

# IMPACT OF THE ADDITIONAL PHYSICAL EDUCATION LESSONS PROGRAMME ON THE PHYSICAL AND MOTOR DEVELOPMENT OF 7- TO 10-YEAR-OLD CHILDREN

Gregor Jurak, Marjeta Kovač and Janko Strel

*University of Ljubljana, Faculty of Sport, Ljubljana, Slovenia*

Original scientific paper

UDC 796.012.6:371.042.1-093.5(497.4)

## Abstract:

The study aimed at finding out how the programme of sports classes, through which some schools in Slovenia offer an enhanced PE syllabus to pupils, influences the physical and motor development of 7- to 10-year-old children. A longitudinal four-year study including 328 pupils in the form of a pedagogical experiment was carried out. Data were collected through tests within the framework of a Sports-educational Chart. Differences in transformation effects were analysed by means of the analysis of covariance. It was found that the programme of sports classes does have a positive impact on the development of motor abilities, particularly given that the results regarding the individual motor abilities of children of that age have been falling in Slovenia over the last few decades. After disparities in the initial status were eliminated, statistically significant differences were noted in the motor tasks *obstacle course backwards*, *sit-ups in 30 seconds* and *600-metre run*. Boys were also significantly different in their body weight. The improvement of pupils from sports classes also points to the better quality of lessons consisting of a wider range of motor skills, a suitable organisation of work and greater exercising. The following recommendations are offered in response to these findings: more frequent co-operation between the PE teacher and the classroom teacher in PE lessons, the organisation of suitable programmes of additional training for teachers, who work with children from 7 to 10 regarding their developmental characteristics, flexible organisation of sports classes due to the changed demands of the school setting and the more systematic planning of lessons for sports classes.

**Key words:** *primary school, PE lessons, sports class, motor abilities*

## Introduction

One of the key objectives of sports activity is to develop motor abilities which assist with more efficient and controlled movement. In addition, the fact that motor development is closely related to cognitive, emotional and social areas of a child's development should not be disregarded. A child's motor development is mainly systematically influenced by the process of physical education (PE) within the education system. The quantity and quality of PE in school is especially important between the ages of 6 and 10, when a child's physical growth decelerates, the muscular system grows intensively and when the level of maturity of movement coordination represents the ideal time to start general sports exercising or the intensive practicing of technically more demanding movements. Due to the fast development of the brain and the myelination of the cortex in particular, this is the ideal time to learn motor activities that demand a large number of learned motor patterns (gymnastics, ballet, skiing, swimming, etc.) and which cannot be found in the ontogenesis of human development (Horvat, 1994).

Nowadays PE in school is not only characterised by developing motor abilities, physical attributes and the acquiring of sports skills - it also involves a motivational process for sport and secondary socialisation, which includes the development of social values, norms, ethical rules and behavioural patterns. Consequently, primary and secondary schools in Slovenia include three hours (135 minutes) of compulsory PE each week. The only exception is the last three years of the nine-year primary school when two hours a week are compulsory (90 minutes), while children can decide for an additional one or two hours a week according to their interests and the selection of optional subjects on offer (Kovač, Jurak, Strel, & Starc, 2003).

In addition to *general classes*, schools in Slovenia have for the last fifteen years also been offering a programme of so-called *sports classes* that are today referred to as classes with additional sport lessons, which entails an enhanced PE syllabus, most often by including two extra hours of PE a week and a wider selection of sports contents, which can also be conducted out of school. This

programme of sports classes has been included in 7% of primary schools in Slovenia (Jurak, Kovač, & Strel, 2004a).

The initial goal of sports classes was to select the youngest children who were then directed towards elite sports training and to accommodate their education from the first year onwards. Since such early selection is problematic from various aspects (Šturm, 1992; Strmčnik, 1995), the primary goal of including children in schools' sports classes soon changed (Cankar & Kovač, 1995). In comparison with secondary school sports classes, their goal today is not to synchronise academic work and training (Jurak, Kovač, Strel, & Starc, 2005) but to offer enhanced PE to all those children and parents who desire more sport (Kovač & Novak, 1998). Its placement in the school environment (the programme being carried out with the permission of the school committee, and the organisation and contents supplementing regular education) and the sports sphere (well organised, regular and well-executed optional sports activity) represents perhaps the best option for a quality regular and expanded school programme with daily PE and additional sports activities (outdoor activities, various sport courses, etc.) for the children of those parents who prefer that kind of education. Changes in the social environment (school reform, longer working hours for parents) also require a different organisation of sports classes according to the specifics of the particular school situation (Jurak, Kovač, & Strel, 2004b), yet it must still serve the same purpose: to improve on schools that offer the same to all children and to adjust to the wishes and needs of the children and their parents.<sup>1</sup>

The latest research on the organisation of work in sports classes (Jurak, et al., 2004a) found that PE lessons usually take place in the middle of the daily educational process. Sports activities that schools offer by way of courses are also usually organised during the educational process and less often after school hours, in the holidays or on weekends. In comparison to general classes, where classroom teachers teach PE from class 1 to 5, PE classes are being taught jointly by a PE teacher and the classroom teacher.

Schools that organise sports classes have good conditions for offering PE: they have large sports halls and outdoor grass or hard surfaces and the majority of them also have smaller sports halls and other special sports surfaces (athletics track, swimming pool, fitness room, long-jumping pit, jogging track, playroom, dancing room, etc.). Most schools

enrol children in sports classes with the parents' prior consent for joining these classes and the payment for additional services. The way sports classes are financed varies. Some schools cover the costs of running the programme with local and government funds, sponsors and their own resources at no cost to the children or parents, whereas others include parents' contributions and some entirely cover the related costs through the parents' funding. Parents' average monthly contribution to running the programme of additional sport lessons is EUR 11.4<sup>2</sup>. Schools believe that the monthly contribution level is not high so that all parents can afford it. Further, it is believed that this is still a cheaper way of exercising than with clubs or private institutions. Namely, with clubs or private institutions parents still also have to pay membership fees, with transport becoming an additional cost; it should also not be neglected that organised exercising at school allows an important saving of time for parents (Jurak, et al., 2004a).

One aspect of the efficiency of sports classes is the programme's impact on the motor status of children and, indirectly, the impact on the quantity and quality of sports skills, participation in sport during one's free time, the impact on the cardiovascular system, regulation of body weight, etc. Therefore, the study sought to find out how the programme of sports classes influences the physical and motor development of 7- to 10-year-old children.

