

Chapter 13

Move Your Brain!

Active Break Activities Based on Cognitively Engaging Physical Activity for Preschoolers

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ABSTRACT

Active breaks have received great attention both among teachers and researchers and are used by those who pursue to take advantage of all its benefits. Because of these benefits, many teachers or schools have incorporated active breaks into their daily classroom routines. However, to the authors' knowledge, there is not any program aimed entirely at preschool age. Also, the type of activities proposed in these programs are mostly mechanic with low cognitive engagement while some authors argue that cognitively engaging physical activity is more beneficial for cognitive and academic performance than mechanic activities. For these reasons, this chapter proposes a new active break program aimed at preschool children. This program, entitled "Move Your Brain," will be composed of physical activities with inherent cognitive demands to challenge the children's brains.

INTRODUCTION

Despite the multiple benefits of physical activity, sedentarism is a worldwide problem that affects young populations and may result in a risk of childhood obesity. According to World Health Organisation (WHO, 2010), 84% of boys and 78% of girls do not meet the minimum daily physical activity recommended, which includes 60 min/day of moderate- to vigorous-intensity physical activity. For that reason, some actions have been put into practice in the educational context, with the purpose of increasing the levels of physical activity among children. One of these actions is the so-called active breaks, which can be

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defined as short bouts (5-10 min) of physical activity included in the school schedule that offer pupils more time of physical activity without reducing their learning time (Martínez-López et al., 2018; Wilson et al., 2013).

Active breaks have received great attention both among teachers and researchers and are used by those who pursue to take advantage of all its benefits. These benefits are not only physical but also psychological and cognitive. In this sense, some studies have shown a positive relationship between an active break program and better cognitive performance (Méndez-Giménez, 2020), since it positively influences different processes of childhood cognition in general (Chaddock et al., 2011; Howie et al., 2014), and attention and memory in particular (Contreras-Jordán et al., 2020; Ma et al., 2015; Mahar, 2011; Martínez-López et al., 2018; Rudasill et al., 2010). Furthermore, children's behavior (Carlson et al., 2015) and academic performance (Pastor-Vicedo et al., 2019) improved significantly after developing an active break program.

In light of these results, many teachers and schools have included active breaks into their daily classroom routines. The birth of these programs took place two decades ago. For example, in 1999, the *International Life Sciences Institute* launched the *Take10!* Program, which combines ten minutes of physical activity through curriculum subjects of Elementary School. Currently, this program is being conducted in other countries such as China (*Happy10*), United Kingdom (*Take10 UK*), Brazil (*Tire 10*) and Chile (*Take10-Chile!*). Due to the lack of programs aimed at Secondary Education, it was created in 2011 the program called *Take a break!* in the United States. The included activities last between 1 and 5 minutes and should be used every 30-60 minutes every day. The Spanish government published the program entitled *¡Dame 10!* which is similar to *Take 10!* This program consists of a series of physical activities related to curricular contents. Each session takes between 5 and 10 minutes. In this same country, another program was created in 2016, called *Móvetete15*. Each session of this program lasts 15 minutes of moderate-vigorous intensity physical activity and activities are usually implemented with music.

In addition to these programs, many technologies resources have emerged in relation to active breaks. For example, *GoNoodle*, or *Energizing Brain Breaks* present a series of physical activities to perform within the school context. The main advantages of these resources are that they do not need preparation and extra material to perform. Both resources contain many videos to use at school context, related (or not) with curriculum subjects.

After reading all these programs in detail, two considerations must be done. On the one hand, although most programs include activities aimed at preschool children, there is not any program aimed exclusively at this educational stage. On the other hand, the nature of the activities proposed in these programs are mostly mechanic with low cognitive engagement (e.g., squads, jumps, aerobic exercise) based merely on the repetition of the action and oriented to endurance. Nevertheless, some authors argue that cognitively engaging physical activity (i.e., physical activity that is cognitively challenging, such as team games) is more beneficial for cognition than mechanic activities (Schmidt et al., 2015).

Background

Since active breaks were created, there have been several researching works that have focused their attention on verifying the effects of active breaks conducted with schoolchildren. The *Healthy School Projects program*, for example, mentions that the methodology presented by active breaks provide subjects with numerous positive effects on both health and academic performance, as well as helps students to reduce the sedentary lifestyle, improves disruptive behaviors, increases motivation to learn, improves

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their physical condition and cognitive function (Sánchez López et al., 2017). Thus, these programs help them to reach global recommendations on physical activity for health, according to the WHO (2010). In addition, these short bouts of physical activity improve the reduction of risk factors such as obesity or diseases at a psychological and social level (Kibbe et al., 2011).

