

## THE INFLUENCE OF ORGANIZED PHYSICAL EXERCISE ON THE TIME SPENT IN MVPA OF ELEMENTARY SCHOOL STUDENTS

## UTICAJ ORGANIZOVANOG FIZIČKOG VEŽBANJA NA VREME PROVEDENO U MVPA UČENIKA OSNOVNIH ŠKOLA

KSENIJA BUBNJEVIĆ, ROMANA ROMANOV, DRAGAN GRUJIČIĆ

Faculty of Sports and Psychology, Educons university, Novi Sad, Serbia

Fakultet za sport i psihologiju, Educons univerzitet, Novi Sad, Srbija

**Correspondence:**  
Dragan Grujičić

Faculty of Sports and Psychology, Educons university, Novi Sad, Serbia, dragan.grujicic@tims.edu.rs

**Korespondencija:**  
Dragan Grujičić

Fakultet za sport i psihologiju, Educons univerzitet, Novi Sad, Srbija  
dragan.grujicic@tims.edu.rs

**Abstract:** The World Health Organization recommends daily physical activity for at least 60 minutes for children, while for adults this recommendation amounts to at least 30 minutes a day. As part of daily physical activity, it is recommended to exercise at a moderate to high intensity for at least 10 minutes. Today, we are increasingly faced with the problem of sedentariness in both adults and children. It is considered that a school is a place where children could be expected to be more physically active because they spend a lot of time there. The subject of this research concerns the time spent in moderate to high-intensity physical activity (MVPA) during one day. A systematic review of two electronic databases (PubMed and Mlibrary) identified a small number of studies that analyzed MVPA between boys and girls. In the studies, organized physical exercise is cited as a way to make children more interested in exercise than usual. The research results of three selected studies indicate that students are not sufficiently physically active and that there are no significant differences in MVPA values between boys and girls (8 to 14 years of age). On the basis of highly qualified scientific studies, including only studies that measured MVPA with an accelerometer, it is observed that boys achieved higher values and are therefore somewhat more physically active compared to girls. **Keywords:** physical activity, physical education teaching, primary school, adolescents.

**Apstrakt:** Svetska zdravstvena organizacija preporučuje svakodnevnu fizičku aktivnost u trajanju od najmanje 60 minuta za decu, dok za odrasle ta preporuka iznosi najmanje 30 minuta dnevno. U okviru dnevne fizičke aktivnosti preporučuje se vežbanje umerenog do visokog intenziteta u trajanju od najmanje 10 minuta. Danas se sve više suočavamo se problemom sedentarnosti kako odraslih, tako i dece. Smatra se da je škola mesto gde bi se moglo očekivati da deca budu više fizički aktivna jer tu provode dosta vremena. Predmet ovog istraživanja tiče se vremena provedenog u umerenom do visokom intenzitetu fizičke aktivnosti (MVPA) tokom jednog dana. Sistematskim pregledom dve elektronske baze podataka (PubMed i Mlibrary) utvrđen je mali broj studija koje su analizirale MVPA između dečaka i devojčica. U studijama se navodi organizovano fizičko vežbanje kao način da se deca nešto više nego inače zainteresuju za vežbanje. Rezultati istraživanja tri odabrane studije navode da učenici nisu u dovoljnoj meri fizički aktivna, kao i da nema značajnijih razlika u vrednostima MVPA između dečaka i devojčica (8–14 godina). Na osnovu visokokvalifikovanih naučnih studija, uključujući isključivo studije koje su vršile merenje MVPA akcelometrom uočava se da su dečaci postigli veće vrednosti pa su time i nešto fizički aktivniji u odnosu na devojčice.

**Ključne reči:** fizička aktivnost, nastava fizičkog vaspitanja, osnovna škola, adolescenti.

### INTRODUCTION

Previous research points out that school-aged children are insufficiently physically active. It is assumed that one of the possible factors can be attributed to the insufficient motivation of students to participate in physical activity, both in an organized form within classes and in free activity after the time spent at school. Physical activity as a significant risk factor for growth and development in chil-

### UVOD

Dosadašnja istraživanja ističu da su deca školskog uzrasta nedovoljno fizički aktivna. Pretpostavlja se da se jedan od mogućih faktora može pripisati nedovoljnoj motivisanosti učenika za učešćem u fizičkoj aktivnosti, kako u organizovanom obliku u okviru nastave, tako i slobodnoj aktivnosti nakon vremena provedenog u školi. Fizička aktivnost kao značajan riziko faktor rasta i ra-

dren is associated with an increased rate of obesity. On the other hand, increased time spent in moderate to vigorous physical activity (“MVPA” - Moderate to Vigorous Physical Activity) is significantly related to a lower rate of obesity in children and youth (Strong et al., 2005). The World Health Organization emphasizes the overall importance of regular physical exercise for both adults and children (WHO, 2019). However, study data indicate that school-aged children are not sufficiently physically active and that they do not meet the recommended minimum regarding exercise intensity (Troiano et al., 2008). School-aged children should exercise daily for at least 60 minutes, while they should spend at least 10 minutes in MVPA during the day (WHO, 2019; Ekelund et al., 2012). Considering that children spend a lot of time at school during working days, it is considered that children should do half of the recommended daily exercise (at least 30 minutes) in the school environment (Kriemler et al., 2011).

Recently, the subject of research is the intensity of physical exercise, which is defined by the parameter of the time interval spent in moderate to high-intensity physical activity (MVPA). Different authors measured this outcome in different ways (accelerometers, pedometers, surveys). Even though the benefits of regular physical exercise are known, the intensity-related effect (MVPA) remains under-researched. It is considered that an increase in MVPA of 10 minutes during one day could be compared with an increase in MVPA of about 50 minutes during a working week, that is, on a weekly basis, with an increase in overall physical activity by about 30% (Jago et al., 2012). Therefore, on the basis of previous research that focuses on the intensity of physical exercise of school-aged children, and not meeting the recommended minimum for exercise dictated by the World Health Organization, this study aims to consider and qualitatively present the time spent in MVPA within the framework of physical education classes and organized school activities in the field of physical exercise.