## Methods

### Subjects and Procedures

A longitudinal study in the form of a pedagogical experiment was carried out. The study included 328 pupils, who in the year 2000 started their first year of education (at the age of 7) and in the next three years (2001 – 2003) were tested in all physical characteristics and motor skill measurements planned. Two groups of children from the same schools were formed: an experimental group, which included children from sports classes (N = 157; 81 boys and 76 girls); and a control group, which included children from general classes (N = 171; 87 boys and 84 girls). This was done to minimise the impact of the conditions for PE offered by individual schools and the impact of the wider social environment on the results. One limiting factor is that the children were tested in April, meaning that any differences from the initial status are already the result of almost a year of systematic work in the two different programmes.

<sup>1</sup> The majority of Slovenian schools offer various additional programmes, such as additional foreign language lessons, music lessons or ecology lessons, etc..

<sup>2</sup> This is 1.6% of an average monthly salary in Slovenia.

Data were collected within the framework of a *Sports-educational chart* (Strel, Ambrožič, Kondrič, Kovač, Leskošek, Štihec, et al., 1997), involving data collection through which the physical (3 measures) and motor (8 tasks) development of children and youth in Slovenia has been followed for 19 years (Strel, Kovač, Jurak, Bednarik, & Leskošek, 2001; Strel, Kovač, Jurak, & Bednarik, 2003; Strel, Kovač, & Jurak, 2004). Measurements are carried out every year in April. The recording, evaluating and monitoring of physical characteristics and motor abilities is conducted on the basis of the following tests (see Table 1).

dividual variables of the two groups of measured subjects shows that in the initial testing (in 2000) there were only significant differences for both genders in the variables *hand-tapping*, *obstacle course backwards* and *sit-ups*. For boys, significant differences were also observable in the variables, *standing long jump*, *forward bend on a bench* and *bent-arm hang*, and for girls in the variable 600-metre run. The average value of motor tasks (XT) shows that the motor status of pupils from sports classes was above the Slovenian average (which is 50.0), whereas that of pupils from the general classes was below the average.

Table 1. Measuring procedures for data collection using the *Sports-educational Chart*, their abbreviations and the dimensions they represent

Abbreviation	Variable	Hypothetical dimension measured
ATV	Body height	Measure of longitudinal dimensionality of the body
ATT	Body weight	Measure of the voluminosity of the body
AKG	Upper-arm skinfold	Percentage of body fat
DPR	Hand tapping	Speed of alternate movements
SDM	Standing long jump	Explosive strength
PON	Obstacle course backwards	Co-ordination of whole-body movements
DT	Sit-ups	Strength of abdominal muscles
PRE	Forward bend on a bench	Flexibility
VZG	Bent-arm hang	Muscular endurance of the shoulder girdle and arms
T60	60-metre run	Sprinting speed
T600	600-metre run	General endurance

In addition a value for the XT variable will be shown to represent the average value of all eight motor tasks and which is comparable with the whole general population. The tests are described in the publication *Sports-educational Chart* by Strel and co-workers (1997).

### Data analysis

A *t*-test for dependent samples was used to calculate the differences between particular variables for individual groups of measured subjects. A *t*-test for independent samples was used to calculate the differences between the individual variables of the two groups of measured subjects. Differences in the transformation effects between the two groups were calculated by using the analysis of covariance.

### Results

In the first year boys and girls from sports classes achieved better results than their peers from general PE classes in all the motor tasks (see Table 2). However, the analysis of differences between in-

At the final testing, pupils from sports classes again had higher values in all of the variables compared with their peers from the general classes (see Table 2, year 2003). Significant differences for both genders can be seen in the variables *hand tapping*, *obstacle course backwards*, *sit-ups* and *600-metre run*. For boys, a significant difference was also noticed for the tasks *bend forward on a bench* and *bent-arm hang*. The difference in the XT value decreased as a result of the higher values of children from general classes.

In order to identify the transformation effects, the impact of the different initial status of the two groups of measured subjects was eliminated (see Table 3). It can be seen that, after eliminating this effect, significant differences at the alpha level of .05 between the groups can be seen in the following motor variables: *obstacle course backwards*, *sit-ups* and *600-metre run*. Boys are also significantly different in the morphological variable body weight. A discussion of the results follows with an illustration of the trends of the results for the aforementioned variables for individual years (see Figure 1).

Table 2. Results of anthropometric and motor variables in the first and the fourth year of the education programme and an analysis of the differences between groups for individual variables.