On the other hand, some researchers point to the effectiveness of active break programs within the school environment, as they prevent children from having childhood obesity and also help them to organize norms and guidelines for the modification of knowledge and conditions towards the practice of physical activity. In relation to this, Visiedo et al. (2016) conducted a systematic review that included studies published over the last 15 years. These studies aimed to increase physical activity levels, improve health, and reduce obesity and overweight in schoolchildren aged 5 and 10 years. Findings from these studies reveal statistically significant improvements in the Body Mass Index, physical condition, and changes in eating habits.

In addition to these benefits, directly related to health, other studies have observed the benefits that active break programs provide students, which are related to health, social and cognitive dimensions (e.g., student behavior, physical condition, academic performance, and attention). Regarding student behavior, the study carried out by Carlson et al. (2015), aimed to investigate and associate the students' physical activity with their behavior in the classroom. Twenty-four Primary schools were involved in this work, with a total of 1,322 students and 97 teachers. At the end of the study, researchers concluded that implementing physical activity breaks in the classroom helped students to improve both their behavior and academic performance.

Regarding physical condition, Jurado et al. (2018) designed a study whose objective was to demonstrate the efficacy of active breaks programs to improve the health of Physical Education students (enrolled in 2nd to 6th grade), increase their physical condition and reduce their percentage of fat and Body Mass Index. After obtaining the results, MÓVETE15 program achieved significant improvements in both health of the students and a decrease in the percentage of body fat. Furthermore, the program increased physical condition in terms of speed, coordination, and aerobic resistance. In this sense, another study conducted in the United States by Kibbee et al. (2011) found that a total of 40% of Physical Education teachers implemented the active break Take 10! program in three or more sessions throughout the morning. They verified that during 10 minutes of physical activity, children burned between 24 and 43 Kcal regarding the intensity of the effort. Thus, these short bouts of physical activity can positively help the gradual deceleration of childhood overweight or obesity.

In relation to the improvement of learning, Pastor-Vicedo et al. (2019) found that by relating academic performance with active breaks in children aged 3 to 5 years, improves the learning of several curricular contents and improves the health of the students. Another study carried out in Australia at the University of Newcastle, conducted by Lloyd (2016), showed that combining mathematics with the practice of physical activity improves the concentration and academic performance of students. The program was based on High Intensity Interval Training, which combined very short intervals of maximum intensity with others a little longer to rest. In addition, the experts observed greater motivation and involvement among some students while they studied mathematics.

Regarding the improvement of the attention through physical activity, it is worth mentioning the study carried out by Janssen et al. (2014), with 10 and 11-year-old students in the Physical Education context, with the aim of knowing the effects of physical activity on the selective attention of students. A total of 123 students took part. Selective attention in the classroom was assessed before and after a 15-minute active break. After completing the study, they verified a positive effect of physical activity on selective

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attention, finding numerous improvements in scores both in passive interruptions and physical activity interruptions. Similar findings were obtained by Altenburg et al. (2016) with primary schoolchildren. This suggests that schools could implement a moderate intensity active break during the school day to optimize levels of attention among children, which in turn improve their academic performance (Liu et al., 2013). Thus, they would improve students' school performance. In the Spanish context, the study carried out by Jiménez et al. (2012) analyzed in a Primary school (Canary Islands) the attention of 1,032 students enrolled from first to sixth grade (6-12 years). The results they obtained showed significant changes in the effectiveness and productivity variables, since they observed a linear trend in the graph, finding differences according to age groups, the older the better results.

Finally, the recent study conducted by Contreras et al. (2020), implemented in two schools located in Albacete an active break program to analyze the attention and concentration of 73 students between 9 and 11 years old. They used the *d2 attention test* instrument and obtained improvements in the students' cognitive functions. Therefore, the implementation of active breaks is an adequate and useful strategy to improve the selective attention and concentration of the students, in addition to increase the motivation and improve their cognitive and academic performance.

Regarding the influence of active breaks on the cognitive dimension, specifically on attention, extant literature suggests that this influence could depend on the type of activity in terms of cognitive engagement. For example, Budde et al. (2008) and Pesce et al. (2009) found that through cognitively enrichment physical activity, students obtained more positive effects on attention than through activities based solely on simple aerobic exercise, which implies a low cognitively engaging physical activity.

