

ADDITIONAL EXERCISE AS AN EFFICIENCY FACTOR IN PHYSICAL EDUCATION LESSONS

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Abstract:

The study, based on the experimental method in which the factors were additional exercises in the parallel-alternating form of work in two teaching units and the pupils' preparedness for more demanding instructional forms, was conducted with a sample of 59 first form pupils (7-year-olds) within their regular physical education classes from March till June 2002. The instructors and observers were students of the Teacher Training College, Petrinja, Croatia, during their student teaching practice. The aim was to establish empirically the actual exercise time in a PE lesson and the role of additional tasks in it. Heart rate was used to estimate the physiological workload. The efficiency of a lesson can be significantly improved through the use of more demanding instructional forms of work, especially the ones including additional exercise (640.3sec.±157.38sec. vs. 923.17sec.±189.27sec. without and with additional tasks per pupil, respectively). The increase in the metabolic rate (initial 132.48 bpm and final 133.82 bpm in the programme without additional exercise – not statistically significant, vs. initial 138.71 bpm and final 158.61 bpm in the programme with additional tasks – statistically significant) is caused by additional exercise, which decreased “waiting in line” and increased the effective exercise time, thus increasing the workload during the lesson and providing a greater stimulus for the transformation of pupils' anthropological characteristics. If we want to increase the actual work time and workload in a PE lesson with the use of more demanding instructional forms of work, we must gradually prepare the pupils for their application.

Key words: physical education, effective work time, group work, instructional forms, first formers, 7-year-olds

ZUSÄTZLICHE KÖRPERÜBUNGEN ALS EIN EFFIZIENZFAKTOR IM SPORTUNTERRICHT

Zusammenfassung:

Es wurde eine Studie an 59 Schülern der ersten Klasse (7jährige Schüler) in der Zeit zwischen März und Juni 2002 gemacht. Diese Studie basierte auf einer experimentalen Unterrichtsmethode, in der die zusätzlichen Körperübungen mit den analog abwechselnden Arbeitsformen in zwei Unterrichtseinheiten und die Fitness von Schülern für die anspruchsvollen methodischen Arbeitsorganisationsformen als Faktoren angewendet waren. Die Studenten der Pädagogischen Hochschule aus Petrinja, Kroatien, waren die Instrukoren und Beobachter dieses Verfahrens innerhalb deren Unterrichts im Studienfach *Methodik* als der praktische Teil des Fachs *Methodik des Sportunterrichts*.

Das Ziel der Studie war, sowohl die eigentliche Übungszeit während einer Sportunterrichtsstunde als auch die Rolle der zusätzlichen Übungsaufgaben empirisch festzustellen. Die Herzfrequenz wurde dazu verwendet, die physiologische Belastung zu bewerten. Die Effizienz einer Unterrichtsstunde kann bedeutend verbessert werden, indem man die mehr anspruchsvollen methodischen Arbeitsorganisationsformen im Unterricht anwendet, besonders diejenigen, die die zusätzlichen Körperübungen einschließen (640,3 Sekunden ±157,38 Sekunden beim Unterricht mit zusätzlichen Übungen und 923,17 Sekunden ±189,27 Sekunden beim Unterricht ohne zusätzliche Übungen). Die Steigerung der Herzfrequenz (anfängliche Herzfrequenz = 132,48 Herzschläge pro Minute und Herzfrequenz am Ende der Belastung 133,82 Herzschläge pro Minute während des Unterrichts ohne zusätzliche Übungen – nicht statistisch bedeutend, und anfängliche Herzfrequenz von 138,71 und Herzfrequenz am Ende der Belastung 158,61 Herzschläge pro Minute beim Unterricht mit zusätzlichen Aufgaben/Übungen – statistisch bedeutend) ist das Resultat von zusätzlichen Übungen, was nicht nur das ‘Schlange-Stehen’ vermindert einerseits, und andererseits die effektive Übungszeit verlängert,

sondern was auch sowohl die Belastung während der Unterrichtsstunde vergrößert als auch einen größeren Stimulus für die Transformation von anthropologischen Charakteristiken der Schüler darstellt.

Wenn wir die eigentliche Übungszeit und die Belastung während des Sportunterrichts durch die Anwendung mehr anspruchsvoller Unterrichts-Arbeitsmethoden verlängern, bzw. vergrößern wollen, ist eine gute allmähliche Vorbereitung von Schülern für einen solchen Unterrichtstyp notwendig.

Schlüsselwörter: Sportunterricht, effektive Übungszeit, Gruppenarbeit, Unterrichtstypen, Schüler der ersten Klasse, 7 jährige

Introduction

In achieving the aims of the school subject Physical Education (PE), a significant place belongs to the methods of classroom management and instruction delivery forms or to, as it is called in Croatia, the methodical organisational work forms. The effects of exercise in PE do not depend only on the material work conditions, but also on the teachers' expertise and his/her readiness to apply the methodical organisational work forms in the best possible way. The standard classification of work forms into the frontal, group and individual work forms has a dynamic character which erases strict borders among them. The preconditions for the change to more demanding work forms are created by simpler work forms and the important "link" in the process are group work forms with additional exercise (Findak, 1999; Sinibaldi, 2002).

