

EFFECTS OF THE "SCHOOL ON THE MOVE" PROGRAM ON THE POSTURAL STATUS OF YOUNGER SCHOOL AGE STUDENTS

EFEKTI PROGRAMA „ŠKOLA U POKRETU“ NA POSTURALNI STATUS UČENIKA
MLAĐEG ŠKOLSKOG UZRASTA

Stojanović Tijana¹, Perić Dragan², Stojanović Darko³ & Stojanović Toplica⁴

¹Faculty of Sport and Physical Education, University of Niš, Serbia

²„Čair“ sports center, Niš, Serbia

³Faculty of sport, University “Union – Nikola Tesla”, Belgrade, Serbia

⁴Faculty of Sport and Physical Education, University of Priština – Kosovska Mitrovica, Serbia

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Correspondance : Stojanović Toplica

Faculty of Sport and Physical Education, University of Priština - Kosovska Mitrovica, Serbia

E-mail:toplica.stojanovic@pr.ac.rs

ABSTRACT

In order to determine the effects of the "School on the Move" program on the postural status of students, a survey was conducted on a sample of 22 younger school age students of both sexes for the duration of one school semester. Students were given lectures on ergonomic risk and ways of reducing ergonomic risk factors, and a number of posters and flyers with proper lifting, bag-wearing and sitting techniques were distributed. The "School on the Move" ergonomic program encouraged students to move freely on their chair or to stand up and stretch when they experienced discomfort/pain, or perform a few brief stretching exercises while sitting on their chair. The postural status of the spine was assessed in the sagittal and frontal plane (thoracic and lumbar scoliosis, kyphosis and lordosis) by the "Spinal mouse" instrument (Quantum Health and Wellness Ltd, Wallasay, England). A repeated measures ANOVA was used for statistical data processing. The results showed that during the 16-week period, there was a significant improvement in the reduction of thoracic scoliosis ($p=0.003$) and kyphosis ($p=0.006$), while there were no significant changes in the lumbar scoliosis and lordosis. On the basis of these results, it could be concluded that such a program could have a significant impact on the posture improvement of the spinal column, and that it can be practically applied in the school curriculum as a preventive measure for spinal postural status disturbance of younger school age students.

Key words: *postural status, students, younger school age, "School on the Move" program.*

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INTRODUCTION

Students spend most of their time at school at their desk. This should be a subject of interest for experts when designing furniture elements. This is a very responsible and difficult task for all actors, considering the fact that due to growth and development as well as continuous sitting, the body suffers the greatest static and other changes, which often leave long-term effects. It has been observed that the child's body is most influenced by the strict and absolute sedentary state which is not peculiar to children, whereby body fatigue and pain can occur in certain regions of the body, and longer sitting time leads to fatigue of the body (Weiss & Werkmann, 2009).

If sitting is done on inappropriate sized furniture or the body position cannot be altered, the effort is even greater. Many studies have shown that children complain about sitting at a desk, complain about discomfort and lower back, neck and upper leg pain, vision impairment and deconcentration (Castellucci et al., 2010; Grimmer & Williams, 2000). The main reason lies in poor or irregular posture, which is manifested by a relaxed posture, uneven shoulder height and a curved or hunched spine. In addition, recent studies in our country and around the world have shown that children spend more than seven hours of their active time sitting at a

school desk and computer at home during the day, assuming a wide variety of forced body positions, adapting to the characteristics of furniture used everyday (Featherset al., 2013). Existing furniture that is actively used, both at school and at home, generally does not meet the needs of children (as well as adults), given the increasingly rapid and complex lifestyle rhythm imposed by modern lifestyles (Domljan et al., 2010).

