

ERGONOMIC ISSUES AT THE SCHOOL ENVIRONMENT IN GREECE

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SHORT COMMUNICATION

Abstract The classroom is the most important place for students and teachers. In an ideal yet realistic scenario, by choosing ergonomic furniture, the classroom can be transformed into a positive work environment, with learning and personal development at the center and the creation of a diverse and flexible space, supporting the various needs and abilities of both students and teachers.

1. INTRODUCTION

Today, we know that the natural environment in the classroom is of great importance for learning. Good posture, lighting, temperature, acoustics, ventilation and a flexible environment that creates variations, improve well-being and facilitate the maintenance of a high level of concentration [1]. But it is a fact that many students – although school is their workplace – do not have the opportunity to work properly, using furniture unsuitable for their age and height. In addition, the variation in height between different students in a class can be significant and also, the same room can be used frequently by different classes of students, with large variations between heights. It is therefore important to design and supply regulated solutions and products.

In addition, children spend many hours a day at the computer, playing video games and reading in the office for their lessons. There is inevitably a discrepancy between the body size of children and the size of furniture and computer equipment. The challenges we have to face in dealing with the prevention of stress in children are many and concern elements such as the diversity of their body size, their growth rate and the high prevalence of obesity, but also differences between them in physical abilities and strength, as well as in cognitive characteristics.

We see a lot of diversity in second-graders, with girls growing up faster than boys. Childhood obesity has tripled from the 60s to 2000s, with children aged 6-11 increasing from 4% to 16% over the decades and those aged 12-19, from 5% to 16%. The physical strength capacity appears greater in boys than in girls, after 10 years, with a greater difference after 16 [2]. The strength capacity of children is often overestimated and during their involvement in sports from an early age, there is a

risk of injuries and stress syndromes, which can affect their development. At the same time, children want to do activities that they like and tend to exaggerate with them, be it sports and games or other cognitive activities, such as surfing the internet, video games, mobile, etc.

It is fundamental that children are taught proper biomechanics from an early age, understand and feel their body in relation to their correct posture in each activity, in order to consolidate the right standards, which are organized in the brain as motor learning, from about 7 years of age.

2. THE SCHOOL BAG ISSUE

The use of the school bag is a dynamic activity of the child, which includes the whole process of loading and transporting, with all that this entails for his musculoskeletal system. Studies in the USA, show more than 40 million children, carrying their school material in backpacks, with several thousand musculoskeletal injuries and 23% of elementary school students and 33% of high school, reporting back pain. Trolley bags are suggested as an alternative. In our study on backpack charges compared to trolley bags [3], we saw how students in smaller grades of elementary school (1st-2nd grade) prefer trolley bags over older students (5th-6th grade), who prefer shoulder bags. Among students of middle grades (3rd – 4th grade), the percentages are shared. In relation to the site of onset of pain, it was observed that students with a shoulder bag, in the majority of them reported pain in the shoulders, 54.7%, in the lumbar spine, 6.7%, in the thoracic spine, 4.0% and 34.6% did not report pain, while those *with trolleys* only 17.6% reported pain in the shoulders, elbow 9.9%, wrist 8.8% , in the lumbar spine 6.6% and 57.1% reported no pain. It is clear that wheeled bags are less stressed and easier to use, especially for distance transport, as long as they have the ability to adjust their arm, so that they are attracted by a suitable grip height, depending on the size of the child. The factors that can cause musculoskeletal injuries in children due to backpacks, are mainly the greater than normal weight and the long time and distance of transportation. The maximum weight of the bag should not exceed 15% of the child's body weight (Table 1) and studies show that on average, high school children carry bags about 7.0 kg, while high school children carry about 6.3 kg.

Table 1. A 15% of the child's body weight, is the optimum weight for the school bag. **No one should carry a bag larger than 11.5 kg.

Weight of person	Maximum bag weight
27 kg	2.5 kg
27 – 35 kg	4.5 kg
45 kg	7 kg
57 kg	8 kg
70 kg	10 kg
>90 kg	11.5 kg**

3. THE FURNITURE ISSUE

Over 83% of primary school children sit on school furniture that is not suitable for their physical height and spend a total of about 9 hours a day in a sitting position. The majority of school furniture is aged and does not comply with the minimum orthopedic - physiological needs of children, with traditional chairs being rigid, with a posterior tilt and causing a position of curvature in the child's spine. Thus, we have phenomena of poor blood circulation in the areas that come into contact with the hard chair (back, legs), kyphotic position (hunchback) with tension in the shoulders and neck and compression in the abdomen area and internal organs. At the same time as sitting, we find in the classroom flat desks (without inclination), which accentuate the kyphotic posture and increase the bending of the head, with the risk of alterations in the neck of children, discomfort and headaches.

