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The influence of non-active lockdowns on children's motor development through SARS-CoV-2 pandemic

Carmen Magdalena Camenidis[1*], Irina Băiţel[2]
[1] University of Pitesti, Faculty of Physical Education, Sport and Computer Science, Pitesti, Romania
[2] Theoretical High School 'Dante Alighieri', Bucharest, Romania

Corresponding author: mcamenidis@yahoo.com

Abstract.
While the SARS-CoV-2 pandemic took the whole world by surprise, humanity sought to organize itself in the fight against an unseen enemy by now. The school has moved into the online teaching system, and physical education classes have not been nearly what they used to be. **Purpose:** In this study, we tried to investigate how children's motor development was influenced due to lack of physical activity because of school closure during the pandemic in order to know if it has influenced the weight of children by collecting data on body mass index (BMI). **Methods:** the anthropometric and motor capacity measurements; the method of comparing the results obtained with those of the National 'Biomotric project'; the bibliographic studying; the data collection; the graphic representation and the data analysis and interpretation. The study subjects/participants were 119 boys and 85 girls aged between 7-14 years old. **Results:** We measured the motor development before the pandemic (AP), respectively February 2020, and during the pandemic (DP), respectively October 2020. The item categories represent the data collected from the motor tests applied to the children when they were physically present at schools, such as mobility, long jump from the spot, abdominal crunches, and speedrunning tests on the following distances: 25m for 1st grade, 30m for 2nd to 4th grade and 50 m for 5th to 8th grade. We chose to refer to the value of the median in order to eliminate, as much as possible, the influence

of the extreme values recorded. **Conclusions:** There are minimal differences between the results obtained in the tests before the pandemic and those during the pandemic period. Although we would have expected the influence of non-active lockdown to be more significant than when schools were opened, in the sense of decreasing children's motor skills, it can be seen that this was not the case for students from Maarif International Schools of Bucharest.

***Keywords**:* body mass index, motor behavior, motor capacity, physical education, online teaching,

Introduction

On 11th March 2020, the World Health Organization (WHO) officially declared the pandemic when the WHO Director-General said, we have therefore assessed that COVID-19 may be characterized as pandemia [...] we experience never underwent a coronavirus-provoked pandemic previously. This is the initially coronavirus-triggered pandemia. (Ghebreyesus, 2020).

Studies have begun to appear around the world showing that the number of children with obesity has increased during the pandemic (Almandoz et al., 2020; Baysun & Akar, 2020; Bănuţ, 2021; Browne et al., 2021; Cuschieri & Grech, 2020; Glabska et al., 2020; Kang et al., 2021; Stavridou et al., 2021). Also, other studies have highlighted the negative impact of frequent use of smart electronic devices on the development of children (Szabo et al., 2019a).

According to Dragnea & Bota (1999, p.136), Avramescu (2006, p. 248), the students are subjected to increased demands, which are felt differently depending on their biological development influenced by the integration in the school environment with broad resonances in psychic, personality, and affective area as well.

According to Bănuţ (2021), 'social distancing, along with strict hygiene measures, has proven effective in reducing the transmission of this virus from person to person and has undoubtedly saved many lives'. However, longer time spent at home, online schooling, or working from home has led to lifestyle changes. Perhaps, the children ate more and messy and indeed became more sedentary

than before the pandemic state. In children, the initial complications associated with obesity may include gait or back pain, impaired puberty (in girls with early puberty, in boys with delayed puberty), anxiety, behavioral changes, and so on. After a few years of the evolution of obesity, children will begin to have varying degrees of hepatic steatosis, high blood pressure, and type II diabetes (Bănuţ, 2021). Lack of sports practice that implies group cohesion and socialization (Sopa & Szabo, 2015; Pomohaci & Sopa, 2018), like volleyball (Szabo & Sopa, 2015; Szabo, 2015, Sopa & Pomohaci, 2018, Szabo et al., 2019b), has led to low capacity of social integration and precarious motor development (Sopa & Szabo, 2014).

