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Effectiveness of Physical Activity Intervention during Music Lessons

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KLJUČNE BESEDE: šola, učne ure, mlajši šolarji, merilnik pospeška, intenzivnost

POVZETEK – Veliko je bilo že objavljenih študij, ki proučujejo vključevanje gibalne aktivnosti otrok v pouk različnih šolskih predmetov. Zelo redke so študije, ki preučujejo vključevanje gibalne aktivnosti otrok v pouk glasbene umetnosti. Prav zato smo se odločili, da s pomočjo merilnika pospeška izmerimo količino in intenzivnost posameznih fenotipov gibalne/športne aktivnosti prvošolcev le med uro glasbene umetnosti brez gibalne in z gibalno intervencijo. Sto osem otrok, v starosti šest in sedem let, iz dveh slovenskih obalnih osnovnih šol je nosilo merilnik pospeška med dvema urama glasbene umetnosti. Primerjali smo fenotipe gibalne aktivnosti med urama glasbene umetnosti z in brez intervencije. Otroci so v povprečju deležni več gibalne neaktivnosti med učno uro glasbene umetnosti brez intervencije kot z intervencijo (p = 0,001, d = 2.8), poleg tega imajo večji delež časa srednje (p = 0,001, d = 5.9) in tudi visoke (p = 0,001, d = 30) intenzivnosti gibalne/športne aktivnosti med uro glasbene umetnosti z intervencijskim programom kot med običajno uro glasbene umetnosti. Otroci so med običajno uro glasbene umetnosti deležni glede na čas kar 39% več gibalne neaktivnosti kot med uro glasbene umetnosti z gibalnim intervencijskim programom. Priporočamo, da prihodnje študije vključijo večji vzorec otrok, pri čemer naj merilnike pospeška nosijo vsaj pet dni zapored.

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KEYWORDS: school, lessons, young children, accelerometer, intensity

ABSTRACT – There are many previously published studies that examine the integration of children's physical activity into various school subjects. However, studies that integrate children's physical activity into music lessons are very rare. Therefore, we decided to use an accelerometer to measure the amount and intensity of individual physical activity phenotypes of first graders during a music-only lesson, with and without a physical activity intervention. One hundred and eight children, aged six to seven, from two Slovenian elementary schools in the coastal region wore the accelerometer during two music lessons. We compared the physical activity phenotypes during music lessons with and without an intervention. On average, children were more physically inactive during music lessons without an intervention than during music lessons with an intervention (p = 0.001, d = 2.8) and spent a higher proportion of time doing moderate (p = 0.001, d = 5.9) and vigorous (p = 0.001, d = 30) physical activity during music lessons with an intervention than during regular music lessons. During regular music lessons, children spent 39% more time being physically inactive than during music lessons with a physical activity intervention programme. We recommend that future studies include a larger sample of children and that they wear the accelerometers for at least five consecutive days.

1 Introduction

Physical activity in childhood is an important component of a healthy lifestyle. Regular and sufficiently intense physical activity has a positive effect on the child's overall development and on maintaining and protecting health (NICE, 2007). It also reduces the risk of many chronic non-communicable diseases (Kriska et al., 2003). The lack of physical activity in childhood may contribute to the development of chronic noncommunicable diseases and the prevalence of overweight and obesity (Sardinha et al., 2008).

Despite the known positive effects of regular physical activity on an individual's development and health, a significant proportion of children and adolescents have lower levels of physical activity than recommended (Biddle et al., 2004; Roberts et al., 2004; Volmut et al., 2013). Several organizations and associations recommend a minimum of 60 minutes of moderate-to-vigorous intensity of physical activity (MVPA) per day for normal healthy development in children and adolescents (DoH, 2019; WHO, 2011). It has been recommended that students complete at least 50 % of daily MVPA at school (Pate et al., 2006), but studies suggest that the school MVPA accounts for only 22–40 % of the daily MVPA (Gidlow et al., 2008; Long et al., 2013; Mooses et al., 2016; Yli-Piipari et al., 2016). Volmut et al. (2013) find that from 21 % to 67 % of all Slovenian children receive more than the 60 minutes of MVPA recommended for a healthy lifestyle. Overall, 81 % of adolescents (aged 11–17) do not meet these recommendations. Similar findings are reported by other authors (Demetriou et al., 2017; Li et al., 2017; Roberts et al., 2004).

However, the recommendations do not specify how much time children and adolescents may be physically inactive during the day. They only mention that children should not spend more than two hours per day using electronic media for entertainment, especially during the day (DoH, 2019). Piątkowska and Biernat (2016) state that 75.2 % of boys and 66.1 % of girls spend at least 2 hours a day sitting; that as many as 63.6 % of boys and 60.4 % of girls spend more than 2 hours a day watching TV; and that as many as 52.5 % of boys and 18.7 % of girls only play video games. Volmut (2014) further states that the amount of physical inactivity (including sitting) is extremely high in children and adolescents, ranging from 583 to 615 minutes a day, which corresponds to > 70 % of waking time. Ayala-Guzmán et al. (2017) find that Mexican children aged eight to twelve are inactive for an average of 3733.5 minutes per week (533 minutes a day).

Several studies examined the variability of physical activity within a day or between days (Brasholt et al., 2013; Bringolf-Isler et al., 2009; Hesketh et al., 2014; Kristensen et al., 2008; Olesen et al., 2014; Riddoch et al., 2007; Verbestel et al., 2011). Most studies report that children are more physically active in the afternoon than in the morning (Hardman et al., 2009; Nilsson et al., 2008; Volmut, 2014). It is also apparent that children are less active during the week due to the nature of school instruction and commitments. However, physical activity patterns within days of the week vary or even differ from week to week, which may be related to class schedules, school workloads, and afternoon activities.

Educational institutions play a central role in promoting and developing healthy lifestyles and managing children's daily physical activities, especially in countries where public education is widely available and compulsory for most children (Hatfield and Chomitz, 2015). Children may spend five to nine hours per day at school (Hauptman and Komotar, 2010), where they are involved in physical activities during physical education classes, recess, and after school. Physical activity can also be increased through outdoor play during school hours, which also contributes to the developmental aspect of outdoor play (Ceciliani and Bortolotti, 2013). In addition, it is still possible to incorporate physical activities into lessons that do not normally include physical activity, and in this way reduce physical inactivity during school hours. The school environment represents a financially favourable and ideal setting for the implementation of intervention programmes, since they are aimed at many children. It provides adequate

facilities and sports equipment, as well as teachers who can incorporate physical activities into their lessons.

As for intervention programmes that incorporate learning through physical activity, evidence shows that they are feasible (Delk et al., 2014) and affordable (Babey et al., 2014). More importantly, the results of these intervention studies show increases in physical activity in children (Daly-Smith et al., 2018; Innerd et al., 2019; Mahar et al., 2006; Martin and Murtagh, 2017; Stewart et al., 2004; Szabo-Reed et al., 2017; Vetter et al., 2020); an increase in their attention and focus on the subject matter (Howie et al., 2015; Ma et al., 2015); higher learning effectiveness (Mahar et al., 2006; Szabo-Reed et al., 2017); and consequently better learning performance (Daly-Smith et al., 2018; Have et al., 2016; Howie et al., 2015; Szabo-Reed et al., 2017). Habe (2018, p. 13) reported that if we want to increase children's motivation for activity lessons and increase their alertness, we can play music loud or even include physical activity. In addition, Sember et al. (2019, p. 10) note in their review that there is ample evidence of the effects of physical activity on children's school performance abroad, but unfortunately the results of Slovenian studies are not consistent in this regard.

Several studies have been published (Adkins et al., 2015; Hatfield and Chomitz, 2015; Volmut, 2014) that examined children's physical activity during school lessons, especially in subjects that do not normally involve physical activity. However, according to recent studies, the average amount of MVPA during school instruction is about 1 % (Martin and Murtagh, 2015; Mooses et al., 2016), while others have found that MVPA can account for up to 13 % of instructional time (Bailey et al., 2012; Nettlefold et al., 2011). Furthermore, more than 70 % of instructional time is spent sitting (Bailey et al., 2012; Martin and Murtagh, 2015; Nettlefold et al., 2011). In America, the TAKE 10! programme was developed to reduce children's physical inactivity during the school day and increase guided physical activity in the classroom. Kibbe et al. (2011) find that children involved in the TAKE 10! programme had a 13 % increase in physical activity. Mahar et al. (2006) implemented the Energizes programme with the intention of incorporating physical activity into the curriculum of courses/subjects that do not normally include physical activity. Children who participated in the programme took 782 more steps than other children.