The application of the appropriate methodical organisational forms of work, especially with additional exercise, may contribute, in the scope of school-based PE, to the intensification, rationalisation, optimisation, humanising and the individualising of the process of exercising (Findak, 1992). The richness of the organisational work forms in PE teaching methods will contribute to a reduction in any loss of time (Prskalo, 2002). This paper especially refers to the main A part of the lesson, in which, according to the aims and the exercise time available, even the most demanding methodical organisational forms of work can be used (Findak, 1992). Effective exercise times and the physiological workloads, calculated from the data on heart rate while using the organisational forms of work with and without additional exercises, are compared.

The significance of this research may be considerable, especially at a time when, for a variety of professional reasons, the stress is put in Croatia on the reduction of the workload pupils have to sustain, especially in terms of the number of contact hours, or, in other words, on the need to reshape the elementary and secondary school curricula. However, childhood has globally changed during

the last few decades – environmental changes, such as an increase in urbanisation, traffic, media offers, "indooring", awareness of education and dissolving of traditional social structures have been described as influencing negatively the motor development in children (Dollman et al., 1999). The changes in children's ability are described as involving a decrease in sensory, motor, playing and social experience, the capacity of concentration and endurance (Kretschmer, 2001). So, at a time in which children suffer from insufficient physical work, movement, spontaneous play and exercise, in short, from insufficient physiological workload, inappropriate diet and increased intellectual and emotional workload (Nagyová & Ramacsay, 1999), every second of effective physical workout is important.

There is a large body of research studies focusing on effective teaching and learning motor skills, including teaching techniques that may facilitate the process of learning and thus improve the effectiveness of work. They focus on a variety of topics like different aspects of teaching styles (Byra & Jenkins, 1998), organisation of work (Ernst & Byra, 1998), effects of two instructional models (Harrison et al., 1999), difficulties in frontal work with large classes (Hastie, Sanders, & Rowland, 1999), effects of two instructional formats on the heart rate intensity (Scantling et al., 1998), interrelationships with task structures and student skill levels (Silverman, Woods, & Subramaniam, 1999), time rationalisation in PE class (Findak et al., 1996) and many others.

Findak and associates (1996) conducted a research in order to get an insight into the effective time structure of the PE pre-school lesson performed by the pre-school teachers (not PE specialists) who employed only the frontal approach. Sixty children (3.5-year-olds on average) were observed during 60 PE lessons scheduled to last 25 minutes. The significant difference was obtained between the scheduled and actual lesson duration (25' vs. 20'46", respectively). Each child exercised on average only 7'29" or 35.6% of the actual lessons' time (introduction: 1'35" or 20.6%; pre-

paration: 1'50" or 22.8%; main A part: 2'50" or 30.8%; main B part: 1'24" or 19%; final part: 35" or 6.8%). The rest of striking 13'17" or 64.6% of time children were waiting for their turn to work doing nothing. The interfering subjective and objective factors must be eliminated by the application of better suited teaching methods and instructional forms, by the appropriate selection of the content of work, by adequate usage of equipment, by more balanced engagement of children during the work, by providing better working conditions, by decreasing the number of children in the class, and by proper professional education of educators, in the field of PE in particular.

The common accent in all the mentioned articles is: the effective work time in PE lessons should be enhanced in order to provide proper stimuli for physical fitness and healthy development of children. And the teachers' expertise and proficiency in content delivery, as well as in classroom and time management play a crucial role in it (Coker, 1999).

The aim of this research is to establish empirically the effective exercise time and to estimate the physiological workload during a PE lesson on the basis of heart rate (HR). All that in view of the application of additional exercise and of the pupils' fitness for more demanding methodical organisational forms of work. The authors hypothesize that (a) effective or actual exercise time in the main A part of the lesson is substantially shorter than the total scheduled time; (b) in the so called passive time of the main A part of a PE lesson there is room for better utilization and an intensification of work; (c) additional exercise may increase the efficiency of the lesson, especially of its main A part; and (d) pupils' fitness for more demanding

forms of work and additional workout tasks may increase the efficiency of a PE lesson, especially of its main A part.

Methods

The sample of participants consisted of 59 first form pupils (7-year-old boys and girls) whose parents gave their informed consent for the children's participation in the study. The pupils attended three co-educational classes at the Second Elementary School, Petrinja, Croatia.

The research design was based on a pedagogical experiment in which the factors were additional exercise tasks in the parallel-alternating form of work during two teaching lessons and the fitness for more demanding methodical organisational forms of work. The experiment was conducted during the period March-June 2002 within the regular 45-minute PE lessons. The contents of teaching embraced two thematic units: jumping on and off the box and climbing up and down the parallel wall bars. Pupils attended their regular stipulated PE classes three times a week, 33 lessons in total. During that period the students of the Teacher Training College performed 14 public presentations within the framework of their student teaching practice in each of the observed first forms. The students were teachers, one in a time, and the rest of the students were observers who collected the data.

At the beginning of the experiment each form had two lessons organised in a parallel-alternating form of work, first without additional exercising (control contents) and second with additional tasks: sideways rolls and squats (experimental contents). The control and experimental lessons were the same as far as the contents are concerned, except for the main A part of the lesson.