Var.	Unit of measurement	group	1 <sup>st</sup> class, age 7-8 years (2000)					4 <sup>th</sup> class, age 10-11 years (2003)				
			AM	SD	Min	Max	Sig.	AM	SD	Min	Max	Sig.
ATV	cm	0_B	130.0	5.4	118.5	152.5	0.407	145.5	6.2	129.0	159.5	0.156
		1_B	130.7	5.0	118.5	149.5		146.7	5.3	133.5	159.0	
		0_G	128.8	5.7	114.0	147.0	0.956	145.4	6.8	130.0	161.0	0.597
		1_G	128.7	4.9	117.0	145.5		146.0	6.6	132.0	165.5	
ATT	kg	0_B	26.7	4.3	18.0	46.5	0.008	38.9	8.2	23.5	71.0	0.290
		1_B	28.7	4.9	20.0	45.0		40.2	8.1	27.1	65.5	
		0_G	26.4	5.1	16.5	44.0	0.947	38.0	8.1	23.5	63.5	0.965
		1_G	26.4	4.1	19.8	38.5		37.9	6.8	24.0	58.5	
AKG	mm	0_B	10.023	3.292	4	25	0.130	13.287	5.534	5	35	0.537
		1_B	10.975	4.741	5	26		13.864	6.536	4	32	
		0_G	11.357	3.633	5	25	0.646	13.381	3.991	7	32	0.755
		1_G	11.618	3.544	5	25		13.592	4.558	5	30	
DPR	Number of repetitions in 20 seconds	0_B	23.322	3.832	12	37	0.003	32.713	4.017	23	42	0.013
		1_B	24.963	3.284	16	33		34.235	3.802	25	43	
		0_G	24.464	3.280	14	32	0.019	34.464	3.775	24	43	0.020
		1_G	25.645	2.992	19	33		35.816	3.475	27	43	
SDM	cm	0_B	132.862	15.685	90	169	0.006	160.770	17.491	102	201	0.384
		1_B	139.901	17.356	77	175		163.247	19.271	110	210	
		0_G	127.988	16.109	90	166	0.056	157.655	18.720	120	199	0.574
		1_G	132.882	15.977	100	170		159.237	16.544	119	204	
PON	sec/10	0_B	189.471	39.141	120	351	0.000	151.747	38.471	95	299	0.000
		1_B	160.593	37.623	105	293		126.914	32.434	76	228	
		0_G	196.048	41.750	113	318	0.008	149.881	36.256	93	250	0.000
		1_G	177.289	46.825	110	310		127.684	24.830	83	212	
DT	Number of repetitions in 60 seconds	0_B	26.931	6.248	11	50	0.000	36.138	8.361	11	56	0.000
		1_B	31.370	6.422	18	48		43.395	7.459	26	60	
		0_G	27.750	5.770	11	40	0.004	38.036	8.091	15	56	0.002
		1_G	30.434	5.829	19	43		41.947	7.325	27	62	
PRE	cm	0_B	41.471	5.793	30	55	0.000	42.322	6.790	20	56	0.020
		1_B	44.519	4.998	32	54		44.617	5.778	22	57	
		0_G	44.631	5.977	24	55	0.181	46.262	8.577	27	65	0.131
		1_G	45.895	5.914	30	60		48.039	5.807	35	63	
VZG	s	0_B	22.598	17.720	3	107	0.005	31.391	26.374	1	120	0.024
		1_B	32.284	26.097	0	120		41.296	29.823	0	120	
		0_G	23.988	20.201	1	85	0.639	30.119	23.012	2	120	0.186
		1_G	25.421	18.192	0	100		35.013	23.558	3	115	
T60	s/10	0_B	123.920	9.174	105	151	0.049	108.851	8.806	90	143	0.594
		1_B	121.235	8.331	103	143		108.099	9.461	90	140	
		0_G	127.131	12.867	101	166	0.098	110.393	8.924	93	147	0.117
		1_G	124.237	8.455	103	147		108.289	7.824	91	128	
T600	s	0_B	206.092	39.153	155	300	0.122	171.494	29.085	130	300	0.000
		1_B	196.679	39.284	141	300		156.494	22.331	124	242	
		0_G	214.333	33.514	156	300	0.010	183.762	25.039	130	255	0.000
		1_G	200.197	34.626	120	300		164.276	21.266	130	219	
XT		0_B	47.717	5.860	28.63	60.25		48.435	5.789	33.75	60.25	
		1_B	53.114	5.908	41.38	70.13		52.519	6.314	38.38	65.88	
		0_G	49.695	6.557	32.63	63.75		51.118	6.557	39.75	69.75	
		1_G	54.533	5.601	39.00	67.00		54.893	5.480	38.25	66.00	

Legend: ATV – body height, ATT - body weight, AKG – upper-arm skinfold, DPR – hand-tapping, SDM – standing long jump, PON – obstacle course backwards, DT – sit-ups, PRE – forward bend on a bench, VZG – bent-arm hang, T60 – 60-m run, T600 – 600-m run, AM – arithmetic mean, SD – standard deviation, Min – minimal value, Max – maximal value, Sig. – sigma

Groups: 0\_B = boys from general PE classes; 1\_B = boys from sports classes; 0\_G = girls from general PE classes; 1\_G = girls from sports classes

Table 3. Differences in the final status (fourth year, 2003) between pupils from general and sports classes after the impact of their initial status (first year, 2000) is eliminated.

Variable	Gender	F	Sig.
ATV	boys	1.616	0.205
	girls	1.455	0.230
ATT	boys	8.263	*0.005
	girls	0.043	0.836
AKG	boys	0.920	0.339
	girls	0.002	0.963
DPR	boys	0.928	0.337
	girls	1.805	0.181
SDM	boys	0.522	0.471
	girls	0.596	0.441
PON	boys	3.993	*0.047
	girls	12.249	*0.001
DT	boys	16.965	*0.000
	girls	3.959	*0.048
PRE	boys	0.184	0.669
	girls	0.869	0.353
VZG	boys	0.370	0.544
	girls	1.651	0.201
T60	boys	0.493	0.484
	girls	0.457	0.500
T600	boys	11.315	*0.001
	girls	20.030	*0.000

Legend: ATV – body height, ATT - body weight, AKG – upper arm skinfold, DPR – hand-tapping, SDM – standing long jump, PON – obstacle course backwards, DT – sit-ups, PRE – forward bend on a bench, VZG – bent-arm hang, T60 – 60-m run, T600 – 600-m run

### Discussion and conclusions

The initial differences in motor abilities indicate that children with better motor status enrol in sports classes (Cankar & Kovač, 1995). Children who participate in various sport programmes from early childhood mature faster and have a biological advantage over other children. Presumably children enrolled in sports classes have parents with more positive attitudes to a sports lifestyle and who are also wealthy enough to provide and are prepared to pay for such a lifestyle (Gubanc, 1999). According to previous findings (Gubanc, 1999; Jurak, Kovač, & Strel, 2002) it can be assumed that these parents also more often enrol their children in sports activities during their free time and they are also sportingly active themselves. Therefore these children get ahead of their peers in motor development, and are more successful in sport and take up sports more frequently.

The higher body weight of the boys in sports classes can be explained by their greater biological maturity (Malina, 1994). It appears as if these boys have more fat and muscle tissues. An increase in body fat can be noted in boys under the age of 12 (Strel et al., 2001; Strel, et al., 2004); therefore, the higher share of body fat in boys from sports classes can be explained by their higher biological age. Simultaneously, the greater differences in body weight compared with body fat indicate a larger percentage of muscle tissue.

As expected, by the end of their fourth year children from both general and sports classes (see