Therefore, once previous research and intervention programs have been reviewed, it is possible to observe that there is enough scientific evidence that shows the several benefits that active breaks have on the health and cognitive performance among students. Also, the literature reveals that short bouts of physical activity help to improve the behavior in classroom by reducing disruptive behaviors. Moreover, students increase the levels of moderate-vigorous physical activity, which reduces the time spent sedentary, improves physical fitness and cognitive functions and finally, they learn the contents of the curriculum in a more meaningful and more playful way.

MAIN FOCUS OF THE CHAPTER

In view of the increasing role of active breaks for both promoting physical activity and academic performance, we propose in this chapter a series of activities for active breaks focused on preschool children. These activities have cognitive demands to challenge the children's brains. Such activities have been designed according to the three curricular areas established within Real Decreto 1630/2006 of Spain for Preschool stage, which are: (1) self-knowledge and personal autonomy, (2) knowledge of the environment, and (3) languages: Communication and representation. Each of these areas is composed of several blocks of contents, which will be also considered in the design of activities. Some examples are the following: body and self-image, play and movement, physical environment, and body language.

1. Area 1: Self-knowledge and personal autonomy
 - a. Block 1: the body and self-image
 - b. Block 2: games and movement
 - c. Block 3: activity and daily life

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- d. Block 4: personal care and health
2. Area 2: Knowledge of the environment
 - a. Block 1: physical environment: elements, relationships, and measure
 - b. Block 2: approximation to nature
 - c. Block 3: culture and life in society
3. Area 3: Languages: communication and representation
 - a. Block 1: verbal language
 - b. Block 2: audiovisual language and information and communication technologies
 - c. Block 3: artistic language
 - d. Block 4: body language

The activities design in this chapter correspond to two different levels of intensity (i.e., low and moderate). High intensity activities were not developed as they seem to impair the cognitive development of children according to Egger et al. (2018). Literature suggests that moderate physical activity may have more benefits on executive functions (e.g., attention, working memory, inhibition), which in turn play an essential role in the learning process and academic performance (Owen et al., 2018). As these last authors point, moderate physical activity changes the structure of the brain, since it increases the nerve cells of the hippocampus, develops the connections between the nerves, the density of neural networks and the volume of brain tissue. Such physiological changes are linked to increased attention and information processing, among others.

Each proposed activity indicates the approximate intensity of the task. However, to know the intensity of the active break in a subjective and ease way with young children, it can be measured at the end of physical activity through the EPinfant scale (Rodríguez, 2016).

The activities proposed are not be composed of fixed sessions of a certain duration but in a battery of activities that teachers or researchers can combine according to their interests and children's needs. However, a previous review recommends taking active breaks of 10 minutes as a minimum to achieve higher cognitive benefits (Janssen et al., 2014). According to this, it would be valuable to conduct two of the provided activities. Moreover, it is no necessary that the teacher who conducts the activity is PE specialist. In regard with the moment to carry out the active breaks, it can be done in any moment, although is recommendable to use the activities when the students are sitting for a long time.

As the activities are aimed at children between 3 and 5 years old, adaptations or progressions have been suggested for some activities because of the cognitive development differences between these ages.

Move Your Brain!**PROPOSAL OF ACTIVE BREAK ACTIVITIES***Table 1. Activity 1*

Activity 1	5 min
Area. Self-knowledge and personal autonomy	
Block content. Body and self-image	
Materials and resources. Blackboard	
<p>Activity. The children will be jogging in place. The teacher will combine different indications: some referring to topological relationships (top-bottom, front-back) and others referring to body parts (head, arms, feet). When the teacher says “up”, children will clap up, stretching their arms. When the teacher says “down”, children will clap down. When the teacher says “in front” or “behind”, children will clap in front or behind themselves respectively. These indications will be combined with different body parts, to which a colour will be assigned:</p> <ul style="list-style-type: none"> • Red: head • Blue: arms • Green: foot <p>An example of a combination for this activity could be the following: red, down, front, back, blue, green, up.</p>	
Approximate intensity. Moderate	
<p>Variants.</p> <ul style="list-style-type: none"> • Add as many colors and body parts as you want. • To help children, the teacher can draw a body on a mural or on the blackboard, placing the colors that correspond to each body part. • To make the task more difficult, instead of saying the colors and associating them with the body parts, it can be done in reverse. The teacher would say the body part and children would have to look for an object of that colour in class to go touch it. 	