A new word, *'covibesity',* was even invented (Khan & Moverley, 2020) that needs swift, effective, comprehensive management involving multiple stakeholders. This phenomenon refers to the rapid weight gain that occurred in some people during the SARS-CoV-2 pandemic.

In Romania, in 2020, all physical activities and school competitions in which students participated have been canceled. Also, this year will remain in the history of the field of Sports Science and Physical Education for the challenge of having conducted in the online system all the lessons of physical education and sport.

For the first time, we faced the lack of a platform with educational resources specific to our field. Thus, we as teachers began to search the internet for methodologies or examples, which we can use in this new type of online teaching of our discipline.

According to Dănăilă & Golu (2000, p.33), the motor behavior of students 'represents the main driving force of the development and improvement of neural structures,' and 'the optimal range of educability for psychomotor skills is between 6 and 10 years' (Horghidan, 2000, pp. 119-121) because it will generally be 'anticipatory and not reactive' (Rosen, 2012, p.357).

According to Epuran (2011, p.75), 'the multitude and variety of exteroceptive, proprioceptive and interoceptive information are analyzed, interpreted, and organized in the cerebral cortex system […] based on which answers can be generated, both stereotypical, for ordinary situations, and unique, creative answers for new situations'.

As Ifrim & Niculescu (1988, p.147) states, 'the nervous system transforms stimuli from the environment into movements either defensive or adaptive, depending on their nature and intensity, making engrams formation (neural fingerprints from the action of stimuli), memorizing them, learning and education.

Other authors state in their books that the child's physical development depends mainly on 'hereditary baggage and environmental conditions, especially economic and social (Gurău, 1994, p.230) so that physical exercise promotes average growth and harmonious development their practice accordingly. Natural factors such as air, sun, and water 'harden the body and increase its power to adapt to environmental conditions and resistance to their sudden changes' (Ionescu, 1994, p.52).

By involving children in physical activities, the 'predominance of cortical arousal causes external stimuli to produce motor reactions' of faster adaptation when these exercises are continuously changed, coordinated, and balanced by the PE teacher (Dragnea & Bota, 1999, p.136). The same author states that 'motor skills at this stage are overflowing, motor learning ability is remarkable, but the possibilities of fixing new movements are reduced […] the systematic repetition integrates and stabilizes the new structure in the child's motor development so that the fundamental motor skills are subjected to a process of consolidation-improvement '.

According to Gagea (1994, p.357), muscle contraction changes 'the initial positions of body segments, moving according to all the classical rules of levers and according to the principles of conservation of momentum, power, and energy so that by structural anticipation, we will observe how the movement is structured (cf. Hillerin, 2021).

We think that doing physical activities is the main argument for improving and supporting physical activity to maximize the beneficial effects on the human body.

From a psychological perspective, there is a definition of the term motor intelligence, which 'expresses the result of the interdependence between motor skills and reasoning [...] which usually operates at the sensorimotor level and involves adapting to specific

data of a situation, based on reporting spatial-temporal and the possibilities to reorganize them in an efficient way' (Dragnea et al., 2006, p.6).

As it is known, the planning of the teaching contents was made at the beginning of the academic year 2019-2020, considering the official school curricula for each year of study in the Romanian education system. Therefore, in March 2020, when this system switched to online teaching, we had to adapt quickly, according to the age of the students, these contents to be able to achieve the general competencies.

What is known from the practice of teaching in students' lessons is that the children's motor skills are similar, while the level of assimilation and the peaks reached in motor learning are different in children in the same grade. Through the creativity of teaching strategies, the PE teacher also tries to consider the children's reaction to effort, the level of their motivation, habits, and attitudes native or acquired in the family, so that individual motor talent is improved during lessons at school.

To compare the motor capacity of a child with another 10 or 20 classmates only with the results obtained in a test or test from the school curriculum and not from a series of tests in total, with equivalent to the teacher's lack of understanding of the learning process for a period that does not produce a predictable result from the programming mode at the beginning of the school year.