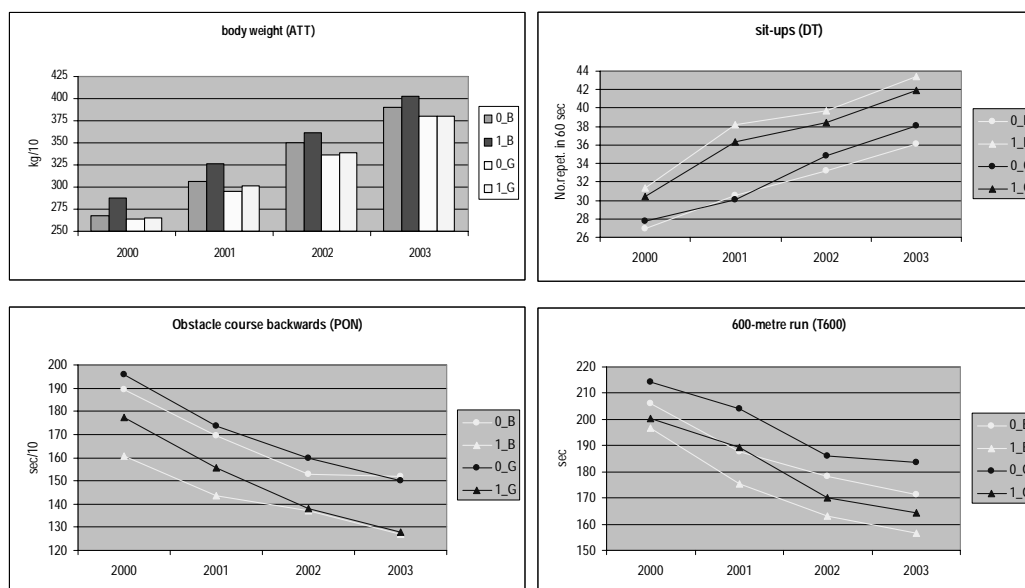


Figure 1. Trends in the results of the variables ATT, PON, DT and T600 of pupils from general PE and sports classes between the first and the fourth year of primary school, for each gender.

Legend: ATT – body weight, PON – obstacle course backwards, DT – sit-ups, T600 – 600-m run

Groups: 0\_B = boys from general PE classes; 1\_B = boys from sports classes; 0\_G = girls from general PE classes; 1\_G = girls from sports classes

Table 2; year 2003) had higher values than the initial ones in all tested variables (difference in tests at the alpha level .01). Namely, a characteristic of the studied period (7 to 10 years of age) is the positive direction of development for both genders in all of the motor abilities (Malina, Bouchard, & Bar-Or 2004; Strel, et al., 2004) as well as the higher values of all three measured anthropometric measurements (Kondrič, 2000; Strel et al., 2001; 2003; Strel, et al., 2004).

On the basis of the final testing results (see Table 2, year 2003) one could assume a better efficiency of work in the general PE classes; however, a more detailed analysis (see Table 3 and Figure 1) paints a different picture.

Boys from sports classes had a higher body weight than their peers from general classes in all years (see Figure 1), however, the difference decreases with age, which shows that their maturity level was higher at the time of entering the school but their peers soon caught up with them. As a result of the reduced difference in skin folds (see Table 2), it can be assumed that the difference in body weight is less due to the smaller increase in body fat in the boys from the sports classes. This is a very important indicator in the light of cross-studies that point towards an increasing percentage of overweight and obese children of this age (Strel et al., 2001; Strel, et al., 2004; Cacciari et al., 2002; Cole & Rolland-Chachera, 2002; Tremblay, Katzmarzyk, & Willms, 2002).

An increase in the difference between the initial and final tests was noticed for all three motor tasks (PON, DT, T600) in favour of both boys and girls from sports classes (see Table 3). Pupils from sports classes had already achieved higher results in all tasks at the time of the first tests; nevertheless, these differences were even higher in the last tests.

A better progression in the co-ordination of the whole body movement of pupils from sports classes indicates a better quality in the running of the lessons, a wider range of motor skills and the suitable organisation of work, which ensured positive changes in such motor abilities (Kovač & Štihec, 1988). It can be assumed that pupils from sports classes received different motor stimuli which teachers passed on in different ways and thus they also indicate a higher level of sports skills.

The better progression in the tasks *sit-ups* and *600-metre run* can mainly be explained by the higher amount of exercising in the form of more hours of PE in sports classes. Tasks represent different forms of endurance, which can be significantly improved through planned and suitable exercising. It is known that children of both genders who are regularly active (included in sports training) show better aerobic endurance and higher levels of physiological and motor abilities (especially muscular endurance and speed endurance). This has been

proved in some cross-studies comparing active children (Strel, et al., 2004) as well as in longitudinal studies (Mirwald, Bailey, Cameron, & Rasmussen, 1981; Kovač & Štihec, 1988; Beunen, Malina, Renson, Simons, Ostyn, & Lefevre, 1992; Karpljuk, Videmšek, Štihec, Kondrič, & Štemberger, 2000; Karpljuk & Videmšek, 2000).

It could have been expected that there would be also bigger differences in the results of the other motor variables. After studying the characteristics of individual dimensions represented by motor variables, it can be seen that an improvement was not mainly achieved in those motor abilities which are largely genetically determined (speed, explosive power). In comparison, an improvement in the sports classes was mostly achieved in those motor abilities which can be significantly improved through exercise and for which the studied age group has revealed particularly negative changes in the last couple of decades (Bös, 2003; Strel, et al., 2004). In addition, it is a custom in schools with sports classes that a higher level of PE for general classes is also achieved as a result of the positive transfer of knowledge between teachers (Novak, Petrovič, Tušak, & Kovač, 1990). Further, a lower initial status always facilitates a bigger improvement compared to those with a higher initial status. These factors could explain the smaller differences between the pupils from general and sports classes and be a result of the samples used.

By limiting the study by excluding out-of-school factors that could have an impact on the development of children's motor abilities, it can be seen that the programme of sports classes in Slovenian primary schools does have a positive impact on the development of motor abilities, especially considering the fact that the results for the individual motor abilities of children aged 7 to 10 years have been falling in Slovenia over the last couple of decades. Strel and associates (2004) found that the body fat of Slovenian children of these ages has increased in the last ten years by 30%, whereas general endurance has fallen by 20% while the level of whole body co-ordination has also decreased by 10%. Other European authors have come to similar conclusions (Bös, 2003, Kemper, 2004). The previous findings indicate threats stemming from changes in both the family environment (insufficient motor stimuli; changes in free-time activities whereby spontaneous activities have been replaced by computers, television and mobile phones; excessive care for the comfort of the youngest children reflected in large amounts of appealing, yet unsuitable food and the school system (permissive education; not enough complex movements in PE, bigger emphasis on aesthetic expression and enjoyment in less demanding physical activities; poor planning of practicing) in which the effect of PE is unsuitable as regards endurance abilities and the regulation of

body weight. These results reveal a worrying pattern of children growing up and provide an unsuitable example for their future lifestyles since indicators of health risks are now already being seen in the youngest age groups (Higgins, Gower, Hunter, & Goran 2001; Eisenmann, 2004).

The better effects of the programme of sports classes on motor development are probably a result of the better quality and higher quantity of exercising. Programme quality is chiefly achieved through the superior knowledge of teachers and the smaller number of children being taught (more individual work and better safety), whereas apart from the mentioned factors the quantity of exercising is also achieved through the larger amount of hours of PE available. Undoubtedly differences between the groups would have been even bigger if the testing had been carried out at the beginning of the first year of school and not in April.