## METHOD

In this study, a bibliographic speculative method was applied, and the research was based on the analysis of already existing bibliographic sources, which for the subject set the time interval as the intensity of physical activity in MVPA. With a systematic review of two electronic databases (PubMed and Mlibrary), without a time limit, a review of scientific studies was carried out based on clearly defined keywords: physical activity, physical education teaching, primary school, and adolescent. Filters were included to select English-language stud-

zvoja kod dece dovodi se u vezu sa povećanom stopom gojaznosti. Sa druge strane povećano vreme provedeno u umerenoj do visoko intenzivnoj fizičkoj aktivnosti (“MVPA” – Moderate to Vigorous Physical Activity) značajno je u vezi sa nižom stopom gojaznosti kod dece i mladih (Strong et al., 2005). Svetska zdravstvena organizacija ističe sveukupnu važnost primene redovnog fizičkog vežbanja, kako za odrasle, tako i za decu (WHO, 2019). Ipak, podaci studija ukazuju na to da deca školskog uzrasta nisu u dovoljnoj meri fizički aktivna, kao i da ne zadovoljavaju preporučeni minimum koji se tiče intenziteta vežbanja (Troiano et al., 2008). Deca školskog uzrasta trebalo bi da vežbaju svakodnevno i to najmanje 60 minuta, dok u MVPA treba da provedu najmanje 10 minuta u toku dana (WHO, 2019; Ekelund et al., 2012). Obzirom, da deca dosta vremena provode u školi tokom radnih dana smatra se da bi pola preporučenog dnevnog vežbanja (najmanje 30 minuta) deca trebalo da realizuju u školskom okruženju (Kriemler et al., 2011).

U poslednje vreme predmet istraživanja je intenzitet fizičkog vežbanja koji se definiše parametrom vremenskog intervala provedenog u umerenom do visokom intenzitetu fizičke aktivnosti (MVPA). Različiti autori su na različite načine vršili merenje tog ishoda (akcelerometri, pedometri, ankete). Iako su poznati benefiti redovnog fizičkog vežbanja i dalje ostaje nedovoljno istražen efekat koji se tiče intenziteta (MVPA). Smatra se da bi povećanje MVPA od 10 minuta u toku jednog dana moglo da se poredi sa povećanjem MVPA sa oko 50 minuta u toku jedne radne nedelje, odnosno, na nedeljnom nivou povećanjem celokupne fizičke aktivnosti za oko 30% (Jago et al., 2012). Dakle, na osnovu dosadašnjih istraživanja koja u fokus postavljaju intenzitet fizikog vežbanja dece školskog uzrasta, te ne zadovoljavanje preporučenog minimum za vežbanjem koji diktira Svetska zdravstvena organizacija upućuje na to da ova studija za cilj razmotri i kvalitativno prikaže vreme provedeno u MVPA u okviru nastave fizičkog vaspitanja i organizovanih školskih aktivnosti na polju fizičkog vežbanja.

## METOD RADA

U ovoj studiji primenjen je bibliografsko spekulativni metod, a istraživanje je bazirano na analizi već postojećih bibliografskih izvora koja za predmet postavljaju vremenski interval kao intenzitet fizičke aktivnosti u MVPA. Sistematskim pregledom dve elektronske baze podataka (PubMed i Mlibrary), bez vremenskog ograničenja, izvršen je pregled naučnih studija na osnovu jasno definisanih ključnih reči: fizička aktivnost, nastava fizičkog vaspitanja, osnovna škola i adolescent. Uklju-

ies as well as highly qualified randomized clinical trials (RCTs). From a total of 346 scientific studies, after removing duplicate studies, and studies with inappropriate designs and criteria, the studies that were obtained were reviewed in their entirety. When reviewing the studies, it was noticed that the methodological criteria for assessing MVPA are not uniform, so the selection of studies included in the analysis of this paper was based on the criteria for the selection of the instrument. Studies in which the time interval as a criterion for MVPA was identified based on the accelerometer were selected.

Studies that stated the use of a pedometer instead of an accelerometer, exercising under the guidance of a teacher (time interval followed by a stopwatch) as a criterion for MVPA, as well as studies that did not use appropriate statistics were rejected. Potentially selected papers were reviewed by two independent authors (R.R. and D.G.). Out of a total of 15 studies that met the set criteria, only 3 studies (Corder, 2020; Resalanda, 2018; Telford, 2016) showed results that highlight differences between male and female students in the values of time (interval) spent in MVPA. Due to the inconsistency of the methods and applied statistics, the obtained data are presented exclusively qualitatively.

### **Primary outcome**

Papers that mention a physical activity that was performed during the time spent at school or after school were selected. The program of organized physical exercise referred to all physical activities that have a stimulating effect on elementary school students (dance, ball games, sports team games, various competitions). The intensity of physical activity, which is defined as moderate to high (MVPA), is significant for its positive impact on the child's organism. In studies, MVPA was defined as >2296 per minute (Evenson et al., 2008). All studies that report the use of accelerometers exclusively in the analysis of MVPA were included in the reviewed paper.

### **Respondents**

A systematic review selected studies that highlight differences in MVPA between school-aged boys and girls (8 to 14 years of age). In all studies, parental consent was requested for the research, as well as permission to wear the accelerometer. The students were divided into two groups. The experimental group practiced with a teacher (and an instructor) during their time at school or outside of school hours. The control group exercised according to the regular curriculum within physical education classes. Because of the known gender differences and the impact they have

čeni su filteri za odabir studija na engleskom jeziku, kao i visokokvalifikovanih randomizovanih kliničkih studija (RKT). Od ukupno 346 naučnih studija, nakon odbacivanja dupliranih studija, studija neodgovarajućeg dizajna i kriterijuma, dobijene su studije koje su pregledane u celosti. Pri pregledu studija uočeno je da metodski kriterijumi za procenu MVPA nisu ujednačeni, te se izbor studija koji je uvršten u analizu ovog rada bazirao na kriterijumu za izbor instrumenta. Izdvojene su studije u kojima je interval vremena kao kriterijum za MVPA bio identifikovan na osnovu akcelometra.