Control-content PE lesson parallel-alternating form of work	Experimental-content PE lesson parallel-alternating form of work + additional exercises
1. INTRODUCTION - warm-up: biotic, natural movement structures of walking and running with inserted tasks, like hopping, jumping, crawling, squatting, turning around, etc.	
2. PREPARATION – total body preparation exercises (no apparatuses)	
3a. MAIN A PART – 2 times two groups of pupils	
- first two groups jump on and off the box - second two groups climb up and down the parallel wall bars	- first two groups jump on and off the box + roll sideways forwards and backwards along two mats - second two groups climb up and down the parallel wall bars + 3 squats
in the middle of the main A part of the lesson, the groups change work places and tasks	
- second two groups jump on and off the box - first two groups climb up and down the parallel wall bars	- second two groups jump on and off the box + roll sideways forwards and backwards along two mats - first two groups climb up and down the parallel wall bars + 3 squats
3b. MAIN B PART – relay games: carrying the ball around cones	
4. FINAL, CLOSING PART – elementary relaxation game and cooling down	

Both the effective work time and heart rate were measured by stop watch. The heart rate was measured every five minutes. Then pupils were trained (March-June) for more demanding forms of work within their regular lessons of PE with their classroom teachers and within the public presentation lessons with the student teachers. In the public presentations, while introducing various methodical organisational forms of work, the principle of progression was applied. This means that frontal work was used at the beginning, then came diverse group forms of work - starting from pair work, threesomes and foursomes, then followed parallel-group work, parallel-group work with additional exercises, parallel-alternating work and parallel-alternating work with additional exercises. The students' individual lessons were prepared and performed in cooperation with their mentors (classroom teachers) and the characteristics of each teaching unit had to be taken into consideration. In all cases, both the pupils and student teachers had an opportunity to get to know the simpler, as well as more demanding forms of work with and without additional exercise.

At the end of the experiment the two described lessons were performed again in the same order and final measurements were conducted.

The sample of variables were: effective exercise time of each pupil (EFET) in each part of the lesson - introduction, preparation, main A, main B, final - EFETI, EFETP, EFETMA, EFETMB, EFETF, respectively, and total effective exercise time in a PE lesson, EFETT. Apart from that, the heart rate at rest was measured (before the lesson) - HRR, and then every 5 minutes during the lesson - HR5, HR10, HR15 etc. The method of heart rate palpation at the wrist was used

Data collection. The measurement of the effective exercise time was conducted by the students, so that one student was responsible for one pupil - he/she observed the child he/she was responsible for and measured his/her effective exercise time, as well as his/her HR for 10 seconds every 5 minutes. On the basis of these results the HR values per minute were calculated.

Data processing methods. The data were processed by means of descriptive statistics and graphically presented. For determining the significance of the differences in the mean results of the variables manifesting normal distribution the

t-test was used from the statistical package Statistica for Windows, release 6.0. (Dizdar & Maršić, 2000). For the variables in which a deviation from the normal distribution was proven by the Kolmogorov-Smirnov test, the U-test was used.

Results and discussion

Effective exercise time depending on the application of additional exercise

The results of observing the effective exercise time of the 59 first formers in connection with the application of additional exercise tasks in the parallel-alternating form of work in two teaching units are presented in Figure 1. The level of significance of the differences in the mean results is established either by using the *t*-test or the U-test, depending on the regularity of distribution, and is presented in Table 1.

Total effective exercise time (first measurement) of the 7-year-old participants in the control PE lesson (without additional exercise) amounted to 10' 21" or 23% of the total lesson, and in the experimental PE lesson with additional exercise to 13' 42" or 30.43%. The difference is mainly a result of the difference in the main A part of the lesson in which the organisation form of work with additional tasks was used. The percentage of the utilization level of the main A part, which is hypothesized to be 18' or 40% of the total duration of the lesson¹, was 15% or 2' 42" without additional exercise and 22.55% or 4' 4" with additional exercise.

Additional exercise has increased the utilization level in the main A part of the lesson by 7.55% which in the end affected the total utilization level of this part of the lesson. Although there is also a significant difference in the introductory part of the lesson, it cannot be ascribed to additional exercising, but to some other reasons. These results are better than the ones achieved in the earlier research (Prskalo, 2001), where the effective exercise time in the lesson was slightly less than 10' per child or 21.58 ± 3.32%. The effective exercise time mentioned by Findak (1992) is 19.32' or 46.14% for the whole lesson and 4.26 or 30.29% for the main A part of the lesson, which is higher than the results achieved in this study, but it

¹ It is planned that a lesson of 45' should have an introduction of 4.5' or 10 % of the total duration of the lesson, preparation of 9' or 20 % of the total duration of the lesson, the main part of 27' or 60 % of the total duration of the lesson. In all this 2/3, i.e. 18' or 40 % of the total duration of the lesson is the main A part, 1/3, i.e. 9' or 20 % of the total duration of the lesson is the main B part. At the end, 4.5' or 10 % of the total duration of the lesson is the final part (Findak, 1999). These data are intended for orientation.