Since the positive effects of the combined teaching of the PE teacher and the classroom teacher have often been proved (Kovač & Štihec, 1988; Muhič, 2000; Muraus, 2000), it would be sensible to offer more often that type of work which is not systematically financed. It is recommended that the responsible ministry and local communities encourage schools through co-financing to more often include a PE teacher in the PE classes of younger children. Programmes should be underpinned by the transfer of knowledge of planning PE as it has been found that classroom teachers lack skills especially in this area (Jurak, Kovač, & Strel, 2004c).

With the increased knowledge of teachers it will be possible to utilise more hours of PE as the amount of time children will spend in the modern Slovenian school will rise. Parents in larger towns finish their work in the late afternoon and therefore expect an appropriate school timetable for their children<sup>3</sup>. Therefore, children will participate in sports activities as a part of extracurricular schoolwork. This kind of PE organisation will demand greater organisational flexibility than the old style of sports classes. Appropriate teaching skills will become even more important from the aspect of planning activities.

Some authors claim (Rowland, 1985; Pate & Ward, 1990) that there is no point in developing the general endurance of children in the period of

their accelerated development, as the human organism does not respond to endurance exercising due to developmental characteristics. The results of our study, however, show a significant improvement in the 600-metre run, which is a good indicator of the general endurance of children of that age (Cureton, 1982; Safrid, 1990; Škof & Milič, 2002; Kropelj, Škof, & Milič, 2002). These improved results are not only a consequence of the better aerobic endurance of children, as other factors also have an impact on long-distance running: persistence, technique and tactics of the running, etc. (Mrak, 2000). Especially as a result of the latter factors the claims of being too early in endurance exercising are incorrect. Namely, endurance exercising, adjusted to the developmental level of children, can create a basis for the successful development of aerobic capacities in later ages. Suitable knowledge and a sufficient amount of PE hours available are necessary for the planning and execution of this kind of exercising.

Results of the study also reveal some shortfalls of current work in sports classes. One can see that teachers in these classes do not pay enough attention to the muscular strength of arms and shoulder girdle and flexibility. Especially the former is worrying, given that the muscular strength of arms and shoulder girdle of boys and girls between the ages of 7 and 9 years has decreased by 50% in the past decade (Strel, et al., 2004). Similar trends have been estimated by Rychtecky (2004) on the sample of Czech, Polish and Slovak children. It is suggested that schools carry out a detailed analysis of the situation at the beginning of the academic year and then include those sports activities in the programme of sports classes which will improve the results of those motor abilities whose results are not so good.

Opportunities for better work also arise with the more systematic planning of lessons. Children from sports classes have around 420 hours<sup>4</sup> of PE between the first and fourth years of their education, which is not negligible in terms of the development of motor abilities. A greater number of hours and the planned direction towards the development of motor abilities could bring about improved effects for the motor status of children and, indirectly, for their health status.

<sup>3</sup> Slovenia already had all-day primary schools in the previous decade which were then transformed into regular schools through various changes in education. PE played an important role in those schools.

<sup>4</sup> A school lesson lasts 45 minutes.

## References

- Beunen, G., Malina, R., Renson, R., Simons, J., Ostyn, M., & Lefevre, J. (1992). Physical activity and growth, maturation and performance: A longitudinal study. *Medicine & Science in Sports & Exercise*, 24, 576–585.
- Bös, K. (2003). Motorische Leistungsfähigkeit von Kindern und Jugendlichen. In W. Schmidt, I. Hartmann-Tews, & W.-D. Brettschneider (Eds.), *Erster Deutscher Kinder- und Jugendsportbericht* (pp. 85-107). Schorndorf: Hofmann.
- Cacciari, E., Dilani, S., Balsamo, A., Dammacco, F., De Luca, F., Chiarelli, F., et al. (2002). Italian cross-sectional growth charts for height, weight and BMI (6-20y). *European Journal of Clinical Nutrition*, 56, 171-180.
- Cankar, A., & Kovač, M. (1995). Pedagoški vidiki športa otrok in mladine. [Pedagogical aspects of the sport of children and youth. In Slovenian.] In A. Cankar & M. Kovač (Eds.), *Športni oddelek v gimnaziji* [Sports classes in grammar school. In Slovenian.] (pp. 28-39). Ljubljana: Ministry for Education and Sport, The National Education Institute of the Republic of Slovenia.
- Cole, T., & Rolland-Chachera, M. F. (2002). Measurement and definition. In W. Burniat, T. Cole, I. Lissau, & E. Poskitt, (Eds.), *Child and Adolescent Obesity* (pp. 1-22). Cambridge: Press Syndicate of the University of Cambridge.
- Cureton, K. J. (1982). Distance running performance tests in children: What do they mean? *The Journal of Physical Education, Recreation & Dance*, 53, 64-66.
- Eisenmann, J.C. (2004). Physical activity and cardiovascular disease risk factors in children and adolescents: An overview. *Canadian Journal of Cardiology*, 20, 295-301.
- Gubanc, M. (1999). *Športni oddelki v osnovni šoli – zadosten pogoj za kvalitetno šolo?* [Sports classes in primary schools – adequate conditions for quality education? In Slovenian.] (Unpublished Bachelor's thesis, University of Ljubljana). Ljubljana: University of Ljubljana, Faculty of Arts.
- Higgins, P. B., Gower, B. A., Hunter, G. R., & Goran, M. I. (2001). Defining health-related obesity in prepubertal children. *Obesity Research*, 9, 233-240.
- Horvat, L. (1994). Motorični in kognitivni razvoj v starostnem obdobju med 6. in 19. letom. [Motor and cognitive development between the ages of 6 and 19 years. In Slovenian.] In *Cilji šolske športne vzgoje. Uvodna izhodišča.* [Goals of Physical Education. In Slovenian.] (pp. 23-30). Ljubljana: The National Education Institute of the Republic of Slovenia.
- Jurak, G., Kovač, M., & Strel, J. (2002). How Slovene primary school pupils spend their summer holidays. *Kinesiologia Slovenica*, 8(2), 35-43.
- Jurak, G., Kovač, M., & Strel, J. (2004a). Analiza nekaterih vidikov organizacije športnih oddelkov ob izteku programa osemletke. [An analysis of some organisational aspects of sports classes at the end of 8-year-long compulsory primary education. In Slovenian.] *Sport*, 52(2), 29-34.
- Jurak, G., Kovač, M., & Strel, J. (2004b). Predlog organizacije športnih oddelkov v devetletki. [Proposal for the organisation of sports classes in 9-year-long primary education. In Slovenian.] *Sport*, 52(3), 16-20.
- Jurak, G., Kovač, M., & Strel, J. (2004c). The opinions of class teachers about their competences for teaching physical education according to the new curriculum. In R. Pišot, V. Štemberger, J. Zurc & A. Obid, (Eds.), *Child in Motion: Abstracts and Proceedings: 3<sup>rd</sup> International Symposium*, Kranjska gora, 2004. /CD-ROM/. Koper: University of Primorska.
- Jurak, G., Kovač, M., Strel, J., & Starc, G. (2005). Academic opportunities for talented athletes in Slovenian secondary schools. *Kinesiologia Slovenica*, 11(1), 50-64.
- Karpljuk, D., & Videmšek, M. (2000). The influence of an experimental training programme on endurance development among boys in their early puberty age. *Acta Universitatis Palackianae Olomucensis, Gymnica*, 30(2), 25-34.
- Karpljuk, D., Videmšek, M., Štihec, J., Kondrič, M., & Štemberger, V. (2000). An experimental training programme and its influence of endurance development among 11-year-old schoolgirls. *Acta Universitatis Carolinae, Kinesiology*, 36(1), 51-66.
- Kondrič, M. (2000). *Promjene odnosa između nekih antropometrijskih osobina i motoričkih sposobnosti učenika od 7. do 18. godine.* [Changes of the relationship between some anthropometric characteristics and motor abilities of pupils between the ages of 7 and 18 years. In Croatian.] (Unpublished doctoral dissertation, University of Zagreb). Zagreb: University of Zagreb, Faculty of Kinesiology.
- Kovač, M., & Novak, D. (1998). *Učni načrt: program osnovnošolskega izobraževanja, Športna vzgoja.* [Teaching curriculum: programme for compulsory primary education. In Slovenian.] Ljubljana: The National Education Institute of the Republic of Slovenia.
- Kovač, M., & Štihec, J. (1988). *Vpliv eksperimentalnega programa vadbe na razvoj nekaterih morfoloških in motoričnih dimenzij osemletnih učencev in učenk.* [The impact of the experimental programme of exercising onto the development of some morphological and motor dimensions of 8-year-old pupils of both genders. In Slovenian.] (Unpublished Master's thesis, University of Ljubljana). Ljubljana: University of Ljubljana, Faculty of Sport.
- Kovač, M., Jurak, G., Strel, J., & Starc, G. (2003). Physical education curriculum in Slovenia. In G. Jurak (Ed.), *Sports activities of Slovenian children and young people during their summer holidays* (pp. 9-22). Ljubljana: Faculty of Sport.
- Kropej, V. L., Škof, B., & Milić, R. (2002). Achievement of VO<sub>2</sub> plateau in children. In D. Milovanović & F. Prot (Eds.), *Proceedings Book of 3<sup>rd</sup> International Scientific Conference, Opatija, 2002, "Kinesiology: New Perspectives"* (pp. 511-514). Zagreb: Faculty of Kinesiology, University of Zagreb.



