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Charilaos Zaragas, Efi Theodoropoulou

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Students' motor attitude during the lesson and the effect of school furniture.

Charilaos Zaragkas & Efi Theodoropoulou
Department of Early Childhood Education, University of Ioannina

Abstract

The aim of the research is to study the sedentary attitude of Greek male and female students during lessons, through the opinions of primary and secondary school teachers. Opinions will be probed on various methods that teachers have already used or hesitated to use in order to reduce sedentary attitude during class time. The methods that will be referred to are the use of adapted desks and chairs, the alternation of motor positions and sitting activities and the training of the students by the teachers about the correct body posture "orthosomia". Additionally, reference will be made to the appropriateness of the school furniture, the correct physical posture of the students and the involvement of the teachers in this. The research was carried out with a related questionnaire of open and closed questions to 396 Greek teachers. The statistical analysis of the responses was done through the SPSS program and the 95% confidence interval. According to the teachers, the school furniture in most cases is not compatible with the physical dimensions of the students and there are no adjustable desks in the classrooms. The possible presence of standing desks seems likely to be accepted by the educational public, although they present various difficulties in their implementation. Difficulties in its application appear while alternating between physical and sedentary activities during lessons. This difficulty increases: a) from the increase in the number of students in the class, b) from the lesson plan and c) from the fear of causing confusion. The "orthosomia" of the students is important, according to the teachers' statement, as it is considered of paramount importance for their musculoskeletal development, while they themselves recognize their own responsibility for this, arguing that the students' orthosomia contributes to increasing their performance. Finally, teachers state that school furniture is not discussed at conferences and seminars, and they themselves are interested in attending such seminars. It is suggested to continue the research on alternative ways of teaching with the aim of "orthosomia", the pleasant mood and the maximization of learning performance.

Key-words: Upright posture, orthosomia, sedentary attitude, school desks, motor attitude

Correspondent Author: Charilaos Zaragas, Department: *Department of Early Childhood Education*, University: *University of Ioannina*
e-mail: hzaragas@uoi.gr
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Introduction

Sedentary attitude is defined as any conscious attitude in which the individual does not waste more than 1.5 metabolic equivalents (MET) from sitting, leaning or prone (SBRN, 2017). The metabolic equivalent (MET) is equal to the energy expended by a person at rest (Corbin, 2002). The activities encompassed by the concept of sedentary attitude are the use of electronic devices, reading, writing, drawing, working hours or school hours and transportation by any means that requires the person to be in a sitting position as well as the activities involved in larger age range. These types of motor attitude are responsible for obesity, type 2 diabetes, cardiovascular disease, and premature death. Also, if the person spends a long time in inactivity, the body has difficulty controlling sugar, regulating blood pressure, and breaking down fat. The consequences are not only physical but also mental as the effect of sedentary attitude is generally negative since the risk of developing depression or other mental disorders is higher. The only way to reduce this attitude is to increase physical activity (Tremblay et al., 2017).

Physical activity, which is characterized by movement produced by skeletal muscles, achieves energy consumption and accelerates the heart rate. It manifests itself with mild, moderate, and high intensity depending on the effort made by the person (WHO, 2022).

The World Health Organization (WHO) recommends, depending on the age, the time that the person should have physical activities. According to the recommendations of WHO, in 2022, it is recommended for adults and the elderly 60 minutes/week while for children and teenagers at least 60 minutes/day. The benefits of physical activity are not only physical, but such also as reducing or controlling weight and metabolism. More specifically, from recent recommendations of the American Center for Disease Control and Prevention, benefits are located for children in academic performance, as attention and memory are improved, as well as brain health, muscle and bone condition are strengthened, and the risk of depression is reduced. Also, physical activity plays an important role in cardiometabolic health by keeping blood sugar and blood pressure at normal levels. Finally, it has long-term effects on good health, reducing the occurrence of chronic diseases such as diabetes or obesity and clearly helps control body weight and reduces body fat.