There are many previously published studies that examine the integration of children's physical activity into various school subjects. However, studies that integrate children's physical activity into music lessons are very rare. Therefore, we decided to use an accelerometer to measure the amount and intensity of individual physical activity phenotypes of first graders during a music-only lesson, with and without a physical activity intervention.

2 Method

Participants

The study involved 108 children (50 boys), aged six to seven, from two randomly selected elementary schools on the Slovenian coast. We submitted the draft of the study to

the school administration. Prior to the study, we obtained written consent from the school principals and the children's parents. The entire data collection process was conducted in accordance with the requirements of the Personal Data Protection Act (RS, 1999).

Instruments

The amount and intensity of physical activity were measured with the accelerometer "MTI Actigraph" (Manufacturing Technology Inc., Fort Walton Beach, FL, USA). Before the start of the lessons, the children were equipped with the accelerometers, with a rubber band around the belt attached to the right hip. During the two lessons, we measured the amount and intensity of physical activity using the accelerometer and calculated the time spent in each phenotype of physical activity. At the end of the lesson, we collected them and transferred the data to the personal computer for further analysis. Only the data from the lessons were analysed. We processed the data for each 15-second epoch. The overall level of physical activity was reported in counts per minute (cpm), while minutes spent in physical activity were reported for sedentary (< 100 cpm), light (100–1262 cpm), moderate (1263–4135 cpm), and vigorous (> 4135 cpm) physical activity intensity phenotypes (Freedson et al., 2005).

Proceedings

The study was conducted during the last week of May and the first week of June 2016. Children from both schools participated in two music lessons in which they learned to practise and develop rhythmic listening through music and didactic games. The first music lesson included musical didactic games with physical activities, while the second lesson did not include physical activities. Both music lessons were held 7 days apart. Both lessons had the same learning objectives.

Description of the physical activity intervention

During the first week, the children developed and reviewed their sense of rhythm using music and didactic games (e.g., Dancing around Chairs, Rhythmic Jumping, Moving in Different Directions, Icemen, Birds in Nests, and Train). The children were active and moving most of the time as they walked, ran, jumped, marched, and hopped to the rhythm. The second music lesson went as usual and the children participated in musical and didactic games (e.g., Musical Hat, Telephones, The Hidden Treasure, What's My Name?, The Bell, What Instrument Is That? and Who Called You?) without much physical activity.

Description of the ordinary course of a music lesson

During an ordinary music lesson, the children played musical didactic games in which they creatively expressed their musical experiences, felt joy in music, and relaxed and motivated themselves to work through the games. During the musical didactic games, they performed small coordinated movements and got used to actively listening to the songs. They practised their verbal communication, had to distinguish voices by colours and the direction from which the sound came. We compiled, adapted and named the listed didactic games for the purpose of the study. We started with the game "What's My Name?". The children stood in a circle in front of their chairs. First, the teacher clapped

his hands each time he pronounced a syllable of his name, which the children then repeated. Everyone introduced themselves in the same way and we all clapped our hands to the syllables of each child's name. In the second musical didactic game, the "Musical Hat", we placed the chairs in a circle, close together. We put a hat on the head of one of the children. While the music was playing, the child had to put the hat on the head of his neighbour in rhythm with the music, who then passed it on again in the same rhythm. In the next musical didactic game, "Telephones", the children were still sitting on chairs in a circle. On the back of one of the children, we played a short rhythmic pattern by tapping lightly, which the children then repeated one by one until it reached the first child, who had to clap his hands in rhythm with the original pattern to see if it had been changed. We repeated the game by changing the sitting order of the children before each new "journey of the rhythmic pattern". In the next game, "The Hidden Treasure", we hid a rattle in the classroom while one of the children was outside the classroom. We had set up the rule that all the other children would help the person looking for the rattle by clapping their hands. When the searcher approached the hidden rattle, the children had to clap quickly and loudly. However, if the child moved away from the rattle or was far away, his classmates clapped slowly and quietly. In the last musical didactic game called "The Bell", the children sat on their chairs in a circle. In the middle of the circle sat a child who was blindfolded. We gave one of the children a bell and he passed it to the next, and so on. The bell travelled around the circle without ringing. We chose one child to ring the bell, and the blindfolded child had to point in the direction from which the sound came.

Description of the teaching process in a music lesson that includes physical activities

In the second lesson, in which the children moved while performing musical didactic games, they achieved the same learning objectives as in the first music lesson. In this lesson too, the children performed musical didactic games that we compiled, adapted, and named for the purpose of the study. In the first musical didactic game, "In the Meadow", the children chose their position in the classroom. We told them to imitate animals (butterflies, frogs, bears) only with their movements. When we played the rattle, the children imagined the flight of the butterflies. When they heard the scratcher, they imitated the jumps of frogs, and when they heard the drum, they imitated the running of a bear. In the musical didactic game "Dancing around Chairs" we placed chairs in a circle, but there was one chair less than there were children. We played music where the children expressed themselves with their movements, and when the music stopped, the children had to sit down on the nearest chair. The one who was left without a chair had to do 10 jumps by pulling his knees closer to his chest, and then he was allowed to play again. At the last attempt, we removed five chairs from the room. In the musical didactic game "Rhythmic Jumping", we stood in a circle with all the children. We presented a rhythmic pattern with different jumps and the children repeated it. By counting rhymes while walking, we chose a child who then presented his rhythmic pattern with jumps. In the next musical didactic game, we went to the world of clown puppets, where Nacek the Clown got a new drum, which he played day and night. But in order not to wake the sleeping people, he drummed very quietly at night. The children – the clown puppets – had to listen carefully to the drumming and guess whether it was day or night. When the teacher drummed softly, it was night and all the clown puppets moved very slowly from their left foot to their right foot. When the teacher drummed loudly, it was daytime and the clown puppets

woke up, jumped, ran – did everything clown puppets do. In the musical didactic game "Moving in Different Directions", the teacher played three instruments: sticks, the rattle and triangle. The children performed specific movements that were predetermined, each movement for a specific sound of the instrument. They expressed the sounds by moving around the room in different directions. For the sound of the drum, they marched forward; for the sound of the sticks, they walked backward; and for the sound of the triangle, they turned. In the musical didactic game "Icemen", we played lively music to the children and they expressed themselves through movement. When the music suddenly stopped, the children "froze" in place. No one was allowed to move until they heard the music again.

Data analysis

All data are shown with an average and standard deviation. Analyses were performed with the SPSS statistical package (IBM Coorp, USA). We used the Kolmogorov-Smirnov test to check the normality of the distribution. For normally distributed data, we used a paired-samples t test, and for nonnormally distributed data, we used a nonparametric Wilcoxon signed-range test. All decisions were made at a risk level of $p \leq 0.05$. In the case of observed differences, we also reported Cohen's d.

3 Results

We conducted two music lessons with the same learning objectives in which the children developed their rhythmic listening skills through musical didactic games. Although we did not measure how the objectives were met, we believe that the children met the objectives in both music lessons, but in a different type of physical activity.

The normality test confirmed normal distribution for all variables, except time spent in moderate-to-vigorous physical activity. The main results are shown in Table 1. We found that PAML increased overall physical activity by 1652 counts per minute ($p < 0.001$, $d = 12.0$). Physical activity phenotypes changed during the PAML class as follows:

- physical inactivity decreased by 17.5 minutes ($p = 0.001$, $d = 2.8$);
- moderate physical activity increased by 10.4 minutes ($p = 0.001$, $d = 5.9$);
- vigorous physical activity increased by 6.7 minutes ($p = 0.001$, $d = 30.0$), resulting in
- a 17.2-minute increase in moderate-to-vigorous physical activity ($p = 0.001$, $d = 9.12$).

Only low physical activity remained unchanged.