- Malina, R. M. (1994). Physical growth and biological maturation of young athletes. *Exercise and Sport Science Reviews*, 22, 389-434.
- Malina, R., M., Bouchard, C., Bar-OR, O. (2004). *Growth, maturation, and physical activity*. Champaign, IL: Human Kinetics.
- Mirwald, R. L., Bailey, D. A., Cameron, N., & Rasmussen, R. L. (1981). Longitudinal comparison of aerobic power in active and inactive boys 7 to 17 years. *Annals of Human Biology*, 8, 405-414.
- Mrak, A. (2000). Povezanost morfoloških značilnosti, motoričnih sposobnosti in osebnostnih lastnosti z rezultati teka 600m in 2400m pri učencih v obdobju adolescence. [Correlation between morphological characteristics, motor abilities, personal characteristics and the results of 600- and 2400-metre run in the period of adolescence. In Slovenian.] In B. Škof, T. Kogovšek & A. Rot (Eds.), *Športna vzgoja za novo tisočletje, Zbornik 13. strokovnega posveta Zveze društev športnih pedagogov Slovenije* [Physical education for the new millennium, Proceedings Book of the 13<sup>th</sup> Conference of Experts of the Union of Sports Pedagogues' Associations of Slovenia. In Slovenian.] (pp. 325-331). Ljubljana: Union of Sports Pedagogues' Associations of Slovenia
- Muhič, M. (2000). Primerjava rezultatov testiranja motoričnih sposobnosti učenk in učencev športnih in nešportnih oddelkov od 1. do 4. razreda osnovne šole. [Comparison of the results of testing of motor abilities of pupils of both genders, attending sports and non-sports forms 1- 4 of primary school. In Slovenian.] In R. Pišot & V. Štemberger (Eds.), *Child in Motion, Proceedings Book* (pp. 219-224). Ljubljana: Faculty of Education, University of Ljubljana.
- Muraus, L. (2000). Primerjava rezultatov motoričnih in drugih gibalno-športnih sposobnosti glede na število ur pouka športne vzgoje. [Comparison of the results of motor and other sport-related movement abilities, according to the number of physical education classes. In Slovenian.] In R. Pišot & V. Štemberger (Eds.), *Child in Motion, Proceedings Book* (pp. 219-224). Ljubljana: Faculty of Education, University of Ljubljana
- Novak, D., Petrovič, K., Tušak, M., & Kovač, M. (1990). *Športni razred z motoričnega, socialno-demografskega, psihološkega in mikrosociološkega vidika*. A sport class from its motor, socially-demographic, psychological and micro-sociological aspect. In Slovenian.] Ljubljana: University of Ljubljana, Faculty of Sport.
- Pate, R. R., & Ward, D. S. (1990). Endurance exercise trainability in children and youth. *Advances in Sports Medicine and Fitness*, 3, 37-55.
- Rowland, T. W. (1985). Aerobic response to endurance training in prepubescent children: A critical analysis. *Medicine & Science in Sports & Exercise*, 17, 493-497.
- Rychtecky, A. (2004). *Study on young people's lifestyles and sedentariness and the role of sport in the context of education and as a means of restoring the balance. Czech, Polish, Slovak, and Slovenian cases*. Prague: Charles University.
- Safrid, M. J. (1990). The validity and reliability of fitness tests for children: A review. *Pediatric Exercise Science*, 2, 9-28.
- Škof, B., & Milič, R. (2002). Delež energijskih sistemov pri teku na 600 in 2400 metrov pri otrocih različne starosti. [Percentage of energetic systems in the 600- and 2400-metre run for children of different ages. In Slovenian.] *Šport*, 50(3), 17-23, Appendix.
- Strel, J., Ambrožič, F., Kondrič, M., Kovač, M., Leskošek, B., Štihec, J., et al. (1997). *Sports educational chart*. Ljubljana: Ministry of Education and Sport.
- Strel, J., Kovač, M., & Jurak, G. (2004, June 15). *Study on young people's lifestyles and sedentariness and the role of sport in the context of education and as a means of restoring the balance. The case of Slovenia*. Retrieved June 30, 2004 from: <http://www.sp.uni-lj.si/didaktika/english.htm>
- Strel, J., Kovač, M., Jurak, G., & Bednarik, J. (2003, June 30). Gender differences of Slovenian school children in physical and motor development in the period from 1990 to 2000. *Finnish Sports and Exercise Medicine, The International XVII Puijo Symposium special issue*. Retrieved September 20, 2003 from: [http://ffp.uku.fi/cgi-bin/edueditor/presenter.pl?slideshow\\_id=101&slide\\_id=1012&language\\_id=1](http://ffp.uku.fi/cgi-bin/edueditor/presenter.pl?slideshow_id=101&slide_id=1012&language_id=1)
- Strel, J., Kovač, M., Jurak, G., Bednarik, J., & Leskošek, B. (2001). Comparison of the physical development of school children between 1990 and 2000 on the basis of data obtained from the sports educational chart. *Anthropological Notebook*, 7(1), 11-32.
- Strmčnik, F. (1995). Skrb za razvoj nadarjenih učencev. [Looking after the development of talented children. In Slovenian.] *Vzgoja in izobraževanje*, 26(1), 3-11.
- Šturm, J. (1992). *Nekateri splošni vidiki dela s športno nadarjenimi učenci*. [Some general aspects of working with children talented for sports. In Slovenian.] Ljubljana: University of Ljubljana, Faculty of Sport.
- Tremblay, M. S., Katzmarzyk, P. T., & Willms, J. D. (2002). Temporal trends in overweight and obesity in Canada, 1981-1996. *International Journal of Obesity*, 26(4), 538-543.