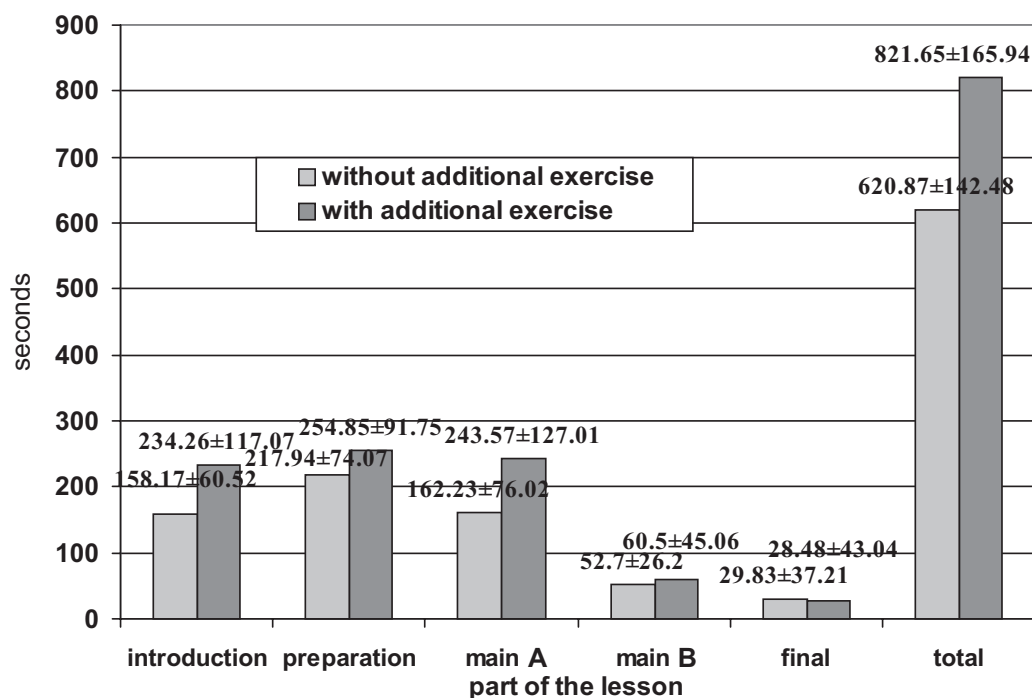


Figure 1. Effective exercise time depending on the application of additional exercise.

Table 1. Significance of the differences in effective exercise time with and without additional exercise in the PE lesson estimated by either the t- or U-test, depending on normality of the distribution

PART OF THE LESSON	EFFECTIVE EXERCISE TIME	
	t	U
INTRODUCTION		0.04
PREPARATION		0.05
MAIN A	0.00	
MAIN B	0.31	
FINAL		0.65
TOTAL	0.00	

can be ascribed to the fact that the sample in that research involved pupils from 1st to 4th form, whereas in this research the sample consisted only of the first form pupils. The percentages of effective work obtained in the present study are proportionally similar to the results obtained in the study with pre-school children (Findak et al., 1996).

Apart from its possible compensating, correctional, relaxing, utilitarian and combining effect, additional exercising plays a significant role in the intensification of the whole process of exercising because it increases the effective exercise time in the main A part of the lesson, thus producing an enhancing effect on the entire lesson.

Physiological workload in PE lessons depending on the application of additional exercise

Table 2. Significance of the differences in heart rate between the experimental lesson with additional exercise and the control lesson without additional exercise as assessed by the t-test

HR MEASURED EVERY 5 MINUTES	p
HR5	0.3137
HR10	0.0016
HR15	0.9838
HR20	0.1638
HR25	0.1108
HR30	0.0000
HR35	0.0017
HR40	0.0000
HR45	0.0377

The total effect on the pupils during the lesson, achieved with the total educational work and defined as workload, is of exceptional importance for the transformation of pupils' anthropological characteristics. Physiological workload has been estimated here by heart rate, since a more intensive metabolic process is manifested in more intensive cardio-respiratory activity (Karpljuk et al., 2000).

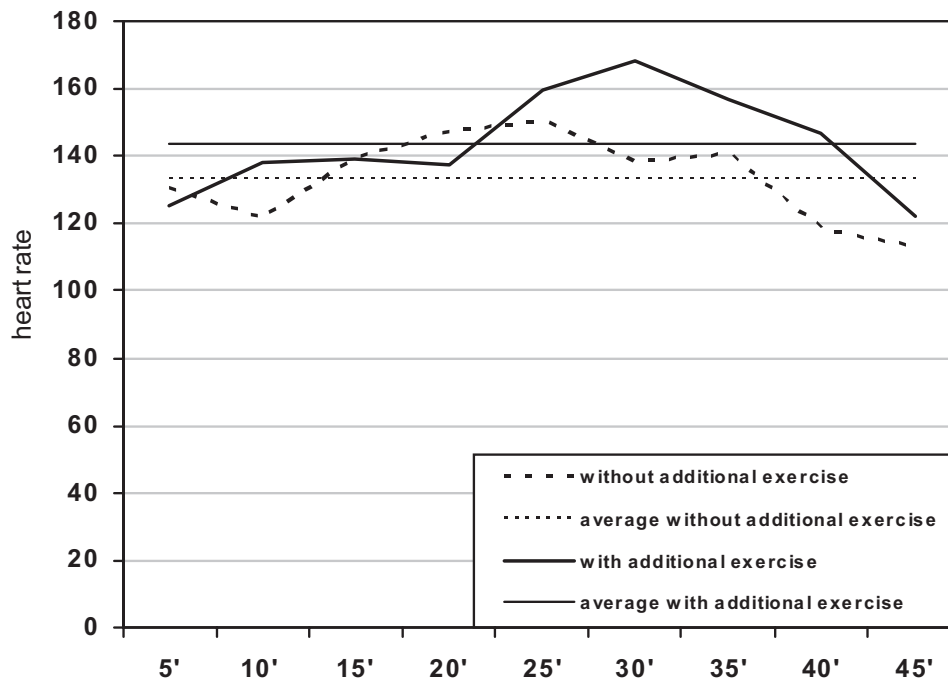


Figure 2. Heart rate measured during the lesson with parallel-alternating methodical organisational form of work with and without additional exercise.