The results show that children achieved 17.2 minutes more moderate-to-vigorous physical activity during the 45-minute music class than during the regular music class, which corresponds to 28.7 % of the minimum daily recommendations for moderate-to-vigorous physical activity.

Table 1

Total Physical Activity and Time and the Proportion of Time Spent in Each Physical Activity Intensity Phenotype during Normal Music Lesson (without PAML) and during Physically Active Music Learning (PAML)

Activity		*No PAML*	*PAML*	*p (Cohen's d)*
Overall physical activity	/ cpm	255 (143)	1907 (467)	< 0.001 (12.0)
Physical inactivity	/ min /%	28.3 (6.3) 62.9 (13.9)	10.8 (3.3) 23.9 (7.4)	< 0.001 (2.8)
Low physical activity	/ min /%	14.5 (5.0) 32.2 (11.4)	14.8 (2.7) 32.9 (5.7)	0.681
Moderate physical activity	/ min /%	2.0 (1.7) 4.4 (3.9)	12.4 (3.2) 27.5 (6.9)	< 0.001 (5.9)
Vigorous physical activity	/ min /%	0,2 (0.3) 0.4 (0.5)	6.9 (2.8) 15.4 (6.3)	< 0.001 (30.0)
Moderate-to-vigorous physical activity	/ min /%	2.2 (1.9) 4.8 (4.2)	19.4 (3.9) 43.1 (8.7)	< 0.001 (9.12)

We also wanted to know if children's physical inactivity decreased by at least 30% during the music lesson with a physical activity intervention programme. We found that children were physically inactive 62.9% of the time during a regular music lesson, but only 23.9% of the time during a music lesson with a physical activity intervention programme.

4 Discussion

We found that the music lesson with additional physical activities included 17.5 minutes less time spent in physical inactivity compared with regular music lessons. In addition, children spent more time in moderate-to-vigorous physical activities.

Similar results were obtained by Hart et al. (2008), who implemented the TAKE 10! intervention programme in schools. This is a school-based physical activity programme that combines academic instruction with 10-minute physical activity breaks to get children moving without sacrificing time for academic learning. The authors found that children in the experimental group who participated in the TAKE 10! intervention programme, on average, exercised more each day. Unfortunately, the study did not find changes in individual phenotypes of physical activity intensity. However, we can assume that physical inactivity also decreased.

We found large effect sizes with very high relative changes and believe that any physical activity measure implemented at the most appropriate time (time of least physical activity) would have large effects. To support this, several studies report daily variability in children's physical activity (Brasholt et al., 2013; Hesketh et al., 2015; Mota et al., 2003; Olesen et al., 2014; Riddoch et al., 2007; Verbestel et al., 2011). Most

studies report that children are least physically active in the morning, during school hours (Hardman et al., 2009; Hesketh et al., 2014; Volmut, 2014). Integrating the physical activity intervention programme into the classroom during the time with the least amount and intensity of physical activity would have the greatest effect on increasing the amount and intensity of physical activity (Volmut, 2014). Volmut (2014) finds that younger Slovenian children have the lowest amount of physical activity in the morning and therefore the morning time is best for integrating intervention programmes. Similar findings are also reported by Hesket et al. (2014).

Nowadays, children spend most of their day at school (Hauptman and Komotar, 2010), where most of them are physically inactive. This is the reason why some countries have introduced physical activity breaks or interventions during class time. There are quite a few studies that implement intervention programmes aimed at increasing moderate-to-vigorous physical activity during physical education classes (McKenzie and Lounsbery, 2013; Powell et al., 2016). On the other hand, there are some studies (Bartholomew et al., 2019; Goh et al., 2016; Hart et al., 2008; Honas et al., 2008; Innerd et al., 2019; Mahar, 2011; Martin and Murtagh, 2017; Stewart et al., 2004) that integrate physical activity breaks or interventions into other school lessons where it is not common. The overarching goal is to reduce children's inactivity during school hours. We see an exceptional opportunity in pursuing this goal in the interdisciplinary integration of physical activity and subjects not normally taught through physical activity. In modern education, teachers should strive to eliminate the fragmentation of school work and modernize the way of teaching to optimize the learning process (Birsa, 2018). Retar and Lepičnik Vodopivec (2017, p. 24) note that teachers are aware of the importance of creativity and innovation as an important factor in teaching with movement. Therefore, we included new teaching methods through movement in music lessons. We also wanted to investigate whether the inclusion of a physical intervention programme would help to reduce physical inactivity. The school subjects of music and physical education have many similarities, as children can create a rhythm through physical activity that can be the basis for their first dance steps. We decided to combine music and physical education lessons because these two subjects are closely related and children can relax through such activities. Jelovčan et al. (2020, p. 30) report that preschoolers are more likely to express their knowledge of fairy-tale content both emotionally and physically through moving in the rhythm of music at different paces.

During school lessons which usually do not include physical activity, it is sometimes difficult to incorporate physical activities. However, we can incorporate physical activities into the lesson as a short break, for example, during the introductory phase, during the consolidation in the main part of the lesson, or during the final phase of the lesson. In order to incorporate physical activities into the lesson, the teacher must be well organized and prepared. By incorporating physical activities into the classroom, we help to achieve the recommended minimum daily physical activity levels and reduce inactivity among children and youth.

The Centre for Disease Control and Preventions study (Rasberry et al., 2010) lists several studies that have been conducted by incorporating physical activity into the school curriculum. The research they have conducted has shown that incorporating physical activities into the classroom not only leads to children being more physically active, but also leads to children memorizing and learning a certain subject matter more

easily and quickly, while at the same time making that knowledge more lasting. We must emphasize that the results of the above-mentioned intervention studies show an increase in children's physical activity (Bartholomew et al., 2019; Daly-Smith et al., 2018; Donnelly et al., 2017; Innerd et al., 2019; Mahar et al., 2006; Stewart et al., 2004; Vetter et al., 2020); in their attention span and concentration in relation to the subject matter (Howie et al., 2015; Ma et al., 2015); in learning effectiveness (Bartholomew et al., 2019; Mahar et al., 2006; Szabo-Reed et al., 2017); and consequently better learning performance (Daly-Smith et al., 2018; Have et al., 2016; Howie et al., 2015; Szabo-Reed et al., 2017).

Even before developing the physical activity intervention programme, we were aware that all of the physical inactivity during music lessons could not be fully converted into moderate-to-vigorous physical activity time. It is much easier if we replace the periods of physical inactivity with low-intensity physical activities (Treuth et al., 2005). Van der Ploeg et al. (2012) found that the risk of death was 2 % higher for people who sat for 4 to 8 hours per day, 15 % higher for 8 to 11 hours of sitting per day, and as much as 40 % higher for > 11 hours of sitting per day. Chau et al. (2015) and Pavey et al. (2015) report a slightly higher percentage increase in mortality with hours of sitting. In addition to hours of physical inactivity per day, uninterrupted sitting is a completely independent factor in mortality. The currently available prospective experimental studies support that interrupting sitting time (e.g., every 30 minutes for 2 minutes) and replacing it with light ambulatory physical activity or simple standing may be a sufficient stimulus to induce favourable changes in postprandial metabolic parameters (Benatti and Ried-Larsen, 2015). In this context, most epidemiological evidence suggests that independent moderate-to-vigorous physical activity is beneficial and that prolonged sitting is still associated with higher CVD and all-cause mortality risk (Matthews et al., 2012; Wijndaele et al., 2014). Accordingly, the findings of Peddie et al. (2013) and Duvivier et al. (2013) suggest that one round of moderate-to-vigorous physical activity cannot offset the deleterious effects of prolonged sitting throughout the day and support the importance of constant interruptions to this sedentary behaviour, even during low-intensity activities.

Some studies even report that additional low-intensity physical activity in children contributes to total daily energy expenditure (Pate et al., 2008; Treuth et al., 2009).