Odbačene su studije koje kao kriterijum MVPA navode upotrebu pedometra umesto akcelometra, vežbanje pod vođenjem nastavnika (vremenski interval praćen štopericom), kao i studije koje nisu imale primenjenu odgovarajuću statistiku. Potencijalni izdvojeni radovi pregledani su od strane dva nezavisna autora (R.R. i D.G.). Od ukupno 15 studija koje su zadovoljile postavljene kriterijume, samo 3 studije (Corder, 2020; Resalanda, 2018; Telford, 2016) pokazale su rezultate koje ističu razlike između učenika i učenica u vrednostima vremena (interval) provedenog u MVPA. Zbog neusaglašenosti metoda i primenjene statistike dobijeni podaci prikazani su isključivo kvalitativno.

### **Primarni ishod**

Odabirani su radovi koji navode fizičku aktivnost koja se izvodila tokom boravka u školi ili nakon škole. Program organizovanog fizičkog vežbanja odnosio se na sve fizičke aktivnosti koje deluju podsticajno na učenike osnovnih škola (ples, igre sa loptom, sportske ekipne igre, različita takmičenja). Intenzitet fizičke aktivnosti koji je definisan kao umeren do visok (MVPA) značajan je radi pozitivnog uticaja na dečiji organizam. U studijama MVPA je bio definisan kao broj >2296 u minuti (Evenson et al., 2008). U pregledni rad su ušle sve studije koje navode korišćenje isključivo akcelometra u analizi MVPA.

### **Ispitanici**

Sistematskim pregledom odabrane su studije koje ističu razlike u MVPA između dečaka i devojčica školskog uzrasta (8–14 godina). U svim studijama tražena je saglasnost roditelja za istraživanje, kao i dozvola za nošenje akcelometra. Učenici su bili podeljeni u dve grupe. Eksperimentalna grupa je vežbala sa nastavnikom (i instruktorom) za vreme boravka u školi ili u vannastavno vreme. Kontrolna grupa je vežbala po redovnom nastavnom planu i programu u okviru nastave fizičkog vaspitanja. Zbog poznatih polnih razlika i uticaja koje

on the realization of physical activity, studies in which the research differences and the stated time of MVPA for male and female students were shown were selected.

### **Measurement**

Selected studies reported that physical activity was measured with an accelerometer worn on the right hip or right arm. The minimum time of physical activity measurement lasted between 3 and 5 days (over a period of 9 to 12 weeks). Also, the studies stated that the minimum time for wearing the accelerometer was at least 3 hours per day.

### **RESULTS**

Based on the set criteria, only three RCT studies were selected that state the use of accelerometers when measuring MVPA during time at school or after school. The review included the results of studies from a total of 94 primary schools with organized physical exercise programs: "GoActive", "ASK" and "SOFIT". The values of MVPA were highlighted specifically for male and female students (8 to 14 years of age).

In the first study (Cordera et al., 2020), which assessed which components (competition, rewards, points, leadership, self-esteem, friendship quality) are associated with changes in MVPA, a total of 671 students (13 to 14 years of age) were analyzed, from 8 schools. Students wore accelerometers on their non-dominant wrists for 7 days continuously (24 hours/day). The time spent in MVPA was measured only at the end of the realized program of organized physical exercise and the obtained results indicate higher values measured in boys compared to girls ( $n=360$ ,  $-1.98$  (23.40);  $n=311$ ,  $-1.55$  (17.04)). Values are presented as percentages or as mean and standard deviation. The impact of competition and scoring was found to be more beneficial among female students, while teacher support was found to be more beneficial among male students. The implemented program aimed to promote FA through a different way of competition and collecting points between students. In order to motivate weaker students to participate in the mentioned program, the collected points were kept secret. Activities were divided into individual and group activities (more detailed description in the study). It was found that this type of physical exercise can have a positive effect on increasing socialization among students, self-esteem, and well-being, but not the time spent in MVPA. The obtained research results can only be relevant to high-income schools in Great Britain. The same time period for measuring the results and not recording the results in

ono ima na realizaciju fizičke aktivnosti odabrane su studije u kojima su prikazane razlike istraživanja i navedeno vreme MVPA za učenike i učenice.

### **Merenje**

U odabranim studijama se navodi da je fizička aktivnost merena akcelerometrom koji je nošen na desnom kuku ili na desnoj ruci. Minimalno vreme merenja fizičke aktivnosti trajalo je između 3 i 5 dana (tokom perioda od 9 do 12 nedelja). Takođe, u studijama se navodi da je minimalno vreme nošenja akcelerometra iznosilo najmanje 3 sata dnevno.

### **REZULTATI**

Na osnovu postavljenih kriterijuma odabrane su samo tri RCT studije koje navode korišćenje akcelerometra prilikom merenja MVPA u toku boravka u školi ili nakon škole. Pregledni rad obuhvatio je rezultate studija od ukupno 94 osnovne škole sa programima organizovanog fizičkog vežbanja: "GoActive", "ASK" i "SOFIT". Vrednosti MVPA istaknute su posebno za učenike i učenice (8 – 14 godina).