Upright position (orthosomy) refers to the ability to keep the head, neck, chest, and abdomen in a vertical balance so that the weight is transmitted to the pelvis and from there to the limbs, achieving the least strain on the muscles, tendons, and ligaments. It is also related to the ability of joints and other anatomical elements to be held in position so that the weight is as small as possible (Kourou, 2022).

Students are at school for at least 7 hours/day, and if a student participates in the full-day program, it reaches 9 hours/day at school, while extracurricular activities that encourage sedentary tutoring or Stude center, etc. and the hours the students stay home are not counted. Staying for long hours at static tables and chairs is associated with musculoskeletal disorders, poor posture causing back and neck pain. Thus, maintaining proper sitting posture is key to avoiding musculoskeletal conditions such as neck, shoulder, arm injury and headaches. The upright posture depends both on the sitting attitude, i.e. on the sitting posture of the person and on the ergonomics of the seat which help to maintain the upright posture. The chair holds a total of 86% of the person indicating the essential role in supporting the weight, 100% of the entire seat surface, 8% of the weight on the back and 17% on the floor. The ergonomic type of seat, in addition to reducing musculoskeletal disorders, promotes motivation and satisfaction with the school environment.

Ergonomics is a new field that deals with the study of the interaction between working people and the remaining elements of a working system, with the aim of promoting the health of workers and optimizing the overall performance of the system (Hellenic Institute of Health and Safety at Work, 2013). In the school environment, with which this paper deals, working people are meant to be as students, teachers, and other administrative staff. As system is considered the school equipment (desks, seats, school bags, computers, etc.), the school environment, which is divided into two parts, the social and the physical, and concern the classroom, the courtyard, the interaction between the teacher and the student and the student with his / her classmates and the general organization of the school (recess, educational practices, etc.) (Hellenic Institute of Health and Safety at Work, 2013). The concern of ergonomics is the adaptation of the school system to its people. Logistical equipment contributes to the success of the educational system and to the provision of the necessary quality of school life for both the teacher and the student (Germanos 2019).

According to ergonomics, chairs and desks should follow specific dimensions. When in a sitting position at the desk the student should observe the "rule of 4 right angles", i.e. the following pairs of shin-foot, thigh-shin, trunk-thigh, and arm-forearm must be at right angles.

The requirements for the students are:

1. The feet must press on the ground

2. The height of the chair should not be greater than the length of the chair

3. The length of the desk should not be longer than the length of the thigh

4. The back of the chair should support the spine at the lumbar spine and specifically at vertebrae 2-5 and the hands should be free

5. The hand forearm — arm should fold at a right angle

6. The spine should be in a straight line

7. The pelvis rests on the back of the chair

8. The knees should be on the extension of the seat and a little lower than the hip

9. The shoulders should be back and the chin inwards

10. Elbows bent close to the body

(Hellenic Institute of Health and Safety at Work, 2013)

Germanos (2019) also mentions the positive effect of ergonomic furniture and the adverse effects of imperfect usable furniture, noting confusion in the classroom, difficulty maintaining attention, and long-term musculoskeletal conditions e.g. scoliosis, kyphosis, lordosis.

According to the literature review, interventions have been carried out abroad by replacing traditional desks with the use of standing / adjustable desks, which are widespread both in the workplace and in schools. Their background, however, is not so recent, as it already dates to 1881, when John Loughlin invented the first standing desk made of wood and cast iron. Now there are various types of desks such as electronic, gas lift, mechanical, technical / manual lift, table, pedal, with exercise balls for seat (OLG Office, 2023).

In a 2015 study in New Zealand after twenty-two weeks and three intervention stages, it was shown that the use of standing desks increased walking pace by 9'/day and standing by 60'/day. From their use, the students declared themselves happy, their writing was participated, they had the feeling of more concentration and strength, while few students complained of feeling tired. Their teachers expressed themselves positively, claiming that they had better, faster, and easier supervision. The use of standing desks according to teachers encourages social interaction between students and teaching with group work. Finally, they showed a particular preference for alternating traditional with adjustable desks (Aminian et al., 2015). Teachers emphasize the positive impact it has on students' attention and curb their mis attitude. Wick et al. (2018) and Clemes et al. (2016), also demonstrated the reduction of sedentary attitude, as students were sitting less than 13' using the