According to Aagten-Murphy et al. (2019, p.8) and Davidenko et al. (2018), the potential mechanisms of visual perception (Brenton & Müller, 2018) are generated by the eyes saccade during the following of an object. The authors conclude that 'the perceptual system will anticipate that the visual landmark would be after the eye movement executed correctly being used to calibrate the visual space and the auditory space in the eye movements'. In physical education lessons with physical presence at school by comparison with video cameras constantly closed by students in the online teaching system, a real help in increasing attention and developing the mechanism of structural anticipation in children is also following and correcting the exercises demonstrated by PE Teachers.

As it knows, the anticipation in motor behavior shows that it is 'controlled by perception, given that visual perception serves behavior' (Gibson, 2015, p.213) confirms what Nadin (1986) stated that 'it is true that perception involves global information (sometimes accidental, entropic, unstructured) while the emission is directed, structured, essential, and 'the sensory data analysis (also called perception) cannot be significant unless we correlate sensory information with action' (Nadin, 2003).

According to Botezatu (2013, p.57) who states, in the context in which anticipation refers to the triggering of a response to a situation before it occurs, it can be defined as a 'configuration of the elements, so it can trigger the preparation of an action based on internal or external clues. Anticipation is considered a crucial factor in acquiring motor skills, which involves the presence of proactive control'. This configuration or preparation can be done through planning, which explains the variables that must be affected by our actions and the nature of their relationships.

Children's choices about whether and how an object is accessible, as well as what kind of motor skills should be used (for example, whether the object is caught with one or two hands or sports equipment), are scaled to the anthropometric properties of the person (Wagman et al., 2020, p.140). Also, at this age, the correct effort adjustment in the antepubertal children, with the avoidance of overload or underload, 'should ensure a complete capitalization of the real effort capacity and increased possibilities of progress' (Avramescu et al. 2006, p.240; Dragnea & Bota, 1999, p.138; Ionescu, 1994, p.52).

The use of movement games by children, both during classes and outside them but also during school holidays, develops their capacity for effort. Children will improve their baggage of qualities and motor skills present throughout the game. From a mental point of view, they will develop a robust, balanced, mobile nervous system, a remarkable ability to concentrate attention and resistance to stress and mental fatigue, operational, concrete thinking as well as good visual-motor coordination, excellent general reactivity, coordination good psychomotor skills, perseverance, perseverance,

speed, and efficiency in the analysis of unforeseen situations and decision making, the spirit of anticipation. Also, all these factors of child development (physical, technical, tactical, theoretical) 'have an appreciable psychological load and it is natural to be so because any means or technique addresses a man and leads to his improvement' (Epuran, 1980).

Even if the academic year 2019-2020 ended in June 2020, the restrictions imposed by the Romanian government have continued during the students' summer vacation. Thus, the new academic year 2020-2021 was opened only for schools that did not register positive Covid-19 tests among students nor teachers. This allowed us to continue at the International Maarif Schools of Bucharest in October 2020, evaluating the children's bio-motor potential from 1st to 8th grade. The concept of biomotor potential' belongs to the Romanian researchers Nicu Alexe, Virgil Mazilu, and Alexandra Focşăneanu, who used it for the first time in 1970 of the first edition of his research and who understood that both somatic and motor components must be measured in children at the same time as well (Băiţel & Camenidis, 2019).

Method*s*

The research hypothesis was as follow: the physical activity, as an external factor, should be able to influence the weight and results of motor tests measured objectively in the pre-pandemic period (AP) and during the pandemic period (DP).

The main research methods used were as following: the anthropometric and motor capacity measurements; the method of comparing the results obtained with those of the National 'Biomotric project'; the bibliographic studying; the data collection; the graphic representation; method of data analysis and interpretation.

The study subjects/participants were 119 boys and 85 girls aged between 7-14 years old.

Results

After performing the measurements and calculating the BMI corresponding to the mean and median values for each item category, we established a marking scale for each of them.

The item categories represent the data collected from the motor tests applied to the students when they were physically present at schools, such as mobility, long jump from the spot, abdominal crunches, and speedrunning tests on the following distances: 25m for 1st grade, 30m for 2nd to 4th grade and 50 m for 5th to 8th grade.

The highest mark, respectively 10, corresponds to the data collected, which are included in the value ranges of the most significant number of subjects in each age category registered on the BIOMOTRIC program platform (http://www.biomotric.ro) in the school year 2017-2018.