U prvoj studiji (Cordera et al., 2020), koja je procenjivala koje su to komponente (takmičenje, nagrade, bodovi, vođstvo, samopoštovanje, kvalitet prijateljstva) povezane sa promenama u MVPA, izvršena je analiza ukupno 671 učenika (13-14 godina) iz 8 škola. Učenici su nosili akcelerometre na nedominantnom ručnom zglobu 7 dana neprekidno (24 sata/dan). Vreme provedeno u MVPA mereno je samo na kraju realizovanog programa organizovanog fizičkog vežbanja i dobijeni rezultati ukazuju na veće vrednosti izmerene kod dečaka u odnosu na devojčice ( $n=360$ ,  $-1.98$  (23.40);  $n=311$ ,  $-1.55$  (17.04)). Vrednosti su predstavljene u procentima ili srednjim vrednostima i standardnoj devijaciji. Uticaj takmičenja i bodovanja pokazalo se korisnijim među učenicama, dok se podrška nastavnika pokazala korisnijim među učenicima. Primenjeni program imao je za cilj promociju FA kroz neki drugačiji način takmičenja i sakupljanja bodova između učenika. Kako bi se slabiji učenici motivisali za učešće u pomenutom programu sakupljeni bodovi su držani u tajnosti. Aktivnosti su bile podeljene na individualne i grupne (detaljniji opis u studiji). Utvrđeno je da ovakav način fizičkog vežbanja može imati pozitivnog uticaja na povećanje socijalizacije među učenicima, samopoštovanja i blagostanja, ali ne i vremena provedenog u MVPA. Dobijeni rezultati istraživanja mogu biti relevantni samo za škole sa visokim primanjima na području Velike Britanije. Kao mana istraživanja navodi se isti vremenski period



the sedentary group of subjects is mentioned as a drawback of the research.

In the second study (Resalanda et al., 2018), the impact of “active learning” through organized physical exercise “ASK” and the impact it can have on the school performance of students (N=1129 students, age 10 years, 57 Norwegian primary schools) was researched. The seven-month program “ASK” tried to influence the increase of weekly physical activity above the regular curriculum (165 min/week). The program consisted of three components: 1-educational classes of physical activities (3 × 30 min every week); classes held on the school playground (basic subjects); 2-Physical activity during the break between classes performed in the classroom (5 min × 5 days each week) and 3-Physical activity in the form of homework (10 min per day; 5×10 min/week). All students, in addition to the mentioned program, attended regular physical education classes. The “ASK” program is designed to make the activities interesting and enjoyable for children (more detailed description in the study). Physical activity and sitting time were measured with accelerometers (at the beginning of the study and after seven months) worn on the right hip for 7 consecutive days at all times (except during sleep and bathing). The minimum wearing time during one week was 4 days (480 min/day) and 3 days during 5 working days (180 min/day, between 09:00 and 14:00). The results of the study indicate higher values of MVPA (mean, SD or %) during the whole day measured in boys of the experimental group compared to girls (EG n=282, 84(31); n=260, 71(22)). Also, higher outcome values were recorded in the control group of boys (KG n=240, 80(25); n=224, 67(20)). The values measured during the school day also indicate higher values of MVPA measured in boys in both groups compared to girls (EG n=284, 33(11); n=268, 26(8); KG n=248, 32 (10); n=232, 25(9)). The study does not show a difference in results at the beginning and end of the research period. The results of the study show that there are no significant differences between boys and girls in MVPA values. This research is considered important in assessing the impact of increased physical activity and the impact it may have on long-term important aspects, such as children’s school performance. However, the weakness of the research can be considered the lack of investigation of other factors that may have an impact on the school success of students.

The third selected study (Telford et. al., 2016), whose aim was to examine the impact of the “LOOK” program on increasing the physical activity of school-aged (8 to 12 years of age) children (EG=457; KG=396), from 29 primary schools through the implementation of

merenja ishoda i nebeleženje ishoda u sedentarnoj grupi ispitanika.

U drugoj studiji (Resalanda et al., 2018), istraživan je uticaj “aktivnog učenja” kroz organizovano fizičko vežbanje “ASK” i uticaj koje ono može da ima na školski uspeh učenika (N=1129 učenika, uzrast 10 godina, 57 norveških osnovnih škola). Sedmomesečnim programom “ASK” pokušalo se uticati na povećanje nedeljne fizičke aktivnosti iznad redovnog nastavnog plana i programa (165 min/nedeljno). Program se sastojao iz tri komponente: 1-edukativni časovi fizičkih aktivnosti (3 × 30 min svake nedelje); nastava koja se izvodi na školskom igralištu (osnovni predmeti); 2-Fizička aktivnost tokom pauze između časova koja se izvodi u učionici (5 min × 5 dana svake nedelje) i 3-Fizička aktivnost u vidu domaćeg zadatka (10 min dnevno; 5×10 min/nedeljno). Svi učenici, pored navedenog programa, pohađali su redovnu nastavu fizičkog vaspitanja. Program “ASK” osmišljen je tako da aktivnosti deci budu interesantne i prijatne (detajniji opis u studiji). Fizička aktivnost i vreme sedenja mereni su akcelerometrima (na početku istraživanja i nakon sedam meseci) koji su nošeni na desnom kuku 7 uzastopnih dana u svakom trenutku (osim tokom spavanja i kupanja). Minimalno vreme nošenja tokom jedne nedelje bilo je 4 dana (480 min/dan) i 3 dana u toku 5 radnih dana (180 min/dan, između 09:00 i 14:00 h). Rezultati studije ukazuju na veće vrednosti MVPA (mean, SD ili %) u toku celog dana izmerene kod dečaka eksperimentalne grupe u odnosu na devojčice (EG n=282, 84(31); n=260, 71(22)). Takođe, veće su zabeležene vrednosti ishoda i u kontrolnoj grupi dečaka (KG n=240, 80(25); n=224, 67(20)). Mrene vrednosti u toku školskog dana, takođe, ukazuju na veće vrednosti MVPA izmerene kod dečaka u obe grupe u odnosu na devojčice (EG n=284, 33(11); n=268, 26(8); KG n=248, 32(10); n=232, 25(9)). Studija ne prikazuje razliku rezultata na početku i na kraju perioda istraživanja. Rezultati studije ističu da nema značajnih razlika između dečaka i devojčica u vrednostima MVPA. Ovo istraživanje smatra se važnim u procenjivanju uticaja povećane fizičke aktivnosti i uticaja koje ono može da ima na duge važne aspekte, kao što je školski uspeh dece. Međutim, mana istraživanja može se smatrati neistraženost ostalih faktora koji mogu imati uticaja na školski uspeh učenika.