standing desks 775'/week, i.e. 39% of the time, simultaneously improving cognitive processes, quality of concentration and physical activity. Similar are the results from the accelerometers of the student participants in the research by Schwenke and Coenen (2022), where the students in the intervention group stood for 9.34' while the students in the control group were only standing for 4.11 minutes. Sudholz et al. (2023), added, as good practice, the use of notes in a prominent place on the desks as a reminder, with the aim of getting up every 15' for at least 2'. This practice was shown to be beneficial as they were sitting for only 67% of the school time compared to students at traditional desks who sat for 83% of the school time.

The next intervention studied is the integration of movement during the lesson based on the theory of brain-based learning (Brain Based Learning). During the 21st century, neuroscientists identified the overall role of the cerebellum, as it was observed to be active during both physical movement and thought movement. This discovery was an integral part of the theory of learning based on the brain (Brain Based Learning), henceforth B.B.L. (Pennington, 2010). It emphasizes physical activity during which both hemispheres are used. The integration of movement activates the mesolobium which facilitates communication between the two hemispheres. It regulates the energy cycles, the secretion of hormones, which are affected during attention. In addition, it is noted that physical activity stimulates positive brain processes, improving the process of high-level thinking, as stronger thought pathways are created, and brain plasticity is harnessed. The latter is related to the ability of the brain to (re)shape and perform better during lessons. Finally, kinesthetic movement increases the brain activation necessary for learning (Pennington, 2010). Therefore, it is demonstrated that movement has a strong connection with students' engagement in the learning process, due to the activation of both sides of the brain.

According to the CDC (Center for Disease Control and Prevention) physical activity in the classroom is especially important in school, it complements and does not replace gym class or recess. It refers to a strategy by which the sedentary attitude of students is reduced as they are physically active. Incorporating movement is defined as "any level of physical activity that is built into scheduled school hours, including academic subjects that incorporate physical activity, short physical activity breaks, and physical activity during transition periods" (Miller et al. 2021).

Movement breaks can be implemented in two ways, either integrated into academic teaching or outside, regardless of the school level. There is no specific time limit, teachers can follow this strategy at any time they wish, with a possible duration of at least 3-5 minutes. Breaks can be incorporated after lunch or for relaxing after a test or calming down or at the end of the day, generally whenever the teacher deems it necessary. Physical activity is suggested to be adapted

according to the cultural context of the classroom, lesson objectives, teacher preferences, student enjoyment/fun levels and available resources, time, and space.

The benefits are shown in academic performance, students' concentration and attitude improve, students find new motivations to participate in the educational process, and at the same time the central goal of increasing physical activity is achieved. Incorporating movement helps students with learning disabilities. A positive influence is also found on the teachers, who can make use of the method for better classroom management, since through the breaks they can maintain the concentration of the students, the good atmosphere, the best learning performance, and the course of the teaching, but also the avoidance of confusion, irritation, agitation, speech. However, it is recalled that it is not about a disciplinary approach. Activities suggested to teachers for breaks in the classroom are lateral stretches, jumping jacks, vertical jumps, arm circles, push-ups.

According to Watson et al. (2019) after six weeks of intervention he concluded that it is possible and positive to integrate movement for all members of the school community. Participating teachers stated that having at least 3 breaks of light intensity is feasible, noting time and limited space as an obstacle. Calella et al. (2019b) with fewer months of intervention, compared to the study by Watson et al. (2019), in Italian classrooms showed the possibility of reducing sedentary attitude by twelve (12) minutes, increasing by five (5) minutes the moderate to vigorous physical activity of girls. Nader et al. (2018) add that teachers play an important role in promoting students' physical activity and the method is crucial for physical activity. Carlson et al. (2015), after an intervention of a whole school year indicated that breaks are positively associated with physical activity of students. The students who were in the classes that implemented physical activity breaks showed a 75% chance of reaching the recommendations of the WHO, i.e. the thirty (30) minutes of vigorous physical activity during the day, improved their attitude and their academic performance. The intervention students of Calella et al. (2019), reported that they were more focused and had more energy and teachers reported that they were able to fit physical activity into their lessons and available teaching time. The strategy was judged to be fun, beneficial to health and capable of keeping students alert during lessons. Educators also noted the general change in student mood (Mullins et al., 2019). Results from the research of Minges et al. (2016), showed that young people spend more than 50% of school time sitting. Incorporating standing desks can reduce it from 59-64' and screen time by 71'. A related study by Clemes et al. (2016), demonstrates the positive effect on mental health indicators. It reduces anxiety, depression and improves self-esteem and academic performance. They also refer to classroom PE being effective for teaching