The results of our study were mainly influenced by the selection of the musical didactic games, because there is no significant difference between the music lessons that included a low intensity of physical activity, but only in the music lessons with a moderate-to-vigorous intensity of physical activity. The games consisted of various forms of making music to the rhythm of the music. The music lessons without physical activity consisted of didactic games with music, in which the children followed the rhythm of the music while sitting and clapping or snapping their fingers. In contrast, the lessons with an additional intervention included physical activities in which the children moved to the rhythm mainly while standing, namely by stamping their feet, jumping, or walking. These movements are considered low-intensity, or mostly moderate-to-vigorous physical activity (Volmut, 2014). We found that the greatest attention was paid to the selection of physical activities to illustrate the rhythm during the musical didactic games. The children who were included in the intervention programme in this way had more opportunities to engage in moderate-to-vigorous physical activity. In addition,

the games in the first music lesson provided much more entertainment for the children. Nevertheless, we believe that the goals of both music lessons were equally achieved.

One of the dangers of integrating physical activity into school subjects that are not based on physical activity is that the goals of one or both subjects can become unclear or even unrealistic, which is why we have encountered the question of what is the right level of physical activity in music lessons? At the same time, we must not forget that we must achieve the goals we have set for both subjects: music and physical education. The children tended to be lively and relaxed in the music lessons that included physical activities. They experienced some problems in listening to the instructions. Since assessing the acquired knowledge is not the goal of our research, we suggest that future studies pay more attention to that as well.

The disadvantage of our study is that the children were equipped with the accelerometer only during two music lessons. We would have obtained more reliable and useful data if the children had been equipped with an accelerometer for at least five consecutive school days. This would allow us to see how and to what extent the intervention programme during music lessons and in other school subjects helped to increase the total daily amount and intensity of physical activity and decrease physical inactivity.

A limitation of our study is the time of physical activity assessment, which would be longer if more music lessons were integrated into this time. In addition, we should strictly monitor whether children achieve the goals of music lessons. We also recommend including children of different ages in the study. In this way, the sample of children would be much larger, and the results could be more broadly generalized.

5 Conclusions

We have provided evidence that physically active learning (in our case, of music) contributes greatly to physical activity; specifically, it decreases physical inactivity and increases moderate-to-vigorous physical activity. There is very little research of this type, and although we have demonstrated very large effects of PAML, we believe it would be even more interesting to conduct a study that incorporates physically active learning in all the lessons that do not normally involve physical activity. The rest of the time spent in school should also include physical activities. This type of instruction requires much more preparation time for the lesson plan and is more difficult to implement. Our results suggest that the children achieved a substantial amount (17.2 minutes) of the daily recommendations for moderate-to-vigorous physical activity (60 minutes) with just one physically active lesson. We believe that effective physical activity intervention programmes or classroom physical activity can reduce children's daily level of physical inactivity during the school day.

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Učinkovitost vključevanja gibalne aktivnosti v pouk glasbene umetnosti

Pri izvajanju medpredmetne povezave imata lahko predmeta različno vlogo. Lahko je nosilna, poudarjena ali podporna, in sicer ne glede na izbrano strategijo povezovanja. Nosilno vlogo ima tisto predmetno področje, iz katerega izhajajo povezave. Podporno ima tisto, ki prispeva k doseganju skupnega cilja, poudarjeno pa tisto predmetno področje, ki dosega lastne predmetne cilje in bistveno vpliva na uresničitev skupnega cilja. Predvsem v nižjih razredih osnovne šole je zaradi nepojmovnega povezovanja in nepoznavanja učnih načrtov umetniških predmetnih področij v praksi zaznati nejasnosti pri načrtovanju in izvajanju povezav (Kopačin in Birsa, 2022, str. 110).

Gibalna/športna aktivnost je v otroštvu pomemben del zdravega življenjskega sloga. Redna in dovolj intenzivna gibalna/športna aktivnost ugodno vpliva na celostni razvoj otroka, ohranjanje in varovanje zdravja ljudi (NICE, 2007) ter zmanjša tveganje za številne kronične nenalezljive bolezni (Kriska idr., 2003). Odsotnost ali pomanjkanje gibalne/športne aktivnosti v obdobju otroštva lahko prispeva k razvoju kroničnih nenalezljivih bolezni, prekomerni telesni masi in debelosti otrok (Sardinha idr., 2008). Vsakodnevna gibalna/športna aktivnost v različnih oblikah je nenazadnje pomembna tudi za ohranjanje potrebne ravni gibalnih sposobnosti in spretnosti ter oblikovanje vedenjskih vzorcev, ki zagotavljajo redno gibalno/športno aktivnost v vseh življenjskih obdobjih.

Vzgojno-izobraževalne ustanove imajo osrednjo vlogo pri spodbujanju in razvijanju zdravega načina življenja ter ukvarjanju z vsakodnevno gibalno/športno aktivnostjo otrok (Hatfield in Chomitz, 2015). Otroci so v času šolskega pouka, ki traja od pet do devet ur na dan (Hauptman in Komotar, 2010), lahko deležni gibalne/športne aktivnosti pri predmetu šport, med rekreativnim odmorom in v času podaljšanega bivanja. Gibalno/športno aktivnost lahko povečamo tudi z gibalnimi igrami na prostem v času šolskega pouka, s katerimi prispevamo tudi k razvojnemu vidiku igranja na prostem (Ceciliani in Bortolotti, 2013). Poleg tega ure pouka, ki niso gibalne narave, dajejo izjemno priložnost, da mednje vključujemo gibanje in tako zmanjšamo gibalno neaktivnost med šolskim poukom. Pri tem pa moramo paziti, da pri vključevanju gibanja v pouk namenimo prednost doseganju ciljev predmeta, ki ni gibalne narave.

Med šolske predmete, ki niso gibalne narave, je težko vključevati gibalno aktivnost ves čas. Zato lahko v učne ure, ki niso gibalne narave, vključimo gibalno aktivnost le v nekaterih učnih urah ali delih učne ure za krajši čas, na primer: v uvodni motivaciji, pri utrjevanju v glavnem delu učne ure ali v zaključnem delu učne ure. Vključevanje gibalne aktivnosti v celotno učno uro, ki ni gibalne narave, zahteva dobro načrtovanje, organiziranost in izvedbo učne ure. Z vključevanjem gibalne aktivnosti v celotno učno uro, ki ni gibalne narave, pripomoremo k doseganju priporočil minimalne dnevne gibalne/športne aktivnosti in s tem k zmanjšanju gibalne neaktivnosti otrok in mladostnikov. Zato je namen našega prispevka, da s pomočjo merilnika pospeška izmerimo količino in intenzivnost posameznih fenotipov gibalne/športne aktivnosti prvošolcev le med uro glasbene umetnosti brez gibalne intervencije in z njo.

V raziskavo je bilo vključenih 108 otrok (50 dečkov), starih šest in sedem let, iz dveh slovenskih obalnih osnovnih šol. Vzorec udeležencev je bil neslučajnostni in priložnostni. Vsi otroci so bili vključeni v dve učni uri glasbene umetnosti, kjer so preko glasbenih didaktičnih iger utrjevali in razvijali ritmični posluh. V eno učno uro glasbene umetnosti, ki je bila izvedena v prvem tednu, so bile vključene glasbene didaktične igre z gibanjem, v drugi uri, ki je bila izvedena v drugem tednu raziskave, pa gibanja ni bilo. Pri obeh urah smo si zastavili iste učne cilje.

Otrokom smo med obema urama glasbene umetnosti s pomočjo merilnika pospeška MTI Actigraph (Manufacturing Technology Inc, Fort Walton Beach, FL, USA) izmerili količino in intenzivnost gibanja ter izračunali čas, preživet v vsakem fenotipu intenzivnosti gibalne/športne aktivnosti. Pred pričetkom učne ure smo otrokom pripeli merilnike pospeška okoli pasu s pomočjo elastičnega traku tako, da so bili na desnem boku. Po koncu ure smo jih pobrali in podatke prenesli na osebni računalnik za nadaljnje analize. Zabeležili smo si čas trajanja ur. V obdelavo smo vzeli podatke za vsakih 15 sekund (15-sekundni časovni interval – epoha). S Kolmogorov-Smirnovim testom smo preverili normalnost porazdelitve. Za normalno porazdeljene podatke smo uporabili parametrični t-test za odvisne vzorce, za nenormalno porazdeljene podatke pa neparametrični Mann-Whithneyjev test. Odločali smo se pri stopnji tveganja 0,05. V primeru ugotovljenih razlik smo zabeležili tudi Cohenov d.