Heart rate values in the first measurement showed normal distribution, so the significance of the differences between HR values in each part of the control and experimental lessons was confirmed by the *t*-test. No significant differences were found in the values of HR at rest – 89bpm and 87bpm for the control and experimental lesson, respectively. The other results are displayed in Figure 2. The presented results were subjected to testing of the significance of the differences in the mean results (*t*-test) which showed a significant difference ($p < 0.05$) in the HR values 10' after the lesson had started. This is sporadic and definitely not the result of the experimental factor – additional exercise. The significant differences in the HR values from HR30 until the end of the lesson (Figure 2) is the result of the increased metabolic rate caused by the additional exercise tasks, which not only reduced the waiting and increased the effective exercise time, but also increased the total workload during the lesson, the physiological workload as well, thus ensuring a greater effect on the transformation of the pupils' anthropological status. This difference resulted in significantly greater average heart rate values for the entire PE lesson. So, when considering time management and the efficiency of work in PE lessons, one has to concentrate first on the main A part of the lesson because, due to its length, it offers the greatest possibility for the

application of the most demanding methodical organisational forms of work and contents enrichment.

Training for more demanding methodical organisational forms of work as the precondition for efficiency in the PE lesson

The choice of instructional forms and methods depends on the aim and tasks we wish to achieve, bearing in mind the age of the pupils/students, their number, content and characteristics of a teaching unit, place of exercise, available space, quantity and quality of equipment and teaching aids, micro-climatic conditions, etc. (Findak, 1992). One methodical organisational form of work creates the preconditions for transferring to the other, bearing in mind that, according to current principles, simpler forms should precede more demanding ones. Since additional exercise is in itself an important factor in the increase of the complexity of organisation forms of work, this research, conducted over a three-month period, studied the effect of the first formers' capacity and maturity for learning and exercising in the complexity of the applied parallel-alternating form of work with and without additional exercise and of the efficiency of the PE lesson, especially its main A part. The results of the effective exercise time depending on the pupils' preparedness are presented in Figure 3.

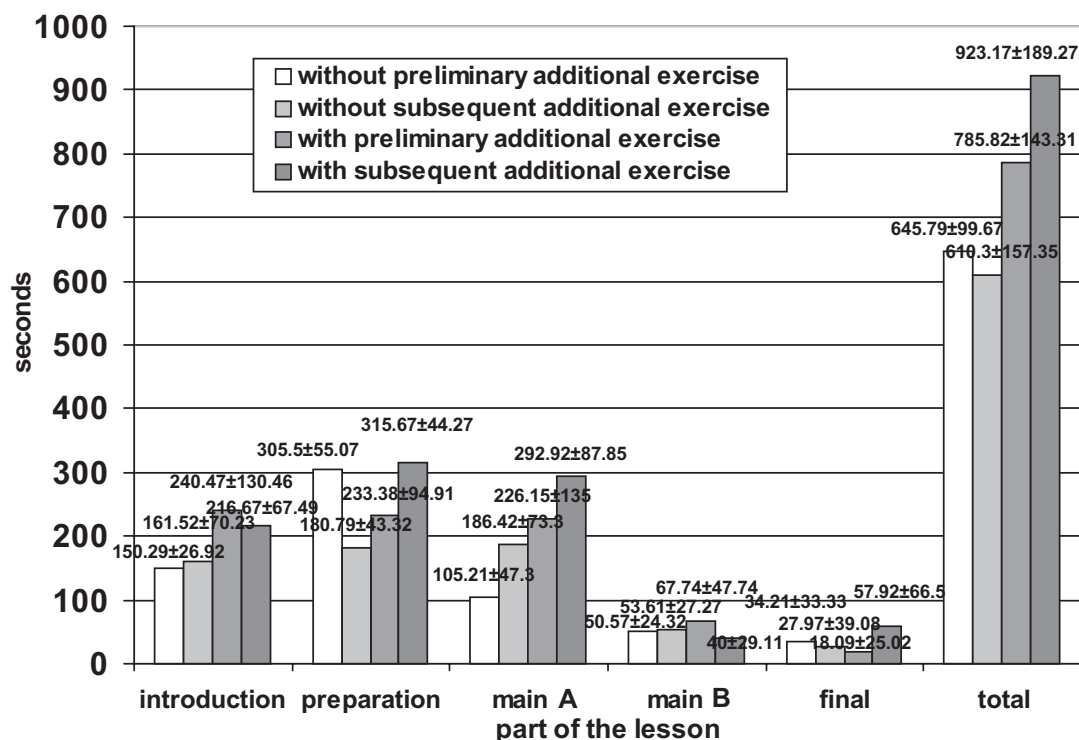


Figure 3. Effective exercise time depending on the application of additional exercise before and after a three-month preparation period for more demanding methodical organisational forms of work.

The significance of the differences in the means of the effective exercise time among the control and experimental lessons, defined on the basis of either the non-application or application of additional tasks before and after the three-month period of work with the student teachers of Petrinja’s Teacher Training College, during which period the pupils acquired a higher level of preparedness for more demanding instructional forms, was examined by the *t*-test. In the case where distribution was not normal, as was the case with the effective exercise time in the introduction and final part of the lesson, the significance in the differences was examined by the *U*-test (Table 3).