vocabulary but not math and literacy skills for secondary and kindergarten students. It did, however, enhance concentration and help with classroom management and control.

Purpose of research

The purpose of the research is to investigate, through the views of teachers in practice, sedentary attitude at school age and the methods they have already been used or do not hesitate to use, with the aim of reducing it during class time. The methods that will be referred to are the following: the use of adapted desks and chairs, the alternation of physical and sedentary activities and informing of students by teachers about upright posture. Finally, reference will be made to the appropriateness of the school furniture, the students' posture, and the teachers' involvement in it.

Research hypothesis

The research hypothesis examined in this research are the following:

1st Research Hypothesis: The school furniture is not suitable; it is ill-adapted for the physical dimensions of the students.

2nd Research Hypothesis: There is no provision for adjustable infrastructural school equipment according to the physical dimensions of the students.

3rd Research Hypothesis: Upright position is important according to teachers.

4th Research hypothesis: During the lessons, teachers take stretching breaks and posture exercises and the level of readiness of teachers to use new ergonomic equipment is low.

5th Research Hypothesis: The teachers have not received relevant training nor participate in sessions and workshops on the correct physical posture of the students and their mobility during the lesson.

Research methodology

The present research is quantitative, it was conducted with the electronic distribution of a questionnaire to Primary and Secondary schools throughout Greece, after first searching for their electronic addresses (e-mails). The questionnaires were sent on November 4, 2022, and the collection of responses was completed on January 28, 2023. The tool was translated into Greek from the foreign language article by Podrekar et al. (2020). From their research, the content of the questions was preserved and translated for the needs of the research. The translation was double from English to Greek and from Greek to English to detect any alteration. The questions included are open-ended, closed Likert-scale and dichotomous. In total, 6 questions are open-ended and the remaining 18 are closed-ended. The teacher perspective questionnaire was preceded by a series of demographic questions to capture the demographics of the sample in terms of teachers' age, gender, educational level they serve, total years of teaching, total years of teaching in the current educational institution, the subjects they teach, the age of their students and the answer about the prefecture they were teaching were optional. A total of responses was collected from 396 teachers. The Cronbach's alpha reliability of the 23 questions of the scale is 0.81, which indicates that the scale has good reliability. Also, the split reliability of the 23 questions of the scale is 0.73, which indicates that the scale is of good reliability.

Results

Result of the First Research Hypothesis

H1: «The school furniture is not suitable; it is ill-adapted for the physical dimensions of the students.»

From the answers of the teachers (54,3%), most of the respondents consider the furniture of the school room to be partly properly equipped and partly adapted to the physical structure of the children, which is characterized as important. We shouldn't also ignore the opinion of the remaining teachers (22%) who describe the room as inappropriately equipped. However, 54.3% claim that school furniture is suitable for students' body shape. Only 23,7% of teachers did not express a clear opinion. Their positive response to the importance of adapting the furniture to the physical dimensions of the students is unanimous. It should be noted that in Greek classrooms, almost all the sample states that there is neither adjustable equipment nor desks that allow students to stand. Only 8.3% of teachers state that they have desks or chairs in their classrooms that adapt

to the physical dimensions of students, but they are unaware of the exact number of classrooms and furniture. It is considered important that they have never dealt with the selection or purchase of school furniture. Ultimately, our hypothesis is not confirmed, as teachers tend to have a more positive than negative view, although they have not engaged in the purchase of new ergonomic equipment.