Vsi otroci, vključeni v raziskavo, so bili deležni dveh ur glasbene umetnosti z istimi učnimi cilji. V prvem tednu so bili otroci med urami glasbene umetnosti s pomočjo glasbenih didaktičnih iger (glasbeni klobuk, telefončki, skriti zaklad, kako mi je ime, zvonček, kateri instrument slišim in kdo te je poklical) deležni običajne učne ure, pri kateri je prevladovala predvsem gibalna neaktivnost. Pri drugi učni uri glasbene umetnosti so tudi s pomočjo glasbenih didaktičnih iger (hoja okoli stolov, ritmično skakanje, pajaci, gibanje v različnih smereh, ledeni možje, ptički v gnezda in vlak) razvijali in utrjevali ritmični posluh.

Pri igrah, ki smo jih za namen raziskave pripravili sami, so bili otroci večji del ure gibalno aktivni, saj so v ritmu hodili, tekali, poskakovali in korakali. Pri prvi glasbeni didaktični igri na travniku so si otroci izbrali svoj prostor v učilnici. Povedali smo jim, da bodo oponašali živali (metulje, žabe, medvede) le z gibi. Ko smo zaigrali na ropotuljo, so si otroci predstavljali let metuljev. Ko so zaslišali strgalo, so otroci oponašali skoke žab, ko pa so zaslišali boben, so ponazarjali medvedjo hojo. Pri glasbeni didaktični igri ples okoli stolov smo v krog postavili en stol manj, kot je bilo otrok. Predvajali smo glasbo, ob kateri so se otroci gibalno izražali, in ko je glasba utihnila, so se otroci morali usesti na najbližji stol. Tisti, ki je ostal brez stola, je moral narediti 10 skokov s pritegom kolen k prsim in se nato vrniti nazaj v igro. Ob zadnjem poskusu smo umaknili iz igre pet stolov. Ob glasbeni didaktični igri ritmično skakanje smo z otroki stali v krogu. S poskoki smo predstavili en ritmični vzorec, ki so ga otroci ponovili. Z izštevanjem ob korakanju smo določili otroka, ki je s poskoki predstavil svoj ritmični vzorec. Pri predzadnji glasbeni didaktični igri smo vstopili v svet pajackov, kjer je pajacek Nacek dobil nov boben, na katerega je igral dan in noč. Da pa ne bi zbudil spečih ljudi, je ponoči bobnal čisto tiho. Otroci so v vlogi pajackov dobro prisluhnili bobnanju in ugotavljali, ali je noč ali je dan. Ko je učitelj bobnal tiho, je bila noč in vsi pajacki so čisto počasi prestopali z leve noge na desno. Ko je učitelj bobnal glasno, je bil dan in pajacki so se zbudili, skakali, tekali – počeli vse tisto, kar pač pajacki znajo.

Pri glasbeni didaktični igri gibanje v različnih smereh je učitelj igral na tri instrumente: palčke, ropotuljo ali triangel. Otroci so se gibali po vnaprej določenih gibih za določen zvok instrumenta. Prepoznavanje zvokov so izrazili z gibanjem po prostoru v različnih smereh. Ob zvoku bobna so korakali naprej, ob zvoku palčk hodili vzvratno, ob zvoku triangla pa so se vrteli okoli svoje osi. Pri glasbeni didaktični igri ledeni možje pa smo otrokom predvajali živahno glasbo, ob kateri so se gibalno izražali. Ob nenadni prekinitvi glasbe pa so otroci "zamrznili" v položaju, v katerem so obstali. Nihče se ni smel premakniti, dokler znova niso zaslišali predvajane glasbe.

Ugotovili smo, da obstajajo razlike med povprečnima vrednostma deleža časa gibalne neaktivnosti med običajno uro glasbene umetnosti in med uro glasbene umetnosti z intervencijskim programom ($p = 0{,}001$, $d = 12.0$). Delež povprečne vrednosti gibalne neaktivnosti med uro glasbene umetnosti se je zmanjšal s 63% na 24%. Rezultati tudi kažejo, da obstajajo razlike med povprečnima vrednostma deleža časa srednje ($p = 0{,}001$, $d = 5.9$) in tudi visoke ($p = 0{,}001$, $d = 30.0$) intenzivnosti gibalne/športne aktivnosti med običajno uro glasbene umetnosti in med uro glasbene umetnosti z intervencijskim programom. Čas srednje intenzivnosti gibalne/športne aktivnosti med uro glasbene umetnosti z intervencijskim programom je daljši za 10,4 minute od časa srednje intenzivnosti gibalne/športne aktivnosti običajne učne ure glasbene umetnosti, medtem ko je čas visoke intenzivnosti gibalne/športne aktivnosti daljši za 6,7 minute. Posledično smo tudi ugotovili, da obstajajo razlike med povprečnima vrednostma časa srednje do visoke intenzivnosti gibalne/športne aktivnosti ($p = 0{,}001$, $d = 5{,}12$) ter da je čas srednje do visoke intenzivnosti gibalne/športne aktivnosti daljši kar za 17,2 minute.

V nadaljevanju nas je tudi zanimalo, ali se otrokom med uro glasbene umetnosti, v katero je vključen intervencijski program, zmanjša gibalna neaktivnost za vsaj 30%. Ugotovili smo, da so bili otroci med običajno uro glasbene umetnosti deležni kar 62,9-odstotnega deleža časa gibalne neaktivnosti, med uro glasbene umetnosti z gibalnim intervencijskim programom pa le 23,9-odstotnega.

Otroci danes preživijo večino dneva v šoli (Hauptman in Komotar, 2010), kjer so večji del časa gibalno neaktivni. Prav zato so v drugih državah začeli med poukom izvajati gibalne intervencijske programe. Obstaja kar nekaj študij o izvajanju intervencijskih programov, s katerimi želijo povečati čas srednje do visoke intenzivnosti gibalne/športne aktivnosti med učno uro športa (McKenzie in Lounsbery, 2013; Powell Woodfield in Nevill, 2016).

Zelo redke so študije (Hart idr., 2008), ki predstavljajo izvajanje intervencijskih programov med učnimi urami, ki niso gibalne narave in s pomočjo katerih se zmanjšuje gibalno neaktivnost otrok med šolskim poukom. Izjemno priložnost predstavlja ravno medpredmetno povezovanje predmeta šport in predmetov, ki niso gibalne narave. Učitelji bi si v sodobnem izobraževanju morali prizadevati za odpravo razdrobljenosti šolskega dela in posodobitev načina poučevanja ter s tem optimizacijo učnega procesa (Birsa, 2018).

Prav zato smo v ure glasbene umetnosti vključili nove načine poučevanja preko gibanja. Poleg tega smo želeli preučiti, ali z vključitvijo gibalnega intervencijskega programa pripomoremo k zmanjšanju gibalne neaktivnosti. Šolska predmeta glasbena umetnost in šport imata veliko skupnih točk (Drovenik Adamec, Blažič, Kovačič, 2020), saj lahko otroci s pomočjo gibalne/športne aktivnosti ustvarijo ritem, ki je lahko osnova

za prve plesne korake. Za vključevanje gibanja v ure glasbene umetnosti smo se odločili tudi zato, ker sta ta dva predmeta ves čas tesno povezana in sta predmeta, pri katerih se otroci lahko sprostijo.

Tovrstnih raziskav je izredno malo, zato menimo, da bi bilo smiselno v prihodnje izpeljati raziskavo, ki bi gibalno/športno aktivnost vključevala v vseh učnih urah, ki niso gibalne narave, ter med preostalim časom, ki ga otroci preživijo v šoli. Tovrsten način izvedbe šolskega pouka zahteva veliko več časa za pripravo na pouk ter večjo zahtevnost pri izpeljavi pouka. Smiselno bi bilo, da otroci nosijo merilnik pospeška več dni zapored, saj bi le tako dobili zanesljivejše rezultate. Le z nadaljnjim tovrstnim raziskovanjem lahko ugotovimo, ali so intervencijski programi med učnimi urami, ki niso gibalne narave, učinkoviti. Prepričani smo, da z učinkovitimi intervencijskimi programi lahko zmanjšamo dnevno raven gibalne neaktivnosti otrok v času šolskega pouka ter povečamo čas dnevnega trajanja v nizki, srednji in visoki intenzivnosti.