Table 2. Activity 2

Activity 2	5 min
Area. Self-knowledge and personal autonomy	
Block content. Games and movement	
Materials and resources. None	
<p>Activity. The teacher will say different animals for the students to imitate their movements and work on different movements and balance (e.g., kangaroo: jump; snake: crawl; dog: quadruped; crab: walk with the four supports facing up; flamingo sleeping: balance with one leg; bird: move arms imitating flight; lazy bear: walk slowly). When the teacher says zoo, each student will imitate the animal they want.</p>	
Approximate intensity. Low	
<p>Variants. Introduce less common animals to add difficulty to the activity.</p>	

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Table 3. Activity 3

Activity 3	5 min
Area. Self-knowledge and personal autonomy	
Block content. Activity and daily life	
Materials and resources. None	
<p>Activity. The teacher will narrate a motor story and the students will have to move through space. Example of a motor story: <i>Start a new day! The sun is shining and from your bed, you hear the birds singing. You get up for breakfast and when you get to the kitchen you find your favorite breakfast on the table. You are so happy that you start jumping for joy. You start to eat breakfast and quickly go back to the room to get dressed for school. You put on your pants, then your shirt, and finally your sneakers. Now, it is time to go to the bathroom to brush your teeth. Now is the time to leave home! You start down the stairs (the children jog). You keep going downstairs, there are so many! You finally get to the street and start walking. You stop at a crosswalk and look to the side to check for cars. None come, so you cross. You keep walking and suddenly you find a very low bridge, so low that you must bend down to cross it. When you cross the bridge, you realize that you are a little late for school and you start to walk faster ... much faster. Far away you see a classmate and you greet him by stretching your arm while you keep walking fast. You have finally arrived at school!</i></p>	
Approximate intensity. Low	
<p>Variants. Extend the motor story as long as you want, adding more activities of daily life.</p>	

Table 4. Activity 4

Activity 4	5 min
Area. Self-knowledge and personal autonomy	
Block content. Personal care and health	
Materials and resources. Flashcards	
<p>Activity. The teacher will say or show flashcards that represent the following healthy or unhealthy and hygiene habits. Children will have to differentiate whether it is a healthy / unhealthy habit or a good / unsuitable hygiene habit. If it is positive, children will jump and if it is negative, they will crouch.</p> <ul style="list-style-type: none"> • Brush your teeth. • Drink coke every day. • Eat fruits and vegetables every day. • Do sports and physical activity. • Eat lots of sweets. • Wash hands before eating. • Sleep a few hours a day. • Eat slowly and chew carefully. 	
Approximate intensity. Moderate	
<p>Variants. Introduce or delete cut as many health and hygiene habits as you want.</p>	

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Table 5. Activity 5

Activity 5	5 min
Area. Knowledge of the environment	
Block content. Physical environment: elements, relationships and measure	
Materials and resources. None	
<p>Activity. Through mime, the teacher will represent different geometric figures (triangle, circle, and square) with their hands. Each of these figures will be associated with a specific movement, which will be the one that the children must do:</p> <ul style="list-style-type: none"> • Triangle: jump. • Circle: turn. • Square: open and close the legs by jumping (jumping jacks) 	
Approximate intensity. Moderate	
<p>Variants. To add more complexity to the activity, the teacher can say a number before representing the geometric figure, so the students will have to repeat the movement associated with that figure as many times as the teacher indicates. For example: 2 means that students have to jump twice.</p>	

Table 6. Activity 6

Activity 6	5 min
Area. Knowledge of the environment	
Block content. Approximation to nature	
Materials and resources. None	
<p>Activity. The teacher will use audios with sounds that represent different phenomena of the natural environment (rain, wind) and moments of the day (morning, night). In the latter case, sounds of birds singing can be used to symbolize the morning and sounds of crickets or owls to symbolize the night. Each sound will be associated with a movement, as indicated below:</p> <ul style="list-style-type: none"> • Rain: students raise their feet and stomp on the ground (they will stomp). • Wind: students move their whole body freely. • Night: students lie on the floor. • Morning: the students walk through space. 	
Approximate intensity. Low	
<p>Variants. To ease the activity, the teacher can mention natural phenomena and different times of the day instead of using sounds.</p>	

Table 7. Activity 7

Activity 7	5 min
Area. Knowledge of the environment	
Block content. Culture and life in society	
Materials and resources. None	
<p>Activity. The teacher will indicate different professions for the students to represent them through mimicry. Some examples of professions can be the following: singer, dancer, driver, soccer player, cook, street sweeper, policeman.</p>	
Approximate intensity. Low	
<p>Variants. The teacher can imagine as professions as he/she wants.</p>	