As can be seen in the results presented, the experimental factor, i.e. the three-month work with the student teachers of the Teacher Training College, prepared the pupils for more demanding organisational forms of work, which caused the significant positive differences in the effective time of work in both the preparation and main A part of the control-content lesson and in the preparation and total time in the experimental-content lesson.

This confirms the need to abide by the principles of systematic and gradual work in the application of more demanding methodical organisational forms of work.

Table 3. Significance of the differences in the effective exercise time before and after the three-month period of preparation for more demanding methodical organisational forms of work calculated by either the *t*-test or the *U*-test

Without additional exercise

EFFECTIVE EXERCISE TIME PART OF THE LESSON	t	U
	p	
INTRODUCTION		0.6806
PREPARATION	0.0000	
MAIN A	0.0004	
MAIN B	0.7208	
FINAL		0.0856
TOTAL	0.4410	

With additional exercise

EFFECTIVE EXERCISE TIME PART OF THE LESSON	t	U
	p	
INTRODUCTION		0.0504
PREPARATION	0.0061	
MAIN A	0.1185	
MAIN B	0.0661	
FINAL		0.0550
TOTAL	0.0120	

Training for more demanding methodical organisational forms of work and the physiological workload of the pupils

When students are well trained for more demanding methodical organisational forms of work, the level of time utilization in the PE lesson is increased through increments in effective exercise time. The results presented in Figure 4 answer the question whether this increased effective exercise time had caused an increase in the physiological workload estimated by the heart rate.

The results of the heart rate measured every 5 minutes displayed more significant differences in the experimental lessons, as was already demonstrated by the average HR values. Despite the ongoing discussion on the reliability and sensitivity of HR as an indicator of exertion and intensity of work, it is still an easy-to-use field diagnostic method and probably the most frequently applied method for actual workload assessment in the world (Bell & Bassey, 1996; Gilman, 1996; O'Toole et al., 1998; Karpljuk et al., 2000). Heart rate is a good indicator of physiological processes

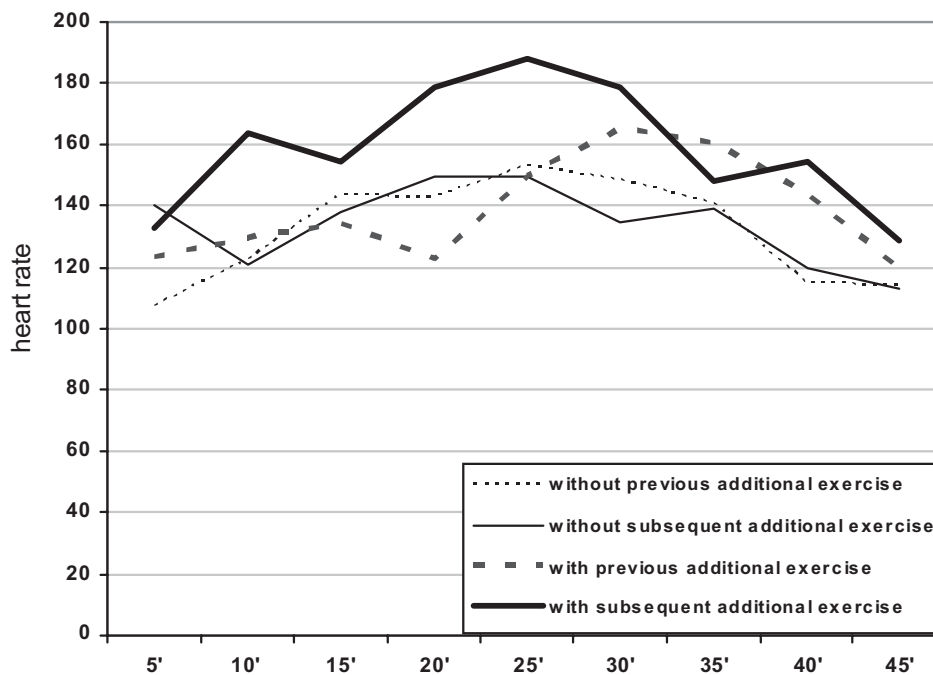


Figure 4. Heart rate measured during the lesson with parallel-alternating methodical organisational forms of work with and without additional exercise, before and after the preparation for more demanding methodical organisational forms of work.

Before and after the application of the experimental factor - the three-month work with the students during their teaching practice and familiarization with more demanding instructional forms, the average HR in the control lessons before the experimental factor had been applied was 132.48 bpm and after the application 133.82 bpm, which is not a statistically significant difference. In the experimental lessons the average HR was initially 138.71 bpm, whereas in the final measurement the average value of 158.61 bpm was obtained, which is a statistically significant difference.

Since for all the obtained results the hypothesis of no normality in the distribution of the differences in the mean results has been rejected, they have been tested by *t*-test and the significance in the difference is presented in Table 4.

of energy transmission and consumption (Wilmore & Costill, 1994).

The increased heart rate values, especially in the experimental lesson, indicate that preparation is necessary if pupils are to be subjected to an increased workload in the PE lessons with more demanding methodical organisational forms of work. The need for gradual introduction of more demanding forms of work, from the frontal to most complex group forms, is confirmed here. The necessary preparation period also allowed greater efficiency of the PE lesson from the energy expenditure point of view, as well as increased total effective exercise time in the lesson.

