions of the participants in the study on the possibilities of the mobile applications for the formation of the emotional component of the executive functions in children with specific learning difficulties.

Despite the positive attitude towards the development of executive functions through the use of mobile applications, from items 3.4. shows the manifested skepticism for implementation of the mobile applications as therapeutic interventions for specific violations of the learning ability.

The last 30th question is "QR code, Barcoo mobile applications are not suitable for specific violations of the learning ability, because... Please complete by answering the question: "Why?".

In the responses received from participants manifests the insufficient knowledge of augmented reality and in this context is the presence of explanatory models such as: ..."We need specific training for them, a lot of them are complex, and require specific reliance and thy can not be measured, can not be used in the school ... ". There are also direct inquiries and findings: "what are these applications, I do not know these applications, I do not know what it is, etc." Such situations are not curious. Mumba & Zhu (2013) share that some teachers are not even aware of the existence of a lot of useful applications. If they are familiar with them, then they should take the time to learn how to use and apply them in the classroom, and to devote the necessary time to train their students to use them effectively (Douglas et all., 2012).

Cognitive models typically describe executive functions as higher-level processes that exert control over elementary mental operations (Luu and Tucker, 2000).

The tasks in MAP are complex. The complexity supports the development of executive functions. Along with the prefrontal cortex, Bunge et all.(2000) detected increased activation in the lateral prefrontal cortex (DLPFC) when participants were engaging in complex task (e.g., reading sentences and trying to retain target words). Moreover, executive functioning tasks that are commonly used not only tap into a particular executive function but also other abilities such as general cognitive skills (Barkley, 2011) or nonexecutive skills (Collette et all., 2006).

As noted Nordness, Haverkost, and Volberding (2011), research in the areas of study of the contents and effectiveness in the use of mobile devices and applications are in the process of the birth. Undoubtedly, the mobile applications as a relatively new technology should not be adopted without a solid theoretical basis and pedagogical justification. Participants in the study after analyzing the authenticity of the tasks, the design, the instructions and more. Adopt mobile applications are relevant in the specific educational context for development of the executive functions in children and students with specific learning difficulties.

There is evidence that the mobile applications can help children and pupils with specific learning difficulties and other students who have problems with the development of executive functions and learning (Twyman & Tyndall, 2006; Rappolt-Schlichtman and others, 2013).

4. Conclusion

In conclusion, this article presents the understanding of professionals working with children with specific learning difficulties for the role of the mobile applications for the development of executive functions. Limits and advantages of the use of mobile applications in specific learning difficulties are marked.

Children and students with specific learning difficulties have problems with executive functions. Each task operation and activity that requires focusing of the attention, memory, planning, organization, time management and flexible thinking become challenging. The more information there is about the challenges the more efficiently the development of the executive functions in children and students with specific learning disabilities will be supported, including specially created mobile applications. Executive functions are important for successful social functioning and performances in school and for real life situations.

In general aspect, the article offers a survey of the attitudes of professionals that can be used both to build the methodology of application of mobile applications as therapeutic interventions in specific learning difficulties students, and for didactic and therapeutic structured mobile applications for children with specific learning difficulties.

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