Result of the Second Research Hypothesis

H2: «There is no provision for adjustable infrastructure school equipment according to the physical dimensions of the students. »

The point of view of the teachers converges, as they attribute several deviations of the school equipment in terms of the physique of the students and the lack of adjustable equipment. They note discrepancies both in terms of physical dimensions and in terms of the general inappropriateness and non-ergonomic characteristics of school furniture. Specifically, 38.2% of teachers detect discrepancies in school desks and chairs or individually. The original hypothesis is confirmed.

Answers are listed such as:

«*Chair height disproportion and their ergonomic weakness. »*

«There are 2 sizes of desk-chairs (small-large).

There is no intermediate size that would be suitable for C-D class. »

«Furniture not at all friendly to children's constitution, needs, development and comfort. »

«Uncomfortable chairs, non-ergonomic, unsuitable furniture for teamwork»

Result of Third Research Hypothesis

H3: «The posture is important during the lesson according to the teachers»

The third hypothesis is fully confirmed. The vast majority (93.6%) of teachers consider it important that students sit correctly during the lesson and helpful to change posture often, stating that it is part of their duties to maintain correct posture. However, it is surprising that 94/396 of the teachers

do not correctly understand what the correct sitting posture is, as they seem to be unaware that the spine should be in a straight line.

Also, as to the reasons for maintaining an upright posture, most cite health reasons (37.6%), noting that:

«*Initially for reasons of correct anatomy of their body, vision and then because it also affects the way they write.* »

«Because it affects their physical and mental development. »

«So that they don't strain their spine, their internal organs. »

«Musculoskeletal problems are created additively over time; therefore, it is important that students from an early age acquire correct habits for correct body posture. »

The reasons for school performance were stated by 25.8% of teachers.

«The comfort of the correct body posture according to the rules of ergonomics makes the children's work more efficient and they can attend the lesson more concentrated. »

«Absolutely important for children's correct physique but also for their concentration. »

«Because they concentrate better and can perform in the learning process without getting too physically tired. »

Several (30.8%) referred to combinations of factors noting:

«Correct body posture, more comfortable posture and thus reduce mobility in the chair. »

«Attention, no slouching, correct distance from the textbook, distance from a classmate and personal space. »

«Visual field in relation to the board (where the projections are also made) which is the most basic educational tool, as well as to the teacher. Also, to reduce stimuli that distracts the student from the educational goal. Secondly, for order and homogeneity, insofar as this contributes to the Psychology of the group. That's it for orientation. As for the correct body posture I imagine without being an expert, the correct posture of the back supported by the chair would be ideal. There are a lot of teaching methods, therefore the change of attitude of the student is frequent, so there are standards and requirements on the part of the teacher. »

Result of Fourth Research Hypothesis

H4: «During the lessons, teachers take stretching breaks and posture exercises, but their level of readiness for the new practices is low. »

Many teachers (73%) seem to use the reminder as a practice for students' posture either every day (46%) or at least once a week (27%) while the rest (27%) are content with either reminding them once a month, either twice times a year or never. Although the percentages remain similar for the frequency of alternating sedentary activities, it appears that a majority of the sample does not take a break for stretching during classes. At the same time, the reasons given for not alternating between sedentary and physical activity are related to the lesson plan (17.7%), confusion (16.9%), habit (6.1%), ergonomics space (2.8%) and a combination of factors (6.6%). It is important to mention that some teachers have the "illusion" that they are following this practice, because the students stand up at the blackboard to solve an exercise.

Answers such as:

«*Because it is very difficult to get the children to sit down, the slightest thing disrupts the class and the time goes by, unfortunately... at Vocational High Schools (EPAL)*»

«I don't think the course structure in Greek courses allows kinesiology. »

In terms of their readiness, teachers state on the one hand that they are prepared (54.9%) to encourage their students to use the adjustable desks correctly and regularly, on the other hand they are unprepared (37.1%) to see their students standing up using raised desks and high seats during lessons. However, they are positive about using adjustable desks as long as they believe that breaking up prolonged sitting is important, and their intended use is feasible. 100 teachers and 25.3% of them maintain their reservations about their use while the majority (74.7%) believe that it is possible but difficult. Their answers show that they are mainly hindered by the confusion (7.6%) that can be caused.