Conclusion

More demanding group forms of work may be used even with first form pupils if substantial preparations have been made in advance. These preparations must respect the following:

- a) Introduction into activity using the following sequence of forms of work: frontal work, pair work, threesomes and foursomes, parallel-group work, parallel-group work with additional exercise, parallel-alternating and parallel-alternating work with additional exercises.
- b) The principle of progression and graduality must be respected when introducing more demanding methodical organisational forms of work with additional exercise.

It was demonstrated that additional tasks are the best solution for the intensification, optimisation and rationalisation of exercise activity. It is particularly so in the poorer material work conditions. Yet, before additional tasks are to be introduced, certain pre-conditions have to be fulfilled, because the first form pupils are not so independent in their activity.

An increase in the metabolic rate is caused by additional exercise, which has not only decreased "waiting in line" and increased the effective exercise time, but has also increased the total, as well as the physiological workload during the lesson, ensuring a greater influence on the transformation

of anthropological characteristics of the pupils. This difference resulted in a significantly greater average heart rate during the entire Physical Education (PE) lesson. So, it can be concluded that the additional exercise tasks, applied in the main A part of the lesson, significantly influenced the total workload during the PE lesson and facilitated the desired transformation of the children's anthropological characteristics.

Research has shown that the following hypotheses were correct:

- Effective, actual exercise time in the main A part of the lesson is substantially shorter than the total scheduled time.
- In the passive time of the main A part of the PE lesson there is room for better utilization and intensification of work.
- Additional exercise increases the efficiency of the lesson, especially of its main A part.
- Pupils' preparedness for more demanding organisational forms of work and additional exercise increase the efficiency of the Physical Education lesson, especially of its main A part.

We hope these findings will contribute to a rational discussion about the effects of contemporary lifestyle changes upon childhood and about the need to reshape the rationale, concepts and application of school-based PE with the ultimate purpose of fostering and promoting effective motor development of children.

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DOPUNSKO VJEŽBANJE - ČIMBENIK UČINKOVITOSTI SATA TJELESNE I ZDRAVSTVENE KULTURE

Sažetak

Uvod

U ostvarenju ciljeva tjelesne i zdravstvene kulture značajno mjesto pripada metodičkim organizacijskim oblicima rada. Primjena odgovarajućeg metodičkog organizacijskog oblika rada u tjelesnom i zdravstvenom odgojno-obrazovnom području, posebice uz dopunsko vježbanje, doprinosi intenzifikaciji, racionalizaciji, optimalizaciji, humanizaciji i individualizaciji upravljanog procesa vježbanja. U radu se uspoređuju efektivna vremena vježbanja i fiziološka opterećenja u primjeni paralelno-izmjeničnog oblika rada sa i bez dopunskih vježbi, pri čemu se vodi računa o pripremljenosti učenika za zahtjevnije metodičke organizacijske oblike rada.

Metode

Istraživanje je provedeno u II. osnovnoj školi u Petrinji, u razdoblju od ožujka do lipnja 2002. godine na uzorku od 59 učenika i učenica prvih razreda, prosječne dobi sedam godina. U tome razdoblju svaki od tri razreda imao je 33 sata tjelesne i zdravstvene kulture (45 minuta). Od toga su studenti razredne nastave Visoke učiteljske škole iz Petrinje, u okviru svoje nastavne prakse, održali po 14 sati javnih predavanja u svakom razredu.

Primijenjen je pedagoški eksperiment u kojemu su eksperimentalni faktori bili dopunsko vježbanje u paralelno-izmjeničnom obliku rada sa dvije nastavne teme (naskok i saskok sa švedskog sanduka i penjanje uz i niz švedske ljestve) te pripremljenost za zahtjevnije metodičke organizacijske oblike rada. Na početku je svaki razred imao dva sata organizirana u paralelno-izmjeničnom obliku rada, prvo bez dopunskog vježbanja (kontrolni sat), a potom s dopunskim vježbanjem (postranično kotrljanje dužinom dviju strunjača i 3 čučnja) – eksperimentalni sat. Varijable u istraživanju jesu efektivno vrijeme vježbanja u pojedinim dijelovima sata te frekvencija srca u mirovanju i svakih 5 minuta tijekom trajanja sata. Mjerenje efektivnog vremena rada i frekvencije srca obavljali su studenti i to tako da je svaki student bio zadužen za praćenje samo jednog učenika. Potom su učenici redovito pohađali nastavu tjelesne i zdravstvene kulture koju su držali njihove učiteljice i studenti Visoke učiteljske škole. Tijekom tog razdoblja učenici su se postupno

privikavali na sve zahtjevnije metodičke organizacijske oblike rada. Na kraju eksperimenta opet su održana dva ista sata kao i na početku eksperimenta – prvo kontrolni sat bez dopunskog vježbanja, a potom i eksperimentalni sat s dopunskim vježbanjem. U oba sata je mjereno efektivno vrijeme rada svakog učenika, kao i frekvencija srca svakih pet minuta.

Rezultati su obrađeni metodama deskriptivne statistike te je ispitana značajnost razlika - *t*-testom za normalne distribucije ili *U*-testom za distribucije s odstupanjem od normalnosti, što je ustanovljeno Kologorov-Smirnovljevim testom. Korišten je programski paket Statistica 6.0.