To decrease a point, which represents a weak value of the data collected from the applied tests, we used the same reference compared to the values registered on the National Institute for Sport Research (NISR).

We chose to refer to the value of the median in order to eliminate, as much as possible, the influence of the extreme values recorded.

The values obtained and the marks awarded are presented in the following tables:

Table 1. Characteristics and marks – 1st to 4th grade Boys

Source: original data resulting from research

Boys	BMI	Mark BMI	Mobility	Mark Mobility	Long jump	Mark Long jump	Crun-ches	Mark Crunches	Run-ning	Mark Running
1st grade AP	15.34	10.00	-3	9	103	9	15.0	10.0	6.75	9.0
1st grade DP	16.32	9.00	-10	7	120	10	14.0	9.0	7.91	8.0
2nd grade AP	16.38	9.50	-2	10	116	10	18.0	10.0	7.58	10.0
2nd grade DP	16.84	9.50	2	10	117	10	18.0	10.0	6.88	
3rd grade AP	17.34	8.50	6	10	132	10	23.0	10.0	5.86	10.0
3rd grade DP	17.29	8.50	-4	9	116	10	21.0	10.0	7.75	8.0
4th grade AP	18.84	8.00	-1	10	123	10	22.0	10.0	6.98	9.0
4th grade DP	19.67	7.50	-5	9	140	10	19.0	10.0	8.88	7.0

Note: AP=ante-pandemic period; DP=during pandemic period

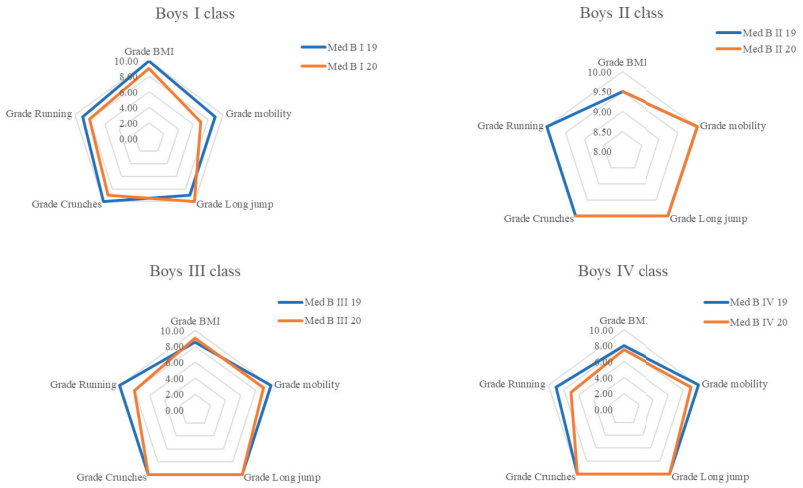

Figure 1. The boys' graph representation for 1st to 4th

Source: figure arising from the original research activity

Table 2. Characteristics and marks – 1st to 4th-grade Girls

Source: original data resulting from research

Girls	BMI	Mark BMI	Mobility	Mark mobility	Long jump	Mark Long jump	Crunches	Mark Crunches	Running	Mark Running
1st grade AP	16.55	9.00	1	10	79	6	13.0	10.0	7.56	9.0
1st grade DP	16.98	9.00	-3	9	89	8	12.0	10.0	8.04	8.0
2nd grade AP	16.13	10.00	6	10	96	10	17.0	10.0	7.60	10.0
2nd grade DP	15.87	10.00	2	10	101	10	16.0	10.0	7.44	9.5
3rd grade AP	16.23	10.00	2	10	117	10	19.5	10.0	6.06	10.0
3rd grade DP	17.11	8.00	-4	9	103	9	18.5	10.0	7.81	9.0
4th grade AP	18.67	7.00	1	10	5	7	14.1	8.0	7.49	9.0
4th grade DP	17.59	8.00	0	10	130	10	19.2	10.0	8.72	8.0