Treća odabrana studija (Telford et. al., 2016), čiji je cilj bio da se ispita uticaj “LOOK” programa na povećanje fizičke aktivnosti dece (EG=457; KG=396) školskog uzrasta (8-12 godina) iz 29 osnovnih škola kroz primenu izvođenja nastave fizičkog vaspitanja sa novijim i interesantnijim sadržajima. Eksperimentalna grupa učeni-

physical education classes with newer and more interesting content. The experimental group of students received instructions for organized exercise by trained instructors (2 × 45 min physical education lessons per week), while students from the control group only exercised according to the usual plan and program. Students have been wearing pedometers for a long period (7 days each year) and accelerometers for the last 2 years to assess the value of MVPA and sedentary activity of students. Organized exercising was based on creating a pleasant environment for performing physical activity, and the tasks were related to encouraging students to discover different physical movements, and game strategies through experimentation and self-discovery. The comparison of experimental and control physical education classes was made according to the fitness teaching observation system ("SOFIT" - activities classified for the assessment of MVPA during physical education classes). The results of the study state that no significant difference was observed between the students. Pedometers recorded a higher number of steps in boys (in both groups of subjects) compared to girls. The "SOFIT" program, which measured MVPA (means; 95 % CI) with an accelerometer, recorded higher values in the experimental group in boys and girls (boys 11 years - 53.3 (49.1,57.4); 12 years - 49.9 (45.8,53.8) ; girls 11 years - 36.0 (31.8,40.1); 12 years - 34.0 (30.1,37.9). The following values were recorded in the control group: boys 11 years old - 44.9 (40.2,49.7) and 12 years old - 48.7 (44.1,53.3); girls 11 years - 41.6 (37.4,45.9) and 12 years - 35.6 (31.8,39.5). However, the authors believe that well-designed physical education by encouraging students to experiment and self-discovery through play contributes to increasing physical activity.

The importance of the four-year "LOOK" study, which was conducted in Australia, is reflected in summarizing the impact of various factors (organized physical exercise, proper nutrition, family influence, health, school success) on increasing MVPA in students. The disadvantage of the study is that accelerometers were not included from the beginning of the research due to the available budget and a large number of respondents.

## DISCUSSION

A systematic review of the available literature found a small number of studies that evaluate the effect of physical activity on the time spent in MVPA of elementary school students. Only three RCT studies that report the use of accelerometers in their research were included in the research. In all three studies, students in the experimental group had slightly higher MVPA values measured.

ka dobijala je instrukcije za organizovano vežbanje od strane obučениh instruktora (2 × 45 min časa fizičkog vaspitanja nedeljno), dok su učenici iz kontrolne grupe vežbali samo po uobičajnom planu i programu. Učenici su tokom dužeg perioda nosili pedometre (7 dana svake godine) i akcelerometre poslednje 2 godine da bi se procenila vrednost MVPA i sedentarna aktivnost učenika. Organizovano vežbanje se zasnivalo na stvaranju prijatne sredine za izvođenje fizičke aktivnosti, a zadaci su se odnosili na podsticanje učenika da otkrivaju različita fizička kretanja, strategije igre kroz eksperimentisanje i samootkrivanje. Poređenje časova eksperimentalnog i kontrolnog fizičkog vaspitanja izrađen je po sistemu posmatranja kondicione nastave ("SOFIT"- aktivnosti klasifikovane za procenu MVPA tokom časova fizičkog vaspitanja). Rezultati studije navode da nije uočena značajna razlika između učenika. Pedometri su zabeležili veći broj koraka kod dečaka (u obe grupe ispitanika) u odnosu na devojčice. "SOFIT" program, koji je merio MVPA (means; 95 % CI) akcelerometrom, zabeležio je veće vrednosti u eksperimentalnoj grupi kod dečaka i devojčica (dečaci 11 godina - 53.3 (49.1,57.4); 12 godina - 49.9 (45.8,53.8); devojčice 11 godina - 36.0 (31.8,40.1); 12 godina - 34.0 (30.1,37.9). U kontrolnoj grupi zabeležene su sledeće vrednosti: dečaci 11 godina - 44.9 (40.2,49.7) i 12 godina - 48.7 (44.1,53.3); devojčice 11 godina - 41.6 (37.4,45.9) i 12 godina - 35.6 (31.8,39.5). Autori ipak smatraju da dobro osmišljeno fizičko vaspitanje kroz podsticanje učenika na eksperimentisanje i samootkrivanje kroz igru doprinosi povećanju fizičke aktivnosti. Značaj četvorogodišnje studije "LOOK", koja je sprovedena u Australiji, ogleda se u sumiranju uticaja različitih faktora (organizovano fizičko vežbanje, pravilna ishrana, uticaj porodice, zdravlje, školski uspeh) i koje ono može da ima na povećanje MVPA kod učenika. Mana studije je što akcelerometri nisu bili uključeni od samog početka u istraživanje zbog raspoloživog budžeta i velikog broja ispitanika.

## DISKUSIJA

Sistematskim pregledom dostupne literature pronađen je mali broj studija koje procenjuju efekat fizičke aktivnosti na vreme provedeno u MVPA učenika osnovnih škola. U istraživanje su uključene samo tri RKT studije koje navode korišćenje akcelerometra prilikom svojih istraživanja. U sve tri studije učenici eksperimentalne grupe su imali izmerene nešto veće vrednosti MVPA. Postavlja se pitanje, koji su razlozi merenja MVPA između učenika i učenica kada se očekuje da postoje razlike između polova, kao i koje benefite

The question arises, what are the reasons for measuring MVPA between male and female students when it is expected that there are differences between the sexes, as well as what benefits we can expect from observing the investigated differences? It is assumed that the obtained results could contribute to the development of the curriculum, as well as to the increase of the required minimum time regarding the intensity of physical exercise during the day. Given the small number of studies, these results should be interpreted with caution, and further research is warranted.