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Table 8. Activity 8

Activity 8	5 min
Area. Languages: communication and representation	
Block content. Verbal language	
Materials and resources. Flashcards	
<p>Activity. Half of the children will carry a flashcard with images of objects, animals or food in their hands. The other half of the children will carry in their hands a flashcard with the written word of the same objects. Children have to move through the classroom and looking for a partner that corresponds to them. Once they meet, they must hold hands and jump together to the place the teacher indicates to deposit the flashcards. Some examples of words can be bed, bread, sun, duck, ball, cat ...</p>	
Approximate intensity. Low	
<p>Variants.</p> <ul style="list-style-type: none"> • Use longer or more complex words to make the activity more difficult. • To simplify the task, use the initial of the name of the images, instead of the whole word. For example: a child bearing the image of a <i>bee</i> should join a child bearing the letter “B”. 	

Table 9. Activity 9

Activity 9	5 min
Area. Languages: communication and representation	
Block content. Audiovisual language and information and communication technologies	
Materials and resources. Flashcards	
<p>Activity. The students in the class will be divided into groups of 4 or 6 students and will get together in pairs. The children will be placed in pairs and united by the hand, in a place of the class. Far from that place, pictures of different technological devices (camera, television, tablet, and computer) will be placed on the floor. Each group will have flashcards with different devices or accessories that are associated with each of the technological devices mentioned. For example:</p> <ul style="list-style-type: none"> • Camera: photography and tripod. • Computer: mouse, keyboard, and USB. • Television: remote control • Tablet: pen <p>In this activity, students will be in pairs and will choose a flashcard. Then, they will run to reach the other end of the class and place it on top of the technological device with which it is associated.</p> <p>* It is recommended that this activity be done outside the ordinary classroom, where there are fewer materials that can limit the movement of children.</p>	
Approximate intensity. Moderate	
<p>Variants. Some technology devices can be removed or added.</p>	

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Table 10. Activity 10

Activity 10	5 min
Area. Languages: communication and representation	
Block content. Artistic language	
Materials and resources. Musical instruments	
Activity. The teacher, by using instruments and body percussion, will mark loud or soft sounds. Students should move through the classroom with fast movements if the sound is loud and slow movements if the sound is soft.	
Approximate intensity. Low	
Variants. The teacher can change the material used as an instrument.	

Table 11. Activity 11

Activity 11	5 min
Area. Languages: communication and representation	
Block content. Body language	
Materials and resources. None	
Activity. Lines of four to five students will be formed. The first in each row will be facing the teacher and the others will be facing away. The teacher will make some body movements that the first children must memorize and pass them on to their partner from behind. Each child will teach the learned gestures to the next partner. When the last child in line has learned the steps, he will go out to act them out in front of everyone, to check if they correspond to those the teacher has taught.	
Approximate intensity. Low	
Variants. Design an easier or more difficult sequence of movements according to the age and level of the students.	

FUTURE RESEARCH DIRECTIONS

As a prospective investigation, the application of the activities to a real context is recommended, with the purpose of knowing its strengths and weaknesses. On the other hand, it would be interesting to see if this active break activities help to improve some of the variables mentioned in the introduction of this article, such as attention, motivation, improved behavior or curricular knowledge of the student. Finally, it is also necessary to mention the possibility of using the activities longitudinally (once a trimester, for example), to check if these possible improvements obtained are maintained throughout the school year.

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Move Your Brain!**KEY TERMS AND DEFINITIONS**

Active Break: Short bouts (5-15 min) of physical activity included in the school schedule that offer pupils more time of physical activity without reducing their learning time.

Attention: Behavioral and cognitive process of selectively concentrating on a discrete aspect of information, whether considered subjective or objective, while ignoring other perceivable information.

Cognitively Engaging Physical Activity: Physical activities in which cognitive functions play a key role.

Curricular Areas: The learning sections in which the curriculum is divided.

Executive Functions: Set of cognitive processes that are necessary for the cognitive control of behavior: selecting and successfully monitoring behaviors that facilitate the attainment of chosen goals.

Physical Activity: Any bodily movement produced by skeletal muscles that require energy expenditure.

Preschool Stage: It is an early childhood program in which children combine learning with play in a program run by professionally trained adults. Children are most commonly enrolled in preschool between the ages of three and five, though those as young as two can attend some schools.