REFERENCES

1. Adkins, M., Bice, M., Bartee, T. et al. (2015). Increasing Physical Activity during the School Day Through Physical Activity Classes: Implications for Physical Educators. The Physical Educator, 72, 173–184. Available at: https://doi.org/10.18666/tpe-2015-v72-i5-5263 (retrieved 20. 12. 2022).
2. Ayala-Guzmán, C. I., Ramos-Ibáñez, N. and Ortiz-Hernández, L. (2017). Accelerometry does Not Match with Self-Reported Physical Activity and Sedentary Behaviors in Mexican Children. Boletín Médico Del Hospital Infantil de México (English Edition), 74(4), 272–281. Available at: https://doi.org/10.1016/j.bmhime.2018.01.003 (retrieved 20. 12. 2022).
3. Babey, S. H., Wu, S. and Cohen, D. (2014). How Can Schools Help Youth Increase Physical Activity? An Economic Analysis Comparing School-Based Programs. Preventive Medicine, 69, S55–S60. Available at: https://doi.org/10.1016/j.ypmed.2014.10.013 (retrieved 20. 12. 2022).
4. Bailey, D. P., Fairclough, S. J., Savory, L. A. et al. (2012). Accelerometry-Assessed Sedentary Behaviour and Physical Activity Levels during the Segmented School Day in 10–14-Year-Old Children: The HAPPY study. European Journal of Pediatrics, 171(12), 1805–1813. Available at: https://doi.org/10.1007/s00431-012-1827-0 (retrieved 20. 12. 2022).
5. Bartholomew, J. B., Jowers, E. M. and Golaszewski, N. M. (2019). Lessons Learned from a Physically Active Learning Intervention: Texas I-CAN! Translational Journal of the ACSM, 4(17), 137–140.
6. Benatti, F. B. and Ried-Larsen, M. (2015). The Effects of Breaking up Prolonged Sitting Time: A Review of Experimental Studies. Medicine and Science in Sports and Exercise, 47(10), 2053–2061. Available at: https://doi.org/10.1249/MSS.0000000000000654 (retrieved 20. 12. 2022).
7. Biddle, S. J., Gorely, T. and Stensel, D. J. (2004). Health-Enhancing Physical Activity and Sedentary Behaviour in Children and Adolescents. Journal of Sports Sciences, 22(8), 679–701. Available at: https://doi.org/10.1080/02640410410001712412 (retrieved 20. 12. 2022).
8. Birsa, E. (2018). Teaching Strategies and the Holistic Acquisition of Knowledge of the Visual Arts. CEPS Journal: Center for Educational Policy Studies Journal, 8(3), 187–206.
9. Brasholt, M., Chawes, B., Kreiner-Møller, E. et al. (2013). Objective Assessment of Levels and Patterns of Physical Activity in Preschool Children. Pediatric Research, 74(3), 333–338. Available at: https://doi.org/10.1038/pr.2013.99 (retrieved 20. 12. 2022).
10. Bringolf-Isler, B., Grize, L., Mäder, U. et al. (2009). Assessment of Intensity, Prevalence and Duration of Everyday Activities in Swiss School Children: A Cross-Sectional Analysis of Accelerometer and Diary Data. International Journal of Behavioral Nutrition and Physical Activity, 6(1), 50. Available at: https://doi.org/10.1186/1479-5868-6-50 (retrieved 20. 12. 2022).
11. Ceciliani, A. and Bortolotti, A. (2013). Outdoor Motor Play: Analysis, Speculations, Research Paths. CEPS Journal: Center for Educational Policy Studies Journal, 3(3), 65–86.

12. Chau, J. Y., Grunseit, A., Midthjell, K. et al. (2015). Sedentary Behaviour and Risk of Mortality from All-Causes and Cardiometabolic Diseases in Adults: Evidence from the HUNT3 Population Cohort. British Journal of Sports Medicine, 49(11), 737–742. Available at: https://doi.org/10.1136/bjsports-2012-091974 (retrieved 20. 12. 2022).
13. Daly-Smith, A. J., Zwolinsky, S., McKenna, J. et al. (2018). Systematic Review of Acute Physically Active Learning and Classroom Movement Breaks on Children's Physical Activity, Cognition, Academic Performance and Classroom Behaviour: Understanding Critical Design Features. BMJ Open Sport & Exercise Medicine, 4(1), e000341. Available at: https://doi.org/10.1136/bmjsem-2018-000341 (retrieved 20. 12. 2022).
14. Delk, J., Springer, A. E., Kelder, S. H. et al. (2014). Promoting Teacher Adoption of Physical Activity Breaks in the Classroom: Findings of the Central Texas CATCH Middle School Project. Journal of School Health, 84(11), 722–730. Available at: https://doi.org/10.1111/josh.12203 (retrieved 20. 12. 2022).
15. Demetriou, Y., Gillison, F. and McKenzie, T. L. (2017). After-School Physical Activity Interventions on Child and Adolescent Physical Activity and Health: A Review of Reviews. Advances in Physical Education, 7(2), 191–215. Available at: https://doi.org/10.4236/ape.2017.72017 (retrieved 20. 12. 2022).
16. DoH. (2019). Australia's Physical Activity and Sedentary Behaviour Guidelines and the Australian 24-Hour Movement Guidelines. Department of Health – Australian Government. Available at: https://www1.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-strateg-phys-act-guidelines (retrieved 20. 12. 2022).
17. Donnelly, J. E., Ed, D., Co-chair, F. et al. (2017). Physical Activity, Fitness, Cognitive Function, and Academic Achievement in Children: A Systematic Review. Medicine and Science in Sports and Exercise, 48(6), 1197–1222. Available at: https://doi.org/10.1249/MSS.0000000000000901 (retrieved 20. 12. 2022).
18. Drovenik Adamec, T., Blažič, M. and Kovačič, B. (2020). Influence of Factors on the Development of Outstanding Musical Talent – A Case Study. Didactica Slovenica – Pedagoška obzorja, 35(3–4), 54–70.
19. Duvivier, B. M. F. M., Schaper, N. C., Bremers, M. A. et al. (2013). Minimal Intensity Physical Activity (Standing and Walking) of Longer Duration Improves Insulin Action and Plasma Lipids More than Shorter Periods of Moderate to Vigorous Exercise (Cycling) in Sedentary Subjects When Energy Expenditure Is Comparable. PLoS ONE, 8(2), e55542. Available at: https://doi.org/10.1371/journal.pone.0055542 (retrieved 20. 12. 2022).
20. Freedson, P., Pober, D. and Janz, K. F. (2005). Calibration of Accelerometer Output for Children. Medicine & Science in Sports & Exercise, 37(Supplement), S523–S530. Available at: https://doi.org/10.1249/01.mss.0000185658.28284.ba (retrieved 20. 12. 2022).
21. Gidlow, C. J., Cochrane, T., Davey, R. et al. (2008). In-School and Out-of-School Physical Activity in Primary and Secondary School Children. Journal of Sports Sciences, 26(13), 1411–1419. Available at: https://doi.org/10.1080/02640410802277445 (retrieved 20. 12. 2022).
22. Goh T. L., Hannon J., Webster C. et al. (2016). Effects of a TAKE 10! Classroom-Based Physical Activity Intervention on Third- to Fifth-Grade Children's On-task Behavior. Journal of Physical Activity and Health, 13(7), 712–718. Available at: https://doi.org/10.1123/jpah.2015-0238 (retrieved 20. 12. 2022).
23. Habe, K. (2018). Z glasbo do učencu prijaznejšega učnega okolja in boljših učnih rezultatov. Didactica Slovenica – Pedagoška obzorja, 33(2), 3–19.
24. Hardman, C. A., Horne, P. J. and Lowe, C. F. (2009). A Home-Based Intervention to Increase Physical Activity in Girls: The Fit "n" Fun Dudes Program. Journal of Exercise Science & Fitness, 7(1), 1–8. Available at: https://doi.org/10.1016/S1728-869X(09)60001-0 (retrieved 20. 12. 2022).
25. Hart, M. A., Meaney, K. S., Klavenieks, V. et al. (2008). Effects of the TAKE10! Curriculum on Behaviors and Physical Activitye. Available at: https://aahperd.confex.com/aahperd/2008/finalprogram/paper_11280.htm (retrieved 20. 12. 2022).
26. Hatfield, D. P. and Chomitz, V. R. (2015). Increasing Children's Physical Activity During the School Day. Current Obesity Reports, 4(2), 147–156. Available at: https://doi.org/10.1007/s13679-015-0159-6 (retrieved 20. 12. 2022).