Authors who conducted research on the impact of physical activity on time spent in MVPA had common characteristics on the basis of which the studies were selected for this review. However, the non-uniformity makes it difficult to analyze the extracted results. The authors did not clearly specify the measurement periods in order to clearly determine the impact of organized physical exercise. Likewise, the authors state several months of follow-up of students and a certain minimum time are required for the results of wearing the accelerometer to be valid. However, it should be kept in mind that the students were probably more motivated to participate in organized physical exercise due to wearing the accelerometer and the challenge provided by the schoolwork. Also, in the investigated differences between the sexes, other factors that can have an impact, both on the development of motor skills and on acquired attitudes about the importance of daily physical activity should be included. Interesting research was conducted in the schools of Vojvodina in 2009. The author monitored the state of nutrition of lower-grade elementary school students in relation to their level of physical activity. Also, the connection between the realization of physical activity by both parents and children was monitored. The results of this pilot study showed that most children are never or only sometimes physically active, while less than 1/3 of children do frequent and daily physical activity (Lepeš, 2011). When looking at the length of the research period, it is assumed that more accurate data is provided by the physical exercise that is organized for a smaller number of students and lasts a shorter period of time. Although female students are more inclined to dance, it is believed that dance tasks could have a positive effect on engagement. However, if no changes occur after a certain time, reduced interest in physical exercise can be expected (Jago et al., 201; O'Donovan, & Kay, 2005). From the above, we can conclude that the measurement of time spent in MVPA certainly depends on the type of physical activity that is carried out by boys and girls in primary

možemo da očekujemo uočavanjem istraženih razlika. Pretpostavlja se da bi dobijeni rezultati mogli doprineti razvoju nastavnog plana i programa, kao i povećanju potrebnog minimalnog vremena koje se tiče intenziteta fizičkog vežbanja u toku dana. Obzirom na mali broj studija ove rezultate treba tumačiti sa oprezom, a dalja istraživanja su opravdana.

Autori koji su vršili istraživanja uticaja fizičke aktivnosti na vreme provedeno u MVPA imali su zajedničke karakteristike na osnovu kojih su studije odabrane za ovaj pregled. Međutim, ono što nije ujednačeno otežava analizu ekstrahovanih rezultata. Autori nisu jasno naveli periode merenja kako bi se jasnije mogao odrediti uticaj organizovanog fizičkog vežbanja. Takođe, autori navode višemesečno praćenje učenika i određeno minimalno vreme koje je potrebno kako bi rezultati nošenja akcelerometra bili validni. Međutim, treba imati u vidu da su učenici verovatno bili više motivisani za učešćem u organizovanom fizičkom vežbanju zbog nošenja akcelerometra i izazova koji im pruža školski zadatak. Takođe, u istražene razlike između polova treba uvrstiti i ostale faktore koji mogu imati uticaja, kako na razvoj motoričkih sposobnosti, tako i na stečene stavove o važnosti svakodnevne fizičke aktivnosti. Interesantno istraživanje sprovedeno je u školama Vojvodine 2009. godine. Autor je pratio stanje uhranjenosti učenika nižih razreda osnovnih škola u odnosu na stepen njihove fizičke aktivnosti. Takođe, pratila se povezanost između realizacije fizičke aktivnosti kako roditelja i dece. Rezultati pilot istraživanja su pokazali da je većina dece nikada ili samo ponekad fizički aktivna, dok čestu i svakodnevnu fizičku aktivnost realizuje manje od 1/3 dece (Lepeš, 2011). Kada se posmatra dužina trajanja perioda istraživanja pretpostavlja se da preciznije podatke pruža ono fizičko vežbanje koje je organizovano na manjem broju učenika i traje kraći vremenski period. Iako su učenice više sklonije plesu, smatra se da bi plesni zadaci mogli imati pozitivnog uticaja na angažovanost. Međutim, ukoliko ne dođe do promena nakon izvesnog vremena može se očekivati smanjena zainteresovanost za fizičko vežbanje (Jago et al., 201; O'Donovan, & Kay, 2005). Iz navedenog možemo zaključiti da merenje vremena provedenog u MVPA zasigurno zavisi i od vrste fizičke aktivnosti koja se realizuje sa dečacima i devojkicama u osnovnim školama.

U studiji domaćih autora, u kojoj je cilj istraživanja bio da se utvrde stavovi nastavnika/profesora o nadarenosti učenika koji prelaze iz razredne u predmetnu nastavu, ističe se značaj i važnost angažovanosti učenika u nastavi. Istraživanje je sprovedeno na 102 ispitanika

schools.

In a study by local authors, in which the goal of the research was to determine the views of teachers/professors on the giftedness of students who are transitioning from the classroom to subject teaching, the significance and importance of student engagement in teaching are emphasized. The research was conducted on 102 respondents (BiH). The results showed that teachers have similar attitudes when it comes to the perception of the interpretation of sports gifted students. As a subject of future research, the question arises as to how it is necessary to implement the methodology of identifying gifted children, and not to neglect the way of animating average students. Also, the authors state the need to create better conditions for working in classes as a possible incentive for greater engagement in physical education classes and extracurricular physical activities (Bajrić et al., 2019). From the above example, it can be inferred that the values of the time spent in MVPA could depend on the degree of student's interest in exercise, but also on motivation, which certainly depends on many factors that need to be investigated. The selected studies in this reviewed paper out that there were no significant changes in the time spent in MVPA after a longer period of organized physical exercise, but there was a change in the form of increased self-confidence and interest of students to be more physically active (Telford et al., 2021).

Longitudinal studies are considered useful and can show significant data on MVPA values. However, it is assumed that the length of the research period can have an impact on the precision of measurements and the realization of various tasks. Authors Telford et al. (2016) point out that due to budgetary and practical restraints, they were limited to making measurements with an accelerometer for the entire period of four years, but they were included in later years when the costs of the devices and the number of participants were lower. If one wants to give an answer to the question of to what extent male and female students are physically active, that is, what is the minimum amount of moderate to high physical activity during the day, it is probably the most representative data that is based on the longest possible measurement period. However, how feasible this is, is stated in this paper by the authors who dealt with the problem posed.