Note: AP=ante-pandemic period; DP=during pandemic period

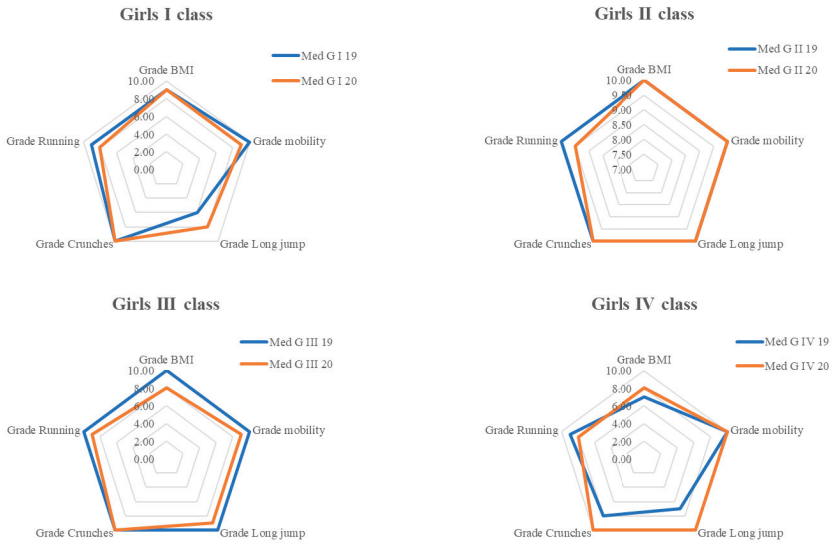

Figure 2. Girls graph representation for 1st to 4th grade

Source: figure arising from the original research activity

Table 3. Characteristics and marks – 5th to 8th grade Boys

Source: original data resulting from research

Boys	BMI	Mark BMI	Mobility	Mark Mobility	Long jump	Mark Long jump	Crunches	Mark Crunches	Running	Mark Running
5th grade AP	19.81	9.00	-3	9	143	8	23.0	10.0	10.78	8.5
5th grade DP	18.72	10.00	-3	9	133	7	23.5	10.0	9.40	9.0
6th grade AP	23.77	5.00	-9	7	136	8	27.0	10.0	10.58	8.5
6th grade DP	21.21	7.00	-16	3	127	6	23.0	10.0	9.76	9.0
7th grade AP	20.84	8.00	-6	8	177	10	24.5	10.0	8.86	10.0
7th grade DP	21.82	7.00	-3	9	170	10	27.0	10.0	9.09	10.0
8th grade AP	21.15	8.50	-2	10	176	10	27.0	10.0	8.69	9.0
8th grade DP	25.92	6.00	-6	8	175	10	23.5	10.0	8.81	9.0