«*There will be confusion, some students will not want to work standing up.* »

In addition, an important reason for the teachers seems to be habit (4.5%), the lesson plan (1%) and fatigue (1.5%), while reference was made to the unpreparedness of the students (2.3%) for such practices. Indicative answers covering all factors.

«*Lively children who do not adapt easily*. »

«*Because young children often have excess energy and standing would easily lead to jumping, playing, and generally a distraction. »*

«I have no experience of such a situation. »

«I don't understand the reason for using such desks. »

«Because there are no activities to encourage this in the textbook, it would be burdensome for teachers to take this into account when they are making lesson plans. Also, I am afraid that chaos would result if there was such a rotation, in case we suddenly operated on the present student body with this attitude of lack of politeness and self-discipline (Don't just consider the experimental schools where the children have exemplary attitude. »

The second practice that was studied was the stretching breaks of up to 3 minutes during the lessons. The majority 63.4% have a positive attitude, the remaining 36.6% are negative due to the following dominant factors such as possible confusion, the time frames of their lessons and their plan, habit and a combination of various factors. The following responses were noted.

«*Kids stretch whenever they want, it's not forbidden. It is probable that a situation similar to the break with a mask that had happened during coronavirus will be repeated and will prove a complete failure. Every 5 minutes someone was throwing up and shouting mask break. »*

«Because preschoolers would quickly lose interest in stretching if they repeated it regularly, even every day. »

«This has to start in kindergarten, or the students will cannibalize it. »

Thus, our hypothesis is confirmed as although they fully understand the importance of standing upright, they do not actively follow any practice, though.

Result of Fifth Research Hypothesis

Y5: «Teachers have not received relevant training nor participated in conferences and workshops on the correct physical posture of students and their mobility during the lesson. »

Due to the practice studied in the present research for the use of ergonomic desks, the selection or ordering of new school furniture is considered, which 83.9% of teachers have never dealt with and which seems not to have been mentioned even in educational conferences/seminars/councils. However, they seem to be willing to attend relevant training seminars on both seat ergonomics and good posture, confirming the hypothesis.

Conclusion

The school, as has been proven by research in classrooms abroad, can play a significant role in promoting physical activity and reducing sedentary attitude, with practices that give a different aspect to the educational process and keep the student's interest undiminished.

Many Greek teachers consider it important that school furniture adapts to the physical dimensions of students. According to their responses, this appears to be partially the case in school classrooms. However, it cannot be ignored that there are strong discrepancies between the physique of the students and the dimensions of the school furniture.

Teachers consider it equally important to maintain students' upright posture, with many considering it their duty to remind them. However, a portion of teachers do not know the correct sitting posture. The importance of standing is linked to good health, school performance and social interaction. They also consider that, due to long hours of sitting for practical learning reasons within the schoolroom, it is necessary to maintain an upright posture.

In the supposed use of elevated desks and the implementation of stretching breaks within the classroom, the attitude of the teachers is positive. On the contrary, some teachers maintain their reservations about these practices, due to the "fear" of causing confusion and they adopt the traditional way of teaching, while others declare ignorance or indifference to these practices and judge the classrooms to be either crowded or unsafe to follow them.

The teachers have not attended seminars related to the selection of school furniture but showed interest in participating in related trainings. Similar is their willingness to apply methods of

standing and increasing the physical activity of their students in the classroom, if they are gradually included in the regular school schedule.

Suggestions for further research

The present research dealt with teachers' perceptions of the search and evaluation of methods to reduce the sedentary attitude of students during the teaching hours.

In future research it is suggested to explore the views of students and parents to reduce sedentary attitude and increase student mobility within the classrooms. Also, it is considered necessary to develop intervention programs to increase the mobility of students during lessons in the classroom, with appropriate physical activities that will not hinder the flow of the lesson.

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