# UTJECAJ PROGRAMA DODATNIH SATI TJELESNOG ODGOJA NA TJELESNI I MOTORIČKI RAZVOJ DJECE U DOBI OD 7 DO 10 GODINA

## Sažetak

### Uvod

Uz razrede s redovnom nastavom, škole u Sloveniji posljednjih petnaestak godina nude i program tzv. *sportskih razreda*, s naprednim i proširenim nastavnim planom i sadržajem tjelesnog odgoja koji najčešće uključuje dva dodatna sata tjedno za bavljenje izabranim aktivnostima u okruženju škole. Dodatne sate zajednički vode nastavnici tjelesnog odgoja i nastavnici razredne nastave. Uz to, program nudi i širi izbor sportskih sadržaja, kojima se učenik može baviti i izvan škole. Ovaj program dodatne sportske nastave uveden je, nažalost, u manje od 7% osnovnih škola u Sloveniji (Jurak, Kovač, & Strel, 2004a). Za razliku od sportskih razreda srednjih škola, ovdje cilj nije usklađivanje školskog rada i sportskih treninga (Jurak, Kovač, Strel, & Starc, 2005), nego ponuda naprednog sadržaja tjelesnog odgoja djeci i roditeljima koji žele više sporta, kao i njihovo usmjeravanje zdravom načinu života (Kovač & Novak, 1998).

Cilj istraživanja bio je utvrditi kako program dodatnih sati tjelesnog odgoja utječe na tjelesni i motorički razvoj djece u dobi od 7 do 10 godina.

### Metode

Provedeno je longitudinalno istraživanje u vidu pedagoškog eksperimenta. U istraživanje je uključeno 328 učenika, koji su u 2000. g. započeli s prvom godinom svog školovanja (u dobi od 7 godina). U sljedeće tri godine (2001-2003) prošli su testiranja u svim mjerenim zadacima. Oblikovane su dvije skupine djece iz istih škola: eksperimentalna skupina, koja je uključivala djecu iz sportskih razreda (N=157; 81 dječak i 76 djevojčica) i kontrolna skupina, koja je uključivala djecu iz običnih razreda (N=171; 87 dječaka i 84 djevojčice). To je učinjeno da bi se minimizirao učinak uvjeta rada za tjelesni odgoj koje nude pojedine škole te utjecaj šireg društvenog okruženja na rezultate.

Podaci su prikupljeni u okviru tzv. "Sportsko-obrazovnog kartona" (Športno vzgojni karton) (Strel et al., 1997), koji uključuje prikupljanje podataka na temelju kojih se kroz 19 godina pratio tjelesni i motorički razvoj djece i mladeži u Sloveniji (Strel et al., 2001, 2003, 2004). Korišteni su sljedeći testovi: tjelesna visina, tjelesna težina, kožni nabor nadlaktice, taping rukom, skok udalj s mjesta, poligon natraške, podizanje trupa, pretklon na klupi, izdržaj u visu zgibom, trčanje 60m i trčanje 600m. Također je izračunata vrijednost XT varijable koja predstavlja prosječnu vrijednost svih osam motoričkih zadataka, a uspoređiva je s cjelokupnom općom populacijom. Testovi su opisani u publikaciji "Sport educational chart", Strela i suradnika (1997).

T-test za zavisne uzorke koristio se za izračun razlika između pojedinih varijabli za individualne skupine mjerenih ispitanika. T-test za nezavisne uzroke se koristio za izračun razlika između pojedinih varijabli dviju skupina mjerenih ispitanika. Razlike u transformacijskim učincima između dviju skupina izračunate su analizom kovarijance.

### Rezultati

Analiza razlika između pojedinih varijabli dviju skupina mjerenih ispitanika pokazuje da su u inicijalnom testiranju (2000.g.) kod oba spola postojale značajne razlike samo u varijablama *taping rukom* ( $p=.003-.019$ ), *poligon natraške* ( $p=.000-.008$ ) i *podizanje trupa* ( $p=.000-.004$ ). Kod dječaka, značajne su razlike između eksperimentalne i kontrolne skupine također utvrđene za varijable *tjelesna težina* ( $p=.008$ ), *skok udalj s mjesta* ( $p=.006$ ), *pretklon na klupi* ( $p=.000$ ) i *izdržaj u visu zgibom* ( $p=.005$ ), a kod djevojčica za varijablu *trčanje 600m* ( $p=.010$ ). Prosječna vrijednost motoričkih zadataka (XT) pokazuje da je motorički status učenika sportskih razreda bio iznad (dječaci 53.114, djevojčice 54.533) slovenskog prosjeka (koji iznosi 50.0), dok je motorički status učenika običnih razreda bio ispod prosjeka (dječaci 47.717, djevojčice 49.695).