Note: AP=ante-pandemic period; DP=during pandemic period

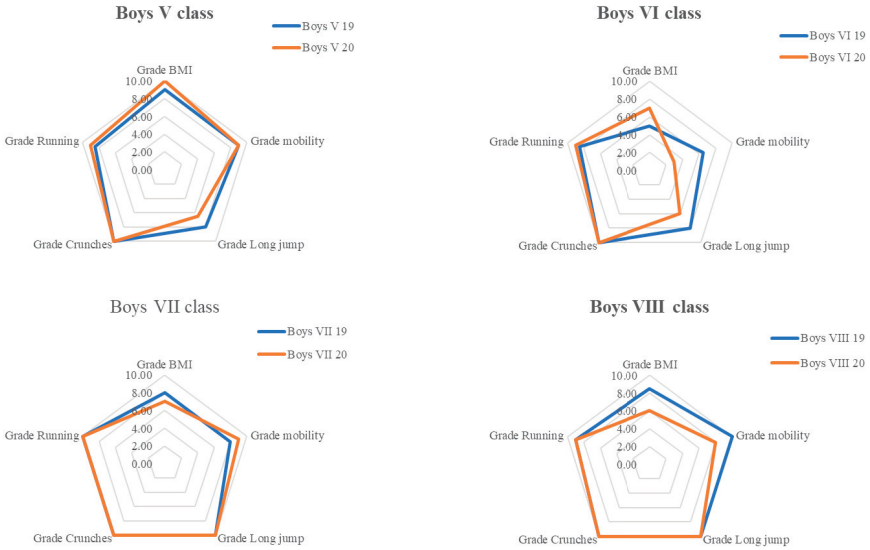

Figure 3. The boys' graph representation for 5th to 8th grade

Source: figure arising from the original research activity

Table 4. Characteristics and marks – 5th to 8th-grade Girls

Source: original data resulting from research

Girls	BMI	Mark BMI	Mobility	Mark Mobility	Long jump	Mark Long jump	Crun-ches	Mark Crunches	Running	Mark Running
5th grade AP	16.58	10.00	-4	9	104	5	20.0	10.0	11.46	8.5
5th grade DP	17.52	10.00	-6	8	120	7	20.0	10.0	10.23	9.5
6th grade AP	21.19	8.00	-6	6	114	4	21.0	10.0	11.99	7.0
6th grade DP	17.89	10.00	-1	8	127	7	21.0	10.0	9.75	9.0
7th grade AP	20.08	8.00	-6	6	166	10	19.0	10.0	10.66	8.0
7th grade DP	20.76	8.00	-3	7	134	9	25.0	10.0	10.65	8.0
8th grade AP	21.51	9.00	-6	8	136	9	18.0	10.0	9.10	9.0
8th grade DP	19.38	10.00	-5	8	135	9	20.5	10.0	9.18	9.0

Note: AP=ante-pandemic period; DP=during pandemic period

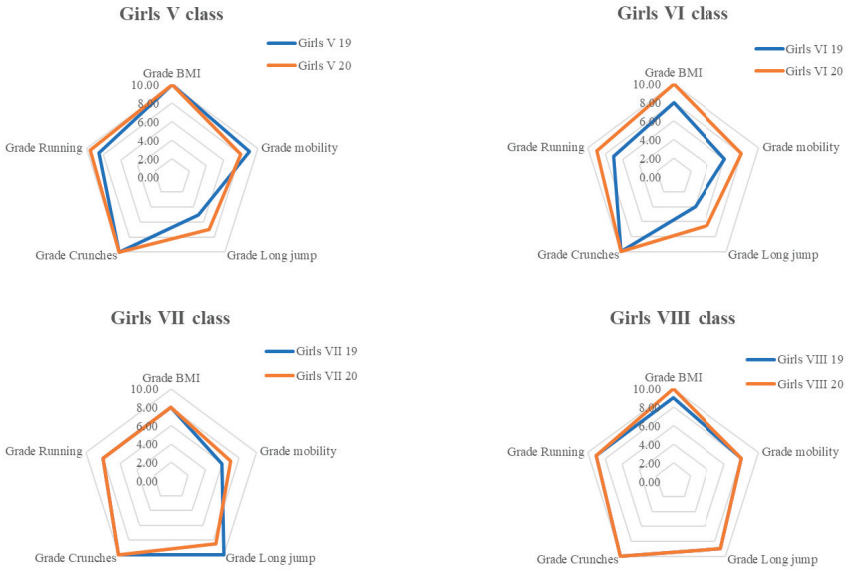

Figure 4. Girls graph representation for 5th to 8th grade

Source: figure arising from the original research activity

Discussions

Unfortunately, in November 2020, positive cases of Covid-19 appeared in our school as well, so the school had to transfer the entire didactic teaching-learning process to the online system until May 2021, when the students returned physically to school.

The complexity of assessing the bio-motor potential of students through the program with the same name did not allow us to collect data in a short time to be presented in this article as a post-pandemic period analysis of it.

Conclusions

There are minimal differences between the results obtained in the tests before the pandemic and those during the pandemic period.

Although we would have expected the influence of non-active lockdown to be more significant than when schools were opened, in the sense of decreasing children's motor skills, it can be seen that this was not the case for students at Maarif International Schools of Bucharest.

We believe that the main determining factor in this situation could be the diversified educational resources applied in online physical education classes. We could say that, despite the online system to which we quickly adapted and taught for 11 months, the physical education lessons were different from the classic ones, and yet they managed to achieve their primary goal, which is to maintain and even to improve the motor qualities and overall motor skills of our students.

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