Rezultati i rasprava

Ukupno efektivno vrijeme vježbanja učenika prvih razreda osnovne škole, prema inicijalnom mjerenju, na satu tjelesne i zdravstvene kulture bez dopunskog vježbanja iznosi 10' 21" ili 23% ukupnog sata, a na satu s dopunskim vježbanjem 13' 42" ili 30,43%. Toj razlici najviše doprinosi razlika u vremenu vježbanja tijekom glavnog "A" dijela sata u kojemu je primijenjen metodički organizacijski oblik rada s dopunskim vježbanjem. Postotak iskorištenosti glavnog "A" dijela, za koji se u literaturi pretpostavlja da bi trebao iznositi 18' ili 40% ukupnog trajanja sata, bez dopunskog vježbanja jest 15% ili 2' 42", a s dopunskim vježbama 22,55% ili 4' 4". Dopunsko vježbanje povećava iskorištenost glavnog "A" dijela sata za 7,55%, što se u konačnici odražava i na iskorištenost ukupnog dijela sata. I rezultati frekvencije srca, mjerene svakih 5 minuta, pokazuju značajne razlike u paralelno-izmjeničnom obliku rada s dopunskim vježbanjem.

Značajne razlike efektivnog vremena vježbanja u "pripremnom" i glavnom "A" dijelu sata na satima tjelesne i zdravstvene kulture bez dopunskog vježbanja te u pripremnom i ukupnom vremenu sata na satima tjelesne i zdravstvene kulture s dopunskim vježbanjem uočavaju se poslije primjene eksperimentalnog faktora - tromjesečnog rada sa studentima Visoke učiteljske škole.

Prosječna frekvencija srca na satima prije i poslije djelovanja eksperimentalnog faktora – tromjesečnog rada sa studentima tijekom metodičkih vježbi i privikavanja na zahtjevnije metodičke organizacijske oblike rada, za oblik bez dopunskog vježbanja iznosi prije eksperimentalnog faktora 132,48 otkucaja, a poslije 133,82

otkucaja, što nije statistički značajna razlika. Za oblik rada s dopunskim vježbama prije tromjesečnog perioda prosječna frekvencija srca iznosila je 138,71 otkucaj, a poslije 158,61 otkucaja, što je statistički značajna razlika.

Dopunsko vježbanje, pored mogućeg kompenzirajućeg, korigirajućeg, relaksirajućeg, utilitarnog i kombiniranog utjecaja, ima i važnu ulogu u intenzifikaciji procesa rada te povećanju efektivnog vremena vježbanja u glavnom "A" dijelu sata tjelesne i zdravstvene kulture, ali povećava i učinak cijelog sata.

Fiziološko opterećenje procjenjuje se frekvencijom srca budući da intenzivnija razmjena tvari rezultira intenzivnijom aktivnošću srca i pluća. Značajna razlika frekvencije srca od tridesete minute (HR30 i dalje) pa do kraja sata rezultat je povećane razmjene tvari prouzročene dopunskim vježbanjem koje ne samo da smanjuje čekanje i povećava efektivno vrijeme vježbanja, nego povećava ukupno opterećenje na satu, pa i fiziološko opterećenje. Time se osigurava veći utjecaj na transformaciju antropološkog statusa djece. Ova razlika rezultira značajno većom prosječnom frekvencijom srca za cijeli sat tjelesne i zdravstvene kulture pa se može ustvrditi da dopunsko vježbanje, primijenjeno u glavnom "A" dijelu sata, značajno utječe na ukupno opterećenje i željenu transformaciju djeteta.

Eksperimentalni faktor, tromjesečni rad sa studentima pripremio je učenike za zahtjevnije metodičke organizacijske oblike rada, što je rezultiralo povećanjem efektivnog vremena

vježbanja. Dobiveni rezultat potvrđuje potrebu poštivanja principa sustavnosti i postupnosti u primjeni zahtjevnijih metodičkih organizacijskih oblika rada. Povećana frekvencija srca osobito nakon tromjesečne pripreme u obliku rada s dopunskim vježbama pokazuje da je za povećanje opterećenja na satu u zahtjevnijim metodičkim organizacijskim oblicima rada potrebna priprema, odnosno postupno uvođenje zahtjevnih oblika rada od frontalnoga ka grupnim.

Zaključak

Temeljem provedenog istraživanja može se zaključiti da se učinkovitost sata može znatno povećati primjenom zahtjevnijih metodičkih organizacijskih oblika rada, posebice onih s dopunskim vježbanjem. Povećanje razmjene tvari, prouzročeno dopunskim vježbanjem koje ne samo smanjuje "čekanje na red" povećavajući efektivno vrijeme vježbanja, već ujedno doprinosi ukupnom povećanju ukupnog, pa i fiziološkog, opterećenja na satu, osiguravajući veći utjecaj na transformaciju antropoloških obilježja učenika. Tromjesečni rad sa studentima Visoke učiteljske škole u Petrinji pripremio je učenike za zahtjevnije metodičke organizacijske oblike rada, što je uvjetovalo značajne pozitivne razlike u efektivnom vremenu vježbanja. Povećana frekvencija srca tijekom vježbanja, nakon tromjesečnog perioda, osobito u obliku rada s dopunskim vježbama, pokazuje da je za povećanje opterećenja na satu primjenom zahtjevnijih metodičkih organizacijskih oblika rada potrebna priprema.