A significant question regarding sitting in school for a long time concerns the incongruity between students and their workstations - the school desks and chairs (Grbac and Domljan, 2007). When an incongruity occurs, ergonomic stress will potentially increase. The anthropometric dimensions of the students' and the dimensions of the workstations (chairs and desks), define ergonomic mismatch. The incongruity occurs when multiple users of different age groups and body dimensions use unsuitable furniture of the same (universal) dimensions. Interestingly, much more effort is made towards providing ergonomically correct work equipment for adults (adjustable chairs, flexible work surfaces and appropriate furniture sizes). However, workstations for school children seem to be neglected as most classrooms are equipped with desks and chairs

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of one size, regardless of the age of the students. This is a common policy, not only in our schools, but also in the region of the former Yugoslavia, primarily because of the lower purchase price, easier disposal, and similar aesthetic appearance of classrooms, but also because of insufficient knowledge of the anthropometric parameters of the school population and the lack of a domestic manufacturer of school furniture in concordance with ergonomic recommendations (Pavlović-Veselinović & Đurašković, 1995).

The main consequence of ergonomic incongruity is the adoption of bad sitting posture. When students of different heights sit on unsuitable chairs and desks, a high percentage of them will have difficulty while sitting. As a result, many children will compensate this by adopting non-physiological, uncomfortable body postures, potentially increasing biomechanical stress on the body. Ergonomic characteristics of school desks and chairs, and their influence on musculoskeletal structures, i.e. postural disorders of the spinal column, is an acute problem in school-aged children both at the global level and in our country, which alarms us to initiate all available resources and take

steps to solve this problem. Each of these changes occurs as a consequence, in part of genetic factors, and very often as a result of acquired postural changes. Some of the mentioned factors have the greatest influence on postural status, such as the working environment, inadequate furniture, forced postures of the body when working or learning, inadequate lighting, etc. (Geldhof et al., 2007).

The ergonomic "School on the Move" program, which encourages students to move freely in their chair or to stand up and stretch during classes when they feel discomfort/pain or do a few short stretching exercises while sitting in a chair, is considered to be effective in preventing the occurrence of discomfort and pain while sitting, as well as postural disorders.

The aim of the study is to evaluate the effects of a specific "School on the move" ergonomic program, which is based on non-engineering preventive measures, consisting of the free movement of students during class in the form of short stretching exercises and getting up from their chair.

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METHODS

The sample of participants was drawn from a population of students of the "Dušan Radović" Elementary School in Niš, chronologically aged 9-10 years. At the time of the survey, the participants met all the health and other criteria and had the status of full-time students whose parents gave written consent for their participation. The total number of participants included in this study is 22 students of both sexes (BH = 146.48 ± 4.80 ; BM = 40.91 ± 8.52).

The postural status of the spinal column was assessed in the sagittal and frontal plane (thoracic and lumbar scoliosis, kyphosis and lordosis) with the "Spinal Mouse" instrument (Quantum Health and Wellness Ltd, Wallasay, England), based on wireless ultrasound technology with the appropriate software (Livanelioglu et al., 2015; Zsidai & Koscis, 2001).

The experimental group of students were lectured on ergonomic risk and ways of reducing ergonomic risk factors, and a number of posters and flyers with the presented correct techniques for lifting and carrying a school bag/backpack and the correct way of sitting were distributed. The

participants underwent the "School on the Move" ergonomic program, which included encouraging students to move freely on their chair or to stand and stretch during classes when they experienced discomfort/pain with a few short stretching exercises of their choice. Participants performed the exercises as needed with 10-12 repetitions while sitting on a chair or standing next to it. The entire training of the participants was practical with a demonstration of possible stretching exercises. The program was conducted over a period of 16 weeks.

Descriptive statistical procedures were applied to analyze the basic statistics and result distribution at the initial and final measurements. In order to analyze the changes in the results of the dependent variables between the initial and final measurements for each variable, a repeated measures analysis of variance (Repeated measures ANOVA) was applied. The significance of inference was determined at $p < 0.05$. The data were processed with the statistical package STATISTICA 10.0 for Windows (StatSoft, Inc., Tulsa, OK).

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RESULTS AND DISCUSSION

Tables 1 and 2 show the results of the postural status of the participants at the initial and final measurements, and in order to solve the problem of the effects of the “School on the Move” program effectively, it was necessary to determine the changes between the initial and final status of the musculoskeletal disorders (MSD) of the

spinal column, following the experimental period. Using the repeated measures analysis of variance, the statistical significance of the differences in the arithmetic means of the initial and final measurements of the group were calculated, and the results are shown in Table 3.