For the promotion of physical education and physical activity, future research could take into account the time spent during school recess, as well as the way in which students use that free time. As children spend a lot of time in the school environment, different tasks during recess could contribute to the amount of movement, and prob-

(BIH). Rezultati su pokazali da nastavnici imaju slične stavove kada je u pitanju percepcija tumačenja sportski nadarenih učenika. Kao predmet budućih istraživanja nameće se pitanje na koji način je potrebno sprovesti metodologiju identifikacije nadarene dece, a ne zapostaviti način animiranja prosečnih učenika. Takođe, autori navode potrebu za stvaranje boljih uslova za rad u nastavi kao mogući podsticaj za veću angažovanost u nastavi fizičkog vaspitanja i vannastavnim fizičkim aktivnostima (Bajrić i drugi, 2019). Iz navedenog primera može se naslutiti da bi vrednosti vremena provedenog u MVPA mogle da zavise od stepena interesovanja učenika za vežbanjem, ali i motivacije koja svakako da zavisi od mnogih faktora koje je potrebno istražiti. Odabrane studije u ovom preglednom radu ističu da nije došlo do značajnih promena u vremenu provedenog u MVPA nakon dužeg vremena organizovanog fizičkog vežbanja, ali je došlo do promene u vidu povećanja samopouzdanja i zainteresovanosti učenika da budu fizički aktivniji (Telford et al., 2021).

Longitudinalna istraživanja smatraju se korisnim i mogu pokazati značajne podatke o vrednostima MVPA. Međutim, pretpostavlja se da dužina perioda istraživanja može imati uticaja na preciznost merenja i realizacije različitih zadataka. Autori Telford i sar. (2016) ističu kako su zbog budžetskih i praktičnih ograničenja bili limitirani da ceo period od četiri godine rade merenja sa akcelorometrom, već su oni uključeni u kasnijim godinama kada su troškovi uređaja i broj učesnika bili manji. Ukoliko se želi dati odgovor na pitanje u kojoj meri su učenici i učenice fizički aktivni, odnosno, koliko iznosi minimum umerene do visoke fizičke aktivnosti u toku dana verovatno da je reprezentativniji podatak koji se zasniva na što dužem periodu merenja. Međutim, koliko je to izvodljivo navode autori koji su se bavili postavljenim problemom u ovom radu.

Za promociju fizičkog vaspitanja i fizičke aktivnosti buduća istraživanja bi mogla da uzmu u obzir i vreme provedeno u okviru školskog odmora, kao i način na koji učenici koriste to slobodno vreme. Kako deca dosta vremena provode u školskom okruženju, različiti zadaci tokom odmora mogli bi doprineti količini kretanja, a verovatno i dovesti do povećanja intenziteta vežbanja u toku dana. Školski odmor ne može da zameni nastavu fizičkog vaspitanja, niti bilo koju vannastavnu aktivnost, ali može da doprinese dodatnoj motivaciji za vežbanjem i promociji fizičke aktivnosti (Kermeci., & Đorđić, 2018).

Smatra se da zainteresovanost za fizičku aktivnost u mnogome zavisi od: pola, uzrasta, stečenih stavova, načina života, kao i uticaja okoline. Kroz primere se isti-



ably lead to an increase in the intensity of exercise during the day. School vacation cannot replace physical education classes or any extracurricular activity, but it can contribute to additional motivation for exercise and the promotion of physical activity (Kermeci., & Đorđić, 2018). It is considered that the interest in physical activity is largely dependent on sex, age, acquired attitudes, lifestyle, as well as the influence of the environment. Through examples, it is pointed out that motivation for physical exercise decreases with age (Lukić et al., 2019). The insufficient motivation of students certainly has an impact on the intensity of physical exercise itself. Future research should find the reasons why older students are less and less interested in different physical activity programs, as well as discover a more successful way of organized physical exercise, which can have an impact on increasing the time spent in MVPA.

### CONCLUSION

From the selected studies, it can be concluded that organized physical exercise programs were perhaps more interesting for male students, but the results between boys and girls did not differ much in terms of the value of time spent in MVPA. The general conclusion from the above-selected studies indicates the need to constantly train and educate professional staff for conducting physical education classes through the design of various programs of organized physical exercise in order to influence the increase of daily physical activity and the value spent in MVPA. Authors who researched the mentioned problem mostly cite data related to students' anthropological status, level of physical activity, academic performance, and well-being. Future research that would include the analysis of family habits, parents' habits, marital status, social status, education, and the level of physical activity of parents (on a weekly basis), would contribute to the understanding of possible differences between male and female students when observing engagement in classes, different programs of organized physical exercise, as well as attitudes about the importance of daily physical activity. Since there are no studies in our speaking area that dealt with the time spent in MVPA of elementary school students, it is necessary to investigate the mentioned problem. Likewise, research by domestic authors who dealt with the issue of student and parent awareness of the importance of physical activity, as well as the need for participation and greater involvement of students in various forms of organized physical exercise, would be of great importance.

će da sa uzrastom dolazi do pada motivacije za fizičkim vežbanjem (Lukić i drugi, 2019). Nedovoljna motivisanost učenika svakako da ima uticaja i na sam intenzitet fizičkog vežbanja. Buduća istraživanja trebala bi da pronađu razloge zbog kojih su stariji učenici sve manje zainteresovani za različite programe fizičke aktivnosti, kao i otkrivanjem uspješnijeg načina organizovanog fizičkog vežbanja, a koje može da ima uticaja na povećanje vremena provedenog u MVPA.