4. THE TEACHERS

At the same time as the students, the teachers share and use the classroom, with a two-way and feedback process of coexistence. Before the pandemic, one of the most common types of injuries that led teachers to absences and reparations due to illness, was overuse syndromes, as a result of prolonged standing, writing on the board, grading and using the computer. In addition, teachers embrace and are subject to various psychosocial factors, which accompany the importance of their function, with increased stress, a sense of responsibility and choices of teaching, as well as all kinds of interpersonal contacts with students and their relatives. Inevitably and sometimes graded according to the level of education, they suffer from pathologies from the other systems of their organism.

5. THE CLASSROOM ISSUE

The classroom is the space that encloses all the above, delimits and imposes practices and regulations and as such a factor, it should be designed to be functional. The placement and orientation of desks in relation to the teaching point has been shown to play an important role in preventing both students' musculoskeletal stresses, as well as their cognitive and emotional performance. At the same time, it works accordingly positively on the part of the teacher, who should have continuous and unhindered visual contact with each student and with the whole class, thus minimizing unnecessary movements and movements within it. We therefore propose the placement of the desks in a "fishbone" layout (Figure 1), with the board and the teaching point located at the top and center, so that each student, placed on his desk, is not forced to a prolonged turn of the head and torso to attend the teacher.

Similar studies have shown one-sided very increased tension in the neck muscles, when watching with the head turned and in different extreme positions of the eyes, while the torso is oriented in front (horizontal desks) [4]. In addition to muscle strain, which is also transferred to the muscles of the torso of children at risk of pain and malformations, we have a manifestation of discomfort during teaching hours. Because of this, increased values of cortisol (stress hormone), a decrease in testosterone, poor mood and decreased ability to concentrate and cognitive processing have been measured.

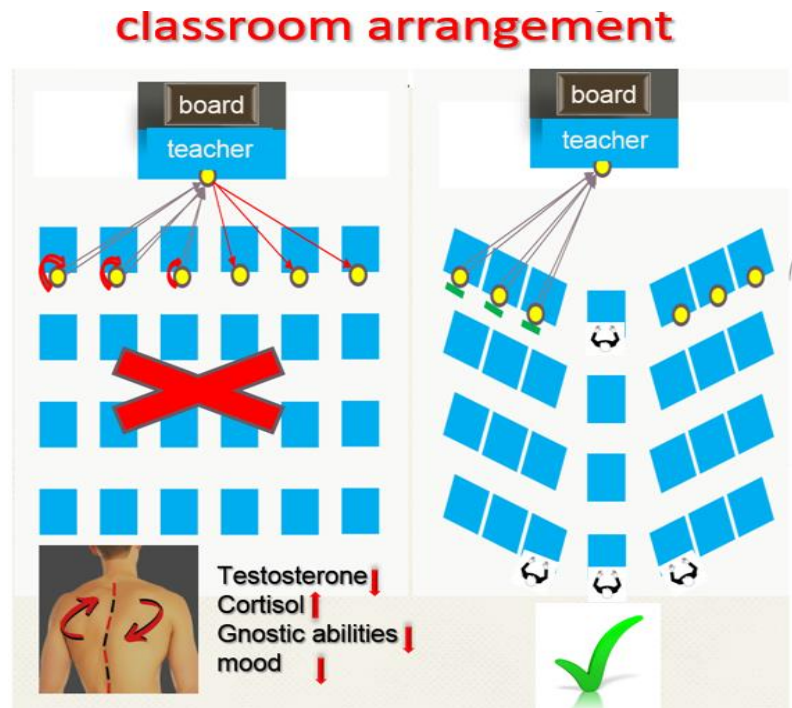


Figure 1. The proposed classroom arrangement, for less MSK and mental stress, for students and teachers.

6. CONCLUSION

All these stressors of the students, such as the bag, the furniture, the hypoactivity and the lack of exercise, lead us to a situation of our children, under constant struggle with their environment, which is not consciously perceived by them, since childhood and young age blur the feeling. Even more so, they are beyond the perception of the parents themselves and the specialists in the field of education, resulting in inefficiency.

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