Table 1. *Descriptive parameters of the Postural status variables of the students – initial measurement*

Variable	N	Mean	Std.Dev.	Min.	Max.	Range	Coef.Var.	Skew.	Kurt.	K-S
AKYP	22	38.50	7.15	25	55	30	18.6	0.47	0.34	0.09
ALOR	22	-10.00	8.91	-26	6	32	-89.1	-0.24	-0.92	0.22
ASCT	22	6.50	2.87	2	12	10	44.2	-0.03	-0.79	0.21
ASCL	22	1.23	1.19	0	5	5	97.2	1.56*	3.66*	0.26

AKYP – kyphosis; ALOR – lordosis; ASCT – thoracic scoliosis; ASCL – lumbar scoliosis; N – sample size ; K-S – Kolmogorov-Smirnov test value.

Table 2. *Descriptive parameters of the Postural status variables of the students – final measurement*

Variable	N	Mean	Std.Dev.	Min.	Max.	Range	Coef.Var.	Skew.	Kurt.	K-S
AKYP	22	33.86	8.35	22	51	29	24.6	0.52	-0.35	0.13
ALOR	22	-10.14	8.33	-24	5	29	-82.2	0.10	-0.94	0.12
ASCT	22	4.82	3.50	0	13	13	72.6	0.83	-0.05	0.15
ASCL	22	1.73	1.61	0	6	6	93.2	1.09*	0.89	0.22

AKYP – kyphosis; ALOR – lordosis; ASCT – thoracic scoliosis; ASCL – lumbar scoliosis; N – sample size ; K-S – Kolmogorov-Smirnov test value.

After analyzing Table 3., at the univariate level, it can be stated that statistically significant changes were observed in kyphosis and thoracic scoliosis, while there were no changes in lordosis. The changes are positive regarding both the kyphotic and thoracic scoliotic curves, which significantly decreased after the four-month experimental program.

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Table 3. Univariate differences between the initial and final measurements of the *Postural status* of the students

Variable	Mean INI	Mean FIN	Difference	Difference %	F (1; 27)	p
AKYP	38.50	33.86	-4.64	-13.7	11.05	0.003*
ALOR	-10.00	-10.14	-0.14	1.4	0.00	0.949
ASCT	6.50	4.82	-1.68	-34.9	9.28	0.006*
ASCL	1.23	1.73	0.50	28.9	1.26	0.274

Mean INI– arithmetic means of the initial measurement; Mean FIN– arithmetic means of the final measurement; Difference – between the initial and final measurements; F – value of the F-test for assessing significance of arithmetic mean differences; p – significance of the differences.

In the discussion regarding statistical analysis of the results of this research, it can be concluded that the "School on the Move" program for the reduction of the spinal column MSD, contributed to a statistically significant reduction of thoracic spinal curves during the 16 weeks, while no changes were recorded in the lumbar section.

Considering the relatively small sample of participants (22), the statistical significance provides complete information about the level of MSD changes of the spinal column of the participants, but these changes are more clearly seen at the numerical level. Considering the significance of the effects of the applied program on the reduction of the MSD of the spine, it is important to state that every, even the smallest reduction in MSD, is essential for improving the quality of life of children, especially at the age when important and

sudden changes of the muscular and skeletal system occur. This is important from an educational point of view of the children and parents, as the constant implementation of such programs contributes to the formation of a better final postural status of children.

For these reasons, it is important to report the numerically pronounced effects of the experimental program, especially those expressed in percentage numbers, where their practical contribution to the reduction of the MSD of the spinal column can be seen. The changes that occurred after the implementation of the "School on the Move" experimental program, expressed as a percentage, are significant in the thoracic section of spinal curves, both in the sagittal and the frontal plane. In kyphosis, a curvature decrease of 4.64 or 13.7% is observed, which is a high percentage of improvement, which is in accordance with the results of similar studies (Weiss &

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Turnbull, 2010; Weiss & Werkmann, 2009; Djurasović & Glassman, 2007; Pizzutillo, 2004). The decrease in the thoracic scoliosis curvature is 1.68, or 34.9%, which represents a significant improvement in the reduction of poor postural status of children

CONCLUSION

Considering that the obtained results showed a positive impact of the "School on the Move" ergonomic program, it could be recommended to the Ministry of Education as an effective program for reducing ergonomic risk, one which does not require large financial investments until the conditions for production and procurement of newly designed school equipment are achieved. Newly designed school equipment must be aligned with the ergonomic requirements of the local child population, for which recommendations are also given.