27. Hauptman, G. and Komotar, M. (2010). Otroci in mladostniki v sodobni družbi. Ljubljana: Zavod IRC.
28. Have, M., Nielsen, J. H., Gejl, A. K. et al. (2016). Rationale and Design of a Randomized Controlled Trial Examining the Effect of Classroom-Based Physical Activity on Math Achievement. BMC Public Health, 16(1), 304. Available at: https://doi.org/10.1186/s12889-016-2971-7 (retrieved 20. 12. 2022).
29. Hesketh, K. R., Griffin, S. J. and Van Sluijs, E. M. F. (2015). UK Preschool-Aged Children's Physical Activity Levels in Childcare and at Home: A Cross-Sectional Exploration. International Journal of Behavioral Nutrition and Physical Activity, 12(1), 123. Available at: https://doi.org/10.1186/s12966-015-0286-1 (retrieved 20. 12. 2022).
30. Hesketh, K. R., McMinn, A. M., Ekelund, U. et al. (2014). Objectively Measured Physical Activity in Four-Year-Old British Children: A Cross-Sectional Analysis of Activity Patterns Segmented Across the Day. International Journal of Behavioral Nutrition and Physical Activity, 11(1), 1. Available at: https://doi.org/10.1186/1479-5868-11-1 (retrieved 20. 12. 2022).
31. Honas, J. J., Washburn, R. A., Smith, B. K. et al. (2008). Energy Expenditure of the Physical Activity across the Curriculum Intervention. Medicine and Science in Sports and Exercise, 40(8), 1501–1505. Available at: https://doi.org/10.1249/MSS.0b013e31816d6591 (retrieved 20. 12. 2022).
32. Howie, E. K., Schatz, J. and Pate, R. R. (2015). Acute Effects of Classroom Exercise Breaks on Executive Function and Math Performance: A Dose–Response Study. Research Quarterly for Exercise and Sport, 86(3), 217–224. Available at: https://doi.org/10.1080/02701367.2015.1039892 (retrieved 20. 12. 2022).
33. Innerd, A. L., Azevedo, L. B. and Batterham, A. M. (2019). The Effect of a Curriculum-Based Physical Activity Intervention on Accelerometer-Assessed Physical Activity in School Children: A Non-Randomised Mixed Methods Controlled Before-and-After Study. PLOS ONE, 14(12), e0225997. Available at: https://doi.org/10.1371/journal.pone.0225997 (retrieved 20. 12. 2022).
34. Jelovčan, G., Lekše, M., Baloh, B. et al. (2020). Pravljica v povezavi z gibalnim izražanjem skozi jezik in ob glasbi. Didactica Slovenica – Pedagoška obzorja, 35(2), 23–37.
35. Kibbe, D. L., Hackett, J., Hurley, M. et al. (2011). Ten Years of TAKE 10!®: Integrating Physical Activity with Academic Concepts in Elementary School Classrooms. Preventive Medicine, 52, S43–S50. Available at: https://doi.org/10.1016/j.ypmed.2011.01.025 (retrieved 20. 12. 2022).
36. Kopačin, B. and Birsa, E. (2022). Medpredmetno povezovanje glasbene in likovne umetnosti. Didactica Slovenica – Pedagoška obzorja, 37(1), 109–124.
37. Kriska, A. M., Saremi, A., Hanson, R. L. et al. (2003). Physical Activity, Obesity, and the Incidence of Type 2 Diabetes in a High-Risk Population. American Journal of Epidemiology, 158(7), 669–675. Available at: https://doi.org/10.1093/aje/kwg191 (retrieved 20. 12. 2022).
38. Kristensen, P. L., Korsholm, L., Møller, N. C. et al. (2008). Sources of Variation in Habitual Physical Activity of Children and Adolescents: The European Youth Heart Study. Scandinavian Journal of Medicine & Science in Sports, 18(3), 298–308. Available at: https://doi.org/10.1111/j.1600-0838.2007.00668.x (retrieved 20. 12. 2022).
39. Li, X., Kearney, P. M., Keane, E. et al. (2017). Levels and Sociodemographic Correlates of Accelerometer-Based Physical Activity in Irish Children: A Cross-Sectional Study. Journal of Epidemiology and Community Health, 71(6), 521–527. Available at: https://doi.org/10.1136/jech-2016-207691 (retrieved 20. 12. 2022).
40. Long, M. W., Sobol, A. M., Cradock, A. L. et al. (2013). School-Day and Overall Physical Activity Among Youth. American Journal of Preventive Medicine, 45(2), 150–157. Available at: https://doi.org/10.1016/j.amepre.2013.03.011 (retrieved 20. 12. 2022).
41. Ma, J. K., Le Mare, L. and Gurd, B. J. (2015). Four Minutes of In-Class High-Intensity Interval Activity Improves Selective Attention in 9- to 11-Year Olds. Applied Physiology, Nutrition, and Metabolism, 40(3), 238–244. Available at: https://doi.org/10.1139/apnm-2014-0309 (retrieved 20. 12. 2022).
42. Mahar, M. T. (2011). Impact of Short Bouts of Physical Activity on Attention-to-Task in Elementary School Children. Preventive Medicine, 52, S60–S64. Available at: https://doi.org/10.1016/j.ypmed.2011.01.026 (retrieved 20. 12. 2022).