Pri završnom testiranju značajne su razlike, za oba spola, u korist učenika sportskih razreda, utvrđene za varijable *taping rukom* ( $p=.013-.020$ ), *poligon natraške* ( $p=.000$ ), *podizanje trupa* ( $p=.002-.020$ ) i *trčanje 600m* ( $p=.000$ ). Kod dječaka, značajna je razlika također utvrđena u testovima *pretklon na klupi* ( $p=.020$ ) i *izdržaj u visu zgibom* ( $p=.024$ ). Razlika u vrijednosti XT se smanjila kao rezultat većih vrijednosti kod djece iz običnih razreda (dječaci 48.435, djevojčice 51.118; sportski razredi: dječaci 52.519 i djevojčice 54.893).

Nakon eliminacije razlike inicijalnog stanja dviju skupina, značajne razlike između dviju skupina na  $\alpha$  razini od .05 mogu se uočiti u sljedećim motoričkim varijablama: *poligon natraške* ( $p=.001-.047$ ), *podizanje trupa* ( $p=.000-.048$ ) i *trčanje 600m* ( $p=.000-.001$ ). Dječaci su se značajno razlikovali i u *tjelesnoj težini* ( $p=.005$ ).

### Rasprava i zaključci

Inicijalne razlike u motoričkim sposobnostima ukazuju na to da se u sportske razrede upisuju djeca s boljim motoričkim statusom. Pretpostaviti je da roditelji djece iz sportskih razreda imaju pozitivniji stav prema sportskom načinu života te da su dovoljno imućni da omoguće i financiraju takav način života.

Veća tjelesna težina dječaka iz sportskih razreda može se objasniti njihovom većom biološkom zrelošću. Istodobno, veće razlike u tjelesnoj težini

u usporedbi s tjelesnom masti ukazuju na veću količinu mišićnog tkiva.

Kao što se očekivalo, na kraju četvrte godine školovanja djeca iz običnih kao i iz sportskih razreda imala su veće vrijednosti svih testiranih varijabli u odnosu na početne. Naime, karakteristika proučavanog perioda je pozitivan smjer razvoja svih motoričkih sposobnosti u oba spola, kao i veće vrijednosti sve tri mjerene antropometrijske mjere (Kondrič, 2000; Strel et al., 2001; 2003, 2004).

Na temelju rezultata završnog testiranja moglo bi se pretpostaviti da je rad u običnim razredima bio učinkovitiji, no detaljnija analiza daje drukčiju sliku.

Dječaci iz sportskih razreda su tijekom svih godina imali veću tjelesnu težinu od svojih vršnjaka u običnim razredima, no razlika se smanjivala s dobi. Na temelju smanjene razlike u kožnim naborima, može se pretpostaviti da je razlika u tjelesnoj težini manja zbog slabijeg porasta tjelesne masti kod dječaka iz sportskih razreda. Ovo je vrlo važan pokazatelj u svjetlu presječnih (*cross-sectional*) studija koje ukazuju na rastući postotak djece ove dobi koja su prekomjerne tjelesne težinom i pretila (Bös, 2003; Strel et al., 2001, 2004).

Bolji napredak u koordinaciji pokreta cijelog tijela (*test poligon natraške*) učenika sportskih razreda ukazuje na bolju kvalitetu vođenja sati, širi opseg motoričkih vještina i odgovarajuću organizaciju rada, što je osiguralo pozitivne promjene u toj motoričkoj sposobnosti (Kovač & Štihec, 1988). Može se pretpostaviti da su učenici sportskih razreda primili drukčije motoričke podražaje, koje su nastavnici prenijeli drukčije, a to upućuje i na višu razinu sportskih vještina.

Veći napredak u testovima *podizanje trupa* i *trčanje 600m* može se prvenstveno objasniti većim

volumenom vježbanja u smislu više sati nastave tjelesnog odgoja u sportskim razredima. Ovi testovi prikazuju različite oblike izdržljivosti, koji se mogu znatno poboljšati planiranim i primjerenim vježbanjem.

Očekivale su se veće razlike u rezultatima drugih motoričkih varijabli. Nakon analize karakteristika pojedinih dimenzija predstavljenih motoričkim varijablama, vidljivo je da napredak nije poglavito postignut u onim motoričkim sposobnostima koje su velikim dijelom genski zadane (brzina, eksplozivna snaga). U usporedbi s time, u sportskim je razredima napredak postignut ponajviše u onim motoričkim sposobnostima koje se mogu značajno poboljšati vježbom, a za koje je proučavana dobna skupina pokazala naročito negativne promjene u posljednjih nekoliko desetljeća (Bös, 2003; Strel et al., 2004; Rychtecky, 2004). Uz to, postalo je uobičajeno da se u školama sa sportskim razredima postiže viša razina nastave tjelesnog odgoja i u običnim razredima, kao rezultat pozitivnog transfere znanja među nastavnicima (Novak et al., 1990). Nadalje, slabije inicijalno stanje uvijek olakšava postizanje većeg napretka u odnosu na ispitanike s boljim (višim) inicijalnim stanjem. Ti bi čimbenici mogli objasniti manje razlike između učenika običnih i sportskih razreda.

Kao odgovor na dobivene nalaze, preporuča se sljedeće: učestalija suradnja između nastavnika tjelesnog odgoja i nastavnika razredne nastave u nastavi tjelesnog odgoja, organizacija primjerenih programa dodatnog obrazovanja nastavnika o razvojnim karakteristikama djece u dobi od 7 do 10 godina, fleksibilna organizacija sportskih razreda zbog promijenjenih zahtjeva školskog rasporeda i sustavnije planiranje nastave za sportske razrede.

Submitted: August 30, 2006

Accepted: October 31, 2006

Correspondence to:

Assist. Prof. Gregor Jurak, PhD

University of Ljubljana, Faculty of Sport,

Gortanova 22, SI-1000 Ljubljana, Slovenia

Phone: +38615207700

E-mail: gregor.jurak@fsp.uni-lj.si