The scientific contribution of this research is also reflected into the effectiveness of educating children about ergonomic risks and preventative exercises, as well as the concept of "School on the Move" in reducing the risk of musculoskeletal disorders in children, as no

aged 11. These results are in agreement with the results of other studies (Negri et al., 2008; Mooney & Brigham, 2003; El-Sayyad & Conine, 1994) that addressed the problem of reducing the scoliotic curvature of the spine.

relevant data have been reported so far from this perspective. Indirectly, the research findings may contribute to the health of the future working-age population.

This research also has practical and theoretical value. First of all, there is a great need to pay attention to the development of children, and to provide them with the best conditions for their upbringing and education, while at the same time prevent the negative effects that are present in our increasingly accelerated social development, such as hypokinesia, obesity, spinal deformities, hypertension and more. Taking into account that there is a risk of developing musculoskeletal disorders, we especially emphasize the spinal column region, which suffers the greatest consequences due to the aforementioned conditions in our schools, so that during

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childhood and adolescence, there may be a predisposition for the onset of serious musculoskeletal diseases in the working age of our population. It is necessary to prevent any postural changes from the earliest childhood.

A previous study indicates that musculoskeletal discomfort and lower back pain are evident not only in adults but also in children. Ergonomic education aimed at proper posture, improvement of body functions and certain movements, as well as their ergonomic implications, can reduce and prevent these problems. Such an educational program which implies the

importance of ergonomics must begin at an early age and should be an integral part of the school curriculum. This research indicates that the "School on the Move" educational program, conducted at the "Dušan Radović" Elementary School in Niš, has produced extremely good results, which has pleased both the children, their parents, teachers and the school principal. This program showed that students of the Faculty of Sport and Physical Education, future professors, should implement postural disorder prevention programs, adjusting their work to the age characteristics of the children.

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SAŽETAK

Sa ciljem da se utvrde efekti programa „Škola u pokretu“ na posturalni status učenika, sprovedeno je istraživanje na uzorku od 22 učenika mlađeg školskog uzrasta oba pola u trajanju jednog školskog polugođa. Učenicima su bila održana predavanja o ergonomskom riziku i načinima za smanjenje ergonomskih faktora rizika i distribuiran je određeni broj postera i flajera sa predstavljenim ispravnim tehnikama podizanja i nošenja školske torbe/ranca i ispravnog načina sedenja. Ergonomski program „Škola u pokretu“ podrazumevao je ohrabrivanje učenika da se slobodno pokreću na stolici ili da ustanu i istegnu se tokom časova kada oseće nelagodnost/bol i uz nekoliko kratkih vežbi istezanja, za vreme sedenja na stolici. Posturalni status kičmenog stuba je procenjen u sagitalnoj i frontalnoj ravni (torakalna i lumbalna skolioza, kifoza i lordoza) instrumentom „Spinal mouse“ (Quantum Health and Wellness Ltd, Wallasay, England). Za statističku obradu podataka primenjena je analiza varijanse za ponovljena merenja (Repeated measures ANOVA). Rezultati pokazuju da je u periodu od 16 nedelja kod učenika došlo do značajnog poboljšanja vrednosti torakalne skolioze ($p=0.003$) i kifoze ($p=0.006$), dok kod lumbalne skolioze i lordoze nije bilo značajnih promena. Na osnovu ovih rezultata se može zaključiti da ovakav program može imati značajan uticaj na poboljšanje posture kičmenog stuba, te se može primeniti u praksi školske nastave i kao preventiva narušavanju posturalnog statusa kičmenog stuba učenika mlađeg školskog uzrasta.

Ključne reči: *posturalni status, učenici, mlađi školski uzrast, program „Škola u pokretu“.*

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Correspondance :

Stojanović Toplica, Ph. D.

Faculty of Sport and Physical Education, University of Priština – Kosovska Mitrovica, Serbia

E-mail:toplica.stojanovic@pr.ac.rs