### ZAKLJUČAK

Iz odabranih studija može se zaključiti da su programi organizovanog fizičkog vežbanja bili možda interesantniji učenicima, ali se rezultati između dečaka i devojčica nisu mnogo razlikovali po vrednosti vremena provedenog u MVPA. Opšti zaključak iz navedenih odabranih studija ukazuje na potrebu da se konstantno vrši obučavanje i osposobljavanje stručnog kadra za vođenje nastave fizičkog vaspitanja kroz osmišljavanje različitih programa organizovanog fizičkog vežbanja kako bi se uticalo na povećanje dnevne fizičke aktivnosti i vrednosti provedene u MVPA. Autori koji su istraživali navedeni problem uglavnom navode podatke vezane za: antropološki status učenika, nivo fizičke aktivnosti, akademski učinak i blagostanje. Buduća istraživanja koja bi obuhvatala analizu: porodičnih navika, navika roditelja, bračni status, socijalni status, obrazovanje i nivo fizičke aktivnosti roditelja (na nedeljnom nivou), doprinela bi shvatanju mogućih razlika između učenika i učenica kada se posmatra angažovanost u nastavi, različitim programima organizovanog fizičkog vežbanja, kao i stavova o značaju svakodnevne fizičke aktivnosti. Kako na našem govornom području ne postoje istraživanja koja su se bavila vremenom provedenog u MVPA učenika osnovnih škola, neophodno je istražiti navedeni problem. Takođe, od velikog značaja u zaključivanju doprinela bi istraživanja domaćih autora koji su se bavili pitanjem svesti o učenika i roditelja o značaju fizičke aktivnosti, kao i potrebe za učešćem i većoj angažovanosti učenika u različitim oblicima organizovanog fizičkog vežbanja.

## REFERENCES:

- Bajric, O., Goranović, S., & Bajric, S. (2019). Teachers' attitudes on sports talent in primary school pupils transferring from class to subject teaching. *Sports Science & Health / Sportske Nauke i Zdravlje*, 9(2). [in Serbian]
- Corder, K., Werneck, A. O., Jong, S. T., Hoare, E., Brown, H. E., Foubister, C., ... & van Sluijs, E. M. (2020). Pathways to increasing adolescent physical activity and wellbeing: a mediation analysis of intervention components designed using a participatory approach. *International journal of environmental research and public health*, 17(2), 390.
- Ekelund, U., Luan, J. A., Sherar, L. B., Esliger, D. W., Griew, P., Cooper, A., & International Children's Accelerometry Database (ICAD) Collaborators. (2012). Moderate to vigorous physical activity and sedentary time and cardiometabolic risk factors in children and adolescents. *Jama*, 307(7), 704-712.
- Evenson KR, Catellier DJ, Gill K, Ondrak KS, McMurray RG. Calibration of two objective measures of physical activity for children. *J Sports Sci*. 2008;26:1557-65.
- Jago, R., Edwards, M. J., Sebire, S. J., Tomkinson, K., Bird, E. L., Banfield, K., ... & Blair, P. S. (2015). Effect and cost of an after-school dance programme on the physical activity of 11-12 year old girls: The Bristol Girls Dance Project, a school-based cluster randomised controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*, 12(1), 1-15.
- Jago, R., Sebire, S. J., Cooper, A. R., Haase, A. M., Powell, J., Davis, L., ... & Montgomery, A. A. (2012). Bristol girls dance project feasibility trial: outcome and process evaluation results. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 1-10.
- Kermeci, S., & Đorđić, V.N. (2018). The role of recess in students' physical activity promotion. *Sports Science & Health/Sportske Nauke i Zdravlje*, 8(2). [in Serbian]
- Kriemler, S., Meyer, U., Martin, E., van Sluijs, E. M., Andersen, L. B., & Martin, B. W. (2011). Effect of school-based interventions on physical activity and fitness in children and adolescents: a review of reviews and systematic update. *British journal of sports medicine*, 45(11), 923-930.
- Lepeš, J. (2011). Socijalno-porodična sredina, ishrana i fizički razvoj. *Sportske nauke i zdravlje*, 1(1), 12-17. [in Serbian]
- Lukić, N., Vukićević, V., Vignjević, S., & Škundrić, G. (2019). Motivational orientation of primary school students in physical education classes. *Sports Science & Health/Sportske Nauke i Zdravlje*, 9(2). [in Serbian]
- O'Donovan, T. M., & Kay, T. A. (2005). Focus on girls in sport. *British Journal of Teaching Physical Education*, 36(1), 29-31.
- Resaland, G. K., Moe, V. F., Bartholomew, J. B., Andersen, L. B., McKay, H. A., Anderssen, S. A., & Aadland, E. (2018). Gender-specific effects of physical activity on children's academic performance: the active smarter kids cluster randomized controlled trial. *Preventive medicine*, 106, 171-176.
- Strong, W. B., Malina, R. M., Blimkie, C. J., Daniels, S. R., Dishman, R. K., Gutin, B., ... & Trudeau, F. (2005). Evidence based physical activity for school-age youth. *The Journal of pediatrics*, 146(6), 732-737.
- Telford, R. M., Olive, L. S., Cochrane, T., Davey, R., & Telford, R. D. (2016). Outcomes of a four-year specialist-taught physical education program on physical activity: A cluster randomized controlled trial, the LOOK study. *International Journal of Behavioral Nutrition and Physical Activity*, 13(1), 1-11.
- Telford, R. M., Olive, L. S., Keegan, R. J., Keegan, S., Barnett, L. M., & Telford, R. D. (2021). Student outcomes of the physical education and physical literacy (PEPL) approach: a pragmatic cluster randomised controlled trial of a multicomponent intervention to improve physical literacy in primary schools. *Physical Education and Sport Pedagogy*, 26(1), 97-110.
- Troiano, R. P., Berrigan, D., Dodd, K. W., Masse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine and science in sports and exercise*, 40(1), 181.
- World Health Organization. (2019). *Global action plan on physical activity 2018-2030: more active people for a healthier world*. World Health Organization.

Primljen: 19. jul 2022. / Received: July 19, 2022

Prihvaćen: 13. oktobar 2022. / Accepted: October 13, 2022