43. Mahar, M. T., Murphy, S. K., Rowe, D. A. et al. (2006). Effects of a Classroom-Based Program on Physical Activity and On-Task Behavior. Medicine & Science in Sports & Exercise, 38(12), 2086–2094. Available at: https://doi.org/10.1249/01.mss.0000235359.16685.a3 (retrieved 20. 12. 2022).
44. Martin, R. and Murtagh, E. (2017). Active Classrooms: A Cluster Randomized Controlled Trial Evaluating the Effects of a Movement Integration Intervention on the Physical Activity Levels of Primary School Children. Journal of Physical Activity and Health, 14(4), 290–300. Available at: https://doi.org/10.1123/jpah.2016-0358 (retrieved 20. 12. 2022).
45. Martin, R. and Murtagh, E. M. (2015). Preliminary Findings of Active Classrooms: An Intervention to Increase Physical Activity Levels of Primary School Children During Class Time. Teaching and Teacher Education, 52, 113–127. Available at: https://doi.org/10.1016/j.tate.2015.09.007 (retrieved 20. 12. 2022).
46. Matthews, C. E., George, S. M., Moore, S. C. et al. (2012). Amount of Time Spent in Sedentary Behaviors and Cause-Specific Mortality in US Adults. The American Journal of Clinical Nutrition, 95(2), 437–445. Available at: https://doi.org/10.3945/ajcn.111.019620 (retrieved 20. 12. 2022).
47. McKenzie, T. L. and Lounsbery, M. A. F. (2013). Physical Education Teacher Effectiveness in a Public Health Context. Research Quarterly for Exercise and Sport, 84(4), 419–430. Available at: https://doi.org/10.1080/02701367.2013.844025 (retrieved 20. 12. 2022).
48. Mooses, K., Mäestu, J., Riso, E.-M. et al. (2016). Different Methods Yielded Two-Fold Difference in Compliance with Physical Activity Guidelines on School Days. PLOS ONE, 11(3), e0152323. Available at: https://doi.org/10.1371/journal.pone.0152323 (retrieved 20. 12. 2022).
49. Mota, J., Santos, P., Guerra, S. et al. (2003). Patterns of Daily Physical Activity during School Days in Children and Adolescents. American Journal of Human Biology, 15(4), 547–553. Available at: https://doi.org/10.1002/ajhb.10163 (retrieved 20. 12. 2022).
50. Nettlefold, L., McKay, H. A., Warburton, D. E. R. et al. (2011). The Challenge of Low Physical Activity during the School Day: At Recess, Lunch and in Physical Education. British Journal of Sports Medicine, 45(10), 813–819. Available at: https://doi.org/10.1136/bjsm.2009.068072 (retrieved 20. 12. 2022).
51. NICE. (2007). Physical Activity and Children. Review 1: Descriptive Epidemiology. National Institute for Health and Care Excellence. Available at: https://www.nice.org.uk/GeneralError?aspxerrorpath=/media/C7C/80/PromotingPhysicalActivityChildrenReview1Epidemiology.pdf (retrieved 20. 12. 2022).
52. Nilsson, A., Anderssen, S. A., Andersen, L. B. et al. (2008). Between- and Within-Day Variability in Physical Activity and Inactivity in 9- and 15-Year-Old European Children. Scandinavian Journal of Medicine & Science in Sports, 19(1), 10–18. Available at: https://doi.org/10.1111/j.1600-0838.2007.00762.x (retrieved 20. 12. 2022).
53. Olesen, L. G., Kristensen, P. L., Ried-Larsen, M. et al. (2014). Physical Activity and Motor Skills in Children Attending 43 Preschools: A Cross-Sectional Study. BMC Pediatrics, 14(1), 229. https://doi.org/10.1186/1471-2431-14-229 (retrieved 20. 12. 2022).
54. Pate, R. R., Davis, M. G., Robinson, T. N. et al. (2006). Promoting Physical Activity in Children and Youth. Circulation, 114(11), 1214–1224. Available at: https://doi.org/10.1161/CIRCULATIONAHA.106.177052 (retrieved 20. 12. 2022).
55. Pate, R. R., O'Neill, J. R. and Lobelo, F. (2008). The Evolving Definition of "Sedentary". Exercise and Sport Sciences Reviews, 36(4), 173–178. Available at: https://doi.org/10.1097/JES.0b013e3181877d1a (retrieved 20. 12. 2022).
56. Pavey, T. G., Peeters, G. and Brown, W. J. (2015). Sitting-Time and 9-Year All-Cause Mortality in Older Women. British Journal of Sports Medicine, 49(2), 95–99. Available at: https://doi.org/10.1136/bjsports-2012-091676 (retrieved 20. 12. 2022).
57. Peddie, M. C., Bone, J. L., Rehrer, N. J. et al. (2013). Breaking prolonged Sitting Reduces Postprandial Glycemia in Healthy, Normal-Weight Adults: A Randomized Crossover Trial. The American Journal of Clinical Nutrition, 98(2), 358–366. Available at: https://doi.org/10.3945/ajcn.112.051763 (retrieved 20. 12. 2022).

58. Piątkowska, M. and Biernat, E. (2016). Does Physical Activity Protect Adolescents against Risk Behaviour? The New Educational Review, 46(4), 72–83. Available at: https://doi.org/10.15804/tner.2016.46.4.06 (retrieved 20. 12. 2022).
59. Powell, E., Woodfield, L. A. and Nevill, A. M. (2016). Increasing Physical Activity Levels in Primary School Physical Education: The SHARP Principles Model. Preventive Medicine Reports, 3, 7–13. Available at: https://doi.org/10.1016/j.pmedr.2015.11.007 (retrieved 20. 12. 2022).
60. Rasberry, C. N., Lee, S. M., Robin, L. et al. (2010). The Association Between School-Based Physical Activity, Including Physical Education, and Academic Performance: A Systematic Review of the Literature. Preventive Medicine, 52(supplement). Available at: https://doi.org/10.1016/j.ypmed.2011.01.027
61. Retar, I. and Lepičnik Vodopivec, J. (2017). Kompetentnost vzgojiteljev za inovativno gibalno poučevanje. Didactica Slovenica – Pedagoška obzorja, 32(1), 17–32.
62. Riddoch, C. J., Mattocks, C., Deere, K. et al. (2007). Objective Measurement of Levels and Patterns of Physical Activity. Archives of Disease in Childhood, 92(11), 963–969. Available at: https://doi.org/10.1136/adc.2006.112136 (retrieved 20. 12. 2022).
63. Roberts, C., Tynjälä, J. and Komkov, A. (2004). Physical Activity. In: Currie, C., Roberts, C., Morgan, A. et al (Eds.). Young People's Health in Context Health Behaviour in School-Aged Children (HBSC) Study: International Report from the 2001/2002 Survey (pp. 90–97). WHO Regional Office for Europe.
64. RS. (1999). Uradni list RS, no. 59/1999. Available at: https://www.uradni-list.si/_pdf/1999/Ur/u1999059.pdf#!/u1999059-pdf (retrieved 20. 12. 2022).
65. Sardinha, L. B., Andersen, L. B., Anderssen, S. A. et al. (2008). Objectively Measured Time Spent Sedentary Is Associated with Insulin Resistance Independent of Overall and Central Body Fat in 9- to 10-Year-Old Portuguese Children. Diabetes Care, 31(3), 569–575. Available at: https://doi.org/10.2337/dc07-1286 (retrieved 20. 12. 2022).
66. Sember, V., Kovač, M., Starc, G. et al. (2019). Povezanost gibalne dejavnosti in učnega uspeha slovenskih otrok. Didactica Slovenica – Pedagoška obzorja, 34(3–4), 3–18.
67. Stewart, J. A., Dennison, D. A., Kohl, H. W. et al. (2004). Exercise Level and Energy Expenditure in the TAKE 10!® In-Class Physical Activity Program. Journal of School Health, 74(10), 397–400. Available at: https://doi.org/10.1111/j.1746-1561.2004.tb06605.x (retrieved 20. 12. 2022).
68. Szabo-Reed, A. N., Wills, E. A., Lee, J. et al. (2017). Impact of Three Years of Classroom Physical Activity Bouts on Time-On-Task Behavior. Medicine & Science in Sports & Exercise, 49(11), 2343–2350. Available at: https://doi.org/10.1249/MSS.0000000000001346 (retrieved 20. 12. 2022).
69. Treuth, M. S., Baggett, C. D., Pratt, C. A. et al. (2009). A Longitudinal Study of Sedentary Behavior and Overweight in Adolescent Girls. Obesity, 17(5), 1003–1008. Available at: https://doi.org/10.1038/oby.2008.598 (retrieved 20. 12. 2022).
70. Treuth, M. S., Hou, N., Young, D. R. et al. (2005). Accelerometry-Measured Activity or Sedentary Time and Overweight in Rural Boys and Girls. Obesity Research, 13(9), 1606–1614. Available at: https://doi.org/10.1038/oby.2005.197 (retrieved 20. 12. 2022).
71. Van der Ploeg, H. P. (2012). Sitting Time and All-Cause Mortality Risk in 222 497 Australian Adults. Archives of Internal Medicine, 172(6), 494–500. Available at: https://doi.org/10.1001/archinternmed.2011.2174 (retrieved 20. 12. 2022).
72. Verbestel, V., Van Cauwenberghe, E., De Coen, V. et al. (2011). Within- and Between-Day Variability of Objectively Measured Physical Activity in Preschoolers. Pediatric Exercise Science, 23(3), 366–378. Available at: https://doi.org/10.1123/pes.23.3.366 (retrieved 20. 12. 2022).
73. Vetter, M., Orr, R., O'Dwyer, N. et al. (2020). Effectiveness of Active Learning that Combines Physical Activity and Math in Schoolchildren: A Systematic Review. Journal of School Health, 90(4), 306–318. Available at: https://doi.org/10.1111/josh.12878 (retrieved 20. 12. 2022).
74. Volmut, T. (2014). Z merilnikom pospeška izmerjena gibalna/športna aktivnost mlajših otrok in analiza izbranih intervencij. Koper: University of Primorska.
75. Volmut, T., Pišot, R. and Šimunic, B. (2013). Objectively Measured Physical Activity in Children Aged from 5 to 8 Years. Zdravstveno varstvo, 52(1), 9–18. Available at: https://doi.org/10.2478/sjph-2013-0002 (retrieved 20. 12. 2022).

76. WHO. (2011). Global plan for the decade of action for road safety 2011–2020. World Health Organisation and United Nations. Available at: https://www.who.int/roadsafety/decade_of_action/plan/en/ (retrieved 20. 12. 2022).

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